CHAPTER II - ALTERNATIVES

This chapter discusses the "reasonable alternatives" under consideration for the proposed action, as well as other alternatives which were considered initially but have been eliminated from detailed study. The reasonable alternatives identified in this chapter are the alternatives for which the environmental consequences are evaluated in Chapter IV. Highway Alternative A has been selected as the preferred alternative based on the evaluation of the alternatives' impacts. Refer to Exhibit II.F.4-1. A two step "screening" and "evaluation" methodology was used to arrive at the selection of the preferred alternative. This chapter documents all alternatives considered during the evaluation process.

The preferred alternative is not final until comments from the public and the resource/reviewing agencies have been fully evaluated. Selection of the preferred alternative is accomplished through an assessment of social, economic and environmental consequences of the alternative in combination with the public involvement process.

Section 404 of the Clean Water Act requires that the alternative selected for construction must be the alternative of least wetland impact on a total project basis. This requirement was a major influence in the selection of the preferred alternative. If changes to the preferred alternative occur as a result of the public and agency review process, the change must be documented to show no greater effect to wetlands.

A. OVERVIEW OF ALTERNATIVES

Initially, a wide range of alternative actions was considered in order to provide the basis for determining the reasonable alternatives. The following categories of alternatives were considered.

1. "No-Build" Alternative

The "No-Build" Alternative was considered as a basis of comparison for evaluating the benefits and impacts of the other reasonable alternatives. The "No-Build" Alternative represents the existing plus committed street and highway network in the project area, including short-term minor safety and maintenance improvements that maintain continuing operation of the existing system.

2. Transportation Systems Management (TSM) Alternatives

TSM alternatives include those activities which maximize the efficiency of the current transportation system. They generally involve relatively limited new construction. Although TSM alternatives usually are applicable only on projects in larger urban areas, the extreme traffic congestion in the Warrensburg area demands a realistic assessment of the benefits and impacts of TSM improvements on Route 13 and other intersecting streets and highways.

3. Mass Transit Alternatives

Transit options such as bus systems and rail transit are usually considered as alternatives to highway projects in large urbanized and suburbanized areas with a large volume of commuter traffic. Therefore, they were eliminated from further consideration in the Route 13 Corridor Study.

4. "Highway Build" Alternatives

"Highway Build" Alternatives on new location, as well as improvements to the existing route, were considered. A large number of highway construction alternatives was subjected to a two-step screening and evaluation process to identify a preferred alternative for the project.

The major steps that were used in this process were:

- Screening Process
  - Identification of all reasonable alternatives on U.S.G.S. sheets at a scale of 1:24000.
  - Selection of major screening factors and sub-factors.
  - Collection of corridor data by study team.
  - Identification of alignment links that displayed "fatal flaws" or unacceptable service.
  - Screening of initial alignments by collective action of study team.
  - Identification of remaining alternatives to be carried forward into a detailed evaluation

- Evaluation Process
  - Collection of detailed data by each study discipline on alignments advanced for further study.
  - Identification of evaluation factors (see Appendix B).
  - Compilation of data for each factor by respective study disciplines for each combination of routings in each county.
  - Preparation of data summaries by alternative.
  - Identification of preferred alternatives in each county exhibiting least negative impacts and least impact on wetlands.

The following Sections B through E discuss each category of alternatives in detail. They include physical descriptions of the alternatives, traffic service evaluations, and screening procedures for eliminating certain alternatives from further consideration. Section F then summarizes the reasonable alternatives and identifies the preferred alternative.

B. "NO-BUILD" ALTERNATIVE

The "No-Build" alternative is being considered as a basis of comparison for evaluating the benefits and impacts of the other alternatives. The "No-Build" alternative represents the existing state highway, city street and county networks, plus committed

improvements planned over the next 30 years. Based on projected traffic volumes, especially through the city of Warrensburg, the "No-Build" alternative was not considered a feasible alternative.

1. Existing and Committed Projects

The "No-Build" condition was defined to include those improvements that could reasonably be expected to occur during the design period (prior to the year 2022). Projects that are expected to be completed and are thereby included as part of the "No-Build" alternative include:

- The widening of Missouri Route 7 to a four-lane arterial street through the Clinton area;
- The widening of Missouri Route 13 to a four-lane arterial street through the Clinton area;

2. Traffic Assignments

Existing traffic conditions were based on traffic counts conducted by the Missouri Highway and Transportation Department. Exhibit II.B.2-1 includes the traffic conditions on Route 13 plus the three urban communities for the base year 1992. The existing traffic conditions are approaching congested levels on several segments of Route 13, as well as within both Warrensburg and Clinton.

Future year traffic assignments were made for both the rural Route 13 segments and the urban city street network. A detailed description of the traffic projection methodology can be found in Section II.E.4 Traffic Assignments. The traffic projections for the "No-Build" alternative reveal an annual growth rate of approximately 4 percent, with traffic levels rising to between 7,000 and 21,000 vehicles per day on the rural segments. Typical two-lane highway segments in the Route 13 corridor can efficiently handle approximately 5,000 vehicles per day with little or no traffic problems. Traffic in excess of this threshold create more frequent speed changes, additional traffic flow problems, and increased likelihood of traffic incidents.

Within the urban areas, through traffic is forced on city streets adding to already congested conditions. Exhibit II.B.2-2 shows the year 2022 traffic projections for Higginsville, Warrensburg, and Clinton, as well as for the rural segments in between. Route 13 through Warrensburg is expected to carry over 30,000 vehicles per day. Without a bypass, a significant transportation investment in Warrensburg's city streets will be needed to meet projected demands. Even with a bypass, some improvements will be necessary.

Systemwide vehicle kilometers (miles) of travel (VKT), vehicle hours of travel (VHT), and average speeds were developed for each county. These three variables are referred to as Measures of Effectiveness (MOEs) and are used to compare macro-traffic changes throughout the Route 13 corridor. The MOEs projections reveal a dramatic increase in both VKT and VHT from 1992 to 2022 for all three counties (Table II.B.2-1). Likewise, average speeds fall as traffic volumes increase over the next thirty years. Changes of

this magnitude correspond to reductions in travel efficiency, increased cost, and improved probability of traffic incidents.

Table II.B.2-1
Baseline Measures of Effectiveness
Lafayette, Johnson, and Henry Counties
Years 1992 and 2022

MOEs	Lafayette County		Johnson County		Henry County		Total Project	
	1992	2022	1992	2022	1992	2022	1992	2022
Vehicle Kilometers (Miles) of Travel/day	321,010 (199,470)	721,870 (448,560)	1,171,920 (728,220)	2,289,570 (1,422,710)	587,020 (364,770)	1,122,540 (697,530)	**2,079,950 (1,292,420)**	**4,133,980 (2,568,740)**
Vehicle Hours of Travel/day	5,660	12,890	19,230	42,170	10,440	24,510	**35,330**	**79,570**
Average Speed, kph (mph)	56.8 (35.3)	56.0 (34.8)	61.0 (37.9)	54.2 (33.7)	56.2 (34.9)	45.9 (28.5)	**58.9 (36.6)**	**52.0 (32.3)**

Source: Wilbur Smith Associates

3. Cost Effectiveness Analysis

The traffic levels associated with the "No-Build" highway network will result in much less desirable driving conditions over the next thirty years. Table II.B.3-1 projects the increased cost to Route 13 corridor drivers for the year 2022 compared to the base, year 1992, expenditures. The average Route 13 driver can expect their transportation costs to more than double (109 percent increase) over base year 1992 conditions. The expected cost increases will be associated with additional vehicle operating costs, travel time costs, and traffic incident costs. The total cost increase for all corridor drivers is expected to exceed the 1992 levels by more than $300 million.

Table II.B.3-1
Projected Cost Increases
Years 1992 to 2022

	Lafayette Co.	Johnson Co.	Henry Co.	Total
Vehicle Operating Costs	$32,166,000	$89,684,000	$42,973,000	**$164,823,000**
Travel Time Costs	21,125,000	67,005,000	41,096,000	**129,226,000**
Accident Costs	4,520,000	13,363,000	7,078,000	**23,961,000**
Total Costs	**$57,811,000**	**$169,052,000**	**$91,147,000**	**$318,010,000**

Source: Wilbur Smith Associates

C. TRANSPORTATION SYSTEM MANAGEMENT ALTERNATIVES

The concept of transportation system management (TSM) was formally initiated twenty years ago with the promulgation of a series of joint regulations by the Urban Mass Transit Administration (now the Federal Transit Administration, FTA) and the Federal Highway Administration (FHWA). These regulations, which were issued in response to an increasing demand for travel and in recognition of limited fiscal and natural resources, required urban areas to more fully use their existing infrastructure and capacity before they seek federal funding for the construction of additional facilities.[1]

[1] *Transportation System Management, Special Report 172*, Transportation Research Board, 1977.

While the concept of TSM was initially developed in response to the needs of large urban areas, the concept has been expanded to encompass transportation alternatives in both urban and rural areas that focus primarily on increasing the efficiency of a transportation facility without significant new construction.

Many TSM strategies focus on transportation problems in a large urban environment, and thus are not applicable to a project such as Route 13. For example, strategies that are considered inappropriate for Route 13 include: preferential treatment for transit and other high occupancy vehicles (HOVs); management and control of parking; incentives for pedestrian and bicycle modes; alternative work schedules; and road use pricing.

While many TSM strategies involve relatively limited new construction and focus on maximizing the efficiency of the existing facility, it should be noted that, in some cases, TSM strategies can be implemented in conjunction with new construction. For example, access management is a critical component considered in the design of a new facility. The following text discusses some of the TSM measures that were considered for implementation in the Route 13 corridor.[2]

1. Intersection and Lane Improvements

Intersection improvements may include traffic control devices (TCDs) such as stop signs, yield signs, traffic signs, turning lanes, traffic islands, channelization, and improved design. These devices may improve the flow of vehicles and the safety of vehicles and pedestrians.

Intersection improvements may be appropriate at some intersections, both existing and planned, on Route 13. In general, improvements should reduce and separate the conflict points, and reduce the area of conflict; avoid multiple merge and diverge maneuvers; provide turn lanes when turning volumes are high or when speed differences are significant, and coordinate the type of TCD with the volume of traffic, favoring the lanes with the greatest volume and highest speeds. The needs of pedestrians and bicyclists should be considered. On Route 13, the need to accommodate pedestrians and bicyclists may be of particular relevance in the cities and towns along the route, especially where volumes might be expected to be significant, for example, near the campus in Warrensburg, and near the bike trail in Clinton.

2. Traffic Signal Improvements

Traffic signal improvements may consist of upgrading physical equipment or signal re-timing. Physical equipment that may be upgraded includes signal controller hardware; equipment for vehicle detection and intersection surveillance; and equipment for coordination between signals. Although the outlay for this equipment may be significant, so are the benefits that result. Benefits may include reduced vehicle delay, provision of data, and increased capability to modify and coordinate signal timing.

Signal timing improvements may consist of re-timing green times and offsets to reflect current volumes, coordinating signals to reduce delay on an arterial or network, and the implementation of actuated or adaptive control, which varies signal timing to reflect

[2] Discussion of TSM strategies is based on information provided in *A Toolbox for Alleviating Traffic Congestion*, Institute of Transportation Engineers, 1989.

current traffic volumes. Signal re-timing is facilitated by solid state signal controllers and communications equipment that allow signal timing to be changed remotely, and detection and surveillance equipment that provides vehicle counts and other information that might affect signal operation.

Signal improvements may be appropriate on some segments of Route 13, and would be expected to be of significant benefit on expressway segments where signals are located in close proximity to one another and where volumes are significant. Signal capabilities at diamond interchanges and (ultimately) on frontage roads should also be considered.

3. Restriping

Restriping is a low cost modification that may increase capacity in some cases. Generally, restriping either utilizes one or more shoulders as a travel lane, or reduces lane widths to provide additional lanes within the existing pavement. While restriping may result in an increase in capacity, and may have (in some cases) a minimal affect on safety, this treatment should in all cases be considered temporary.

Restriping would not be appropriate on Route 13 due to the fact that most of Route 13 does not have any shoulder.

4. Access Management

Access management may be used to enhance safety, and to improve the speed on a facility. Access management may include left turn restrictions, driveway and curb cut restrictions, separation of conflict areas, elimination of parking, adequate intersection spacing, and use of frontage roads. While access management may enhance safety and allow increased vehicle speeds for through traffic, local accessibility must also be considered when evaluating the desirability of access management components in any given location.

Access management is recommended for consideration on all segments of Route 13, both in the short term and during the design of the proposed facility. All new construction of the freeway/expressway facility will obviously integrate access management principles, for example through minimum intersection and interchange spacing. Furthermore, in the interim, other measures such as left turn restrictions and the separation of conflict areas may be appropriate on some segments of the facility.

5. One-Way Streets

One-way traffic regulations may be considered for implementation on facilities that have high volumes of traffic and vehicle conflicts. One-way regulations are often used in major activity centers such as central business districts, where large traffic volumes and closely spaced intersections are typical. In this environment, one-way streets may increase capacity and facilitate the timing of coordinated traffic signals, and enhance safety, particularly pedestrian safety.

One-way regulations might be appropriate on the existing Route 13 in the cities, particularly where pedestrian safety is a significant consideration, such as near the

campus in Warrensburg. Note that one-way streets are generally implemented in pairs, which is necessary to provide adequate capacity in both directions.

6. Demand Management

Demand management includes any actions, activities or regulations that attempt to reduce the impact of traffic by influencing travel behavior. Demand management may attempt to influence mode choice, route choice, time of travel, or to eliminate a trip altogether. While it may be possible to reduce demand under certain circumstances, for example during the peak period traffic for a short period of time, there are limitations to demand management. Specific elements that may be part of a demand management program include growth management, road pricing, auto restricted zones, parking management, ride-sharing, alternative work hours, and trip reduction ordinances. While demand management might be desirable from the standpoint that it may result in improved traffic flow, the impact of these strategies on mobility must also be addressed. Any conflict between the objective of limiting demand and the objective of providing adequate mobility must be resolved with consideration to local circumstances and objectives.

Demand management is generally not appropriate for implementation on Route 13. While demand management may be appropriate to temporarily relieve congestion on specific segments of Route 13 (in cities or near activity centers), demand management alone will not provide adequate mobility in the Route 13 corridor, and is not a feasible alternative to the construction of additional lanes.

7. Conclusion

While some of the TSM measures discussed above may be appropriate for implementation on segments of Route 13, TSM measures alone would not provide the same mobility that would be provided by the construction of a freeway/expressway facility in the corridor. However, TSM measures should be considered for application as interim measures during the construction and phasing of the project (for example, restriping), and may be appropriate for implementation in conjunction with the construction of a freeway/expressway facility (for example, intersection improvements, traffic signal improvements, and access control). TSM may be especially important in the areas of Higginsville, Warrensburg and Clinton, where congestion may be more of an concern.

D. PUBLIC TRANSPORTATION ALTERNATIVES

Public transportation alternatives to highway improvements, such as bus systems and rail transit, are generally considered viable alternatives in large metropolitan areas, where land use intensity is relatively high, and where concentrated trip origins and/or destinations (such as central business districts) make mass transit a more viable alternative. Mass transit systems are generally not a viable alternative in areas with low population densities and with distributed origins and destinations.

Public transportation is capable of carrying a large number of people in relatively few vehicles, which can increase the capacity of a facility, measured in passenger-trips, and

can contribute to a reduction in fuel consumption and vehicle emissions. However, these benefits are realized only if transit ridership is adequate. Whereas in fact, bus ridership has been declining in many areas, even in urbanized areas where higher density development has traditionally supported transit ridership. Because of the low population density and the dispersed trip origins and destinations in the Route 13 Corridor, public transportation would not provide the same level of mobility as would the construction of a freeway/expressway, nor would it provide the economic benefits that would be expected to accrue as the result of a Highway Build Alternative. Thus, public transportation alternatives are not considered a reasonable alternative to the proposed action. Further note that existing and future public transit, including paratransit, would be expected to benefit from an improved Route 13 roadway. Transit users would benefit, just as other users would benefit, from improved mobility, enhanced safety, and a reduction in congestion and delay, especially in Warrensburg and in other areas where the current roadway does not meet the existing demand.

E. HIGHWAY BUILD ALTERNATIVES

1. Overview of Highway Build Alternatives

a. Purpose

As discussed in the purpose and need section, the Missouri Highway and Transportation Commission (MHTC) has included in the 1992 plan "Highway Right-of-way and Construction Program" the improvement of Route 13 to a four-lane expressway. The Commission has also stated that total control of access (freeway) will be used on Route 13 in the urban areas of Warrensburg and Clinton.

The two options that are traditionally considered to satisfy a traffic service need are to 1) improve the existing facility or 2) construct an expressway/freeway either adjacent to the existing route or on totally new alignment.

b. Design Criteria

The design criteria established for this project that is consistent with the intent of the MHTC is shown in table format in Appendix A. The primary design elements of this criteria are summarized as:

- Design speed of 100 kph (60 mph).
- Maximum horizontal curvature of 395 meters (1,296').
- Four basic through lanes (two in each direction).
- Maximum vertical grade of four percent.
- Full width paved shoulders both left and right of through pavement.
- An 18 meter (60') depressed median where possible.
- Partial control of access in rural area and full control of access in Warrensburg and Clinton.
- At-grade intersections along expressway to be generally no closer than 0.8 kilometers (0.5 miles).
- Where needed, frontage roads would be used for local access (No private access to expressway).

Sufficiency of the existing Route 13 was determined by a comparison of the existing condition to the project design criteria.

c. Sufficiency of Existing Facility

Based on a review of "as-built" drawings of existing Route 13 it was found that much of the route was not of sufficient design to be incorporated into the new Route. 13 improvement. Most of the existing deficiencies were vertical considerations. Many existing grades were higher than the maximum criteria and most of the crest and sag vertical curves were too short to accommodate the design speed.

Of the total existing Route 13 length of approximately 110 kilometers (68.5 miles), only five segments were usable for a 100 kph (60 mph) design speed, these are:

- A newly constructed bridge over Tabo Creek, north of Higginsville, a distance of 1.13 kilometers (0.7 miles);
- A 5.3 kilometers (3.3 mile) section of Route 13 north of U. S. 50;
- A 6.1 kilometers (3.8 mile) section north of the Route 13/Route 7 intersection in Clinton;
- A 1.6 kilometers (2.3 mile) section of combined Route 7 and Route 13 in Clinton; and
- A 3.2 kilometers (2.0 mile) section south of Clinton.

These sections in conformance only constitute 18% of the total project length and may not be placed properly to be incorporated into the new facility.

To bring the existing facility into conformance with the project design criteria, a total rebuild of 82% of the project length would be needed. When maintenance of existing traffic is considered, the rebuild of Route 13 in places becomes operationally unfeasible because of the added cost of the temporary roadway and the disruption to traffic during construction.

Where new alignments are coincident with existing Route 13 in areas of compliance with design criteria, these existing sections have been incorporated into viable route alternatives for the improved Route 13. These opportunities occur for:

- A 1.13 kilometers (0.7 mile) section of Tabo Creek north of Higginsville;
- A 1.61 kilometers (1.0 mile) section north of Warrensburg;
- A 2.44 kilometers (1.5 mile) section north of Clinton; and
- A 0.80 kilometers (0.5 mile) section south of Clinton.

Based on the design criteria of this project and other considerations such as maintenance of traffic during construction, the improvement to the existing Route 13 option has been found to be inconsistent with the purpose and need of the project.

d. Review of Improvement and Stage Construction Options

The improvement options that have been found to be consistent with the project purpose and need are:

- Expressway/Freeway on New Alignment, and
- Expressway/Freeway adjacent to existing Route 13 right-of-way.

If the ultimate right-of-way is purchased initially, either of the two build options can be constructed in stages. The first stage could be configured to build two lanes of ultimate roadway and use one lane initially for each direction of travel. This staging can apply to each of the two location options.

A second method of staging can apply to only the location option adjacent to existing Route 13. Two new lanes can be constructed initially for one direction of travel while the existing Route 13 can be used for the other direction of travel. This staging option will provide four lanes of pavement initially although two of these lanes (one direction of travel) will not conform to project design criteria until the project is completed (second stage of construction).

2. Identification of Reasonable Alignment Alternatives

a. Segment Definitions

The study area, as defined for the purpose of this corridor location study, is approximately 105.7 kilometers (65.7 miles) long and 9.66 kilometers (6 miles) wide extending from U.S. 24 on the north to the northern edge of Truman Reservoir, south of Clinton. A more detailed study area description was given in Section I-B.

In order to provide for the logical and orderly compilation of data for all alignment alternatives, a naming convention was developed. The study area was identified by nine analysis segments labeled Segment A through Segment I. The limits of these segments were defined by logical geographic areas. The coverage of each of these segments is shown graphically in Exhibit II.E.2-1 and is described in the following tabulation:

Segment A - Begins at the north project limits at U. S. 24 and extends southerly to the northern urban limits of Higginsville.

Segment B - Extends from north of Higginsville to Interstate Route 70 (I-70).

Segment C - Extends from I-70 to the Lafayette/Johnson County line.

Segment D - A specific segment in the general vicinity of the existing I-70/Route 13 interchange included for detailed work on the I-70 interchange type selection.

Segment E - Extends from north Johnson County line to the divergence of bypass alignments around Warrensburg.

Segment F - Includes the urban area of Warrensburg.

Segment G - Extends from the south side of Warrensburg to the Johnson County/Henry County line.

Segment H - Includes all of the Route 13 corridor in Henry County to the southerly project limits.

Segment I - Includes all of the Route 7 alignment alternatives within the limits of this study corridor.

In order to minimize duplication of effort, link numbers were assigned to portions of alignments within a segment to allow use of a link in several different alignments.

b. Alignment Controls

In the process of identifying all reasonable alternatives for the expressway/freeway on new location, the study team identified the many controls that influenced the positioning of the expressway alternatives. Typical controls included mine shafts, missile sites, wetlands, hardwood forests, public use/recreation areas, cemeteries, parks, culturally significant structures, threatened and endangered species habitats, wildlife refuge areas, floodplains, and other factors of significance to the placement of the roadway.

Each discipline of the study team identified controls relative to their expertise in each section of the study area. This data was used to influence alignment location. Most controls were avoided. Where an avoidance was not workable, suitable mitigation measures were developed and are discussed in greater detail in Chapter IV.

c. Identification of Initial Alternative

Using the control data collected by the study team, all reasonable alternatives were located on 1:24,000 (1"=2000') topographic base maps. Aerial photomosaic basemaps at a scale of 1:12,000 (1"=1000') were also used in the alignment location procedure. A best fit of the alignment to the terrain was made for alternatives along existing Route 13 and for alternatives on new alignment both east and west of Route 13. Exhibit II.E.2-1 illustrates all alternatives identified for consideration in the initial screening process. The intent of this initial screening process was to identify those alternatives that were of sufficient merit to be considered in greater detail in subsequent steps of the evaluation process.

3. Preliminary Screening of Highway Alternatives

a. Screening Methodology

A meeting of study team members was held on October 13, 1994 for the purpose of eliminating alignment alternatives from further consideration in the corridor alignment selection process.
The primary goal of this meeting was to eliminate alignments of least benefit from further consideration. Three objectives were used to meet this goal. They were: 1) identify any fatal flaws; 2) make collective team judgments of the relative impacts of alignments on a segment by segment basis; and 3) check retained alternatives for compliance with the project "Purpose and Need".

The result of the screening process is depicted on Exhibit II.E.3-1. This exhibit indicates retained alternatives by a wide line and deleted alternatives by a narrow line.

This screening of alternatives is intended to serve as documentation of the second concurrence point of the merged NEPA/CWA review process. See Exhibit I.A.3-1.

Each study discipline was asked to complete a Summary of Data Form for each of the nine segments of the project. Each discipline presented collected data to the group on a segment basis. If any fatal flaws were present in the segment, this was brought to the group's attention. A fatal flaw is an impact that for one reason or another cannot be mitigated and will cause the alignment to be deleted or shifted significantly. An example would be a cemetery located on the alignment.

After each study team discipline presented its data, a group discussion of all disciplines was held to develop a consensus on which links of the segment were least beneficial. These links were deleted from further consideration. No attempt was made to determine the most beneficial alternative.

A summarization of data for each alignment in each segment was compiled using generalized evaluation factors. These factors included length, costs, traffic service, hazardous waste sites, archeological/architecture sites, wetlands, major stream crossings, potential 4(f) sites, natural features, displacements (residential, business and public use), critical noise receptors, and land use. Where it was possible to do so, factors were quantified. Where judgment was involved, a plus, zero, minus scale of impacts was assigned by the respective discipline expert involved.

A narrative of the results of this initial screening process is presented in the following segment by segment description.

b. Alternatives Retained for Further Study

In all Route 13 segments, the alignment adjacent to existing Route 13 was retained because of the distinct advantages of constructing the project by stages of development. An alignment along existing Route 13 is considered to meet the "Purpose and Need" of the project and will be evaluated with other alternatives in the subsequent detailed evaluation of alignments.

Segment A

The initial identification of alignments was responsive to three possible Missouri River crossing alignments north of U. S. Route 24. The alignment identification process of those three alternatives, which is the subject of a separate study by others, has identified the "middle" river crossing site as the preferred alignment. The terminus of this site on U. S. 24 is located east of Lexington approximately 610 meters (2,000 feet) west of the existing intersection of U. S. 24 with Missouri Route 224 (old U. S. 24).

Two primary alignments were identified in Segment A, one along existing Route 13 and another along an abandoned Missouri-Pacific Railroad track north of Route 13. Both alignments follow previously established barriers and, as such, would not create a new barrier, only an intensification of an existing impact. The combination of these two basic alignments created five possible routings in Segment A.

Segment B

Segment B extends from north of the Confederate Soldiers Home on the north to Interstate 70 on the south and, as such, includes all routings around Higginsville. The

preliminary alignments in Segment B established two western bypasses of Higginsville and two bypasses east of Higginsville.

Any alignment containing Link B5, an east-west link adjacent to existing Missouri Route 20 (old Route 13), was more costly and contained social impacts to both the Soldiers Home, the city golf course and numerous residences. For these reasons Link B5 was deleted.

Link B10, an alignment approximately 3.2 kilometers (two miles) west of Route 13 affects an archeological site, would involve a major stream crossing, would run linearly in the flood plain of a tributary of Tabo Creek, and would impact three areas tentatively identified as wetlands. For these reasons Link B10 was deleted. As a result of deleting B10, Link B2 was no longer needed.

In the study team discussions, it was agreed that Link B4 was located too close to established businesses, including John Knox Retirement Center, and should be moved about 350 meters (1,000 feet) further west. This relocation of Link B4 will affect the northern ends of Links B11 and B12.

The eastern bypasses of Higginsville were considered by the study team to be located inappropriately. The near bypass was too close to the existing development and the outer bypass was considered to be too far east to be of value to the community. A compromise location in between the two preliminary alignments was suggested. This single eastern location will allow room for future growth but will be close enough to have significant initial value to the community. Links deleted by this compromise location are B6, B7, B8, B13, B14, and B15. The retained alignment will be B9 plus a new link of either B18 or B19 (a connection to Route 13).

Link B16 was deleted because it was considered to be too far away from existing Route 13 to serve existing traffic efficiently.

Thus, Segment B retains two western bypasses, an eastern bypass, an alignment approximately 0.8 kilometers (one-half mile) west of Route 13 south of Higginsville, and the existing Route 13 alternative.

Segment C

In Segment C, the consensus of the study team was to delete the far east and west alignments and retain all other links. Links deleted were C1, C2, C15 and C8. All other links were either associated with alternatives along Route 13 or connected to bypass links in Segment B. Link C1 and C2 would have a direct negative impact on the Maple Leaf Reservoir recreation area. Link C3 and C7 are controlled by proper interchange spacing requirements on I-70.

Segment D

Segment D is the I-70 interchange area and the north and south approaches to the interchange. Along existing Route 13, at least two interchange types can be considered, a normal diamond or an access controlled clover-leaf.

The existing interchange can be bypassed either to the east or west with a "grade separation" only using the existing interchange to serve turning traffic.

Thus, in Segment D, at least four primary alignment possibilities exist along with at least two interchange type evaluations on the existing Route 13 alignment. All alternatives in Segment D were retained for further evaluation.

Segment E

Link E1 and combined Links E2-E9 have significant impacts on the Walnut Creek, Crooked Creek and North Blackjack Creek tributaries requiring long structures over flood ways and filling in floodplains. These links provide less traffic service than do links that are more closely located to existing Route 13. Therefore the far western links - E1, E2, E3 and E9 - were deleted from further consideration.

The far eastern alignment, E8, was deleted for the same reasons as was described in Segment C and B, too far removed from existing Route 13 to provide good traffic service. All other links were retained for more study.

Segment F

The alignment using links F17 and F25, the "close in" alternative, would displace over 200 residences and 15 businesses and public use facilities. These links were eliminated due to displacement impacts.

Although a "close in" western alignment would be of value relative to traffic service, the impacts associated with Links F23 and F24 were significant. These two links passed through Cave Hollow Park, the Warrensburg Country Club and a city park south of the country club. This park is expected to be extended to the west and will require a slight realignment to Link F22. Based on these recreational impacts, Links F12, F23 and F24 were deleted.

Link F1 along with its connecting links of F8 and F9 have major impacts on the Blackwater River crossing and floodplain. The far west alignment in Segment E was deleted. The western alignment in Segment F did not present sufficient benefit to consider retaining the west alternate thus, Links F1, F8, F9 and F20 were deleted in favor of the western alignment closer to downtown.

The relative impacts of the Post Oak Creek crossing were considered to be more severe on Link F29 than on Link F22 in terms of length of river crossing structure, amount of fill in a floodplain and residential displacements. Based on this data, Links F21 and F29 were deleted.

On the east side of Warrensburg, to comply with findings in Segment E, the far east alternative was eliminated which deleted Links F7, F18, F19, and F36.

North of Highway 50, Link F4 was compared with combined links F5-F16 to determine the best Blackwater River crossing east of Route 13. Residential displacements were

approximately ten times greater on Link F4 when compared to the combination of Links F5-F16 (36 to 40 compared to 3 to 5). Minimization of residential displacements is of primary significance in a corridor level evaluation, thus, it was the opinion of the study team that Link F4 should be deleted and Links F5 and F16 retained.

A direct comparison of Links F31 and F32 indicated that F32 conformed to existing land use patterns better than F31. Link F32 is placed east of the high school thus placing any possible divisive impacts on the side of the high school that is away from the major population concentration. Link F31 was deleted by consensus of the study team.

The near east bypass, Link F26, and the far east, Link F28 were considered to have fewer negative impacts than does Link F27. Link F27 runs longitudinally through 350 meters (1,000 feet) of the East Bear Creek floodplain and adjacent to both a significant natural prairie and four archeological sites. Because of these and other impacts Links F27, F33, and F34 were deleted.

In order to develop continuity of the retained links, four new connections are required. These added links connect F16 with F26, F16 and F28, F28 with G4 and F22 with G1.

The retained alignments in Warrensburg include one primary western bypass and two different eastern bypass alignments.

Segment G

In Segment G, only one significant decision was made, to delete the far easterly alignment - Links G5-G8.

As a result of alignment relocations made in Segment F, the northerly part of G4 was relocated to match Segment F. G2 connected F29 with existing Route 13. Since F29 was deleted, G2 was deleted. With the deletion of the far east alignment, a cross-over, Links G7-G9, was also deleted. In order to retain flexibility of evaluations, a new connection was added between relocated G4 and Route 13.

Again, in Segment G, the primary goal of retaining all Route 13 alternatives plus an alignment option both east and west of Route 13 was achieved.

Segment H

All concepts in Segment H were retained for further evaluation. Link H6 was deleted due to the elimination of the far east alignment in Segment G. Due to the elimination of westerly bypasses around Clinton, Links H9, H10, H11 and H13 were deleted. In order to maintain the viability of a westerly alignment in Segment H, a new connection between H1 and Segment I was added to the links for further study.

The alignments retained in Segment H include an eastern and western alignment and two variations of a route paralleling Route 13.

Although these two segments represent independent route continuity for their respective routes, when considered as a whole they must be analyzed as one comprehensive unit.

Segment I and Segment J

If properly located, the north-south element of the Route 13 bypass can also serve as the north-south element of the east-west Route 7 Bypass.

Based on 1993 traffic counts the existing traffic volumes approaching Clinton are: North 4400 vehicles per day (vpd); east 4860 vpd; south 7300 vpd; and west 8050 vpd. Thus, the predominant traffic flow through the Clinton area is the west to south/south to west movement.

This predominant flow influenced the design team to identify alternatives around the southwest side of Clinton. The Truman Lake flood pool is immediately adjacent to developed areas of Clinton. In addition, the Artesian Park, a municipal water plant, a sewage lagoon, a newly platted subdivision, a wildlife preserve, and the local office of Missouri Department of Conservation are all located in close proximity to the proposed alignment. A 4(f) statement would undoubtedly be needed for this westerly bypass. The collective opinion of the study team was that impacts associated with the westerly bypass would require extensive mitigation and this alignment should be deleted from further consideration. Those alignments containing links I1, I25, I5, I14, I22, and I23 were deleted. Likewise, those Segment J alignments containing Links J12 and J13 were also eliminated.

The impacts associated with the upgrading of existing Route 13 in Clinton to freeway status was considered to be unworkable along with undesirable spacing of interchanges needed for Route 52 and the connection to existing Route 13 south of Route 52. Therefore the alignment made up of Links I2-I6-I9-I15 was considered unworkable.

A variation of this alignment, Links I2-I6-I10-I16-I24 was considered to have too many residential and business displacements and was also deleted. These two decisions deleted Links I6, I9, I15, I10, and I16. These decisions also deleted Link J9 because it has the same alignment as Link I9. Since J9 was deleted, the portion of Link J11 from J9 east to Link I12 is not necessary and was not retained.

Links I19-I21 and Link I20 serve the same purpose between two common points. The study selected a relocation of links I19 and I21 and deleted I20 from further consideration.

All other Segment I links were retained for further study. These combinations described five alignment variations on the east side of Clinton starting from two entry points at the Segment H/I border.

The study team also had the opinion that the upgrade of existing Route 7 on the north side of Clinton to an access controlled freeway would present impacts difficult to mitigate, therefore, Links J8 and J10 were deleted in favor of less disruptive alternatives. Nineteen residences, five businesses and one public use facility would have been affected if this alignment had been retained.

The northern Route 7 Bypass, located 4.0 kilometers (2.5 miles) north of the existing M-7, is considered to be too far removed from the urban area of Clinton to provide a proper degree of local service. The location of this alignment was influenced by the extensive area of abandoned strip mines. It was agreed that this northern bypass (Link J1)

offered no advantage over the retained alignments and was deleted from further consideration.

Two primary east-west Missouri Route 7 alignments were retained with three points of departure from existing M-7 west of Clinton. Three primary north-south Route 13 alignments were retained along an easterly bypass of Clinton. When the Route 7 Bypass alternatives are combined with the Route 13 retained alternatives, a continuous routing for the M-7 Bypass is achieved.

c. Corridor Advisory Council Review

On October 25, 26, and 27, 1994 the results of the initial screening process were presented to the three Corridor Advisory Councils (CAC) established to enhance public information and coordination. The results of this initial screening was also published in the January 25, 1995 project newsletter.

The results of this initial screening established the first step of a more detailed evaluation procedure of the retained alternatives which is discussed in Section II.E.6 of this document.

4. Traffic Assignments

The ability to provide an improved and efficient transportation system is an integral component of the Missouri Route 13 Corridor Study. Drivers save time and money when congestion is reduced, average speeds are raised, or trip distances are shortened and businesses save transportation costs when shipments enter or exit the area more efficiently.

a. Projection Methodology

Based on input from the Missouri Department of Transportation (MoDOT), the study corridor was divided into an urban and rural component. The rural traffic projections were provided by MoDOT with modifications by the HNTB Study Team. The urban traffic projections were developed by Wilbur Smith Associates using the TRANPLAN transportation modeling package. The urban component includes the three communities of Higginsville, Warrensburg, and Clinton. Finally, the urban and rural components were combined to allow a county-wide analysis of each alternative.

Traffic analysis was conducted using the TRANPLAN computerized transportation modeling software package. A separate traffic network was established for the three urban communities of Higginsville, Warrensburg, and Clinton. In each community a roadway network based on the existing street and highway system was established and calibrated based on existing land-use and traffic count information. The modeling procedure assigns vehicle trips to various street segments based on the location of commercial, industrial, and residential development and the results of the origin-destination surveys. A general form of the traffic modeling process is depicted on Exhibit II.E.4-1.

The main model inputs include various travel characteristics (obtained from surveys), land-use information, and a description of the highway network. Input data, which included existing traffic counts, future traffic estimates, and origin and destination

surveys were provided by MoDOT. The output data include average annual daily traffic (AADT) and three measures of effectiveness (MOEs): vehicle kilometers (miles) of travel (VKT), vehicle hours of travel (VHT), and average vehicle speeds.

Average Annual Daily Traffic (AADT)

Once the modeling procedure assigns trips to the roadway network, each roadway or roadway segment has a specific number of assigned vehicles. Fluctuations in the number of vehicles will occur based on seasonal factors, as well as variations throughout the day. The AADT is the number of vehicles crossing a specified point on an average day throughout the year.

Vehicle Kilometers (Miles) of Travel (VKT)

The distance vehicles travel between their origin and destination is the primary determinant of the path chosen, with drivers typically choosing the shortest route. Sometimes, however, the shortest route has the most congestion and a longer route would be quicker. The model calculates a travel path for each vehicle trip in the network depending on both travel distance and travel time. By summing up the travel distances made by each vehicle, the traffic model can calculate the total VKT for the network.

Vehicle Hours of Travel (VHT)

The amount of time vehicles are on the road is a function of how far they must travel between their origin and destination and the level of congestion encountered. While travel distances along bypasses are typically longer, the travel is accomplished on a better facility, at higher speeds, which allow motorists to avoid congested highway sections or urban areas. The VHT is calculated by summing the travel time made by each vehicle in the network.

Average Vehicle Speeds

Major improvements in travel time are readily explained by the introduction of a higher speed facility, as well as four lane segments which permit safe and efficient passing maneuvers. The traffic model reports average network wide speeds, based on congestion levels on the highway network.

The general procedure for evaluating roadway alternatives begins with calibrating the model to existing conditions, estimating the growth or decline in traffic into the future, and comparing the network with the alternative to the baseline network without the alternative. The differences between networks would be attributable to the alternative, with the AADTs and MOEs quantitatively measuring those changes. Changes in AADT on existing roads will occur as traffic diverts to the new roadway and overall changes in VKT, VHT, and average speeds will occur as the community travel patterns change. Finally, the changes between alternatives is measured and compared to determine which alternative creates the greatest benefit to the community.

b. Rural Assignments

The rural traffic component comprises the highway segments outside the urban areas of Higginsville, Warrensburg, and Clinton. MoDOT provided the HNTB Study Team with

existing and projected traffic counts for those segments, with the initial assumption that the alternatives would not significantly affect those projections. In other words, the projected traffic in the rural segments would remain constant for all Route 13 alternatives.

The rural traffic projections were used by the HNTB Study Team to:

- Assign trips to both the new highway and existing highway on segments where separate parallel facilities would remain;
- Adjust the urban traffic component to include the rural component when evaluating the alternatives on a county-wide basis; and
- Calibrate the urban traffic model's external zones.

The procedure used in developing the rural traffic projections includes analyzing the historic AADT for each segment, developing traffic growth rates, assuming those rates will remain constant through the design year, and projecting Year 2022 traffic based on those growth rates.

AADT Trends

Exhibit II.E.4-2 presents the AADT for each rural segment since 1985. It shows that traffic volumes along Route 13 have steadily increased over the last 10 years. The 1993 volumes range from 3,260 to 7,290 vehicles per day, with a weighted average of 5,500 vehicles per day.

Projected Rural Traffic

Based on the historic traffic trends, the year 2022 AADT was estimated for each Route 13 segment as shown on Exhibit II.E.4-3. The projected year 2022 rural traffic projections range from approximately 7,100 vehicles per day just south of Highway 2 to 20,700 vehicles per day south of Clinton. The weighted AADT over the entire corridor is approximately 12,200 vehicles per day.

Generally, when traffic on a two-lane highway segment exceeds 5,000 vehicles per day congestion begins, more frequent starts and stops occur, and the accident risk increases. Several Route 13 segments have already exceeded this traffic level and several more are quickly approaching this threshold. By the year 2022, every Route 13 segment is projected to carry more than 5,000 vehicles per day. Clearly, the existing two-lane facility cannot safely and efficiently handle those volumes of traffic.

c. Urban System Networks

The general procedure for evaluating traffic for the various alternatives included developing a baseline traffic projection for the urban areas, incorporating the rural traffic component, and modifying that projection based on the various alternative alignments. The urban traffic component was based on the traffic networks discussed in the traffic methodology section. The rural traffic component was added to allow an evaluation on a county-wide basis. Finally, the baseline traffic projections were developed for both the urban and rural segments of Route 13.

Once the baseline traffic forecasts were developed for each county, the impact each highway build alternative had on the network was estimated. The traffic impact is measured in terms of AADT along specific roadway segments, as well as the three MOEs. This section develops the baseline traffic forecasts and evaluates each alternative with respect to the three MOEs and the AADT.

d. Urban Assignments

The baseline traffic forecasts for each county were developed based on expected growth rates in both the urban and rural Route 13 segments. Section II.B "No-Build" Alternative discusses baseline conditions in both year 1992 and year 2022. The 1992 existing AADTs for each county are shown on Exhibit II.B.2-1. The Year 2022 forecasted AADTs for each county are shown on Exhibit II.B.2-2. These baseline traffic forecasts show a substantial increase in traffic over the next 30 years. The baseline MOEs for each county are shown on Exhibit II.B.2-3 for both 1992 and 2022. Likewise, each county shows substantial growth in both VKT and VHT, with a corresponding decline in average vehicle speeds.

Once the baseline traffic forecasts were developed, each alternative was independently analyzed. The addition of a new roadway creates changes in vehicle travel patterns. Commuters take different paths to work, drive-through trips avoid congested city streets by using the bypass, and the removal of drive-through trips reduces congestion on city streets. These changes can be quantitatively measured in terms of differing AADTs, VKTs, VHTs, and average speeds.

The projected AADTs for each alternative are spatially represented for Higginsville on Exhibit II.E.4-4; Warrensburg on Exhibit II.E.4-5; and Clinton on Exhibit II.E.4-6. The projected MOE's are shown in Table II.E.4-1. Each county experiences a positive change in traffic patterns for each highway build alternative.

In Lafayette County, both Alternatives A and B result in lower VKT, VHT, and improved vehicle speeds over the "No-Build" alternative. Alternative B results in lower VKT, but Alternative A reduces VHT and improves travel speeds more than Alternative B. In other words, Alternative B is the shorter of the two alternatives accounting for the VKT savings, but since Alternative B is located away from the existing alignment a larger percentage of vehicles continue to use the old road resulting in higher VHT and average speed problems.

In Johnson County, the urban far east alternatives for both Alternatives A and B result in the greatest traffic benefit. The urban west and near east alternatives provide improvement over the "No-Build," but not to the extent of the far eastern alternatives. Likewise, Alternative B tends to be slightly better than Alternative A for all of the rural options.

In Henry County, all three alternatives create substantial improvements over the "No-Build" alternative. In fact, there is relatively little difference between the three alternatives.

Table II.E.4-1
Measures of Effectiveness by Alternative
Route 13 Corridor
Year 2022

MOEs	Vehicle Kilometers (Miles) of Travel per Day	Vehicle Hours of Travel per Day	Average Speed kph (mph)
Lafayette County			
No-Build	721,870 (448,560)	12,890	56.0 (34.8)
A	**688,340 (427,340)**	**10,350**	**66.6 (41.3)**
B	651,060 (404,560)	9,960	65.3 (40.6)
Johnson County			
No-Build	2,288,860 (1,422,710)	42170	54.2 (33.7)
A West	2,331,780 (1,448,940)	39600	58.9 (36.6)
A Near East	2,335,880 (1,451,490)	39660	58.9 (36.6)
A Far East	**2,243,070 (1,393,820)**	**39360**	**57.0 (35.4)**
B West	2,313,580 (1,437,630)	39410	58.7 (36.5)
B Far East	2,228,670 (1,384,870)	39210	56.8 (35.3)
Henry County			
No-Build	1,122,540 (697,530)	24,510	45.9 (28.5)
A	**1,116,390 (693,710)**	**19,710**	**56.6 (35.2)**
A (East Option)	1,127,350 (700,520)	19,990	56.3 (35.0)
B	1,100,540 (683,860)	19,540	56.3 (35.0)
PROJECT TOTAL			
Preferred (A)	**4,047,800 (2,514,870)**	**69,420**	**58.3 (40.5)**

Source: Wilbur Smith Associates

5. Cost Effectiveness Analysis

Since four-lane highways create a more efficient method of vehicle transportation than do two-lane highways, they are an efficient and effective way of integrating regions and improving the efficiency and safety of commerce. By eliminating vehicle stops and making passing easier and safer, four-lane facilities reduce travel delay, improve safety, and increase vehicle speeds. By building bypasses around towns, through traffic trip delays are reduced, congestion on the existing road is reduced, as are vehicle operating costs. In addition, all of these improvements may divert traffic from substandard state and county roads, and this diverted traffic also benefits from the highway improvement.

Transportation efficiency is a legitimate local, state, and national goal. If a road improvement creates road user cost savings that, over time, exceed the cost of the road improvement, then that road improvement should be implemented. Therefore, travel efficiency is relevant to the funding decision for MoDOT. However, travel efficiency is only one of a number of factors to consider when making the investment decision. Other factors include system continuity, the environment, and economic development.

Complicating the investment decision is the likelihood that MoDOT seldom has sufficient funds to build every highway project that might be deemed 'feasible'. Typically, MoDOT

must select between numerous highway projects, all of which would be built if sufficient funds existed. Generally, MoDOT should select that combination of projects which, within the funding constraints, yields the greatest return on the money spent. Under this scenario, some feasible projects are deferred and, conceivably, some may not be built for many years.

a. Benefit/Cost Methodology

In this assessment of travel efficiency feasibility, a life cycle cost approach is used. The costs of building and maintaining the various alternatives over the estimated design life of the project (1992-2022) are estimated. Then, the travel efficiency gains over that same period are estimated, and compared with the costs to determine whether or not the highway improvement is economically feasible. Travel efficiency is measured in terms of vehicle operating costs saved (fuel, tires, vehicle maintenance, etc.), value of time saved, and accident reduction. All three are measured in monetary terms. Conventional benefit/cost indicators (Benefit/Cost Ratio, Net Present Value, and Internal Rate of Return) are used to gauge feasibility from the travel efficiency perspective. This section presents the results of the travel efficiency analysis for all the highway build alternatives.

To determine the relative costs and benefits, each candidate improvement alternative is compared with the "No-Build" alternative. The costs are the differences between the "No-Build" construction and maintenance costs and the improved alternatives costs. Similarly, the travel efficiency benefits are the net savings between the travelers on the existing network and the travelers with each candidate improvement alternative.

b. Travel Efficiency Costs

The cost side of the benefit/cost calculation comprises the costs to the agency that is responsible for building and maintaining the highway. Since Route 13 is a state-administered highway, the costs are those that would be incurred by MoDOT, regardless of the source of the funds. For analysis purposes, all costs are assumed to accrue in the base year 1992, except the maintenance costs which will begin in 1992 and continue through the design year 2022.

Construction and Maintenance Costs

The total construction cost for the different improvement options include right-of-way acquisition, structures, and the roadway construction. The total maintenance costs include the added cost of maintaining the additional highway, including snow removal, mowing, striping, crack sealing, patching, and other work activities. Table II.E.5-1 summarizes the total construction and maintenance costs for each alternative. To ensure that the Benefit/Cost analysis allows an equitable treatment of all three improvement options, the capital costs were all assumed to be spent in the study's initial analysis year (1992).

Table II.E.5-1
Capital and Maintenance Cost Summary
($ Thousands)

Alternatives	Lafayette County		Johnson County		Henry County	
	Capital	Maintenance*	Capital	Maintenance	Capital	Maintenance
A	95,454	22	---	---	137,320	145
B	88,907	94	---	---	134,323	166
A (East Option)	---	---	---	---	137,209	152
A West	---	---	128,257	187	---	---
A Near East	---	---	134,981	182	---	---
A Far East	---	---	132,708	196	---	---
B West	---	---	135,602	215	---	---
B Far East	---	---	128,053	212	---	---
PROJECT TOTAL						
Preferred Alternative (A)					365,480	363

**Note: Average annual maintenance cost increase (decrease)*
Source: Wilbur Smith Associates

Residual Value

By the end design year 2022 some of the highway improvements will be depreciated (used some or all of their useful life), while other elements have longer lifespans. To account for these differences, a residual value was assigned in the year 2022 as a benefit, where the residual value of the highway is the value of the remaining life of the facility. The residual lives for each improvement cost component are:

Cost Component	Useful Life
Right of Way	Infinite
Structures	60 years
Roadway	30 years

To estimate the residual values, composite residual factors were developed based on the useful lives of the various construction cost elements within each construction item. The resultant residual values for each improvement alternative are summarized on Table II.E.5-2. These are based on the capital costs, exclusive of engineering and administration costs.

c. Travel Efficiency Benefits

By investing in Route 13, MoDOT will save the traveling public time, cost, and accident risk. The travel efficiency benefits of the highway improvements are of three types: vehicle operating cost savings, accident cost savings, and value of travel time savings.

Total travel efficiency benefits were calculated for the base year (1992), as if the highway were already in place, and for the end year (2022). In each year, the benefits of each alternative were evaluated against the "No-Build" Alternative using consumer surplus techniques. The intermediate year benefits were interpolated from the base and end years.

Table II.E.5-2
Residual Value Estimates
($ Thousands)

Alternatives	Lafayette County Residual	Johnson County Residual	Henry County Residual
A	7,302	---	10,196
B	6,197	—	10,527
A (East Option)	—	—	10,474
A West	—	13,795	—
A Near East	—	14,169	—
A Far East	—	13,205	—
B West	—	13,284	—
B Far East	—	10,474	—
PROJECT TOTAL			
Preferred Alternative (A)			30,703

Source: Wilbur Smith Associates

Vehicle Operating Cost Savings

Each of the alternatives creates improved vehicle operating conditions by eliminating stopping and starting traffic. On the other hand, the average travel speed increases thereby reducing fuel efficiency. Therefore, the net vehicle operating cost savings involves the increased cost from higher travel speeds compared to the efficiency and cost savings from a constant flow of traffic.

Passenger vehicle and commercial truck operating cost savings were estimated using the Federal Highway Administration's Technical Report, "Vehicle Operating Costs, Fuel Consumption, and Pavement Type and Condition Factors; Final Report," updated to 1995 conditions. The vehicle operating cost changes reflect differences in vehicle miles of travel, travel speed changes, curvature and gradient changes, reduced number of speed change cycles, and other changes that affect vehicle operations. The estimated motor vehicle operating cost savings attributable to the alternatives are depicted on Table II.E.5-3.

Table II.E.5-3
Estimated Annual Vehicle Operating Cost Savings
($ Thousands)

	Lafayette County		Johnson County		Henry County*	
Alternatives	1992	2022	1992	2022	1992	2022
A	824	2,206	---	---	8,167	441
B	805	2,163	—	—	8,431	1,058
A (EastOption)	—	—	—	—	8,179	468
A West	—	—	608	(3,486)	—	—
A Near East	—	—	348	(3,778)	—	—
A Far East	—	—	1,428	3,179	—	—
B West	—	—	1,236	(2,205)	—	—
B Far East	—	—	2,052	4,262	—	—
PROJECT TOTAL						
Preferred Alternative (A)					10,419	5,826

**Note: Includes Route 13 Bypass Option*
Source: Wilbur Smith Associates

Travel Time Savings

All the various alternatives will increase travel speeds, thereby reducing travel time in the corridor. The alternatives will reduce delay by allowing vehicles to pass slower moving vehicles, avoid vehicles turning at major intersections, and bypassing communities with traffic signals and lower speed limits.

To include time savings in the travel efficiency evaluation it is necessary that a monetary value be placed on the time saved. The value of time varies from person to person and situation to situation. What is certain is that everyone is willing to pay something to reduce the amount of time spent in travel. For analysis purposes, the FHWA suggests that the method contained in the AASHTO publication, "A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements," be used. These values in 1992 dollars are equal to $ 8.00 for each vehicle hour saved. Applying these values of time to the estimated hours saved produces the travel time cost savings shown on Table II.E.5-4.

Table II.E.5-4
Estimated Travel Time Savings
($ Thousands)

Alternatives	Lafayette County		Johnson County		Henry County*	
	1992	2022	1992	2022	1992	2022
A	3,094	7,187	—	—	9,197	14,005
B	2,851	6,673	—	—	9,286	14,155
A (East Option)	—	—	—	—	9,00	14,003
A West	—	—	3,856	8,130	—	—
A Near East	—	—	3,761	7,293	—	—
A Far East	—	—	4,133	7,926	—	—
B West	—	—	4,086	7,929	—	—
B Far East	—	—	4,364	8,312	—	—
PROJECT TOTAL						
Preferred Alternative (A)					16,424	29,118

**Note: Includes Route 13 Bypass Option*
Source: Wilbur Smith Associates

Accident Cost Savings

A new and improved highway will have a lower accident rate than the existing two-lane highway in the corridor. Also, by skirting the communities along the route, the alternatives will reduce the number of vehicles and accidents on the existing route within those communities. A higher percentage of accidents typically occur in areas with a high percent of turning movements and stop and go traffic.

To enable the accident calculations, accident information was obtained from MoDOT for highways throughout the study region. Accidents were identified and categorized by three types: 1) fatality, 2) personal injury, and 3) property damage only (PDO). Each accident type was assigned a monetary value based on average costs developed by MoDOT. The monetary values by accident costs are:

Accident Type	Cost
Fatalities	$1,500,000
Personal Injury	$41,000
Property Damage Only	$2,000

Source: Missouri Department of Transportation

The projected number of accidents, by type, were determined for the existing corridor and for each of the build alternatives for both 1992 and 2022. The accident reductions were estimated using the difference between the respective build alternative and the "No-Build" Alternative. The accident reductions were then assigned monetary values to determine the estimated accident cost savings. Table II.E.5-5 shows the estimated accident cost savings by alternative for both 1992 and 2022.

Table II.E.5-5
Estimated Accident Cost Savings
($ Thousands)

Alternatives	Lafayette County		Johnson County		Henry County*	
	1992	2022	1992	2022	1992	2022
A	1,434	3,254	—	—	2,042	4,697
B	1,361	3,089	—	—	2,050	4,715
A (East Option)	—	—	—	—	2,041	4,694
A West	—	—	5,063	9,032	—	—
A Near East	—	—	5,041	9,222	—	—
A Far East	—	—	5,136	9,772	—	—
B West	—	—	5,114	9,347	—	—
B Far East	—	—	5,160	8,859	—	—
PROJECT TOTAL						
Preferred Alternative (A)					8,612	17,723

**Note: Includes Route 13 Bypass Option*
Source: Wilbur Smith Associates

d. Cost Effectiveness

To calculate the economic feasibility in travel efficiency terms, all costs and benefits in constant dollars were determined by year, 1992 through 2022, and then discounted back to 1992 using the FHWA recommended discount rate of seven percent. The benefits were then compared with the costs using conventional feasibility indicators.

The travel efficiency feasibility of the three candidate improvement alternatives is summarized on Table II.E.5-6. To interpret this exhibit the following rules are appropriate. A feasible project is one that has:

- A positive Net Present Value (NPV),
- An Internal Rate of Return (IRR) equal to or exceeding the discount rate (7%), and
- A Discounted Benefit Cost Ratio (B/C) of 1.0 or higher.

The higher the NPV, IRR, and B/C, the more feasible the project.

Travel efficiency is the conventional method of determining whether or not a highway improvement project is economically feasible. According to this test, a highway improvement needs to be quite successful in reducing per vehicle operating costs, travel time, and accident risk. Table II.E.5-6 suggests the following conclusions:

- All highway build alternatives provide a positive NPV, a B/C above 1.0, and an IRR greater than seven percent;
- Alternatives A and B in Lafayette County are virtually the same;
- Both the A and B far east Alternatives in Johnson County are the most feasible, with B slightly better than A.
- Alternative B in Henry County is slightly more feasible than Alternative A and A (East Option).

Table II.E.5-6
Travel Efficiency Feasibility

Alternatives	Lafayette County			Johnson County			Henry County		
	NPV*	IRR*	B/C*	NPV*	IRR*	B/C*	NPV*	IRR*	B/C*
A	**9,356**	**8%**	**1.10**	—	—	—	**121,033**	**16%**	**1.88**
B	8,567	8%	1.10	—	—	—	130,522	17%	1.97
A (East Option)	—	—	—	—	—	—	121,306	16%	1.88
A West	—	—	—	17,120	8%	1.13	—	—	—
A Near East	—	—	—	2,967	7%	1.02	—	—	—
A Far East	—	—	—	**54,803**	**11%**	**1.41**	—	—	—
B West	—	—	—	23,693	9%	1.17	—	—	—
B Far East	—	—	—	69,226	12%	1.53	—	—	—

**NPV-Net Present Value*
IRR-Internal Rate of Return
B/C-Benefit-Cost Ratio
Source: Wilbur Smith Associates

6. Evaluation of Retained Alternatives

a. Evaluation Methodology

The detailed evaluation of retained alternatives utilized a methodology similar to that used in the initial screening. The major difference was in the level of detail that was used. The evaluation factors and units are shown in Table II.E.6-1.

Table II.E.6-1
Evaluation Factors

Factor	Units
ENGINEERING	
Alignment Length	Kilometers (miles)
Project Cost	
Construction	$
Right of Way	$
Total Project Cost	$
Compatibility with Staged Construction	Rating
TRAFFIC	
Projected Traffic, Year 2022	
Vehicle Miles of Travel Reduced	Kilometers (miles)/Year
Vehicle Hours of Travel Reduced	Hours/Day
Projected Reduction in Accidents, Year 2022	
Fatal Accidents	Number
Personal Injury Accidents	Number
Property Damage Only Accidents	Number
ECONOMIC	
Displacements	
Permanent Residence (By Class)	Number
Mobile Homes (By Class)	Number
Business (By Class)	
Commercial	Number
Agricultural (Parcels/Acres)	Number/Hectares (acres)
Public Use Facility	Number
Consistency w/ Current and Future Land Use	Rating
Economic Considerations	
Highway User Cost Savings	$ Million
Economic Development Potential	$ Million
Removal of Farmland from Production	$ Million
Benefit to Cost Ratio	Ratio
ENVIRONMENTAL	
Parks and Wildlife Areas	Number
Wetlands Area	Number
Flood Plains (100 Year)	Hectares (acres)
Major Stream Crossings	Length
Threatened and Endangered Species	Number
Natural Communities (Woodlands, etc.)	Number
Prime Farmland Soils	Hectares (acres)
Visual and Aesthetic Considerations	Rating
Noise Sensitive Receptors	Number
Cultural Resources	
Archeological Sites	Number
Predictive Archeological Model	Rating
Architectural Sites/Bridges	Number
Hazardous Waste Sites	
High Potential Sites	Number
Moderate Potential Sites	Number

In order to keep the combinations of links to a manageable number, basic alignments were defined for each county. These combinations of links into alignments included all reasonable routings using the retained alignments from the initial screening. The definition of alignments, using link numbers, is given in Table B1 shown in Appendix B.

These link combinations define ten alignments in Lafayette County, eleven in Johnson County, and twelve in Henry County.

In addition to the basic alignments in each county, one additional alignment was retained. This alignment represents the staged construction of the alternative adjacent to existing Route 13. This alternative uses existing Route 13 as two lanes for one direction of travel in the first stage of the project. Initial cost savings can be attributed to this staged alternative.

Quantifiable factors such as costs were entered directly into a segment summary table. For those factors that were not quantifiable, the study team professional with the most knowledge of the particular factor was asked to rank all alignments from best (1) to least desirable (10, 11, or 12 depending on county). The alignments were ranked for each factor and a sum of rankings was made to determine the desirability of each alignment. No attempt was made to establish a weight for each factor, thus, threatened and endangered species was equally as important as total project costs or wetlands. Although all of the retained alternatives were studied to the same degree of detail, only the Preferred Alternative is shown in detail on the plan plates in Appendix C.

b. Results of Evaluation Process

The detailed evaluation summary tables for each county are presented in Appendix B. A discussion of the results of the evaluation is presented by county in the following section of this report. Refer to Appendix B for link numbers and alignment letter and number designations.

Because of the joint NEPA/CWA merged review process, a single factor of primary importance is the degree of wetland impact. The Clean Water Act Section 404(b)(1) Guidelines require that the alternative of least wetland impact be used unless the applicant can demonstrate that the least wetland impact alternative would have other significant adverse environmental consequences. Thus, the alternative of least negative overall impact must be qualified by the alternative of least wetland impact.

Exhibit II.E.6-1 illustrates the alternative links used in the evaluation and Exhibit II.F.4-1 illustrates the results of the evaluation.

Lafayette County

In Lafayette County, the alternative of least impact was Alternative L1, which is located principally on new alignment approximately 2.41 kilometers (1.5 miles) west of existing Route 13. This alignment is also the alternative with least wetland impact. Alternative L1 exhibited the least impacts in all three major categories of engineering, environmental and economic (EEE).

Alternative L2 was second in the ranking of least negative impacts and was found to rank second in all three major EEE categories.

Alternative L11 (the initial construction stage of L2) was also ranked as having relatively low negative impacts on the three EEE's.

For Alternative L1, the interchange type selected for use at I-70 was a clover-leaf interchange. This type of interchange will require the greatest amount of right-of-way for

construction. Subsequent design studies may find a different type of interchange to be best suited for this location.

On Alternative L2, a comparison of several interchange types was made. These were:

- An improvement to the existing I-70/Route 13 interchange;
- A flyover of I-70 to the east of Route 13;
- A flyover of I-70 to the west of Route 13;
- A new folded diamond east of Route 13;
- A new folded diamond west of Route 13;
- A normal diamond located on an easterly relocation of Route 13; and
- A clover-leaf type interchange at the existing I-70/Route 13 interchange location.

A comparative analysis of all seven interchange types was made using factors such as construction costs, right-of-way costs, travel time delay, and traffic service. A benefit/cost comparison was made which divided the yearly benefits derived from reduced delay by the yearly amortized cost of initial construction. The greatest benefit from alternatives consistent with the design criteria was derived from the east and west flyover concepts that utilized the existing interchange to serve turning movements. Of these two interchanges, the east flyover was preferred because of lesser impacts on existing commercial development.

Summary - In Lafayette County, two alignments were retained for presentation at the Location Public Hearing: 1) the alternative on new alignment (L1) west of existing Route 13, and 2) the alternative adjacent to existing Route 13 (L2). Both retained alternatives bypass Higginsville on the west. The easterly flyover of I-70 at existing Route 13 was selected as the most beneficial interchange location for Alternative L2.

Johnson County

In Johnson County, two methods of evaluation were used. The first looked at the County as a whole and the second method looked at the aggregate of the Warrensburg Urban area linked to a rural segment north of Warrensburg and a rural segment south of the City. The identification of the two retained alternatives was a composite of the two methods.

Method 1 (Johnson County as a whole) - Reference to the evaluation summary table in Appendix B (Table B3) indicates that Alternative J8 exhibits the least negative impacts. This alignment uses existing Route 13 north of Warrensburg, the far east bypass of the City, and the new location east of Route 13 south of Warrensburg. Alternative J6 has the least wetland impact while J8 exhibits the second least impact on wetlands. Alternatives J6 and J8 are the same to a point south of the crossing of the Blackwater River.

The second and third most beneficial alternates are J10 and J11, respectively. A commonality of all three alternatives (J8, J10, and J11) is that they all use the far east bypass of Warrensburg. Only J8 minimizes impacts on wetlands.

Method 2 (Urban section plus two rural sections) - In order to more closely analyze the urban portion of the County, a separate impact summation was made for five alternative bypass routings around the city (Appendix B, Table B4). The only useful conclusions that can be drawn from this compilation of data is that the west bypass location is considered the least desirable routing because of impacts on both the social and natural environment. The near and far east alternatives were retained for further study. Based on network considerations and local sentiment, the western bypass was also retained for further documentation.

A sub-segment analysis in the rural portion of Johnson County north of Warrensburg indicated that the link E4, a new alignment parallel to and 460 meters (1,500 feet) west of Route 13, was the most beneficial location, along with the existing Route 13 as the second best location.

A sub-segment analysis south of Warrensburg indicated that links G4 and G10, an alignment on new location parallel to and 805 meters (2,640 feet) east of existing Route 13 was the most beneficial overall and had the least impact on wetlands.

Summary - Based on a combination of the two summation methods described above, the retained alignments in Johnson County include:

- Rural North - A new alignment immediately west of Route 13 along with the alignment adjacent to Route 13;
- Urban Warrensburg - The western, near east and far east bypass alternatives; and
- Rural South - The new alignment immediately east of Route 13 along with the adjacent routing.

Henry County

Two separate but related projects were studied in the Clinton area, the north-south location for Route 13 and the east-west future relocation of Route 7. Although these two projects are interrelated and use common routing east of Clinton, they will be discussed separately.

Route 13 - Three easterly north-south bypass locations were carried forward from the initial screening process. These three urban locations coupled with four basic rural section locations north of Clinton produced twelve Route 13 alignment locations in Henry County. Refer to alignment layouts in Appendix B (Exhibit B3 and Table B5).

The three alternatives found to have the least negative impacts were H5, H8 and H11. An inspection of these three routings indicate that the middle east bypass of Clinton was common to all three alignments. Based on this finding, the middle eastern bypass location was selected as the preferred routing around Clinton.

In the rural area north of Clinton, Alternatives H5 and H8 are similar and differ only in the placement of the short sections of new alignment either east or west of existing Route 13. For presentation at the Location Public Hearing, these two alignments were combined and represented by the alignment adjacent to Route 13. In this location, a

short section of new alignment replaces the geometrically deficient section of existing Route 13 3.2 kilometers (two miles) north of Quarles.

Route 7 - The future relocation of Route 7 will pass around the northern and eastern sides of Clinton due to environmental and topographical restrictions on the western and southern sides of the city. Refer to discussions in Section II.E.3. The north-south routing of Route 7 east of Clinton is coincident with the Route 13 routing as described in the previous discussion. Thus, the evaluation of Route 7 alternatives was applicable to only the east-west routing.

Two basic locations were identified, either 0.8 kilometers (0.5 mile) or 1.61 kilometers (1.0 mile) north of the existing Route 7 location. These two alignments either extended westerly to intersect the diagonal routing of existing Route 7 or passed diagonally northeast/southwest at the northwest corporate limits of Clinton to reach existing Route 7 by circumventing the ecologically sensitive abandoned strip mine area northwest of Clinton. Refer to Appendix B for routing. The combination of these routings established five different alignments for evaluation.

Through the evaluation process, the three east-west alignments (S1, S2, and S3) were deleted due to unacceptable impacts on wetlands and mined lands. The two remaining alternatives used the northeast/southwest diagonal location to tie back to existing Route 7 approximately 1.61 kilometers (1.0 mile) west of the west corporate limits of Clinton. These two alignments were very similar in impacts with one exception. The alignment closest to Route 7 (S5) would displace thirty permanent and mobile residences compared to six for alignment S4, 1.61 kilometers (one mile) north of Route 7. Alignment S4 exhibited four distinct advantages over S3: 1) 24 fewer residential displacements, 2) better interchange spacing, 3) provided more area for development on the city side of the bypass, and 4) was endorsed by the City's Economic Development Commission. Alignment S4 was retained as the preferred location for the future routing of Route 7.

F. SUMMARY OF REASONABLE ALTERNATIVES

1. "No-Build" Alternative

The No-Build condition can be defined to include those improvements that can reasonably be expected to occur during the design period as described in II.B.1.

Even with the assumed improvements, the No-Build Alternative is not consistent with the purpose and need of the project, does not accomplish the mission of the MHTC, and will not serve the future traffic service and access needs of the motoring public. Therefore, the No-Build alternative was not retained for further consideration.

2. TSM Alternative

Transportation Systems Management measures are routinely considered in any new highway construction project. Some aspects of TSM are applicable to new construction and some are remedial measures applicable to overloaded existing facilities. Where

applicable, TSM measures will be incorporated into all the "build" alternatives. The selection of the applicable TSM measures is a function of final design of the roadway.

3. Improvement to the Existing Facility

By definition, the improvement to the existing facility would include some or all of the conditions described in II.F.1 and II.F.2, above. As discussed in the purpose and need section, improvements to the existing facility, such as climbing lanes, turning lanes, limited access control and other traffic management measures does not eliminate the existing design criteria deficiency of horizontal and vertical geometrics. To improve safety of Route 13 in place would require a total rebuild to over 80 percent of the facility. The only practical way to accomplish this end is to retain existing Route 13 for maintenance of traffic during the building of a new facility either adjacent to Route 13 or on new alignment. Improvement to the existing facility is not retained as a viable alternative.

4. Highway Build Alternatives

The assessment of the Social, Economic and Environmental impacts of the highway build alternatives was based on the ultimate four-lane improvement. The Build Alternatives include the following conditions:

- An expressway/freeway alternative adjacent to existing Route 13 in all places except where bypasses are needed around cities or where the existing Route 13 horizontal geometrics are so severe that a localized alignment relocation is required. This alternative is referred to as Alignment A.

- Any alternative that is placed adjacent to existing Route 13 may be stage constructed by buying ultimate right-of-way, but building only one direction of the ultimate roadway. Thus the alternative adjacent to Route 13, for analysis purposes, will have an interim stage and an ultimate condition. This will directly affect some factors such as construction costs but will have no effect on other factors that are right-of-way dependent such as threatened and endangered species or hazardous waste sites.

- An expressway/freeway alternative essentially on new alignment. This alternative is labeled Alternative B.

The alternative on new alignment, Alignment B, may also be located adjacent to Route 13 for short sections. If an adjacent routing occurs for more than five miles (a "significant" opportunity for staging) then it will also have an interim staging and an ultimate condition (two cost summations).

Exhibit II.F.4.-1 illustrates the location of the build alternatives that are discussed in the impacts section of this FEIS. Appendix C presents the preferred alternative in plan view at a scale of 1:12,000 (1 inch = 1,000 feet).

5. Preferred Alternative

Based on the initial cost savings achieved by building only two new traffic lanes, the staged construction of Alignment A is the preferred solution in all rural sections of the

study area. Those sections of Alignment A on new location will be constructed in the ultimate configuration initially.

As a result of the evaluations for the DEIS, comments received at the location public hearing and study team deliberations that occurred after the public hearing, the preferred Alternative A presented in this document is:

- ***Lafayette County*** - Alternative L2-Modified at I-70 (Links A4-A15-A16-A17-B4-B12-B21-D4-C5-C12-C17).
- ***Johnson County*** - Alternative J7-Modified (Links E5-E12-E13-F41-F38-F28-F42-G3-G6-G11-G12).
- ***Henry County*** - Alternative H5-Modified (Links H2-H15-H12-I2-I7-I16-I18-I21-I24).
- ***Route 7*** - Alternative S4 (Links J7-J8-J2B).

Refer to Exhibit II.E.6-1 for link locations.

In Higginsville, Alignment A uses the near west bypass location. Diamond interchanges for local access are proposed to be constructed in stages at North Business Route 13, Route FF, and Route MM. These intersections may operate at-grade initially until traffic volumes warrant a separation interchange.

In Warrensburg, the far eastern bypass was selected as the preferred routing based on the summary of statistical data and public input.

Three interchange locations are planned in Warrensburg. A cloverleaf interchange at US 50 is proposed for the far east alternative. Diamond interchanges are to be used at Montserrat Road and Route DD.

In Clinton, the middle east location for the north-south section of Routes 7 and 13 was preferred based on the statistical data. On the relocated Route 7, the northernmost alignment was considered preferable to the closer-in location.

6. Interchange Locations

Table II.F.6-1 lists interchange locations on the preferred alternative for both initial construction and locations that will be constructed at a later date. All interchanges to be constructed in the future will be justified by increased traffic volumes and based on criteria contained in the MoDOT Design Manual.

All interchange types will be normal diamonds except as noted in the table. The Diamond/Directional type interchange will use directional ramps for movements from/to the existing Route 13 in those areas where the preferred alternative leaves a position of adjacency to the existing route. The final interchange configuration will be established in final design. Impact assessment is based on interchange type selection as listed in Table II.F.6-1 and shown in Appendix C.

In those areas where the interchange is expected to be warranted in the future, right-of-way for the interchange will be purchased initially. Until the time that the interchange is warranted by growth in traffic volumes, an at-grade (surface) intersection will be used for local access. Stop signs on the cross-road will be used for traffic control.

Table II.F.6-1
Interchange Locations on Preferred Alternative

Location	Type	Staging		Remarks
		Initial	Future	
LAFAYETTE CO.				
• U.S. 24	Folded Diamond	√		Complete 2nd Stage
• Business Route 13	Diamond		√	Connection to Bus. 13
• Route FF	Diamond		√	
• Route MM	Diamond		√	Connection to Bus. 13
• Interstate Route 70	Bypass		√	Through Bypass with Existing Diamond
-Connect to Rt 13 No	Diamond/Directional		√	North Tie to Exist. 13
-Connect to Rt 13 So	Diamond/Directional		√	South Tie to Exist. 13
JOHNSON CO.				
• Business Route 13	Diamond/Directional	√		Diverge from Exist. 13
• U.S. Route 50	Cloverleaf	√		
• Montserrat (E-Div)Rd	Diamond	√		
• Route DD	Diamond	√		
• Business Route 13	Diamond/Directional	√		Converge W/ Exist. 13
• Missouri Route 2	Diamond		√	
HENRY CO.				
• Business Route 13	Diamond/Directional	√		Diverge from Exist. 13
• Mo. Route 7 Reloc.	Diamond/Directional		√	Converge W/ Reloc. 13
• Missouri Route 52	Folded Diamond	√		All on So. Side M-52
• Mo. Route 7 Exist.	Diamond	√		
• Business Route 13	Diamond/Directional	√		Converge W/ Exist. 13
ROUTE 7 RELOC.				
• Business Route 7	Diamond/Directional		√	Diverge from Exist. 7
• County Rte. NW 221	Diamond		√	
• Business Route 13	Folded Diamond		√	All on West Side M-13

G. AREAS OF CHANGE FROM DEIS AS A RESULT OF LOCATION PUBLIC HEARING

As a result of public input at the Location Public Hearing and subsequent design activities in cultural resource and wetland analysis, nine areas of localized change has occurred to the preferred alignment (Alternative A) since the DEIS was circulated for review. In each case, the Design Team analyzed the various impacts of these localized alignment shifts and found that the alignment shifts did not create any unacceptable impacts.

These nine areas of change have been incorporated into the plan plates shown in Appendix C and are a part of revised estimates of costs. Exhibit II.G-1 shows the new

Preferred Alternative and serves as an index of the areas of change within the corridor and Exhibit II.G-2 illustrates each area of change.

1. Area 1 - Shift of Alignment to miss Baker House

As a result of a detailed study of all historically significant structures, it was determined that a house, south of County Road 107 between County Roads 108 and 112, was a potential candidate for inclusion on the National Register of Historic Places (NRHP). This house is referred to herein as the Baker House.

As a matter of policy, if it is possible to shift the proposed alignment to miss a NRHP eligible structure without creating other more significant impacts, this course of action should be followed. In the case of the Baker House, the alignment for relocated Route 13 was shifted approximately 1,000 feet to the east creating one additional horizontal curve. The shift in alignment was controlled to some degree by the location of wetlands south and east of the Baker House.

No significant additional impacts occur as a result of this alignment shift.

2. Area 2 - Shift of Alignment to miss Moore House

In a similar situation to Area 1, the result of the historic structure inventory indicated a potential candidate for inclusion on the NRHP on the north side of Route 13 at the intersection of County Road 121. This structure is referred to herein as the Moore House.

The location of the new roadway was originally planned to be on the north side of the existing Route 13 in this area. In order to miss the Moore House, the new location was shifted to the south side of the existing Route 13 in the local area of the Moore House. The alignment shift introduces one additional horizontal curve in the new alignment.

No significant additional impacts occur as a result of this alignment shift.

3. Area 3 - Improve Alignment in Area of Route FF Interchange to Reduce Impacts

The alignment presented in the DEIS for the section of the Higginsville bypass immediately west of the City displaced three residences. By moving the centerline of the roadway 125 feet east and rotating the direction (bearing) of the alignment counterclockwise seven degrees at the crossing point of Route FF, the three residences can be avoided.

The benefits of this slight shift in alignment can be summarized as:

- Eliminates three residential displacements
- Slightly shorter
- Impacts fewer wetland and prime farmland acres
- Has a lower probability of impacting archeological sites, and
- Minimizes severances

No significant additional impacts occur as a result of this alignment shift and rotation.

4. Area 4 - Shift of Alignment to avoid Burchett House

As with Areas 1 and 2, the alignment has been moved to avoid impacting a historic resource. The alignment was shifted from the east side of existing Route 13 to the west side at the intersection with Route YY to avoid the taking of a residence that is considered by the Study Team to be eligible for inclusion on the NRHP. The structure is referred to herein as the Burchett House.

The shift of alignment to the west side of Route 13 will place the new roadway immediately adjacent to the east side of an abandoned missile site. The impacts of a possible contaminated soil cleanup adjacent to the missile site is considered to be less than the detrimental impacts associated with the acquisition of a possible historic resource.

No other adverse impacts are known to occur as a result of this alignment shift.

5. Consideration of Alternatives North of Warrensburg

The City of Warrensburg requested moving the proposed location of Route 13 closer to the City, preferably south of the Blackwater River, to be more compatible with the City's plans of economic development.

In an effort to respond to this request, the Study Team prepared three alternative alignments. One alternative was located south of the river while the other two were immediately north of the river.

After a detailed review of the three alternatives, the Study Team determined that none of these alternatives were acceptable due to impacts on jurisdictional wetlands, floodplains, cultural resources, economic development potential, compatibility with stages construction, and roadway horizontal alignment.

This evaluation was presented to the Citizens Advisory Council (CAC) at an informational meeting held on March 11, 1996. During the meeting two additional alignment variations were suggested. The Study Team agreed to include these two new variations in the evaluation.

The two new alignments were evaluated along with the four previous alternatives (the three new alignments, and the preferred alignment shown in the DEIS) using the same 21 factors as were used previously. Based on a ranking of the six alternatives using engineering, natural environmental, and socioeconomic factors, the DEIS alignment was ranked as having the best balance of transportation benefits to environmental impacts.

As a result of this extended evaluation of six alternatives on the north side of Warrensburg, the DEIS Preferred Alignment (Alternative A) is retained as the alignment included in this Final Environmental Impact Statement (FEIS).

6. Area 5 - Move Alignment Closer to the City, South of Warrensburg

In their response to our request for comments at the Location Public Hearing, the City of Warrensburg requested moving the proposed location of Route 13 closer to the city to be more compatible with the City's plans for future land use and economic development.

The study team identified three basic alignments (Alternatives A, B and C) that responded to the City's request. These alternatives were presented and discussed at the March 11th CAC meeting. Subsequent to the CAC Meeting, an Ad-Hoc committee representing the City of Warrensburg and the Chamber of Commerce prepared a joint resolution supporting the relocation of the south diversion point of the bypass from existing Route 13 to the location represented by either Alternative A or B.

In an effort to further minimize impacts to wetlands, parcel severances and public use facilities, the Study Team considered a fourth alternative which was essentially a slight southerly shift of Alternative B. This alignment was referred to as Alternative B-Modified.

The same methodology was used to evaluate all alignments and represented the composite effects of 21 evaluation factors. When the factor rankings are summed for each alternative, the results indicate a preference for Alternative B-Modified.

Some of the advantages of the selection of "B-Modified" compared to the other alternative are:

- Along with Alternatives A and B, uses the greatest length of existing Route 13 for reduced initial costs of staged construction, a savings of 7.7% compared to the DEIS alignment.
- Has the lowest finalized cost of alternatives A through C and is only 2.6% greater than the DEIS alignment over comparable segment distances.
- Reduces segment wetland impacts by two acres (46 acres for B-Modified compared to 48 acres for the DEIS baseline condition).
- Creates less impact on prime farmland soils.
- Impacts only one more cultural resource site (historical structure) than does the DEIA alignment (Note: This structure is not considered to be eligible for the National Register).
- Requires acquisition of only one of the two churches west of Route 13, north of "Y" Highway.
- Requires only one farm severance, although Alternative B-Modified will require partial takings from 35 parcels.
- Will enhance economic development by placing the divergence from existing Route 13 as close to the developed portion of South Warrensburg as is practical.

It is the collective opinion of the Study Team that Alternative B-Modified should be used as the preferred alignment in the FEIS.

7. Area 6 - Shift to Reduce Impacts on Farmstead

In the DEIS, an alignment shift, from the east side of Route 13 to the west side, was shown to occur south of County Road 860 in Johnson County. This shift involved the acquisition of a residence and other farm buildings, one of which was a barn that is over 100 years old. After a more detailed review, it became apparent that a slight northerly shift in this cross-over would eliminate the need to acquire these buildings.

This alignment shift does not create any additional impacts and will involve no additional landowners.

8. Area 7 - Improve Interchange Position at Route 2

As a result of comments received at the Location Public Hearing, the Study Team reconsidered the placement of the intersection of Relocated Route 13 with Missouri Route 2. This intersection is the site of a future interchange when warranted by traffic demand.

The DEIS alternative crossed Route 2 at an acute angle which created concern about the possible lack of sight distance. Also, the terrain is hilly in this location. Displacements and disturbances to springs, well, and wildlife are also possible impacts of the DEIS alternative in this location. The public comments suggested extending the expressway south past Route 2 and then rejoining existing Route 13.

A study was conducted in this area to determine if there was a more feasible alternative to the preferred. This study also included severances as an evaluation factor. Two alternatives (Alternative A and Alternative B) were compared to the DEIS alternative between County Road 1000 in Johnson County and County Road NE 1230 in Henry County.

Alternatives A and B require the conversion of a forty-nine and fifty-two, respectively, more acres of prime farmland soils than the DEIS alignment. Alternative A impacts the same wetland acreage as the DEIS alignment, while Alternative B impacts two more acres. Likewise, Alternative A has about the same probability of impacting archeological sites at the DEIS alignment, while Alternative B has a higher probability.

With the exception of number of parcels affected, the engineering and economic impacts are less for the two alternatives than the DEIS Alignment. Each displaces two fewer residences and severs fewer parcels (Alternative A severs one less and Alternative B, three less). Alternatives A and B are also shorter and less expensive.

There are obvious advantages to adjusting the Preferred Alternative in this area. Of the two alternatives studied, Alternative A is superior to Alternative B. It impacts fewer wetlands and farmland acreage. Since it parallels existing Route 13 for one more mile than Alternative B, Alternative A would be lower cost initially since it can utilize staged construction for a greater percentage of its length.

The DEIS Alignment was adjusted to utilize the Alternative A location. It will continue south through the intersection with Route 2 and then curve southwest to

the Chicago, Rock Island and Pacific Railroad tracks where it will turn south and parallel existing Route 13. Alternative A is used in the FEIS.

9. Area 8 - Shift to Avoid Farmstead

The alignment used in the DEIS parallels existing Route 13 on the east side in the area just south of Quarles in Henry County. A diagonal is shown in the DEIS to provide a section line connection but still remaining on the east side of existing Route 13. The southern end of this diagonal displaces several farm buildings. By moving this short diagonal to the north, the displacement of these buildings can be avoided. The northerly shift of this diagonal will not effect any additional landowners.

No significant adverse impact occurs as a result of this change.

10. Area 9 - Revise Interchange Layout to Reduce Impacts

The DEIS illustrated a normal rural diamond interchange to be used at the intersection of Relocated Route 13 and Missouri Route 7 east of Clinton. The northbound exit ramp to Route 7 would be located in close proximity to farm building which are part of the Poague Homestead.

In order to minimize these proximity impacts, the northbound exit ramp was redesigned as a loop (folded ramp) in the northeast quadrant of the interchange. This change will require a slightly greater land acquisition in the northeast quadrant, but no residential buildings are involved. No additional parcels are affected. The ramps on the west side of relocated Route 13 would remain as shown in the DEIS.

No additional adverse impacts are expected as a result of this change.

H. CONSTRUCTION COST SUMMARY

Table II.H-1 is presented herein to summarize construction, right-of-way, and total costs on both a county basis and for individual construction projects. The two options summarized in the table are:

- Alignment A - Placed adjacent to existing Route 13 in all places except where new alignment is used to bypass urban areas or to improve horizontal geometrics, and
- Alignment A (Initial Construction) - The first phase of implementation of Alignment A in which two directional pavement lanes are placed in the full width of new right-of-way while using the existing Route 13 pavement as two traveled lanes in the opposite direction. Some sections of new four lane highway are used in this option.

A review of Tables II.H-1 and 2 reveals the following observations:

- The cost in millions of dollars per kilometer (mile) for the total build option is $3.000 ($4.829).
- If the construction is staged to use existing Route 13 in the initial stage, a 20% reduction in first cost is realized.
- The cost per length of the Route 7 relocation is similar to Route 13.

Table II.H-1
Summary of Construction Costs - By Project

LAFAYETTE COUNTY	Staged	Ultimate
J4P1103: Rte. 24 to Co. Rd. 113 (Exist. Rte. 13) 4.99 km (3.1 mi.)		
Grading & Drainage	$ 4,210,000	$ 4,323,000
Base & Surface	4,073,000	5,441,000
Bridges	0	0
Miscellaneous	1,489,000	1,744,000
Sub-Total	**$9,772,000**	**$11,508,000**
J4P1104: Co. Rd. 113 (Exist. Rte. 13) to Rte. FF 10.8 km (6.7 mi.)		
Grading & Drainage	$ 9,100,000	$ 9,343,000
Base & Surface	8,803,000	11,759,000
Bridges	1,150,000	1,750,000
Miscellaneous	3,218,000	3,770,000
Sub-Total	**$22,271,000**	**$26,622,000**
J4P1105: Rte. FF to Johnson County Line 16.4km (10.2 mi.)		
Grading & Drainage	$10,865,000	$11,156,000
Base & Surface	10,511,000	14,041,000
Bridges	3,150,000	4,943,000
Miscellaneous	3,843,000	4,501,000
I-70 Interchange		14,690,000
Sub-Total	**$28,369,000**	**$49,331,000**
Lafayette County Total	**$60,412,000**	**$87,461,000**

JOHNSON COUNTY	Staged	Ultimate
J4P1106: Lafayette County Line to Rte. V 11.9km (7.4 mi.)		
Grading & Drainage	$11,698,000	$13,043,000
Base & Surface	9,804,000	13,005,000
Bridges	0	0
Miscellaneous	5,313,000	6,097,000
Sub-Total	**$26,815,000**	**$32,145,000**
J4P1138: Rte. V to 0.4 mi. north of Rte. Y 18.5 km (11.5 mi.)		
Grading & Drainage	$18,180,000	$20,269,000
Base & Surface	15,236,000	20,211,000
Bridges	15,850,000	15,850,000
Miscellaneous	8,256,000	9,474,000
Sub-Total	**$57,522,000**	**$65,804,000**

J4P1139: 0.4 mi. north of Rte. Y to the Henry County Line 13.5 km (8.4 mi.)		
Grading & Drainage	$13,279,000	$14,805,000
Base & Surface	11,129,000	14,763,000
Bridges	1,400,000	2,000,000
Miscellaneous	6,030,000	6,920,000
Sub-Total	**$31,838,000**	**$38,488,000**
Johnson County Total	**$116,175,000**	**$136,437,000**

HENRY COUNTY	Staged	Ultimate
J4P1117: Johnson Co. line to 1.6 mi. north of Clinton 16.7km (10.4 mi.)		
Grading & Drainage	$11,619,000	$13,879,000
Base & Surface	13,833,000	17,602,000
Bridges	0	0
Miscellaneous	4,801,000	5,841,000
Sub-Total	**$30,253,000**	**$37,322,000**
J4P1120: 1.6 mi. north of Clinton to 0.4 mi. south of Clinton 11.4km (7.1 mi.)		
Grading & Drainage	$ 7,932,000	$ 9,475,000
Base & Surface	9,444,000	12,017,000
Bridges	5,842,000	5,842,000
Miscellaneous	3,277,000	3,987,000
Sub-Total	**$26,495,000**	**$31,321,000**
Henry County Route 13 Total	**$56,748,000**	**$68,643,000**
HENRY COUNTY ROUTE 7		
J4P1119: 1.2 mi. west of Clinton to 0.4 mi. east of Clinton 7.1km (4.4 mi.)		
Grading & Drainage		$ 6,801,000
Base & Surface		8,015,000
Bridges		3,473,000
Miscellaneous		2,832,000
Total		**$21,121,000**

Table II.H-2
Generalized Cost Summary of Retained Alternatives

	Construction	R.O.W.	Total	Length		Cost Per Unit Length	
				Km	(Mile)	Kilometer	(Mile)
Lafayette County							
Alignment A	$87,461,000	$4,391,200	$91, 852,200	32.19	(20.00)	$2,853,400	($4,592,600)
Alignment A - Initial Construction (L11)	$60, 412,000	$4,583,600	$64,995,600	32.19	(20.00)	$2,019,100	($3,249,800)
Johnson County							
Alignment A	$136,437,000	$9,247,100	$145,684,100	43.90	(27.28)	$3,318,500	($5,340,300)
Alignment A - Initial Construction	$116,175,000	$9,247,100	$125,422,100	43.90	(27.28)	$2,857,000	($4,597,600)
Henry County							
Alignment A	$68,643,000	$3,232,700	$71,875,700	28.10	(17.46)	$2,557,900	($4,116,600)
Alignment A - Initial Construction (H13)	$56,748,000	$2,609,300	$59,357,300	28.10	(17.46)	$2,112,400	($3,399,600)
Total Route 13 Costs							
Alignment A	$292,541,000	$16,871,000	$309, 412,000	104.19	(64.74)	$2,969,700	($4,779,300)
Alignment A - Initial Construction	$233,335,000	$16,440,000	$249,775,000	104.19	(64.74)	$2,397,300	($3,858,100)
Route 7 Total Costs							
Alignment S4 (Links J7, J8 and J2B)	$21,121,000	$1,246,900	$22,367,900	11.4	(7.1)	$1,962,100	($3,150,400)

I. REFERENCES

American Association of State Highway and Transportation Officials, "A Manual on User Benefit Analysis of Highway and Bus Transit Improvements," Washington, D.C. 20001, 1977.

American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, Washington, D.C. 20001, 1990.

Institute of Transportation Engineers, "A Toolbox for Alleviating Traffic Congestion," Washington, D.C. 20024, 1989.

Missouri Highway and Transportation Department, Division of Planning, "Highway Right of Way and Construction Program," Jefferson City, Missouri, 1994.

Missouri Highway and Transportation Department, "Policy Procedure and Design Manual," Division of Surveys and Plans, Jefferson City, Missouri, September 1970.

Transportation Research Board, "Transportation System Management, Special Report 172," National Academy of Sciences, Washington, D.C., 1977.

Zaniewski, J.P., "Vehicle Operating Costs, Fuel Consumption and Pavement Type and Condition Factors; Final Report," Texas Research and Development Foundation, Austin, Texas, June 1982.

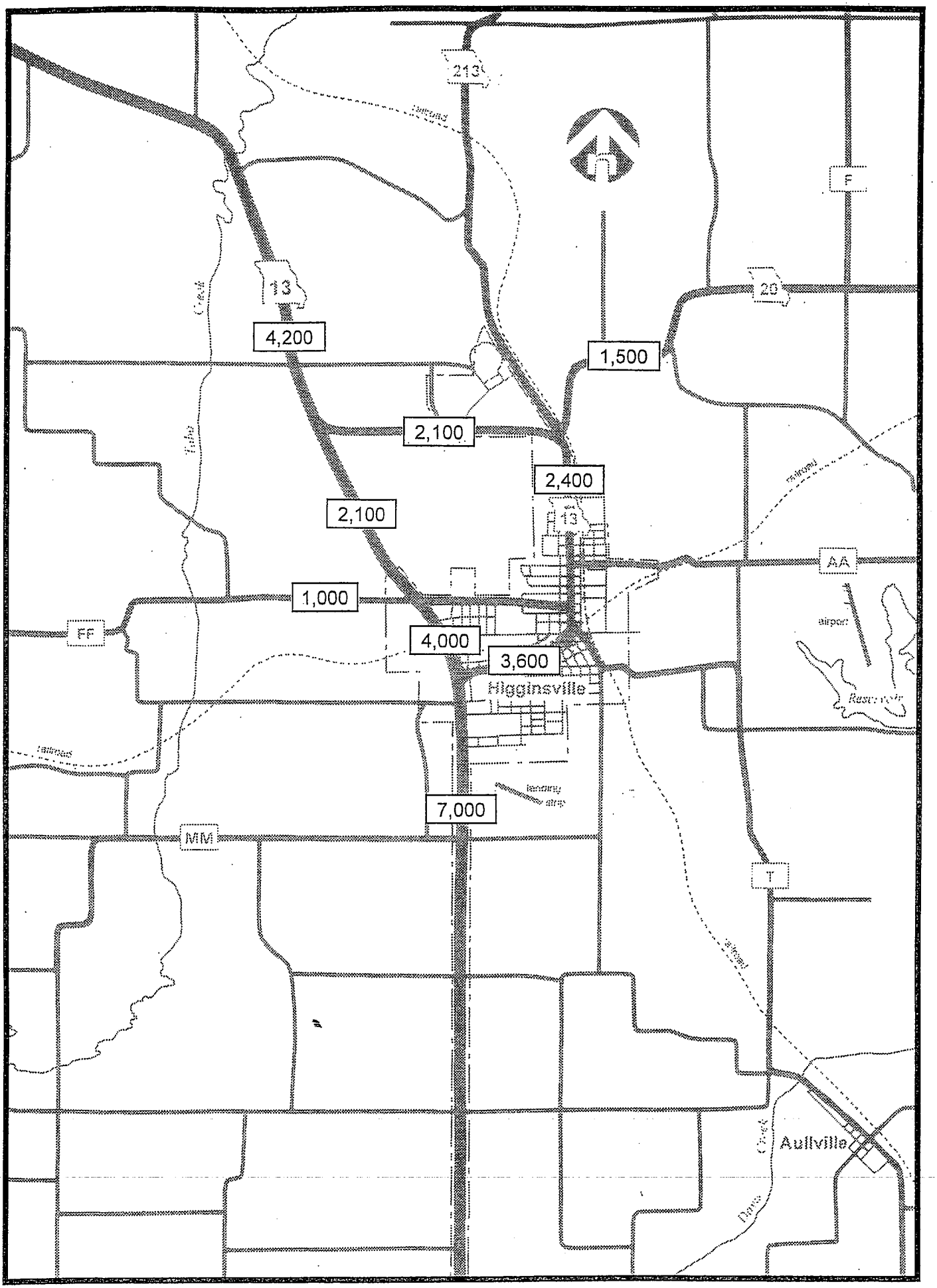


EXHIBIT II.B.2-1 Year 1992 Average Annual Daily Traffic - Higginsville

"No-Action" Alternative

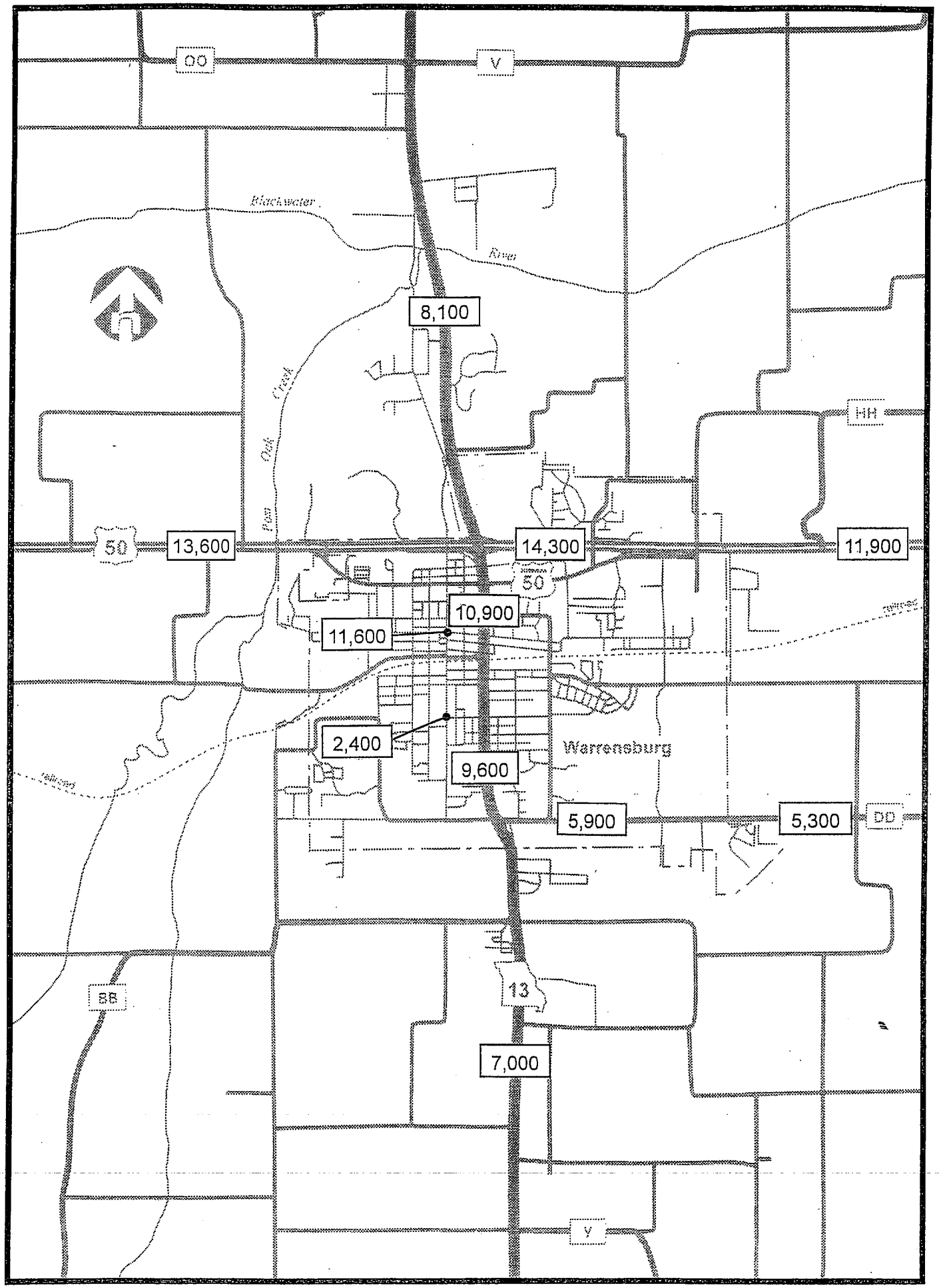


EXHIBIT II.B.2-1 Year 1992 Average Annual Daily Traffic - Warrensburg

"No-Action" Alternative

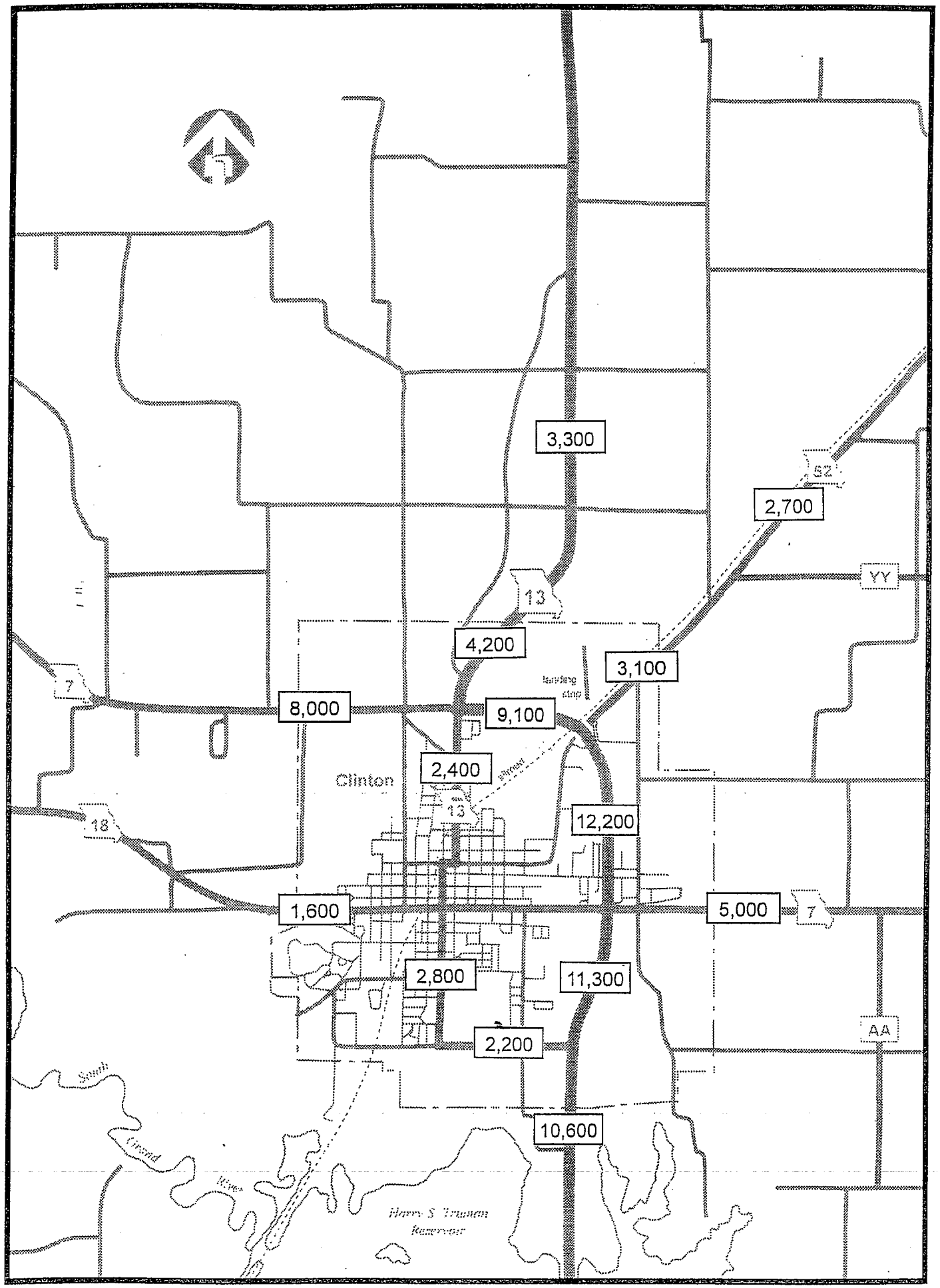


EXHIBIT II.B.2-1 Year 1992 Average Annual Daily Traffic - Clinton
"No-Action" Alternative

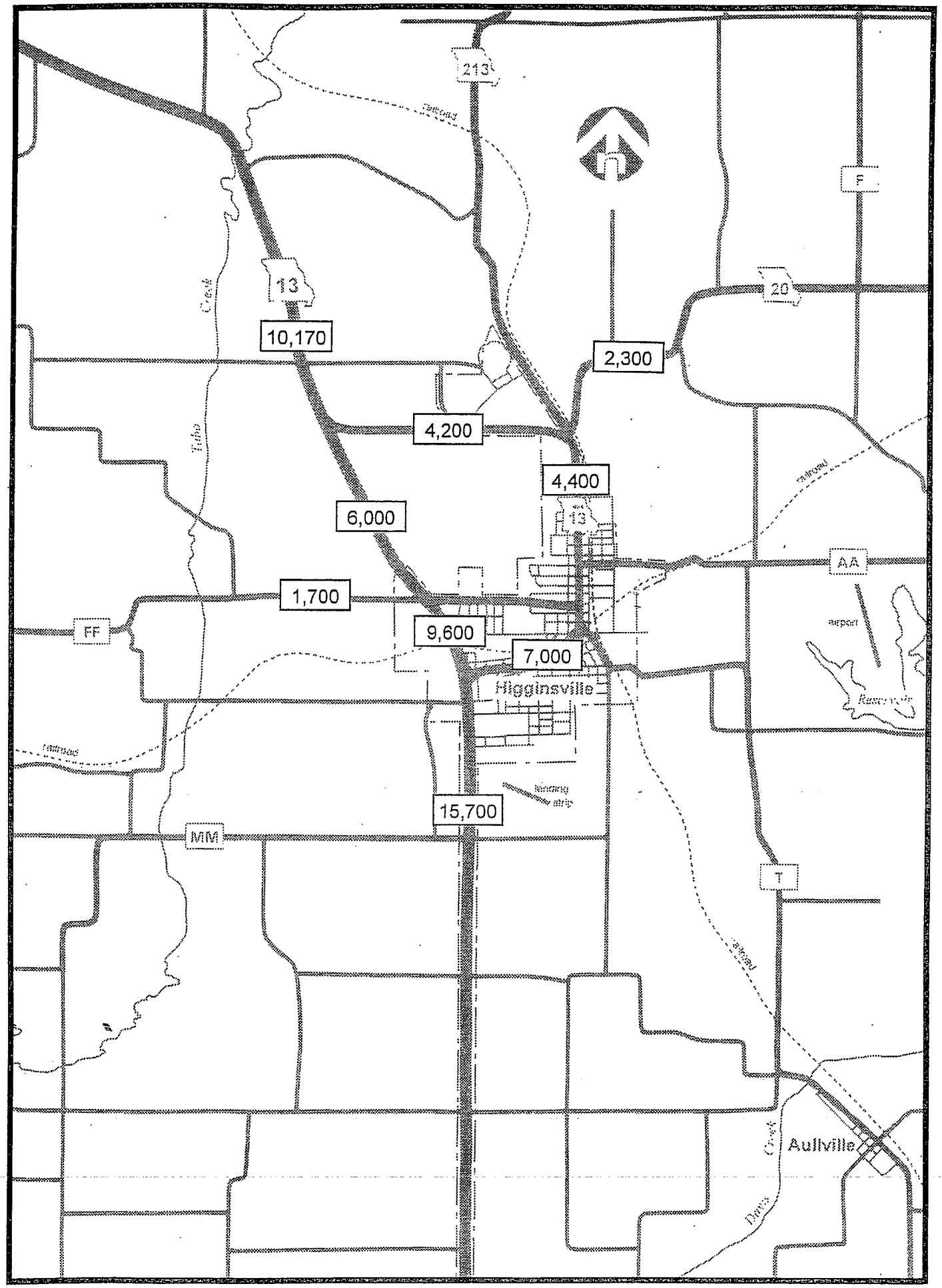


EXHIBIT II.B.2-2 Year 2022 Average Annual Daily Traffic - Higginsville
"No-Action" Alternative

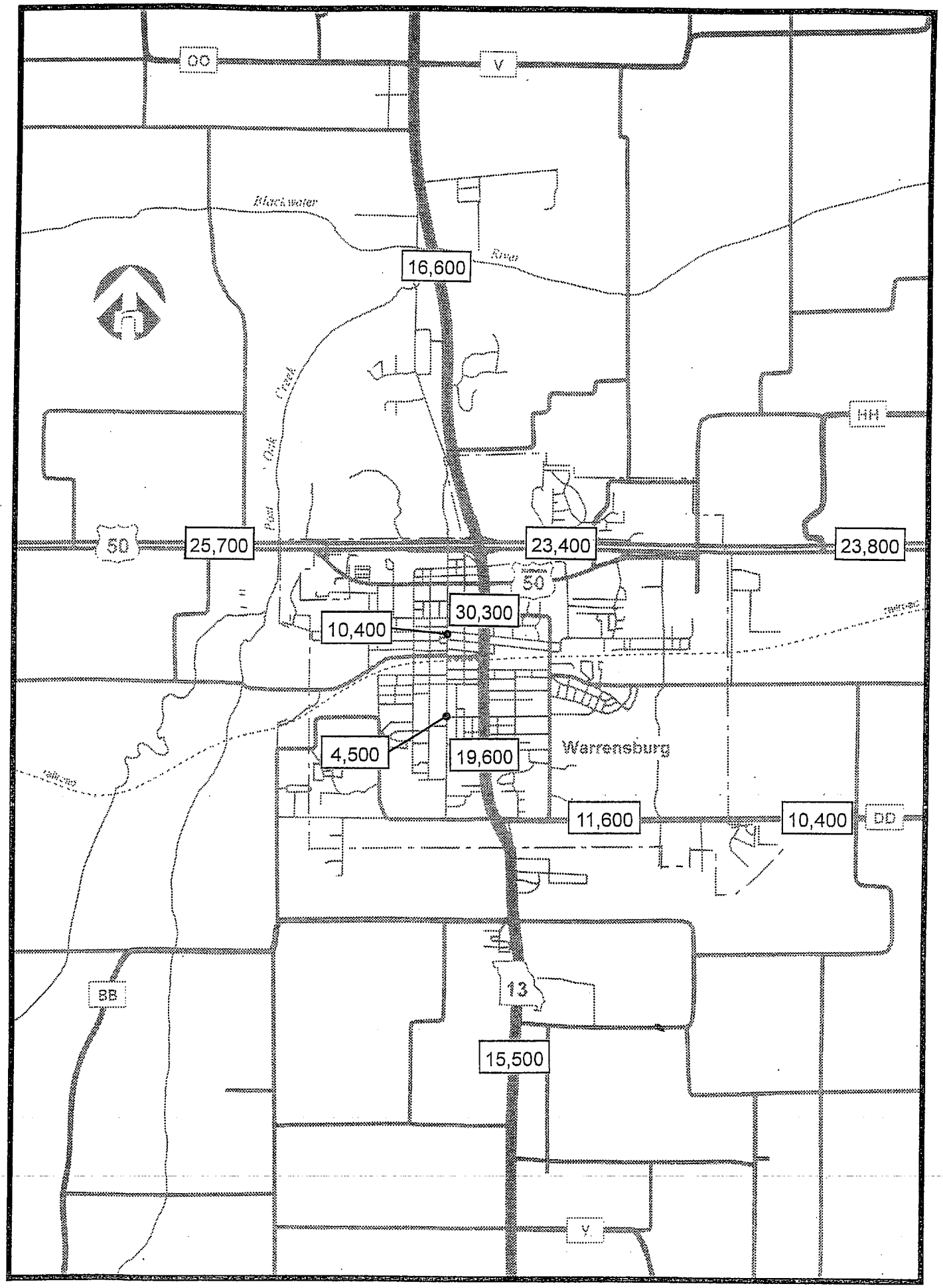


EXHIBIT II.B.2-2 Year 2022 Average Annual Daily Traffic - Warrensburg
"No-Action" Alternative

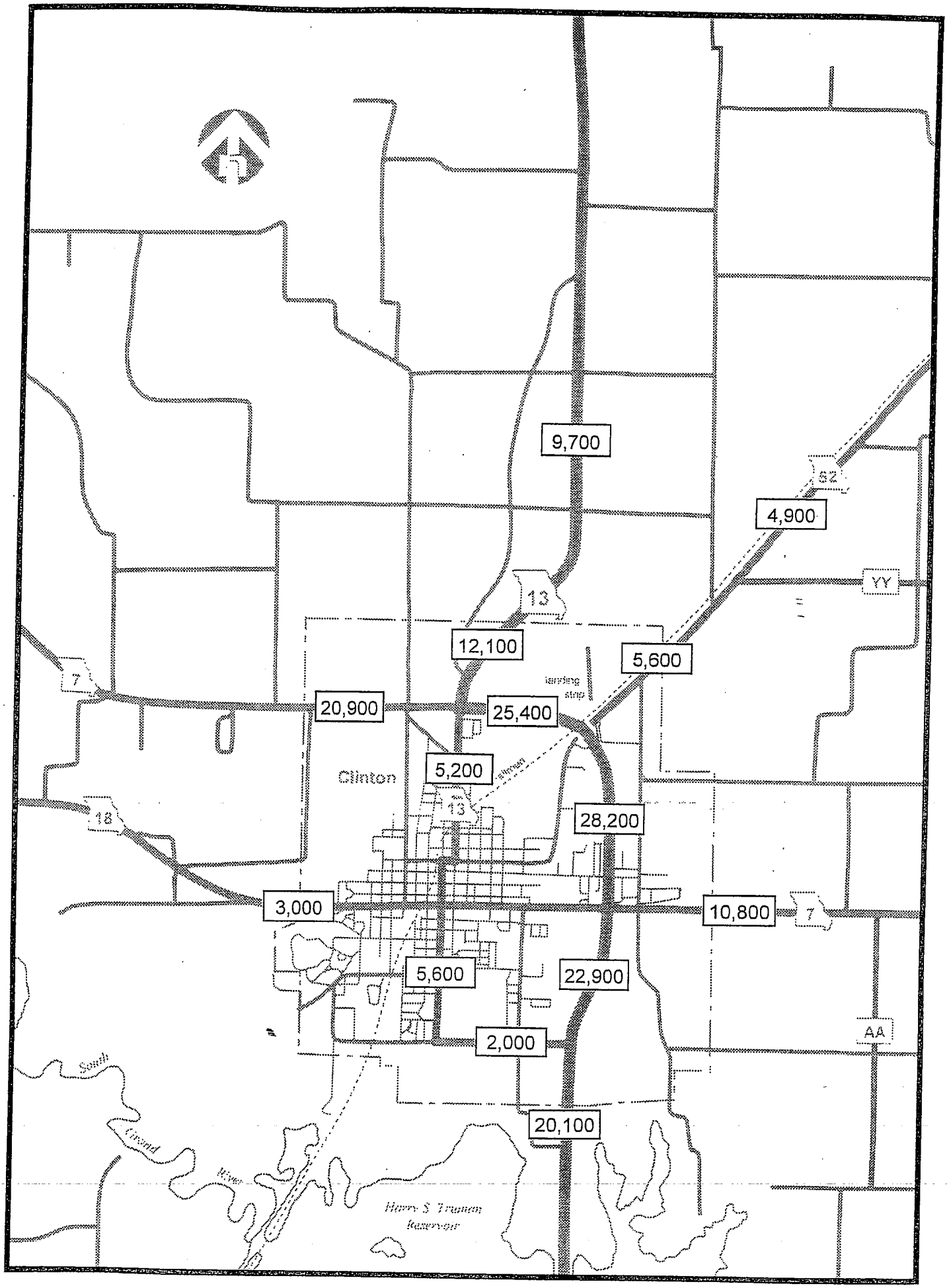


EXHIBIT II.B.2-2 Year 2022 Average Annual Daily Traffic - Clinton
"No-Action" Alternative

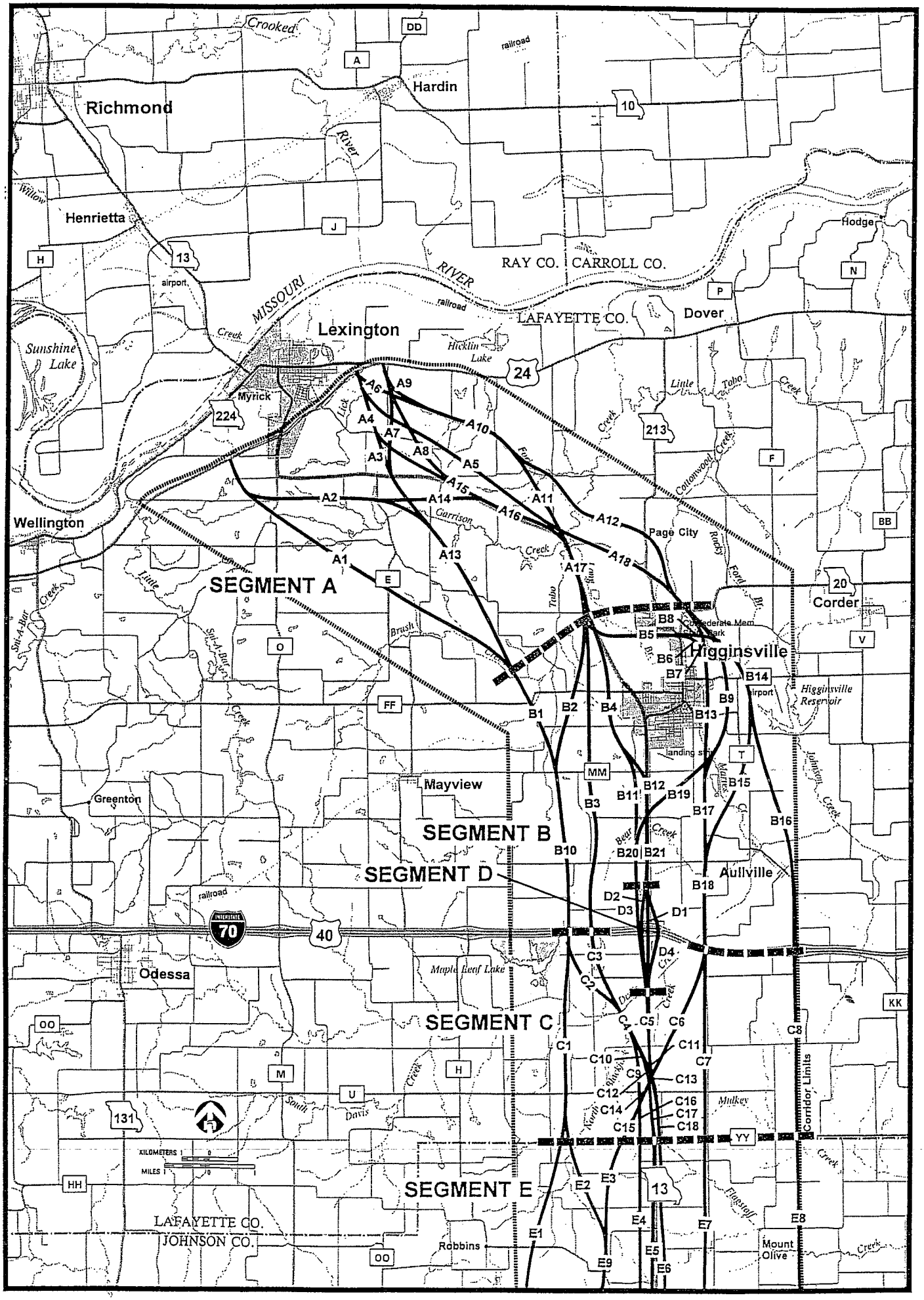


EXHIBIT II.E.2-1 Identification of Alternatives - Lafayette Co.

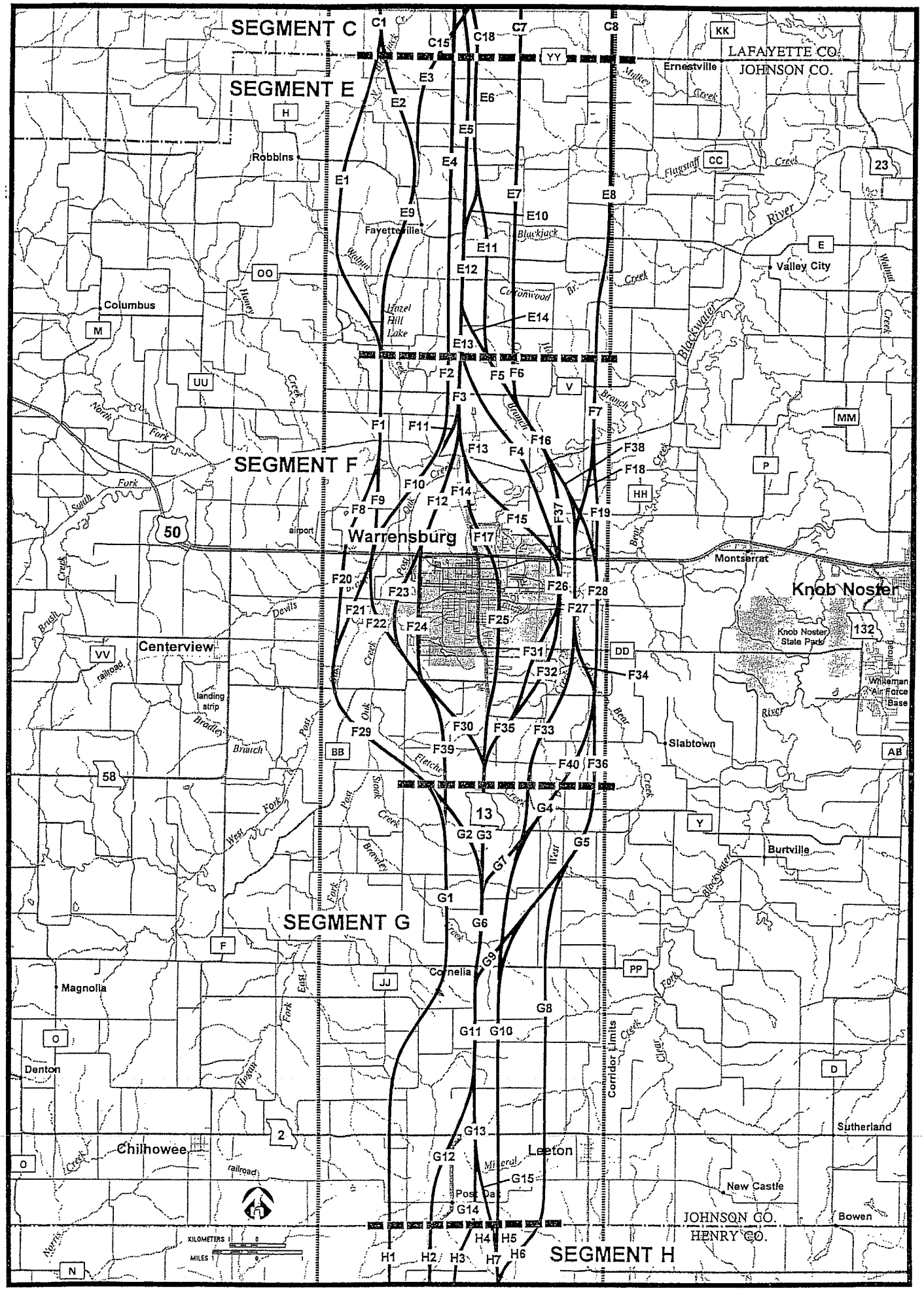


EXHIBIT II.F.2.1 Identification of Alternatives – Johnson Co.

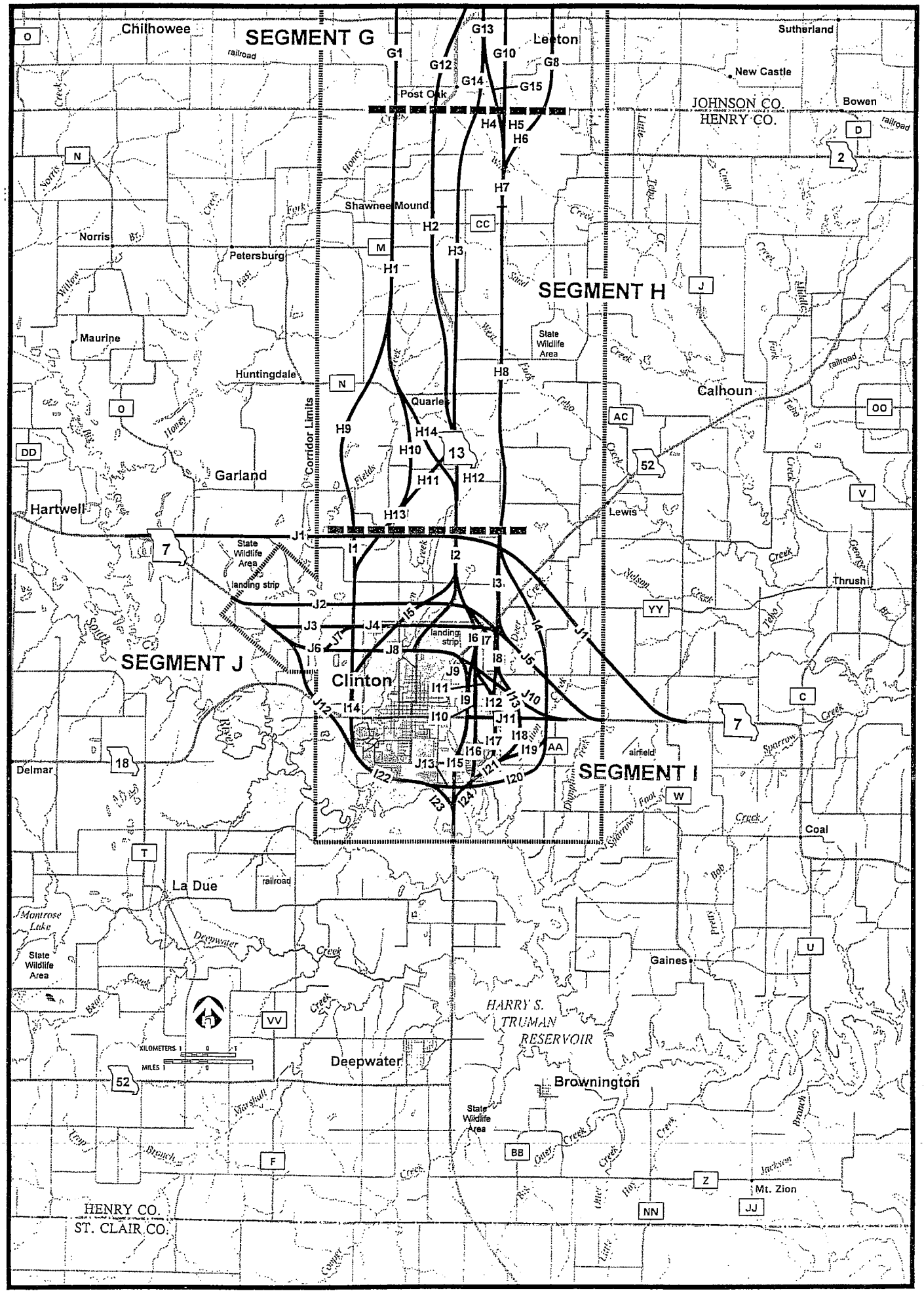


EXHIBIT II.F.2-1 Identification of Alternatives - Henry Co.

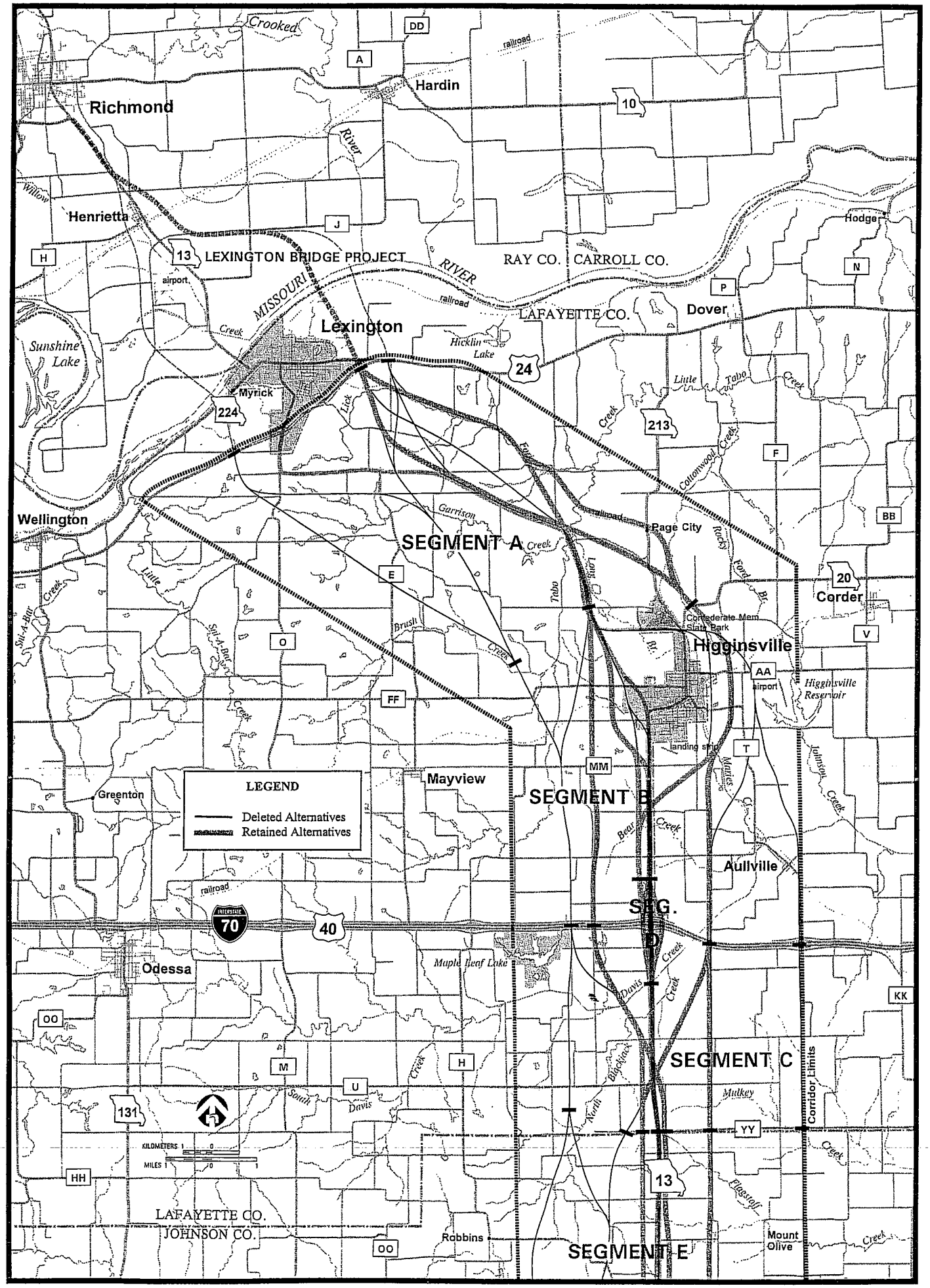


EXHIBIT II.E.3-1 Results of Screening - Lafayette Co.

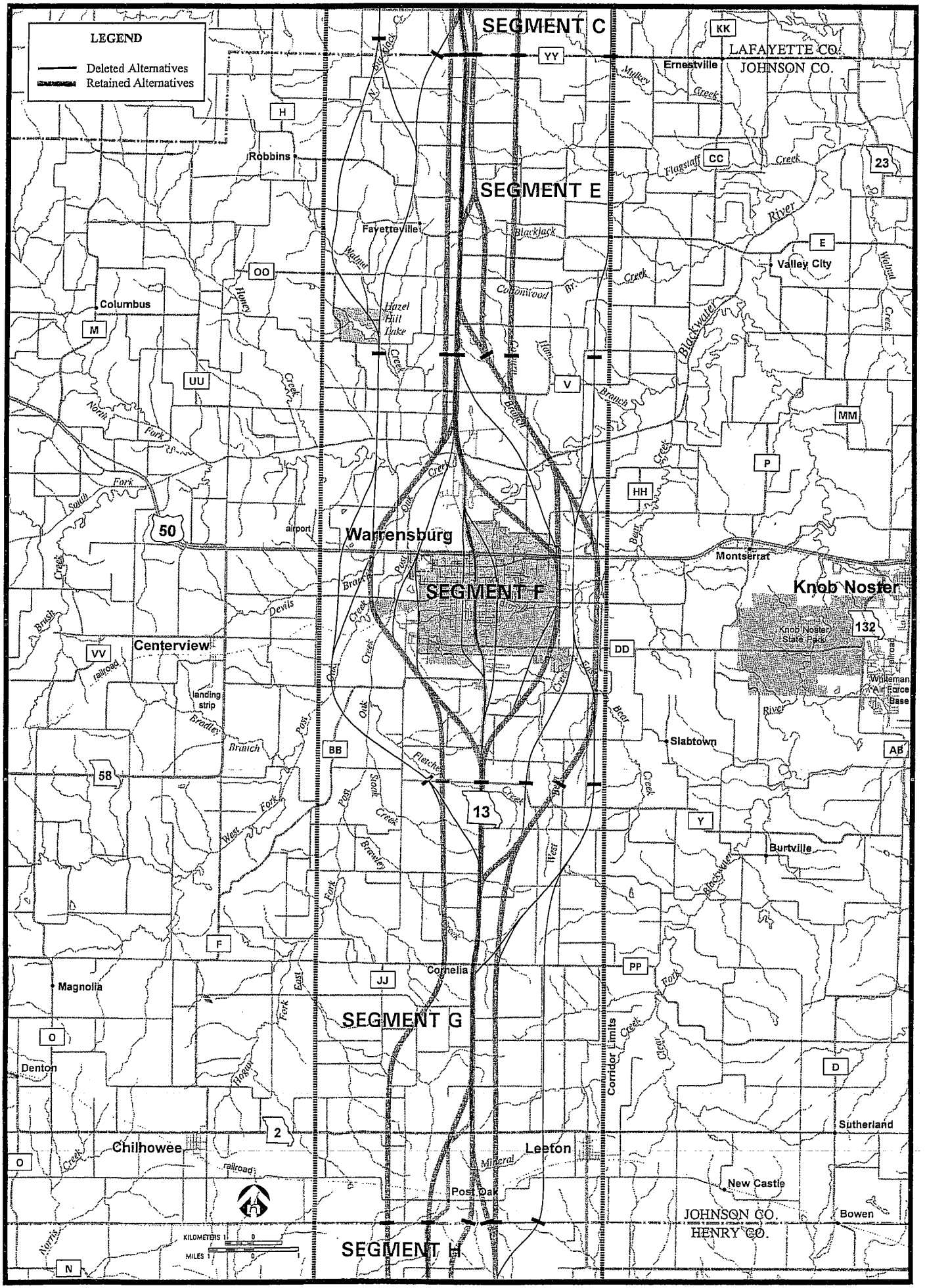


EXHIBIT II.E.3-1 Results of Screening - Johnson Co.

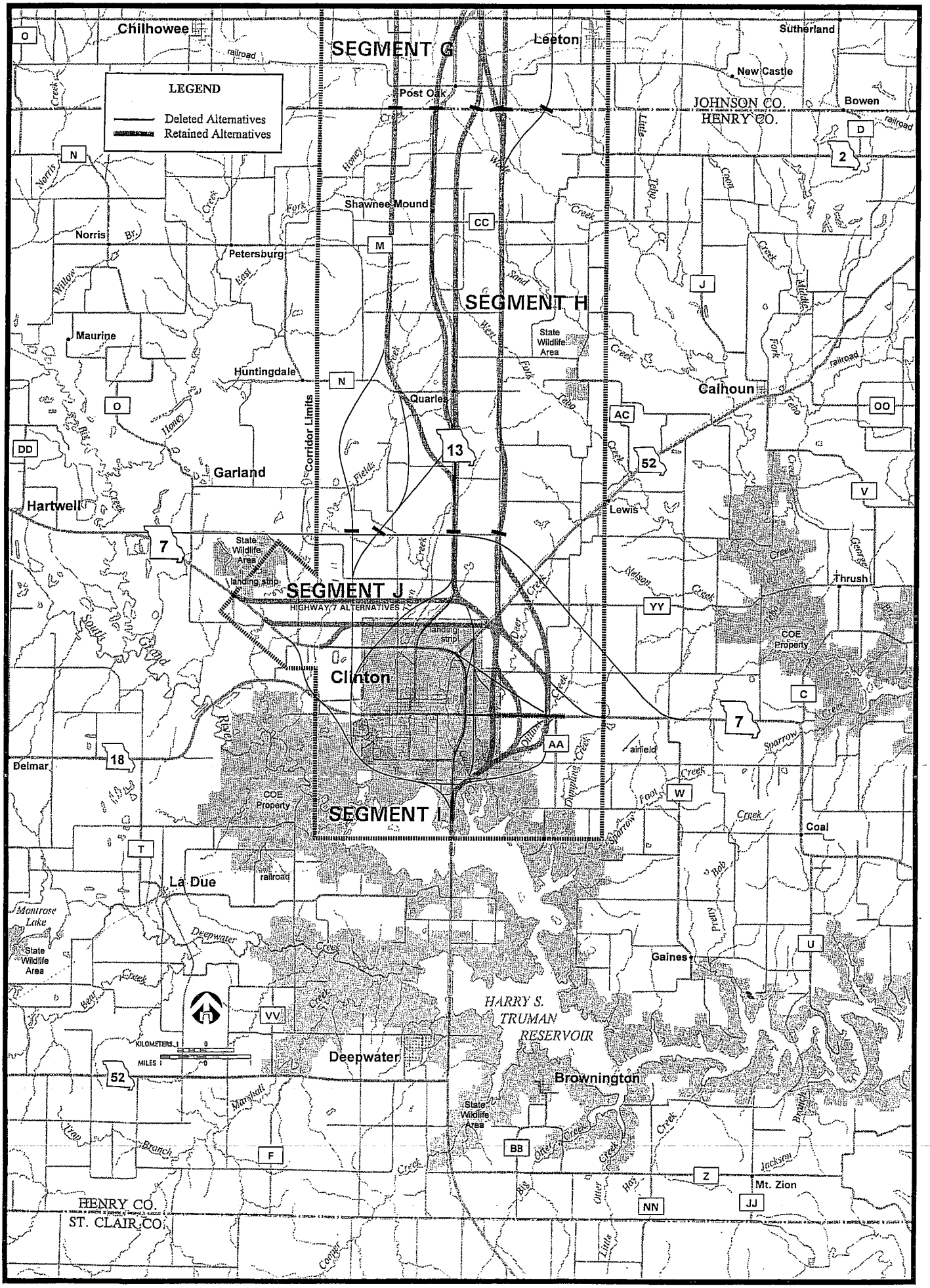


EXHIBIT II.E.3-1 Results of Screening - Henry Co.

EXHIBIT II.E.4-1
Traffic Forecasting Model Flow Diagram

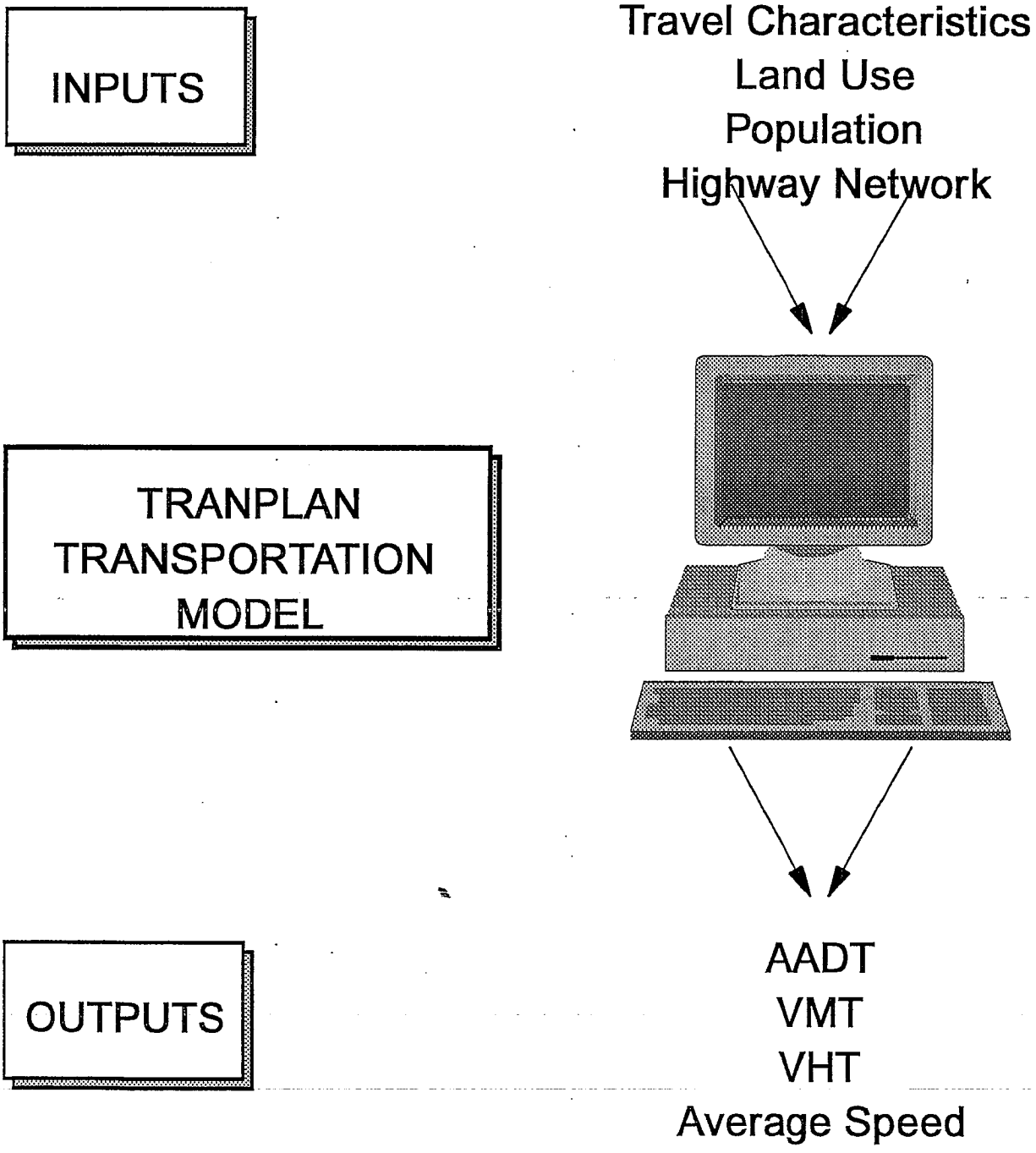
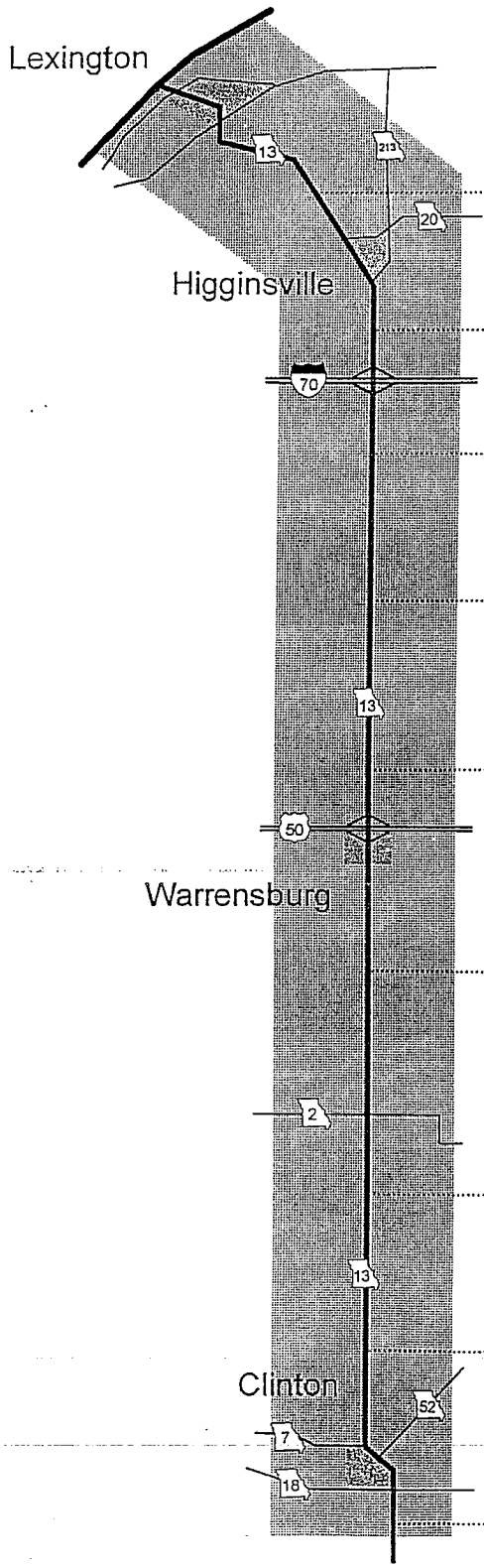
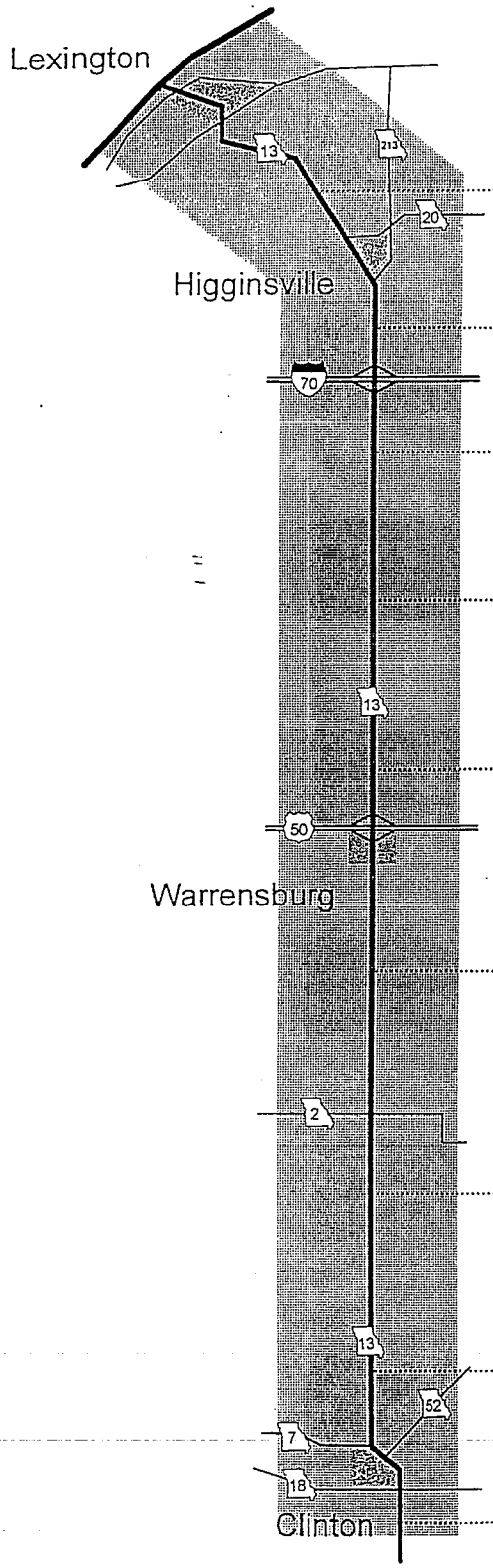


EXHIBIT II.E.4-2
Historical Daily Traffic Volumes by Highway Segment
1985 - 1993



	Average Daily Traffic (ADT)				
	1985	1987	1989	1991	1993
	2680	3240	3680	3820	4140
	4940	5120	6210	6450	7000
	3010	3390	4550	4730	5130
	4390	4640	5790	5910	6000
	5920	6260	7820	7970	8100
	4490	5070	8890	6440	6990
	2650	2740	3580	3540	3260
	3570	3510	4590	4770	4400
	6260	8150	8000	8360	7290
Weighted Average	3883	4249	5724	5373	5501

EXHIBIT II.E.4-3
Estimated Total Daily Traffic Volumes by Highway Segment
Base Case Alternative
1993 - 2022



	1993 ADT (Actual)	2022 ADT (Forecasted)
	4140	10,100
	7000	15,700
	5130	14,500
	6000	15,700
	8100	16,600
	6990	11,800
	3260	7100
	4400	9700
	7290	20,700
Weighted Average	5501	12,187

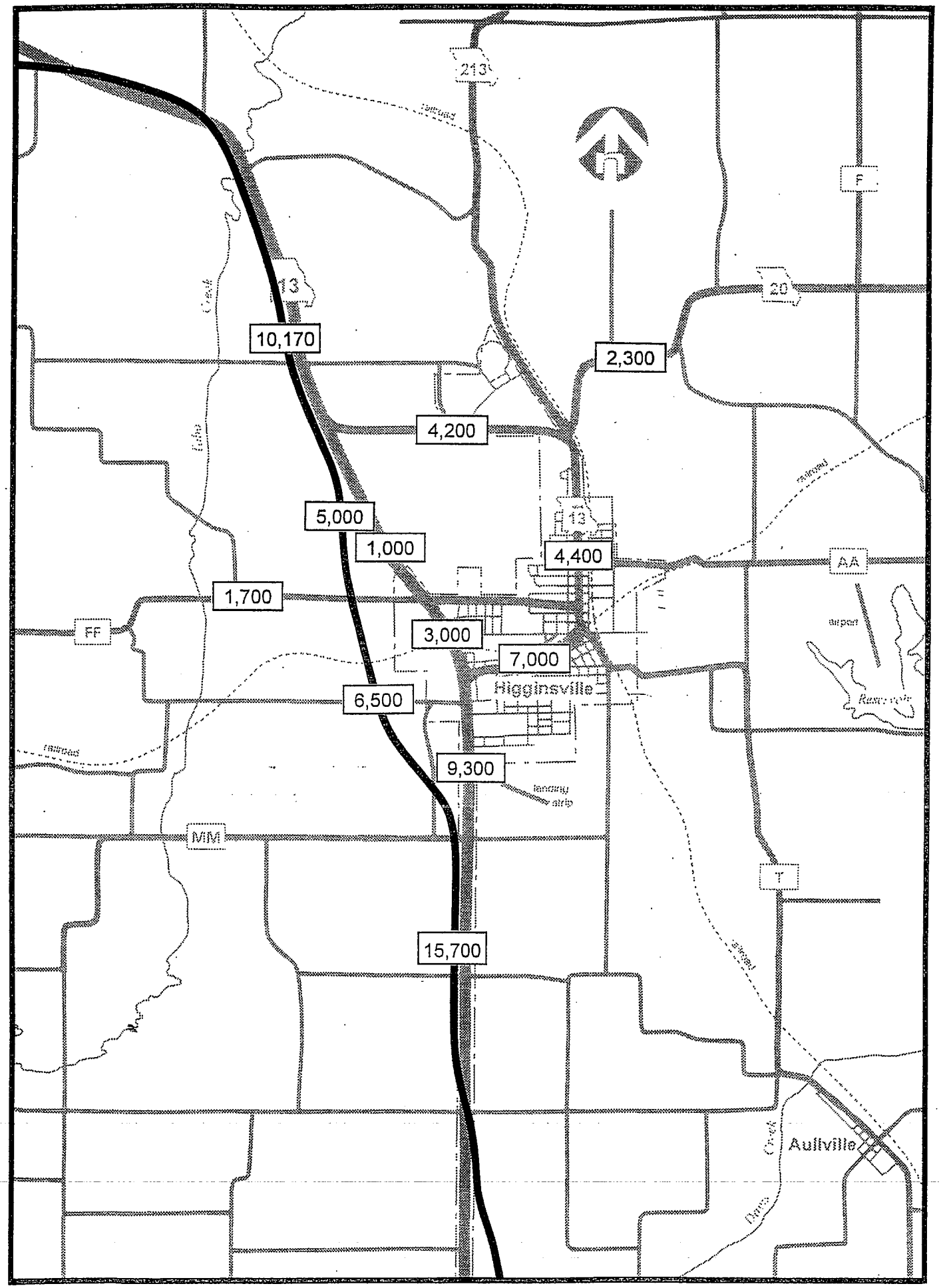


EXHIBIT II.E.4-4 Year 2022 Average Annual Daily Traffic - Higginsville

Alternative A

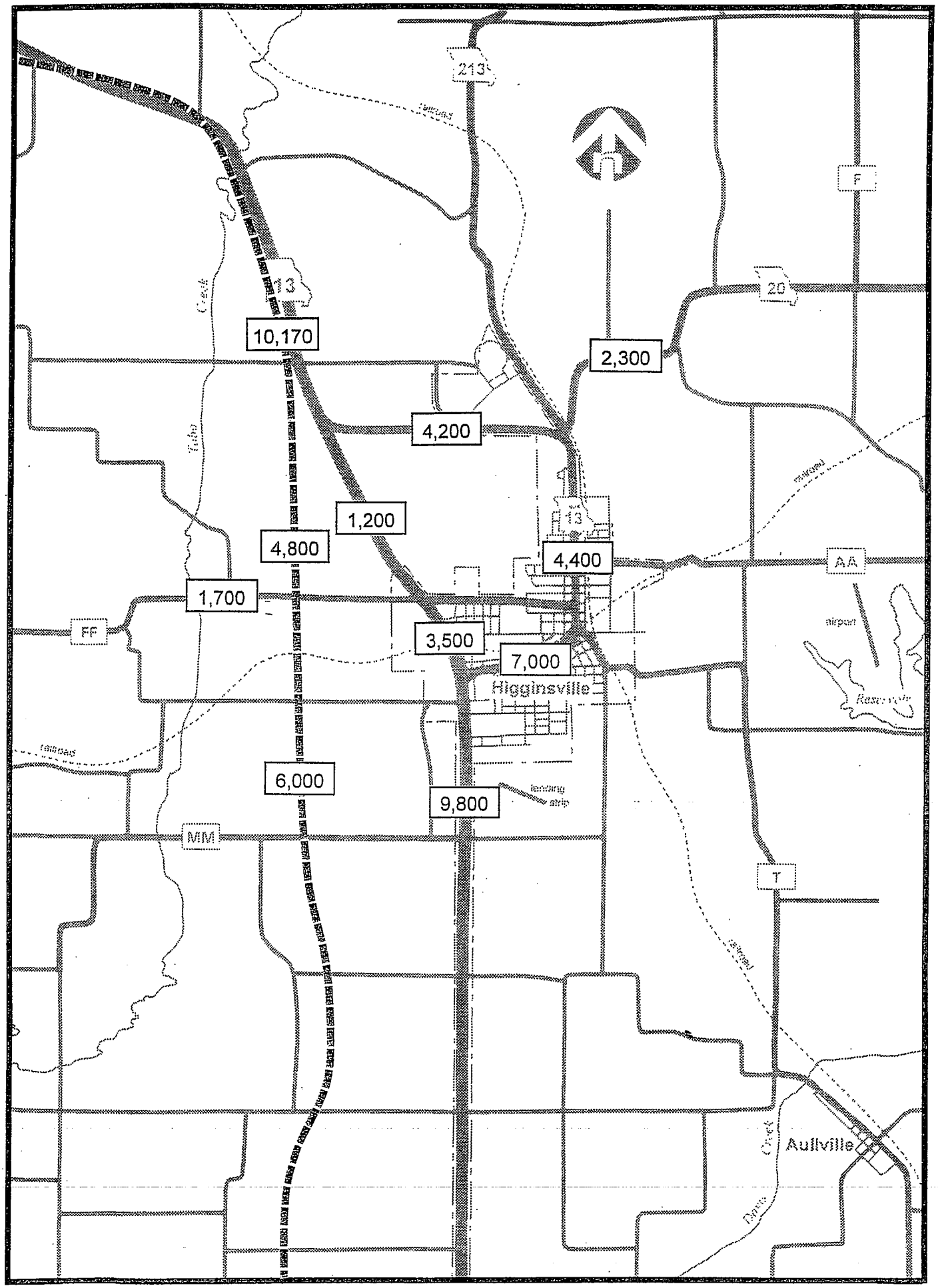


EXHIBIT II.E.4-4 Year 2022 Average Annual Daily Traffic - Higginsville

Alternative B

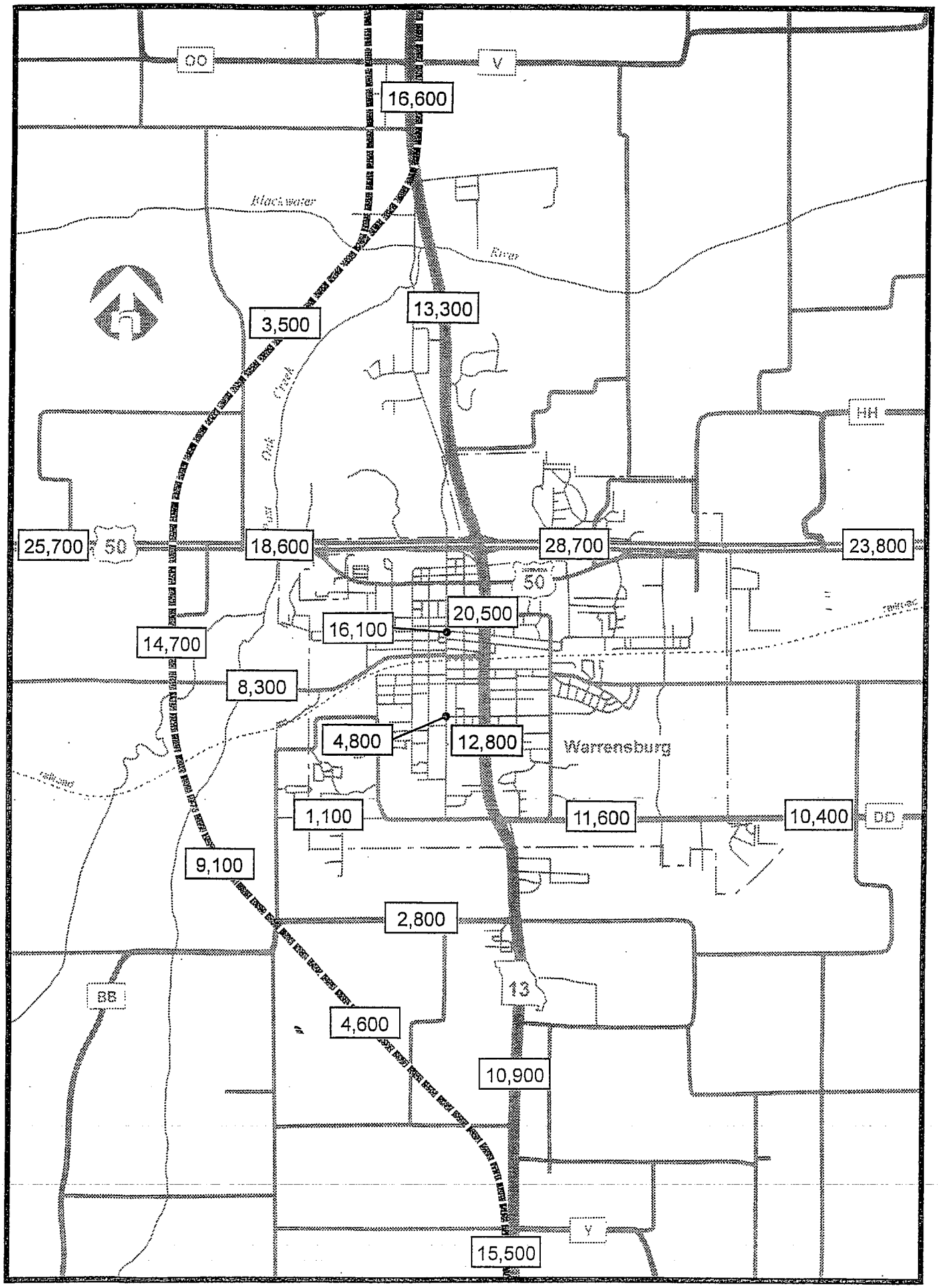


EXHIBIT II.E.4-5 Year 2022 Average Annual Daily Traffic - Warrensburg

Alternative A and B West

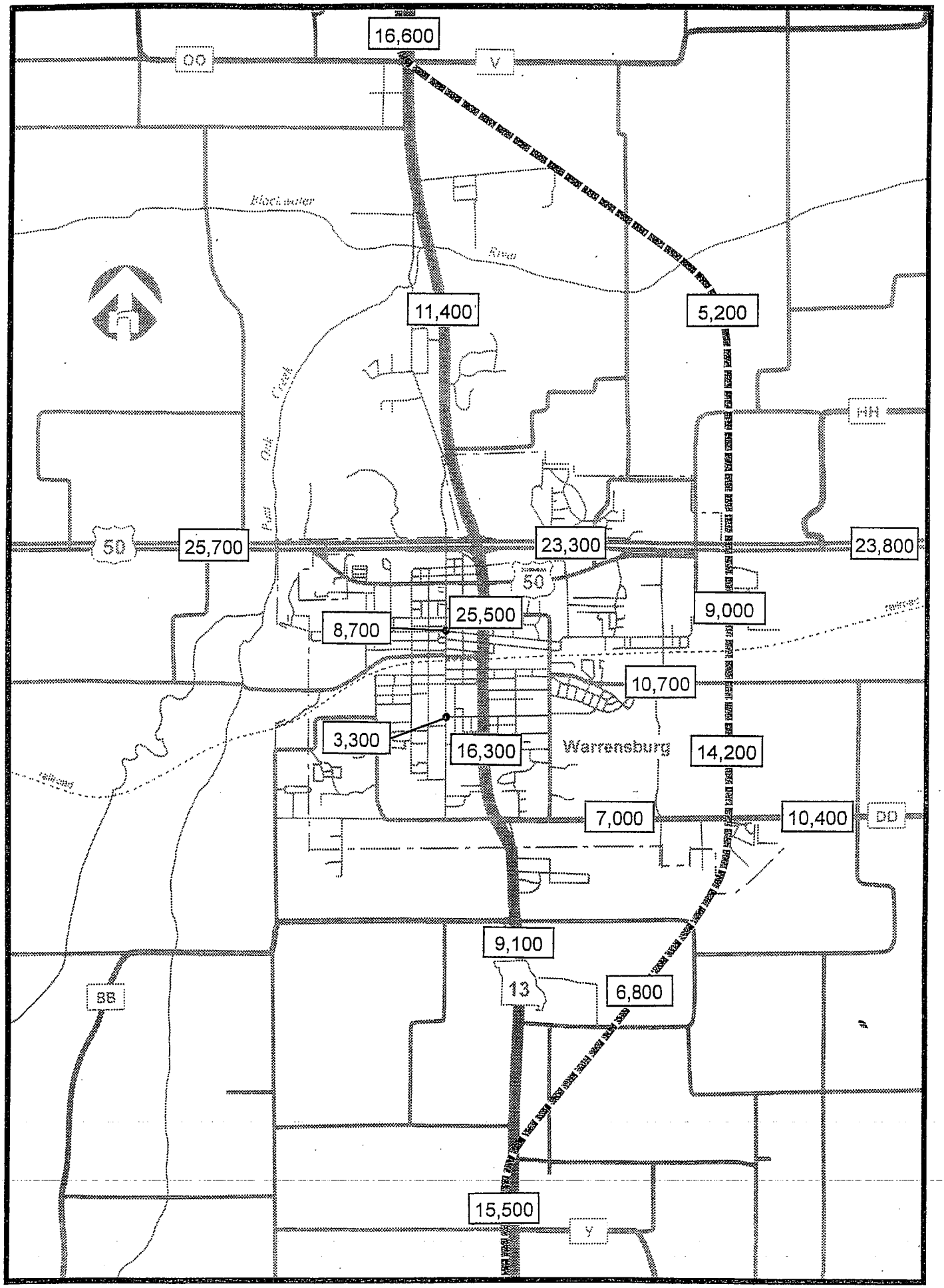


EXHIBIT II.E.4-5 Year 2022 Average Annual Daily Traffic - Warrensburg

Alternative A Near East

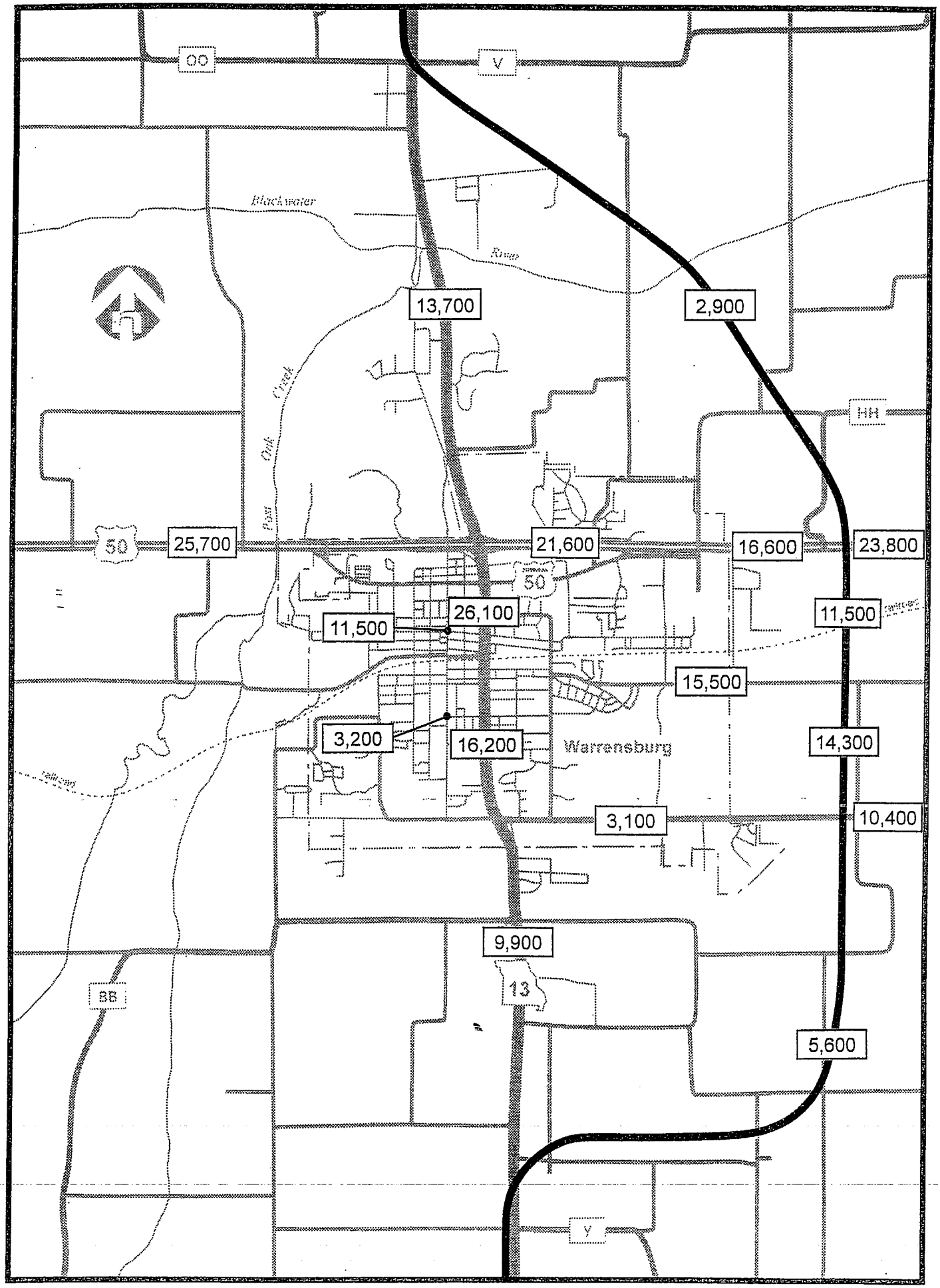


EXHIBIT II.E.4-5 Year 2022 Average Annual Daily Traffic - Warrensburg
Alternative A and B Far East

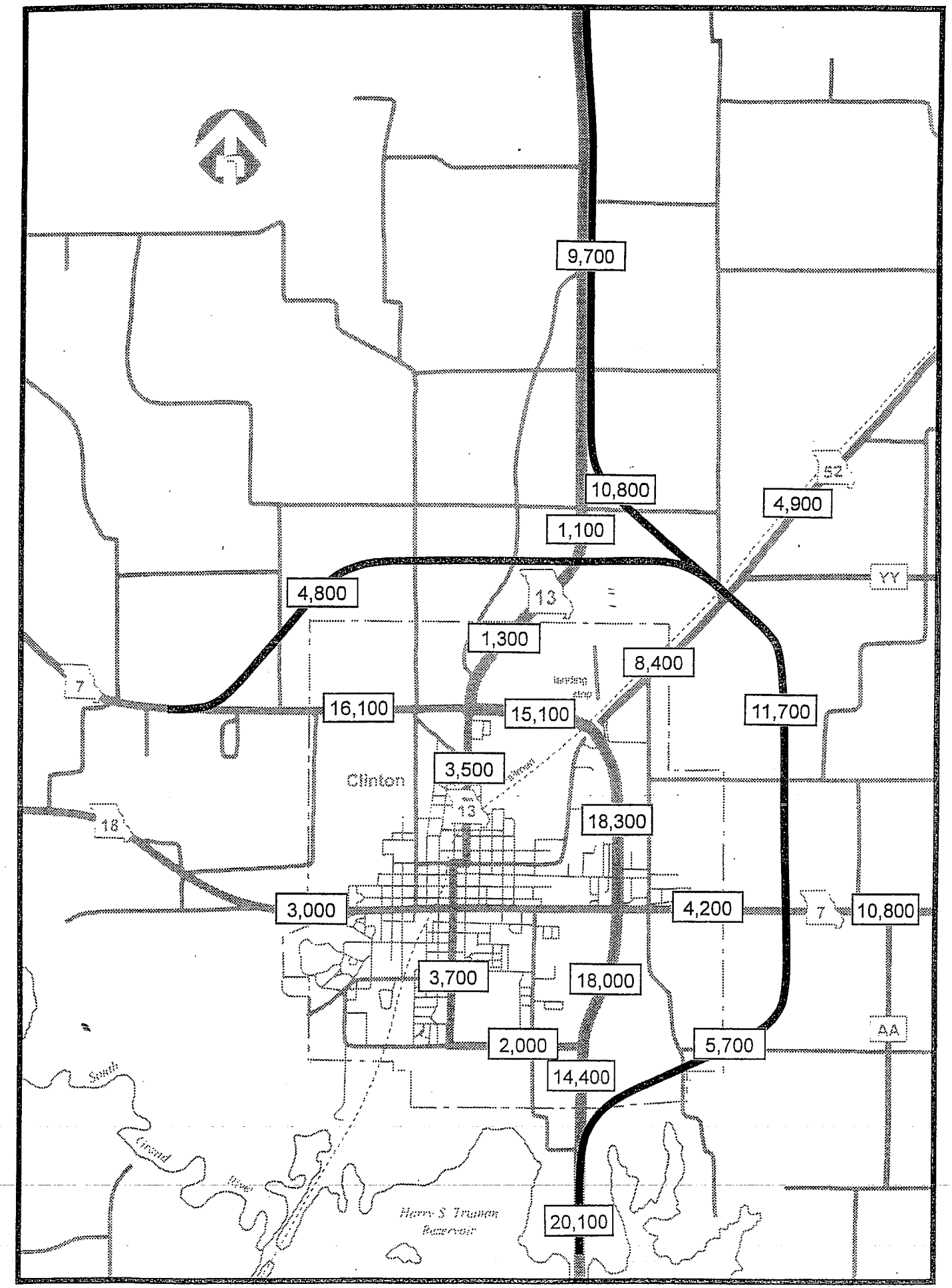


EXHIBIT II.E.4-6 Year 2022 Average Annual Daily Traffic - Clinton

Alternative A

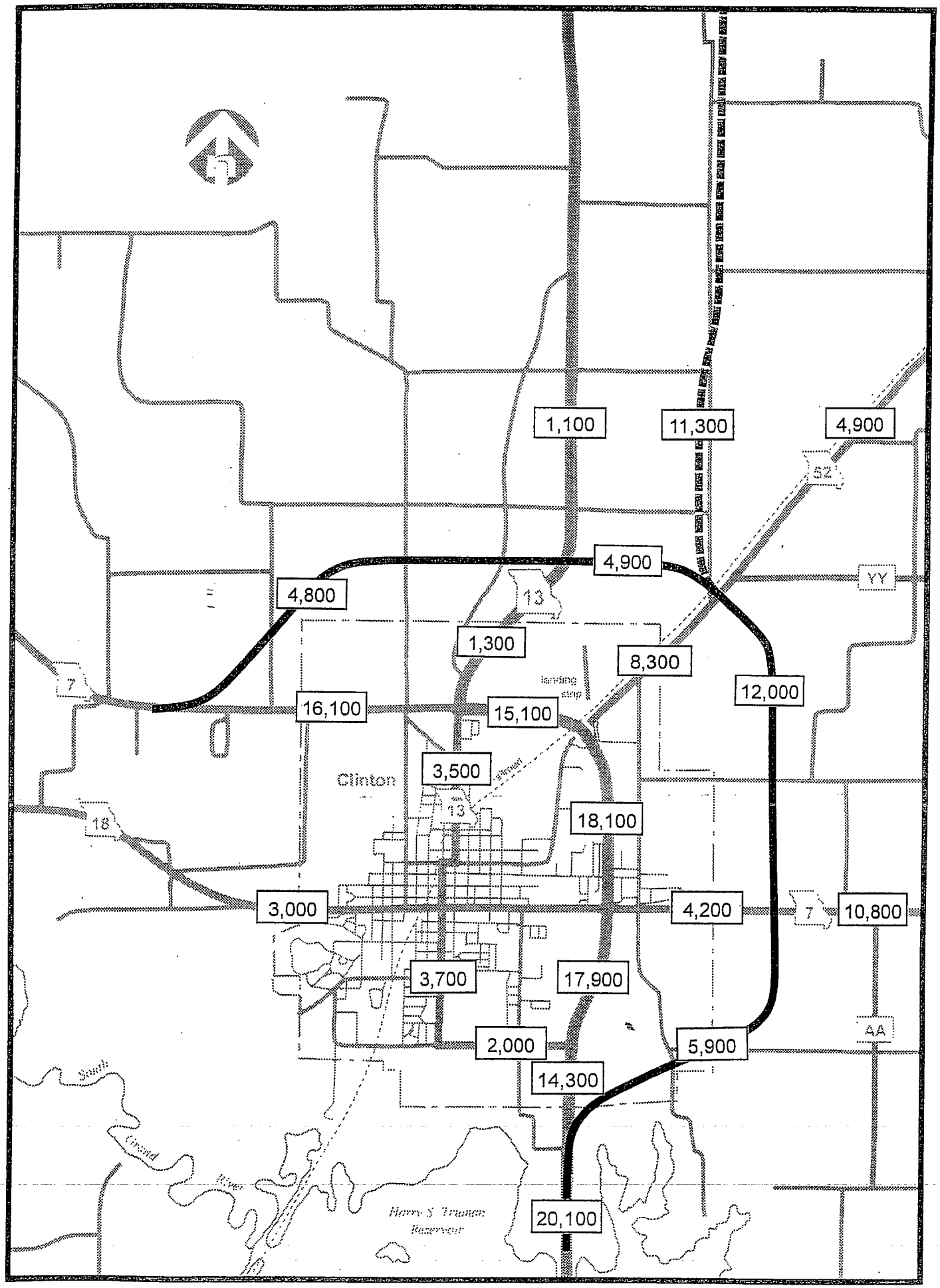


EXHIBIT II.E.4-6 Year 2022 Average Annual Daily Traffic - Clinton

Alternative B

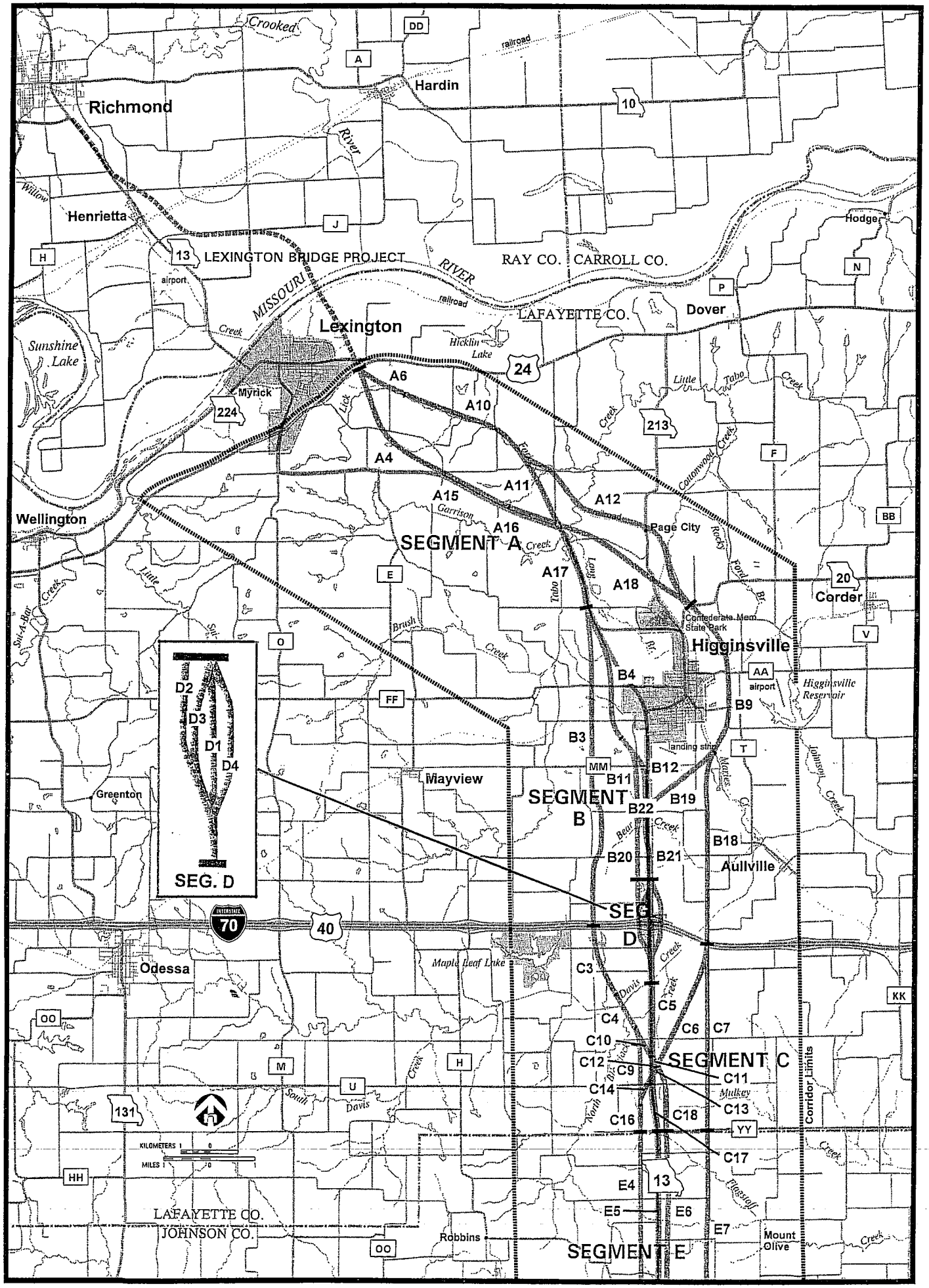


EXHIBIT II.E.6-1 Alternatives Considered in Evaluation - Lafayette Co.

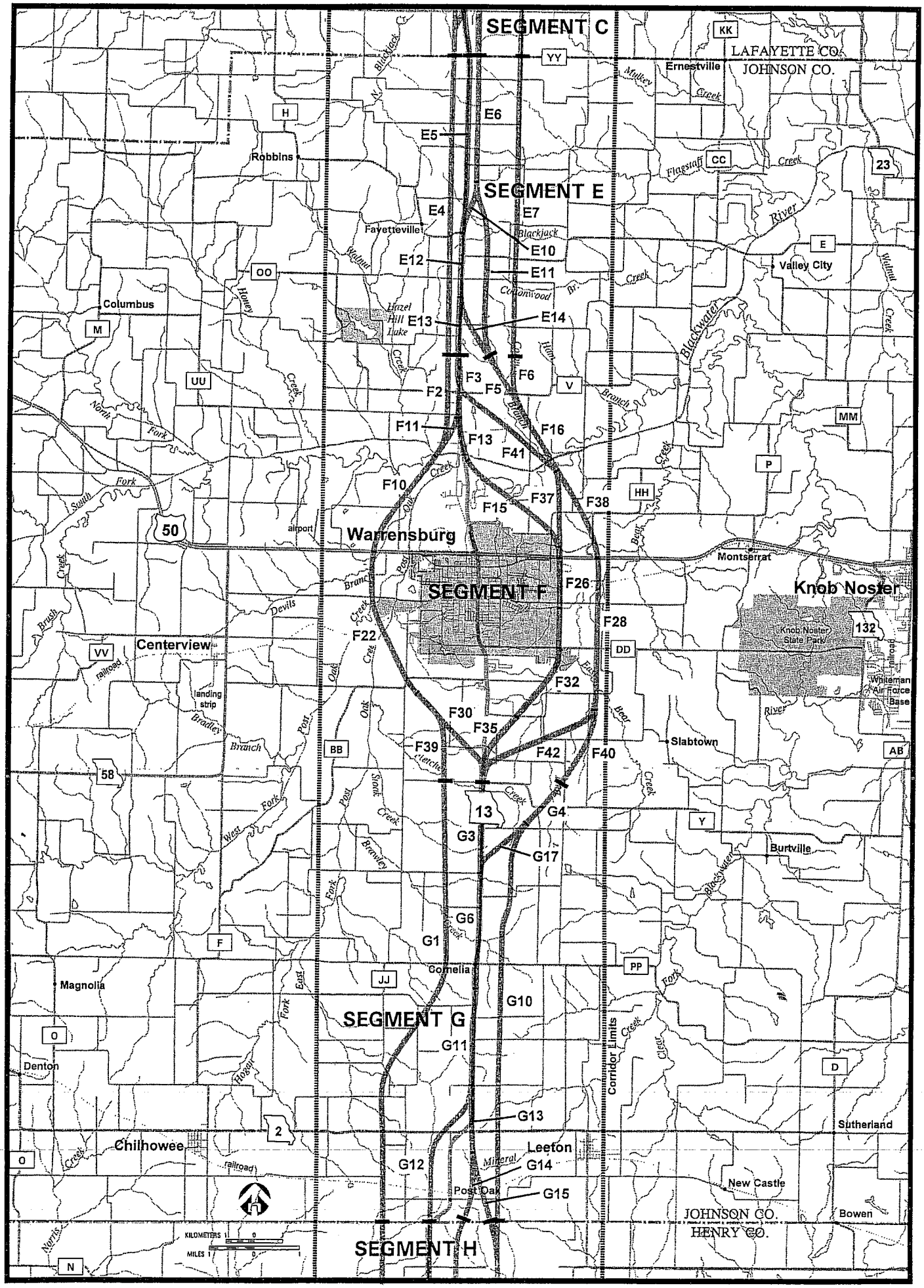


EXHIBIT II.E.6-1 Alternatives Considered in Evaluation - Johnson Co.

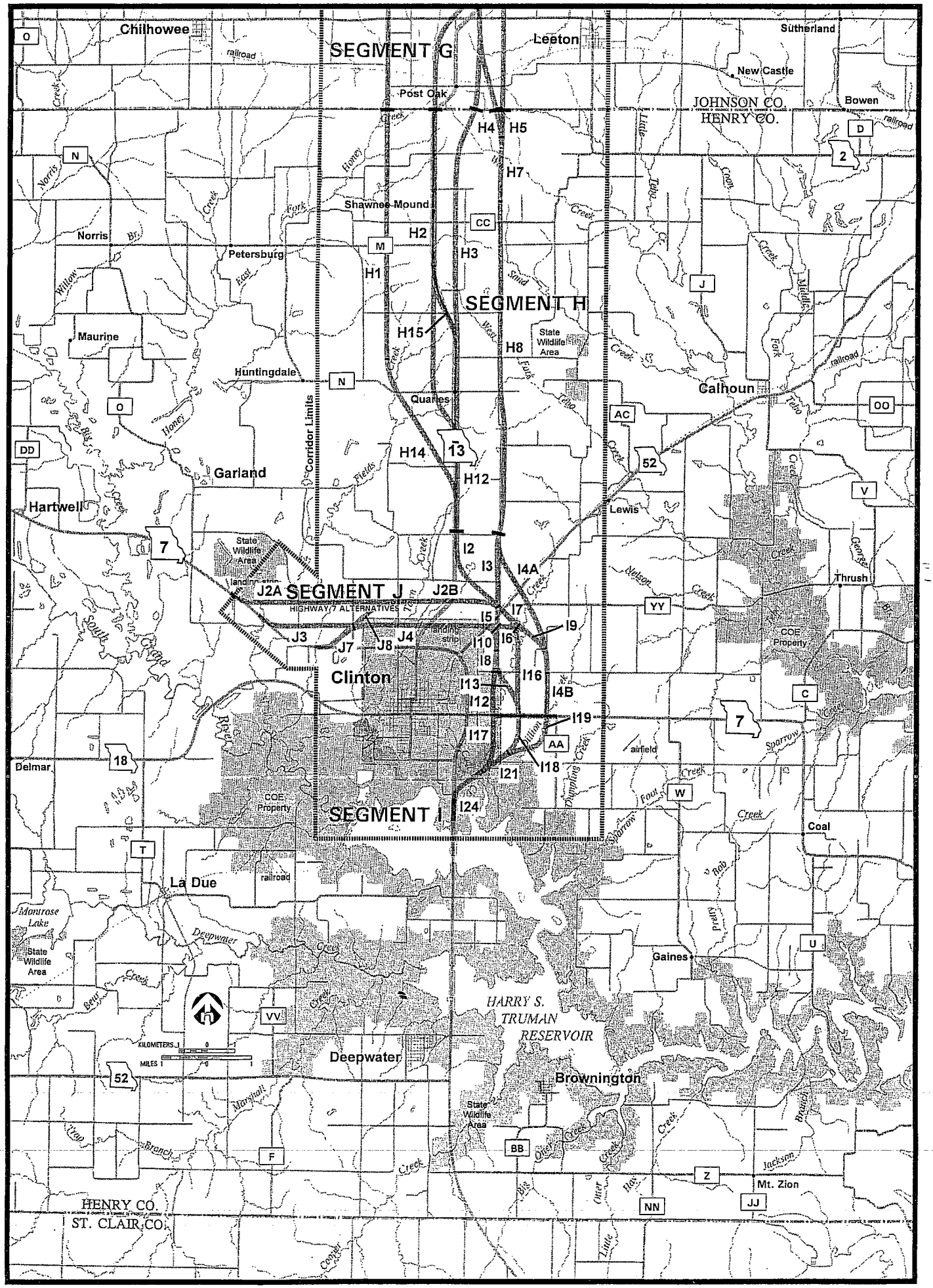


EXHIBIT II.E.6-1 Alternatives Considered in Evaluation - Henry Co.

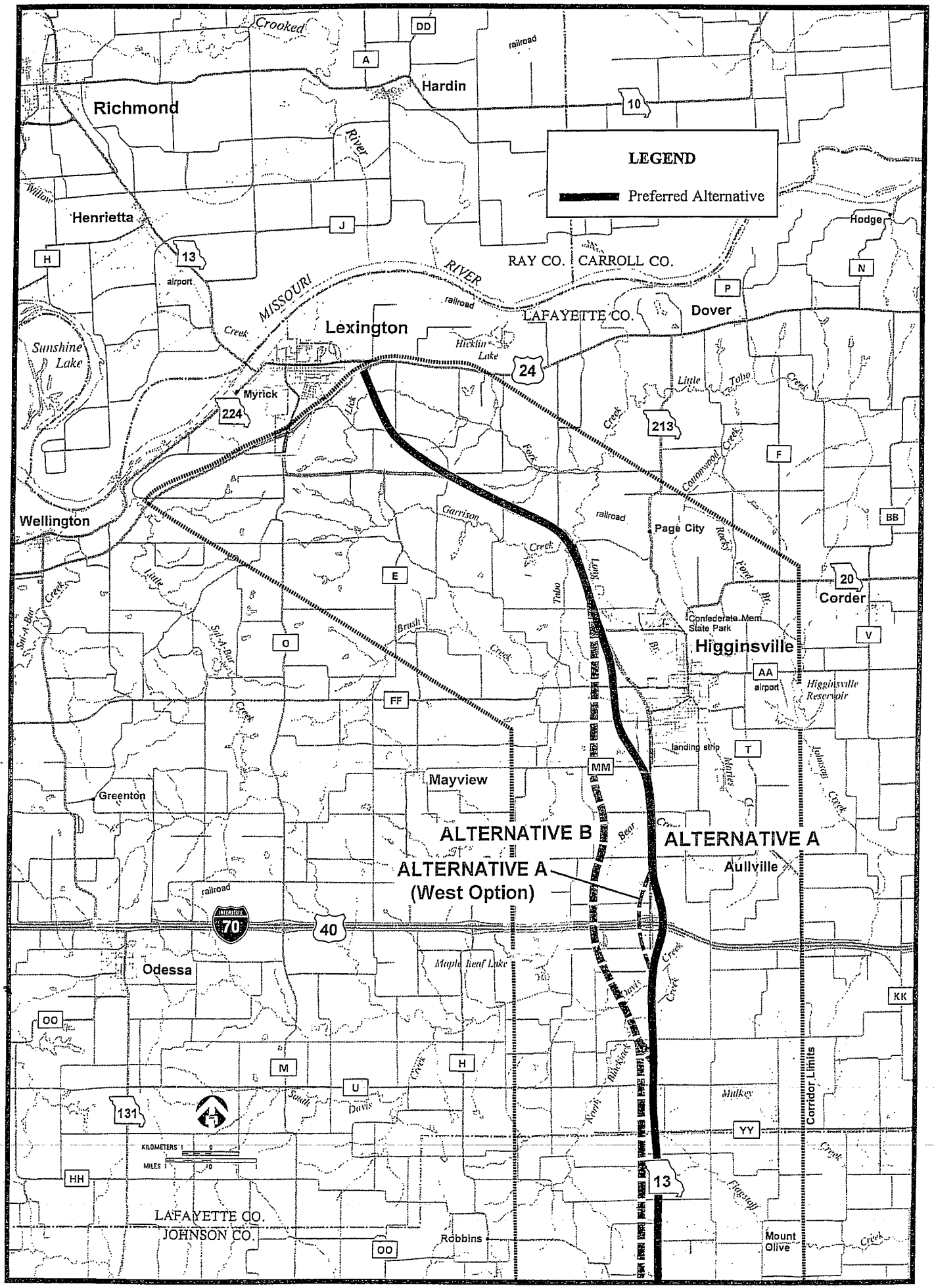


EXHIBIT II.F.4-1 DEIS Preferred Alternatives - Lafayette Co.

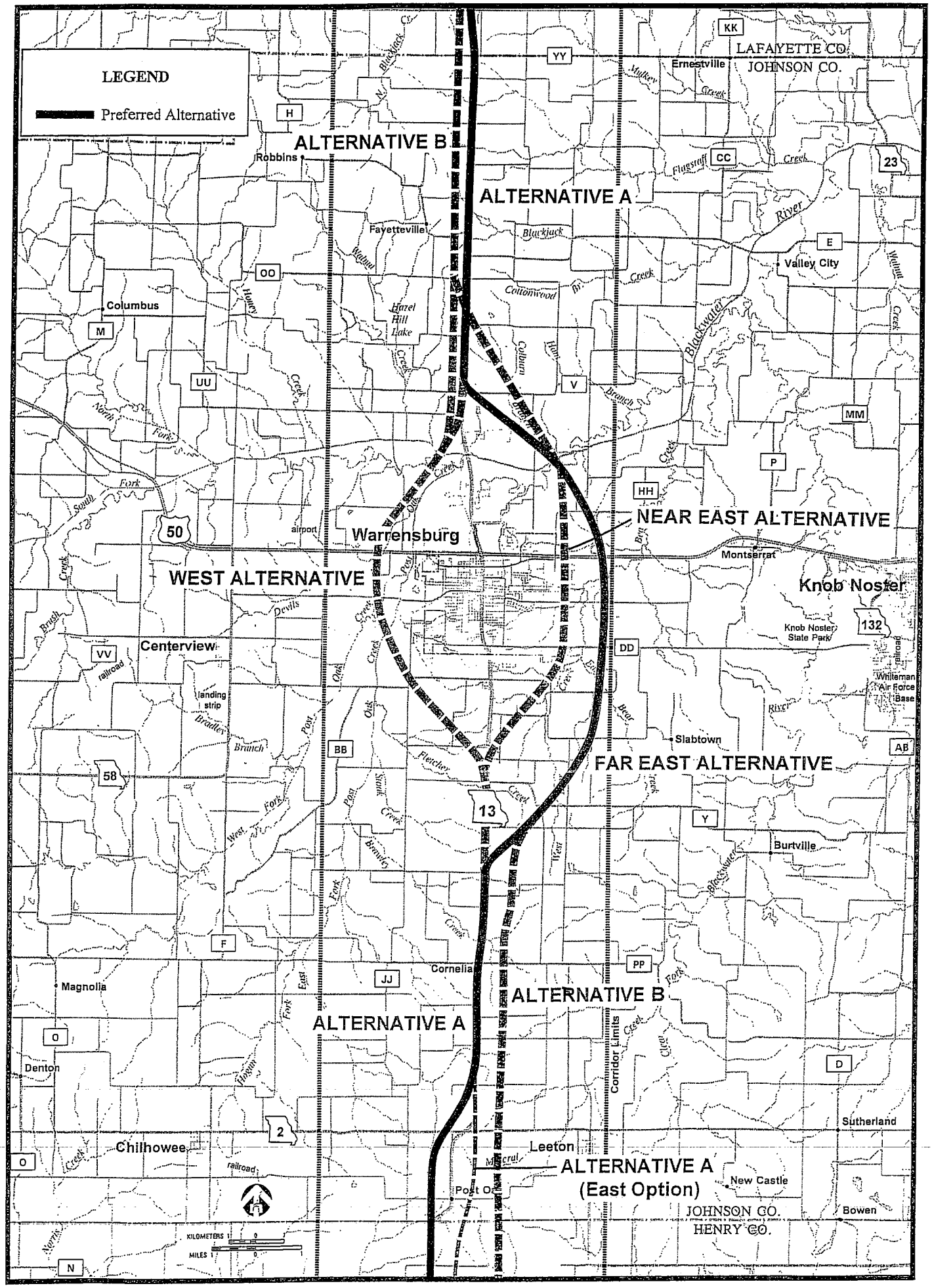


EXHIBIT II.F.4-1 DEIS Preferred Alternatives - Johnson Co.

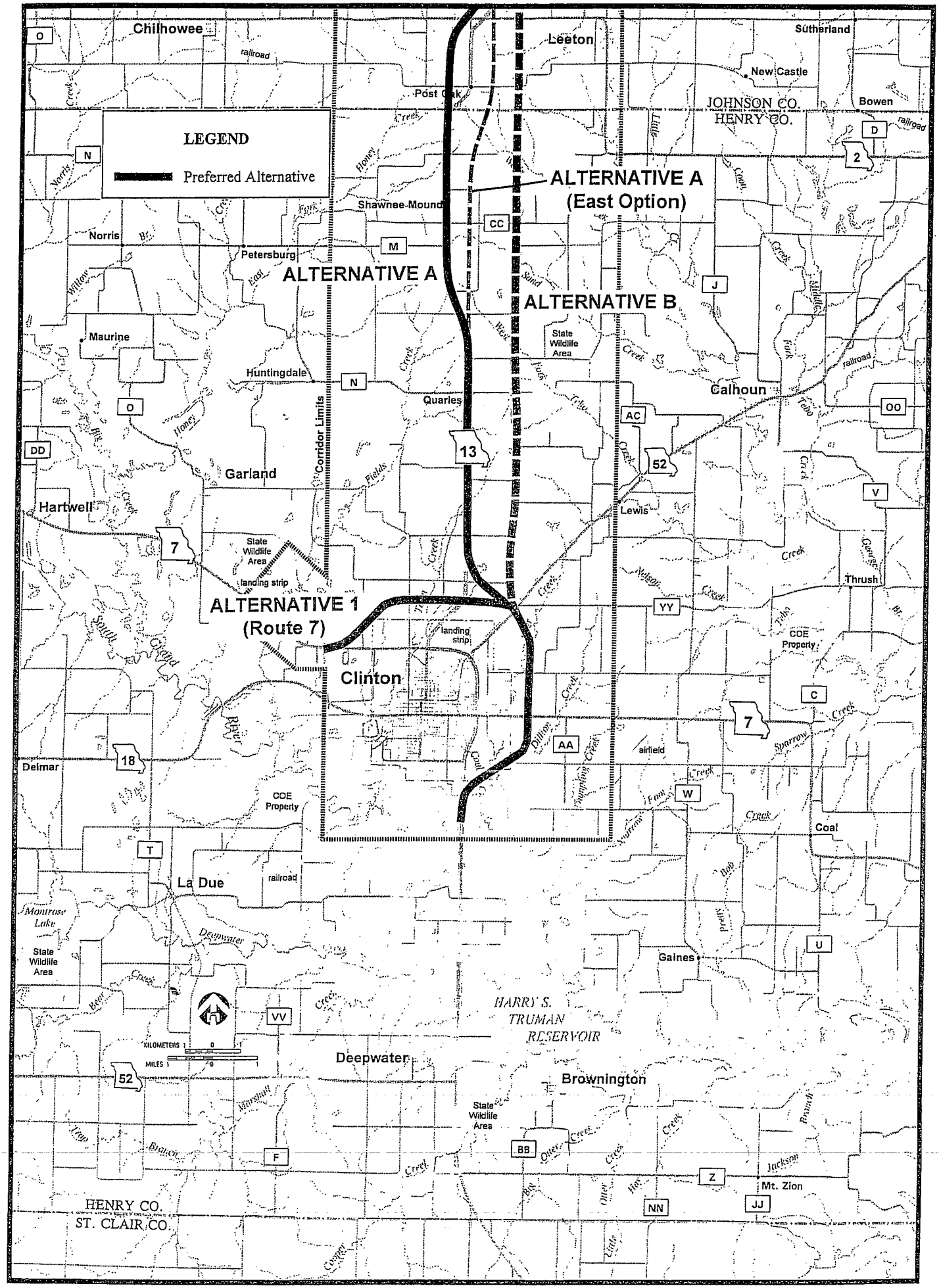


EXHIBIT II.F.4-1 DEIS Preferred Alternatives - Henry Co.

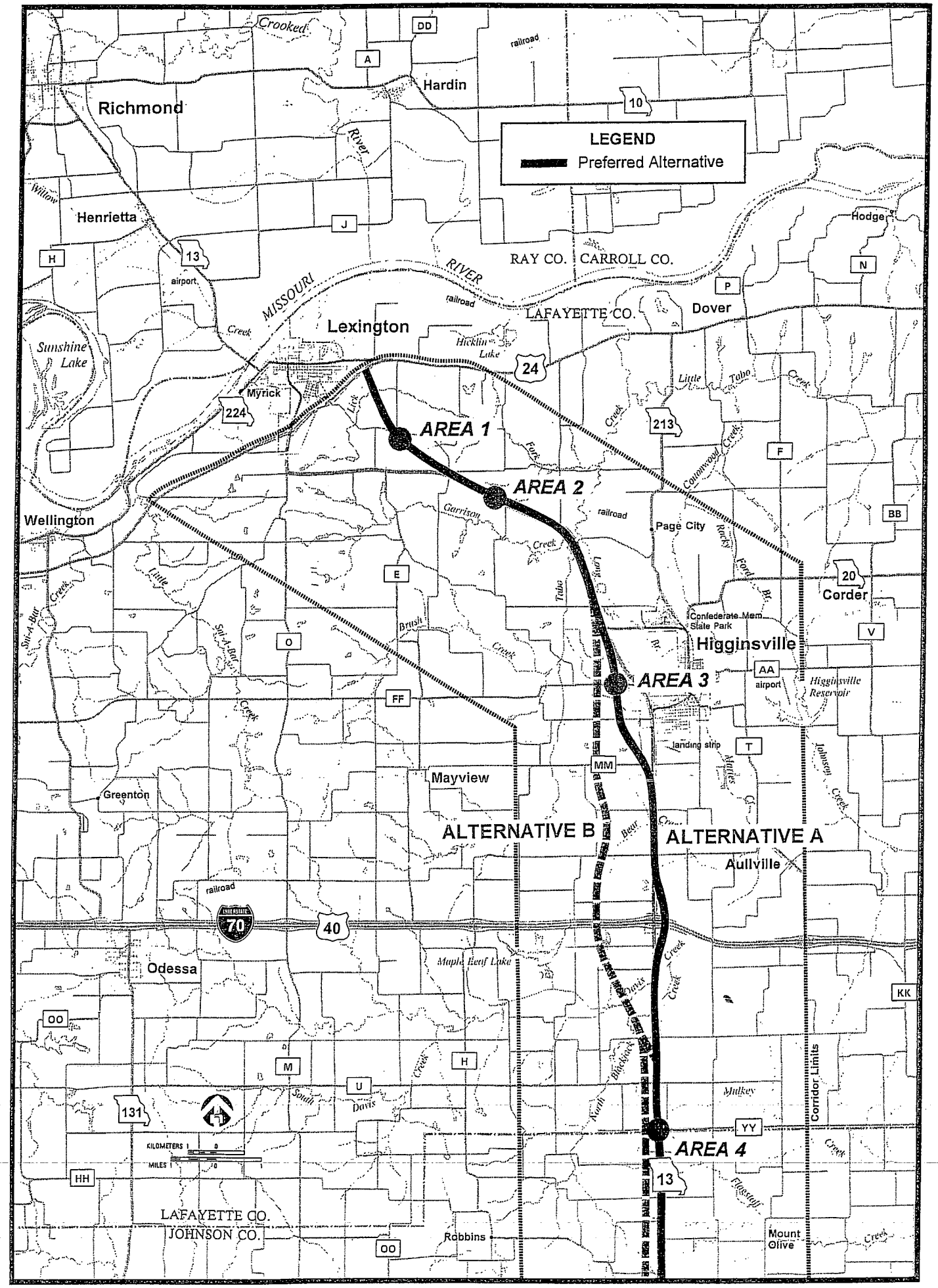


EXHIBIT II.G-1 Index of Areas of Change - Lafayette Co.

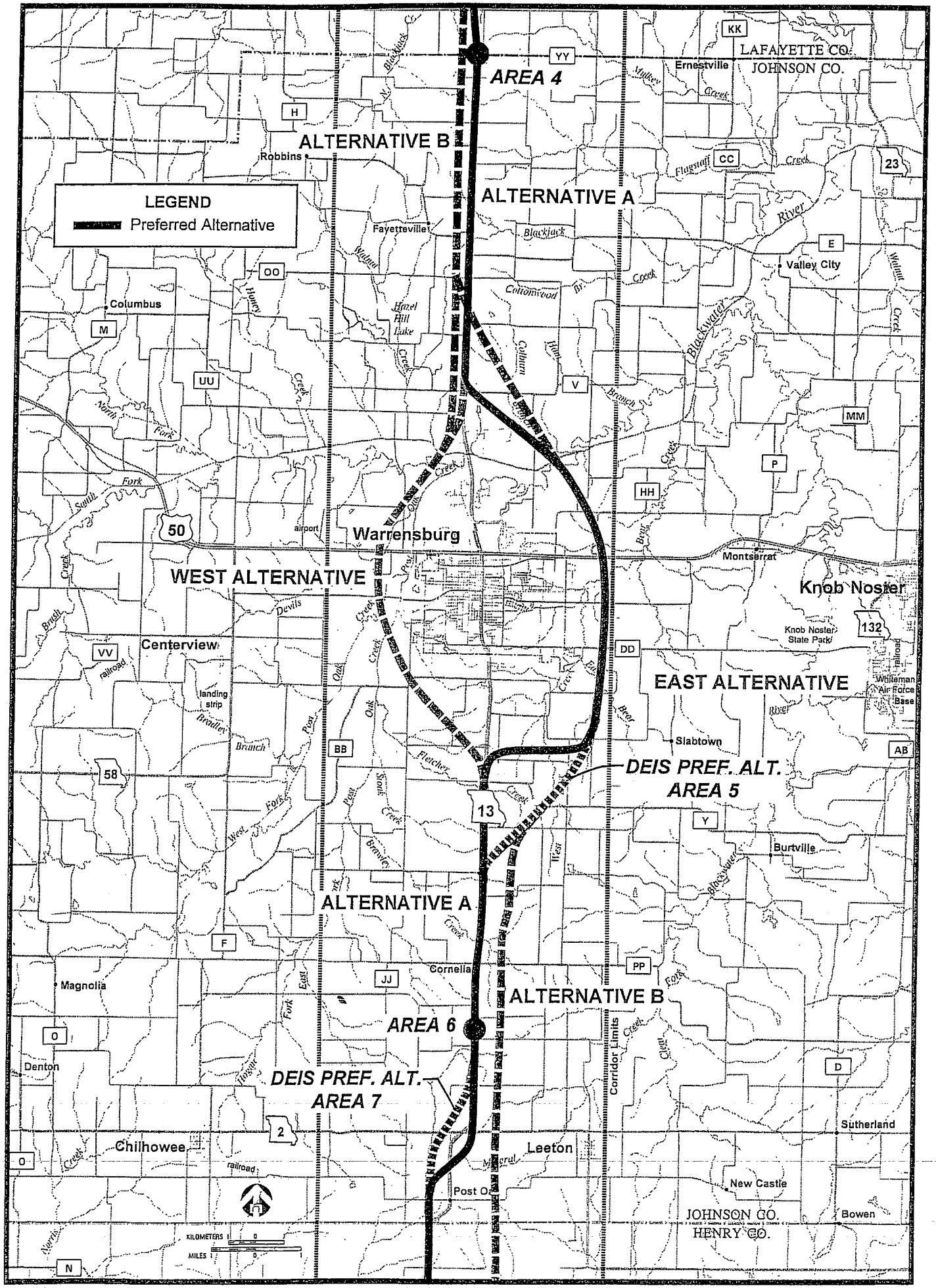


EXHIBIT II.G-1 Index of Areas of Change - Johnson Co.

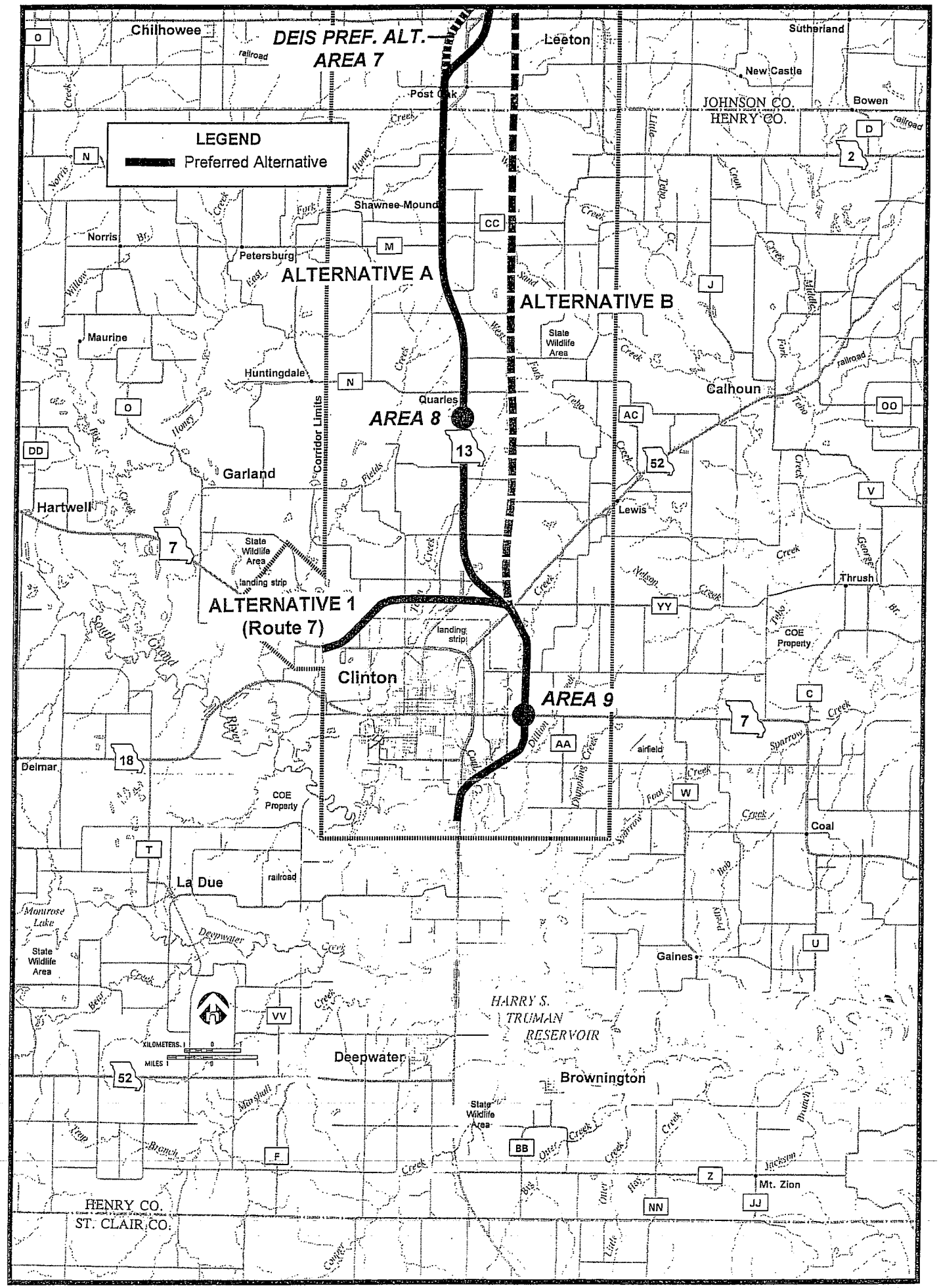
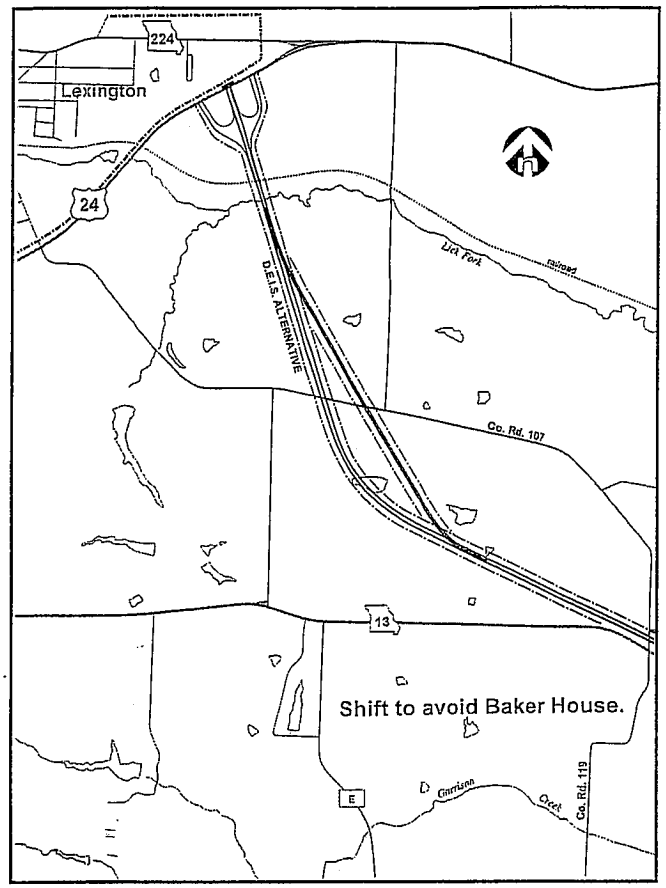
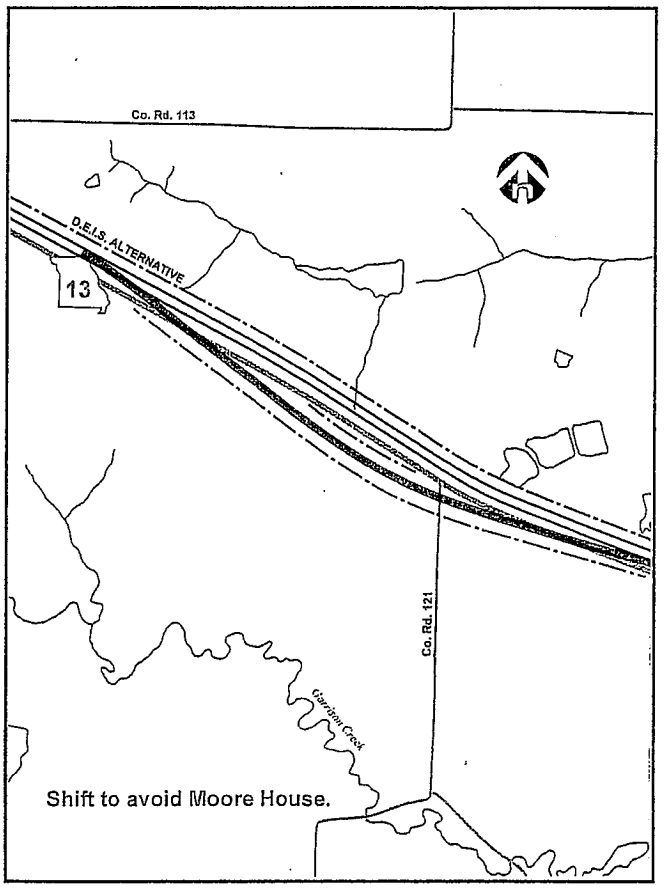


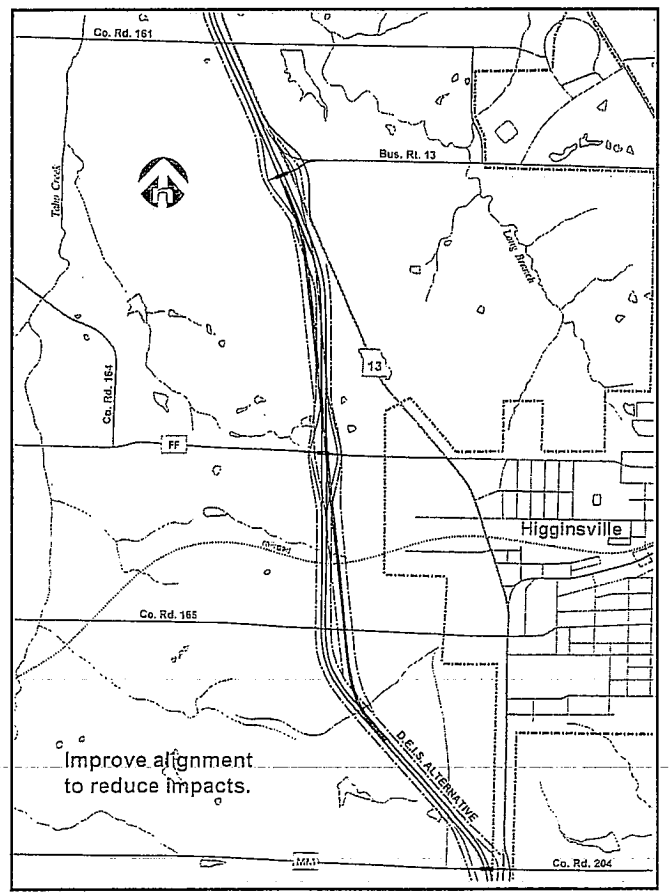
EXHIBIT II.G-1 Index of Areas of Change - Henry Co.



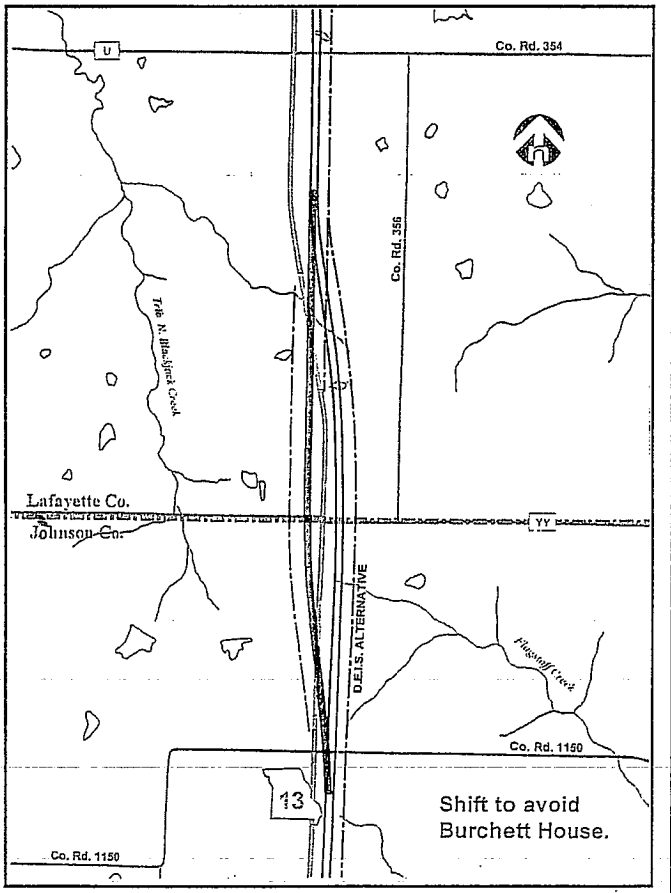
CHANGE AREA 1



CHANGE AREA 2

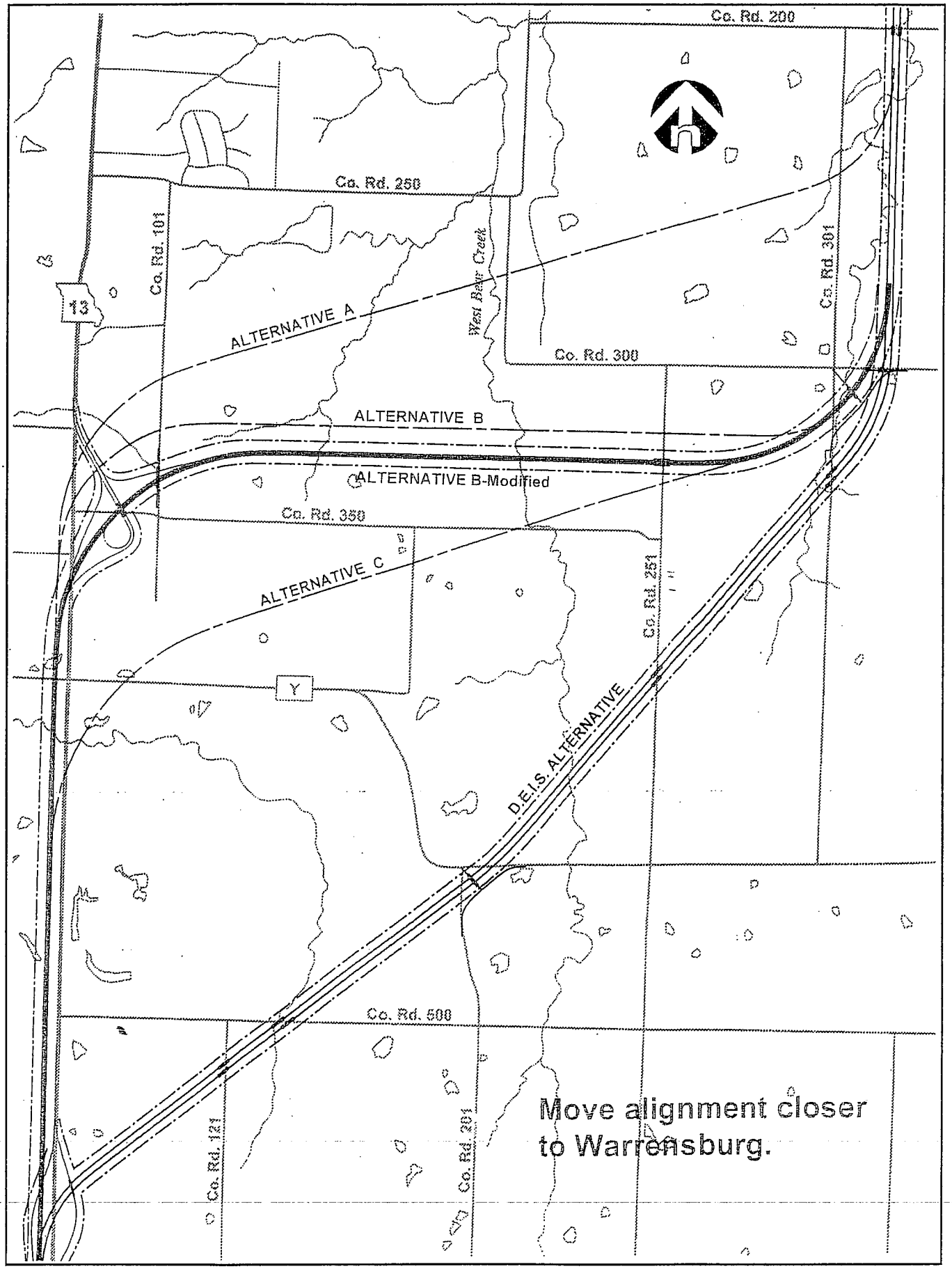


CHANGE AREA 3



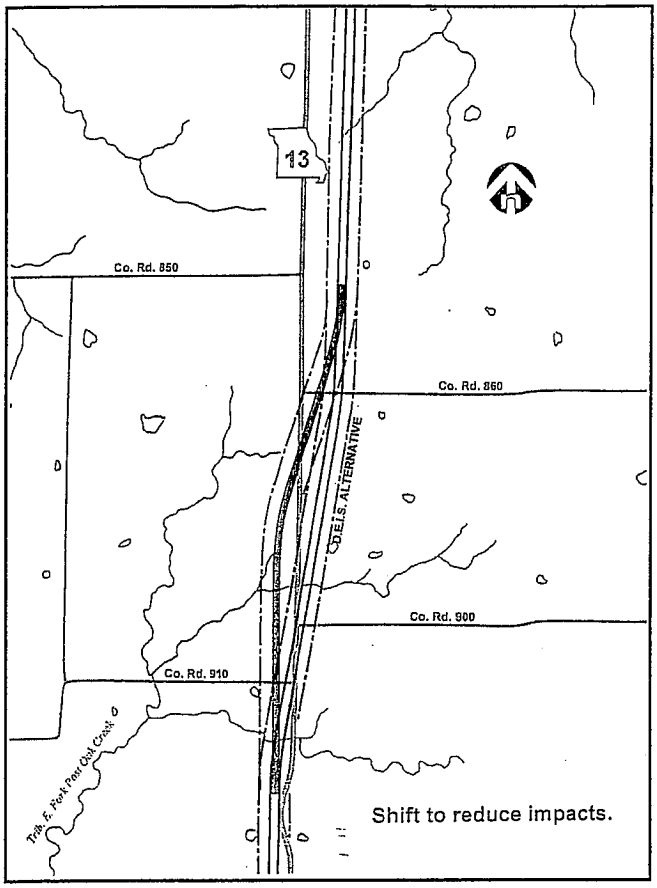
CHANGE AREA 4

EXHIBIT II.G-2 Areas of Change

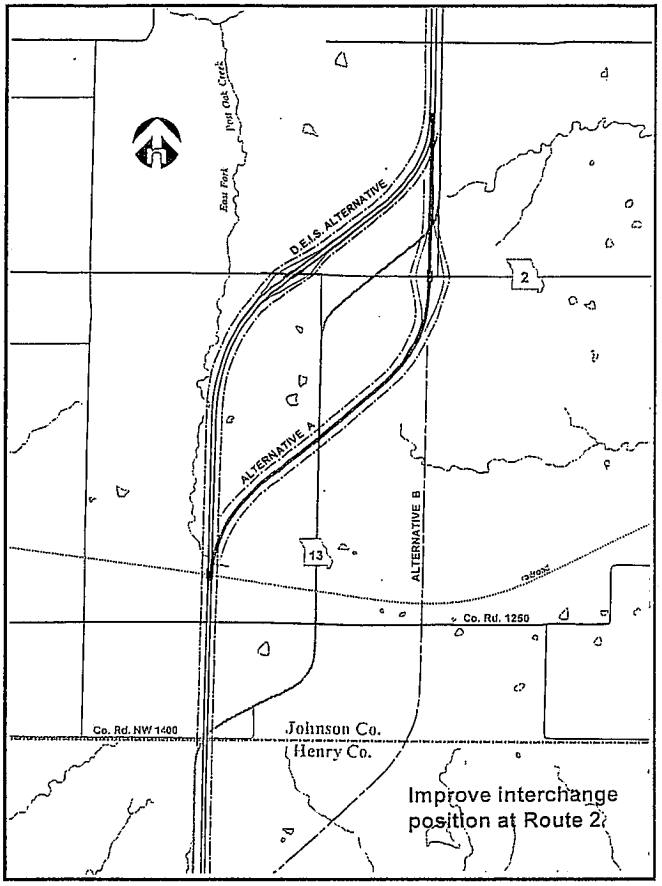


CHANGE AREA 5

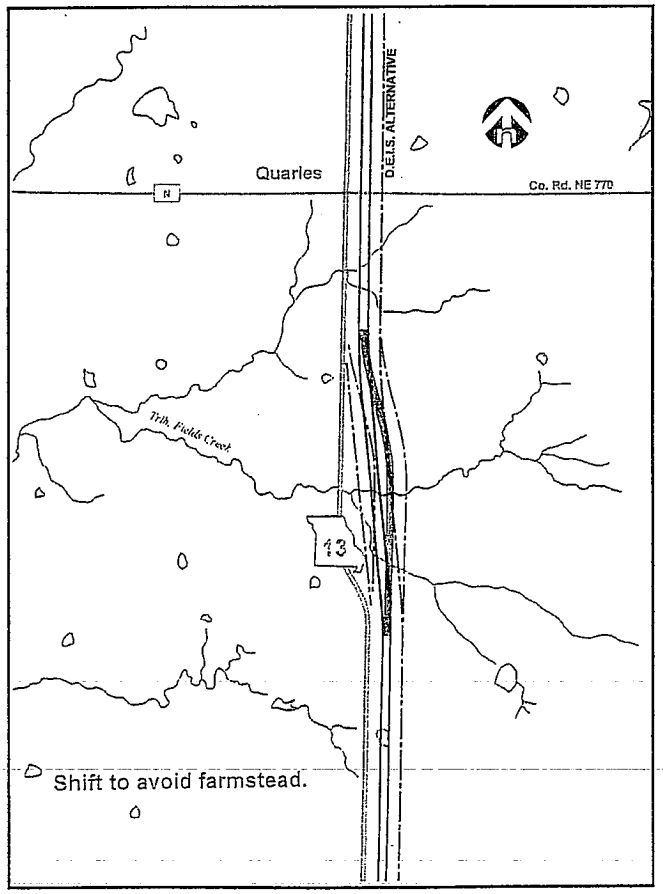
EXHIBIT II.G-2 Areas of Change



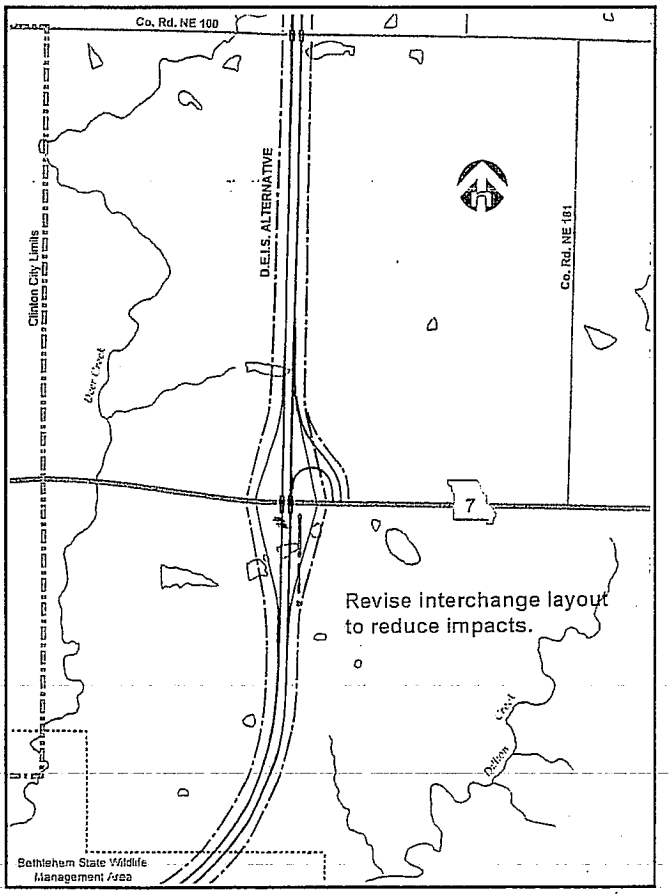
CHANGE AREA 6



CHANGE AREA 7



CHANGE AREA 8



CHANGE AREA 9

EXHIBIT II.G-2 Areas of Change