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STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

SAN ANTONIO - BEXAR COUNTY

FREEWAY OPERATIONS STUDY

AUGUST, 1981

TECHNICAL REPORT STANDARD TITLE PAGE

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FREEWAY OPERATIONS STUDY	August 1, 1981
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Abstract

The freeways have been divided into ten study sections as shown on page 2. This report includes the ten studies under one cover. Each study presents a detailed analysis of the existing freeway operations and delineates problem areas. Alternative solutions have been analyzed and recommendations developed for improving operations in the problem areas. These studies also include a detailed analysis of the impact these recommendations will have on air quality.

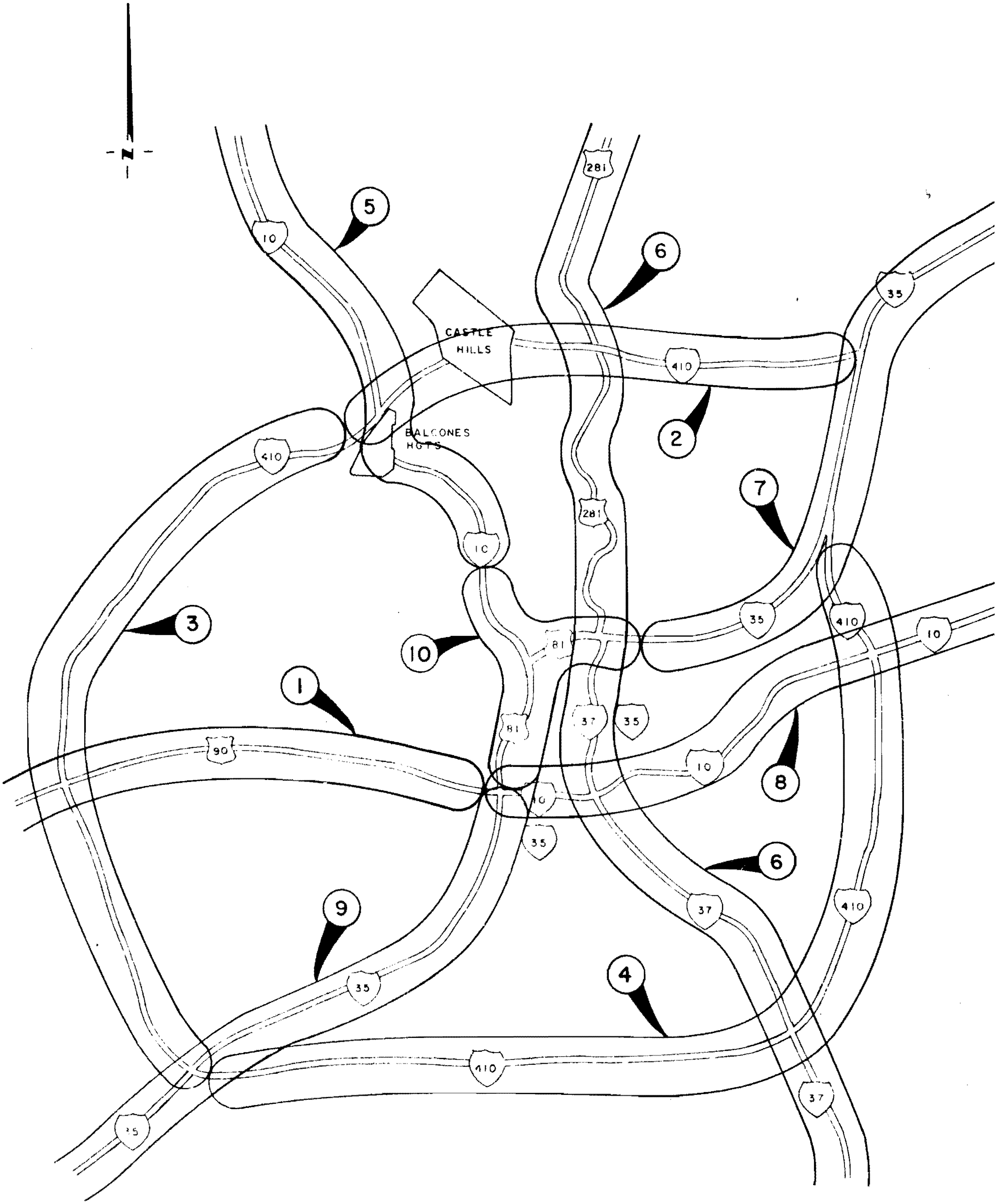
Related Reports	Distribution Statement	Permanent File
North Loop 410 Operations Plan	This document is available to the public through Texas State Department of Highways & Public Transportation, P. O. Box 29928, San Antonio, Texas 78284	
No. of Pages	Cost of Report	Reproduction Cost
394	$50,000.00	$10.19

The Freeway Operations Study presents a detailed analysis of existing freeway operations and delineates problem areas. Solutions have been analyzed and recommendations developed for improving operations in the problem areas.

The study limits are the freeways inside Bexar County, Texas. The freeways have been divided into ten sections shown in Figure 1. The general methodology employed in analyzing each section was to identify capacity deficient areas, high accident locations and other problem areas. To determine capacity deficient areas volumes were determined for the mainlanes, ramps, frontage roads and for turning movements at the interchanges and intersections. High accident areas were determined using 1978 accident data. Other problem areas were identified through numerous ways including citizen complaints, police assignment reports and interagency communication.

Based upon the results of these three factors, problem areas were determined and solutions to the problems identified. To assess the proposed improvement's impact, additional data like turning movements and small scale origin-destination studies were conducted. The results of these data were applied to existing and forecast traffic volumes to determine the extent of the impact each proposal would have on the facility. An air quality impact of each proposal were also made using EPA Mobil I emissions factors.

Table I presents a summary of the recommended improvements made in the Freeway Operations Study.



FREEWAY OPERATIONS STUDY

TABLE I

SUMMARY OF RECOMMENDED IMPROVEMENTS
FREEWAY OPERATIONS STUDY

Recommended Type	Number	Percentage
Ramp Additions	41	19.7
Ramp and Connector Modifications	38	18.3
Traffic Signal Replacement or Additions	20	9.6
Ramp Removals	19	9.1
Braided Ramp Additions	13	6.3
Right Turn Lane Additions	12	5.8
Conversion from Two-Way to One-Way Operation on Frontage Raod	11	5.3
Turnaround Additions	10	4.8
Mainlane Modifications or Additions	10	4.8
Frontage Road Extensions	10	4.8
Ramp Metering	6	2.9
Frontage Road Widenings	6	2.9
City Street Connections/Circulation	6	2.9
Provision of Grade-Separated Interchange	3	1.4
Miscellaneous	3	1.4
TOTAL	208	100.0

Over fifty-five percent of the recommendations involve freeway ramps. These include such things as ramp removal, relocation, addition, metering, etc. Nearly thirty-five percent of the recommended improvements involve intersection and frontage road improvements. These include projects like right turn lane provisions, turnarounds, frontage road operations and traffic signals.

About twelve percent of the recommendations stem directly from areas with higher accident records. Another forty-nine percent of the recommended improvements stem from congestion problems. These improvements to relieve congestion will also improve traffic safety and accidents. The remaining recommendations stem from access considerations and other problems.

The overall estimated air quality impact of these improvements is an annual reduction of 215 tons of hydrocarbons (HC), 1178 tons of carbon monoxide (CO), and 2 tons of nitrogen oxides (NO_x). This represents about a 2.6% reduction in 1982 total HC emissions emitted from urban freeways and a 1.6% reduction in total CO emissions from urban freeways. However, for all emissions on Bexar County freeways, arterials, collectors, and local streets this is about a 1 percent reduction in total HC and .5 percent reduction in CO in the 1982 total emission inventory. Table II presents the general air quality impacts of the Freeway Operations Study's recommendations. Please note that the air quality impacts of Section 10 have not been included since its implementation date is after 1982 and because the project is of

TABLE II

SUMMARY OF THE AIR QUALITY IMPACTS OF THE FREEWAY OPERATIONS STUDY

	Hydrocarbons (HC) (Annual Tons)	Carbon Monoxide (CO) (Annual Tons)	Nitrogen Oxides (NO_x) (Annual Tons)
1977 Base Emissions in Study	527	3,972	367
1982 Emissions after Improvements	312	2,795	365
1977-1982 Net Change in Emissions after Improvements	-215	-1,178	-2
Percentage Change of 1977 Base after Improvements	-40.7%	-30.0%	-.4%
1982 Total Urban Freeway Emissions	8,251	73,667	9,948
Percentage Change in 1982 Urban Freeway Emissions after Improvements	-2.6%	-1.6%	-.01%
1982 Total Emissions	23,563	214,145	24,600
Percentage Change in 1982 Total Emissions after Improvements	-.9%	-.6%	-.01%

such a scope as to have its own environmental impact statement which includes an air quality analysis. Also please note that the report makes several recommendations that could have significant impacts on future emissions but the time frame for the recommendations' implementation exceeded the 1982 base inventory upon which the reductions were to be based. The study quantifies the emissions of the vehicular traffic directly impacted by the recommended freeway improvement. The emission reductions also stem from improved fleet emission standards applicable in the forecast year of 1982.

The following is a compendium of the Freeway Operation Study's recommendations. The summary is organized by freeway section. The full Freeway Operations Study presents the detailed problem identification, data, analysis and layouts showing the recommendations.

STUDY No. 1

SUMMARY OF RECOMMENDED IMPROVEMENTS ON U.S.90 WEST

1. Change the two-way frontage roads from Loop 1604 to Hunt Lane to one-way and remove the hook ramps.

2. Relocate the westbound entrance ramp from Hunt Lane.

3. Remove the eastbound exit ramp to I.H. 410 and replace it with an entrance ramp.

4. Construct a right turn lane on Southbound Military Dr. at the approach to the westbound frontage road.

5. Construct a westbound entrance ramp east of Loop 13.

6. Construct an eastbound exit ramp east of Loop 13.
Extend the westbound frontage road under Old Hwy 90.
Replace the westbound exit ramp to Old Hwy 90 with an entrance ramp.

7. Relocate westbound exit ramp to Old Hwy 90 just west of Leon Creek.

8. Construct a westbound exit ramp to Callaghan Rd.

9. Construct an eastbound entrance ramp from Callaghan Rd.

10. Construct a westbound exit ramp to General McMullen over a westbound entrance ramp from Cupples Rd.

11. Construct an eastbound exit ramp to Cupples Rd.

12. Construct an eastbound exit ramp to Zarzamora St.

STUDY NO. 2

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.410 NORTH

1. Construct braided ramps for an eastbound exit to Cherry Ridge with the eastbound entrance from I.H.10 westbound.

2. Construct frontage road turnarounds and right turn lanes at Vance Jackson.

3. Install new traffic signal control equipment at Vance Jackson.

4. Construct braided ramps for an eastbound exit to Jackson-Keller with the entrance from Vance Jackson.

5. Construct braided ramps for a westbound entrance from Jackson-Keller with the exit to Vance Jackson.

6. Construct frontage road turnaround on the west side of Jackson-Keller.

7. Construct frontage road turnaround on the east side of West Avenue.

8. Install new traffic signal control equipment at West Avenue and Jackson-Keller.

9. Construct braided ramps for a westbound exit to West Ave.

10. Construct frontage road turnarounds and right turn lanes at Blanco Road.

11. Install new traffic signal control equipment at Blanco Road.

12. Construct braided ramps for an eastbound entrance from Blanco Road with the exit to San Pedro.

13. Construct braided ramps for a westbound entrance from McCullough with the exit to San Pedro.

14. Construct a continuous acceleration-deceleration lane on the westbound mainlanes between the Jones-Maltsberger entrance ramp and the San Pedro exit ramp.

15. Install new traffic signal control equipment at McCullough.

16. Construct a continuous acceleration-deceleration lane on the westbound mainlanes between the Airport entrance ramp and the Jones-Maltsberger exit ramp.

17. Construct braided ramps for a relocated eastbound entrance from McCullough with the exit to Jones-Maltsberger and relocate the eastbound exit to Airport.

18. Install new traffic signal control equipment at Jones-Maltsberger.

19. Construct braided ramps for an eastbound exit to Broadway and Wetmore with the entrance from Airport and remove the existing exit to Broadway.

20. Replace the westbound exit to Airport with an entrance from Wetmore.

21. Construct braided ramps for a westbound exit to Airport with the entrance from Broadway.

22. Install new traffic signal control equipment at Broadway.

23. Reverse the eastbound ramps between Broadway and Nacogdoches.

24. Construct frontage road right turn lanes at Nacogdoches.

25. Install new traffic signal control equipment at Nacogdoches.

26. Construct an additional frontage road approach lane on both frontage road approaches to Starcrest.

27. Construct an additional eastbound frontage road approach lane to Perrin-Beitel.

28. Install new traffic signal control equipment at Perrin-Beitel.

STUDY NO. 3

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.410 WEST

1. Install new traffic signal at the Pearsall Road interchange.

2. Construct frontage road turnarounds and right turn lanes at Marbach Road.

3. Relocate the existing southbound exit to Marbach Road further north.

4. Construct a grade-separated interchange at Military Drive.

5. Construct continuous frontage roads over Slick Ranch Creek and Leon Creek and reverse the southbound ramps at Slick Ranch Creek.

6. Construct frontage road right turn lanes at Culebra Road and a turnaround on the north side.

7. Construct frontage road right turn lanes at Ingram Road.

8. Construct frontage road right turn lanes at Evers Road.

9. Install interchange lighting.

10. Construct an additional mainlane in each direction from Ingram Road to Valley-Hi Drive and provide continuous lighting.

11. Install new traffic signal at the Medina Base Road interchange.

STUDY NO. 4

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.410 SOUTH AND EAST

1. Construct an I.H.410 southbound entrance ramp from F.M.78.

2. Convert the two-way frontage roads near Moursund Blvd. to one-way.

STUDY NO. 5

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.10 WEST

1. Construct a ramp for a westbound exit to F.M.3351.

2. Convert the frontage roads to one-way from Beckmann to DeZavala Road. All ramps in the same section are to be changed to conform to the one-way system.

3. Construct a frontage road turnaround on the southside of Spur 53. Widen the bridge to four lanes.

4. Construct a ramp for an eastbound exit to DeZavala Road. Construct a ramp for an eastbound entrance from Spur 53.

5. Construct a ramp for a westbound exit to Spur 53. Construct a ramp for a westbound entrance from DeZavala Road.

6. Construct a frontage road turnaround on the southside of DeZavala Road and a right turn lane on the westbound frontage road approach.

7. Remove the westbound exit to DeZavala Road and construct an entrance ramp at the same location. Construct westbound mainlanes to run parallel with the eastbound mainlanes at the U.S.87 Interchange. The existing westbound mainlanes are to be used as a collector-distributor road. Construct a ramp for a westbound exit to DeZavala road from the collector-distributor road. Remove existing westbound entrance ramp from Huebner Road.

8. Construct a hook ramp from the eastbound frontage road to U.S.87.

9. Construct a right turn lane on the westbound frontage road approach at Huebner Road.

10. Install new traffic signal control equipment at Wurzbach Road.

11. Construct a ramp for an eastbound entrance from Medical Drive between Wurzbach and Callaghan Roads; and construct a continuous acceleration-deceleration lane between the recommended ramp and the Callaghan Road exit.

12. Remove the westbound exit ramp for Wurzbach Road and construct at a site further back. Construct a continuous acceleration-deceleration lane between the new Wurzbach Road exit and the I.H.410 westbound to I.H.10 westbound connector.

13. Construct a third lane on the eastbound mainlanes between the entrance ramp from Wurzbach road to the exit for I.H.410 eastbound.

14. Construct a continuous acceleration-deceleration lane on the eastbound mainlanes between the Callaghan Road entrance and the exit for I.H.410 westbound.

15. Construct braided ramps for a westbound exit to Callaghan Road and the entrance ramp of I.H.410 westbound to - I.H.10 westbound connection. Construct an exit ramp from the connector to the frontage road relocate the westbound exit ramp for Callaghan Road.

16. Construct a third lane on the westbound mainlanes between the exit for I.H.410 eastbound and the exit ramp for I.H.410 westbound. Construct a continuous acceleration-deceleration lane between Wonderland Drive entrance ramp and the exit ramp for I.H.410 eastbound

STUDY NO. 6

SUMMARY OF RECOMMENDED IMPROVEMENTS ON U.S. 281 AND I.H. 37

SUMMARY OF RECOMMENDED IMPROVEMENTS ON U.S. 281

1. Install new traffic signals at Winding Way-Oak Shadows intersection.

2. Replace existing northbound entrance ramp from Bitters Road with an exit ramp.

3. Replace the existing northbound hook ramp from Bitters Road with a slip ramp.

4. Construct a southbound San Pedro entrance ramp from Rhapsody Drive and convert the existing two-way frontage road between Rhapsody Drive and Silver Sands Drive to one-way southbound.

5. Construct a northbound San Pedro exit ramp to Sandau Road and install a traffic signal at the intersection.

6. Convert the existing two-way west frontage road between Braniff Drive and Rhapsody Drive to one-way southbound and construct a city street to connect Rhapsody Drive with Braniff Drive.

7. Construct a grade-separated interchange at Terminal Drive. Provide a continuous southbound frontage road between Jones-Maltsberger and I.H.410. Replace the existing southbound entrance ramp from Jones-Maltsberger with an exit ramp and provide a southbound entrance ramp from Terminal Drive.

8. Provide a two lane exit for the northbound exit to Airport Blvd.

9. Provide a connector for northbound Jones-Maltsberger traffic to use the existing southbound entrance ramp and install a traffic signal at the intersection of U.S. 281 northbound exit ramp with Jones-Maltsberger.

10. Install ramp metering signals on the southbound entrance ramp from eastbound Basse Road and provide a bus bypass lane when warranted.

11. Provide a connector from Avenue B to the northbound entrance ramp from Josephine Street.

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H. 37

12. Construct a southbound exit ramp to Crockett Street.

13. Construct a northbound exit to Gonzales Street.

14. Modify existing traffic signal control equipment at the Commerce Street - Bowie Street intersection.

15. Provide a three lane entrance ramp on the I.H. 37 northbound entrance ramp from I.H. 10 eastbound and westbound. Provide a three lane entrance ramp on I.H. 10 westbound entrance ramp from I.H. 37 northbound and southbound.

16. Install new traffic signals at Pecan Valley interchange.

STUDY NO. 7

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H. 35 NORTH

1. Construct an additional eastbound mainlane from the I.H.37-U.S.281 interchange to the Walters Street exit.

2. Reverse the eastbound ramps between New Braunfels Street and Walters Street.

3. Construct an eastbound exit ramp just east of Coliseum Road.

4. Construct a westbound entrance ramp just east of Coliseum Road.

5. Install traffic signals on the I.H.410-I.H.35 connector, north frontage road intersections with F.M.78 and with the I.H.35 south frontage road.

6. Construct new I.H.35 southbound mainlanes between Rittiman Road and I.H.410 to run parallel with the northbound mainlanes. Convert the existing southbound mainlanes to be used as a connector to I.H.410 southbound. Construct an entrance ramp from the I.H.35 southbound frontage road to the new I.H.410 southbound connector. Remove the existing I.H.35 southbound entrance ramp from Rittiman Road. Relocate the existing I.H.35 southbound exit to Holbrook Road further south. Construct an I.H.35 northbound exit to Rittiman Road south of the I.H.410 northbound entrance.

7. Install ramp metering signals on the I.H.35 southbound entrance ramp from Rittiman Road prior to implementing recommendation number 6.

8. Remove both northbound and southbound exit ramps to Rittiman Road and relocate them at a location further back from Rittiman Road. Construct an additional frontage road approach lane on both sides of Rittiman Road. Construct a frontage road turnaround on the south side of Rittiman Road.

9. Construct an additional I.H.35 southbound frontage road approach lane to Eisenhauer Road and construct a frontage road turnaround on the north side of Eisenhauer Road.

STUDY NO. 8

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H. 10 EAST

1. Convert the two-way frontage road in the northwest quadrant of the I.H.10 - I.H.410 interchange to one-way.

2. Construct an I.H.10 westbound frontage road between Loop 13 and just east of the Southern Pacific Railroad. Construct an underpass just east of the Southern Pacific Railroad tracks connecting the eastbound frontage road with the recommended westbound frontage road. Construct a city street to connect Pop Gunn Rd. with the recommended bridge underpass.

STUDY NO. 9

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.35 SOUTH

1. Construct a city street to connect Somerset Road to Palm Beach.

2. Install new traffic signals at Zarzamora Street interchange.

3. Relocate the I.H.35 northbound entrance ramp from Southcross Blvd. further north.

4. Provide an additional I.H.35 northbound mainlane over Theo Avenue.

5. Install a ramp closure gate on the I.H.35 northbound entrance ramp from Theo Avenue.

STUDY NO. 10

SUMMARY OF PLANNED SOLUTIONS ON I.H.10 AND I.H.35 - DOWNTOWN "Y"

1. Expand the existing facility to a total of 10 mainlanes. Five mainlanes in each direction, part of which would be in elevated sections above the existing roadway and other parts as widening the existing roadway.
2. Relocate the I.H.10 southbound exit ramp to Fredericksburg Road further north to provide access to the area streets.
3. Relocate the I.H.10 southbound entrance ramp to Fredericksburg Road to the upper level to prevent merging problems with the entrance ramp from Woodlawn Avenue.
4. Provide a continuous frontage road on the west side of I.H.10 between Woodlawn Avenue and Culebra Road. This will provide a continuous frontage road from I.H.410 to Culebra Road.
5. Construct a bridge on McAllister Street over Martinez Creek to provide access to the area streets from Culebra Road and convert the two-way traffic on the I.H.10 west frontage road north of Culebra Avenue to one-way.
6. Construct a right turn lane on the eastbound Culebra Road approach to the I.H.10 southbound frontage road.
7. Provide a continuous frontage road on the east side of I.H.10 between Cincinnati Avenue and Culebra Road. Convert the existing two-way traffic to one-way.
8. Remove the existing I.H.10 southbound entrance ramp from Colorado. The removal of this ramp will eliminate the mainlane weaving problem between this entrance ramp and the Poplar Street exit ramp.

9. Relocate the existing I.H.10 northbound entrance ramp from Marshall St. further north.

10. Provide an I.H.10 southbound exit ramp to the frontage road just south of N. Frio. This frontage road will provide access to the C.B.D. via N. Laredo or Pecos Street.

11. Remove the existing I.H.10 southbound one lane loop connection to I.H.35 northbound and provide an elevated two lane direct connection.

12. Provide an elevated three lane connection from I.H.10 southbound to I.H.35 southbound over Martin St.

13. Provide an I.H.35 southbound two lane connection to I.H.10 northbound.

14. Provide an I.H.35 northbound two lane connection to I.H.10 northbound.

15. Provide a grade separated interchange on I.H.35 at Durango Blvd.

16. Provide an I.H.35 southbound two lane loop connection to Durango Blvd. which will also provide access to Vista Verde South.

17. Grade-separate the I.H.35 southbound exit to Alamo Street with an entrance from Guadalupe Street.

18. Convert S. Laredo from two-way traffic to one-way traffic from Guadalupe to Cevallos. S. Laredo will become the northbound frontage road.

19. Remove the existing I.H.35 ramps from Alamo Street and relocate them from the frontage roads.

20. Provide an I.H.35 northbound entrance ramp from Powell Street.

21. Provide continuous frontage roads on the west side of I.H.35 between San Marcos and Nogalitos and from El Paso to S. Laredo.

22. Grade-separate the I.H.35 southbound entrance from San Marcos and the exit to Nogalitos.

23. Remove the I.H.35 northbound entrance ramp from Main Avenue and provide an entrance from Quincy.

24. Widen the Main Avenue Bridge over I.H.35 to provide a northbound left turn lane.

25. Convert the two-way traffic on Brooklyn Avenue and McCullough

Avenue to one-way, making Brooklyn Avenue one-way away from downtown and McCullough Avenue one-way toward downtown.

26. Provide an I.H.35 northbound exit ramp to McCullough Avenue from the upper level mainlanes.

27. Provide an I.H.35 southbound entrance ramp from McCullough Avenue to the upper level mainlanes. This entrance ramp will be grade-separated with the lower level exit ramp to Lexington.

28. Provide an I.H.35 northbound entrance ramp from Brooklyn Avenue to the upper level.

29. Provide an I.H.35 southbound exit ramp to Brooklyn Avenue from the upper level.

30. Remove the I.H.35 southbound exit ramp to Atlanta Avenue.

31. Remove the I.H.35 southbound entrance ramp from N. St. Mary's.

32. Remove the I.H.35 northbound entrance from N. St. Mary's.

33. Provide an exit to Broadway via Newell Street from the I.H.35 northbound connection to U.S.281 northbound.

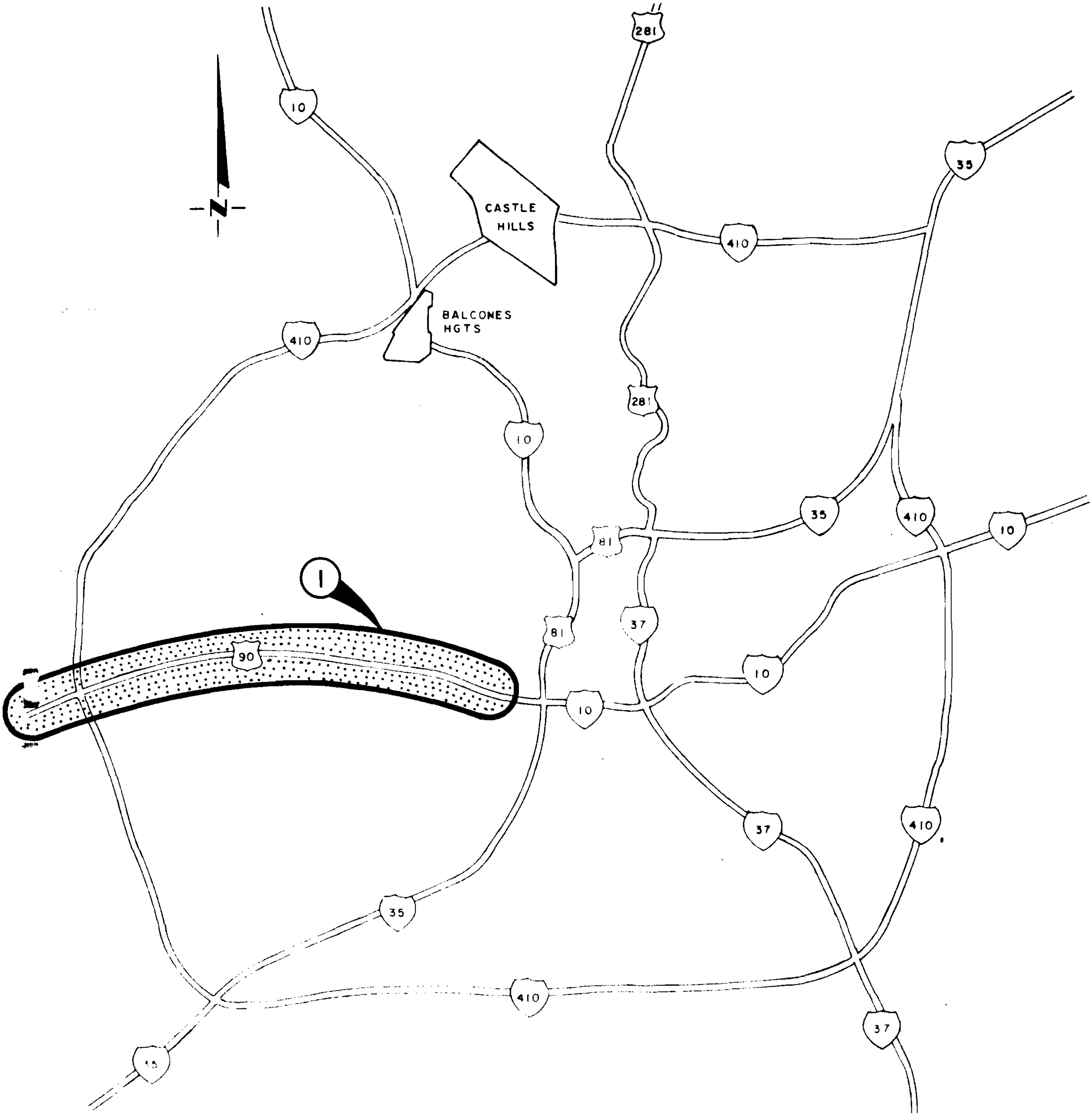
34. Improve Newell Street to become a four lane divided street from Quincy to Broadway.

35. Extend Quincy northbound under I.H.35 to intersect with Newell Street to provide a continuous frontage road.

36. Extend Newell Street to Elmira Street to provide a continuous southbound frontage road.

CONCLUSION

The planned solutions will solve the existing problems by improving the level of service, providing better access, improving the overall circulation and eliminating the weaving sections. These improvements will eliminate the congestion which will reduce the high accident rates. Therefore, this study will recommend no additional improvements to the already planned solutions.



U. S. 90 WEST

FREEWAY OPERATIONS STUDY

FROM: HUNT LANE

TO: NOGALITOS STREET

INTRODUCTION

This study will identify the areas that were at capacity in 1978 or were approaching capacity and expose the areas where access is not easily available. It will also identify the areas that have become high accident locations.

Once these locations have been identified, the study will provide recommendations as to what measures should be taken to solve the problems.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10. They provided volumes for the mainlanes, ramps, frontage roads and turning movements at the interchanges and intersections. Level of Service was calculated for all conditions to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing". The high accident locations could therefore be identified. The accident breakdown can be found in Table I-A through I-G.

The areas where access is not easily available were identified by citizen and police participation and from observations made by this Office and the San Antonio Traffic and Transportation Department. This Office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio Traffic and Transportation Department notifies us of any problem areas they have noticed or have received complaints about.

GENERAL DISCUSSION

The mainlanes of U.S. 90 are presently operating at an acceptable level of service, although some frontage roads and interchanges are experiencing congestion during the peak hours due to the high volume of traffic that is generated from Kelly and Lackland Air Force Bases. Circulation problems have also developed in the adjacent neighborhoods since vehicles from some neighborhoods do not have easy access to the freeway.

U.S. 90 is a controlled access freeway from Loop 1604 to I.H. 35 where it becomes concurrent with I.H. 10 to the east. From the west it is a divided expressway with crossovers up to Loop 1604. The San Antonio City Limits extend westward to Ray Ellison Dr. A detailed layout can be seen on Figure I-A through I-J which shows the existing roadway and the recommendations which will be discussed in the Problems and Recommended Solutions portion of this Study.

PROBLEMS AND RECOMMENDED SOLUTIONS

The following discussions will describe the various problems identified by this Study and will recommend solutions which may relieve, if not completely solve, these problems.

PROBLEM: Fatal Accidents resulting from Wrong Way Movements on the Freeway Mainlanes

In 1978 there were ten wrong way accidents resulting in 19 injuries and 4 fatalities. It is true that nearly everyone of these accidents involved a drinking driver, and it is doubtful that the design of the roadway was a major contributing factor. Still, however, the Study attempted to identify any design features which might be conducive to wrong way movements. Some questionable areas were located, and those requiring only minor modifications such as sign changes, post-and-cable barrier, etc. were changed immediately due to the seriousness of this problem rather than waiting to address them in this report.

Since two-way frontage roads are obviously more conducive to wrong way entry onto the mainlanes than one-way frontage roads, all two-way frontage roads were studied very closely. Also, two-way frontage roads require hook ramps which force the driver to make a rapid speed change at the terminal end. The slip type ramp is a much preferred design, but is only safe where frontage roads are one-way. Recent studies have revealed that the overall accident rate for two-way frontage roads is twice as high as for one-way frontage roads in urban areas. Normally the severity of accidents involving wrong way movements is high because high speed, head-on collisions result. Therefore, one-way frontage roads should provide a safer operation and will be consistent with the rest of the full controlled access freeway and will eliminate the hook ramps.

Although the traffic volumes were low on the two-way frontage roads between Loop 1604 and the Hunt Lane-Ray Ellison Dr. Interchange, it is recommended that the frontage roads be changed to one-way.

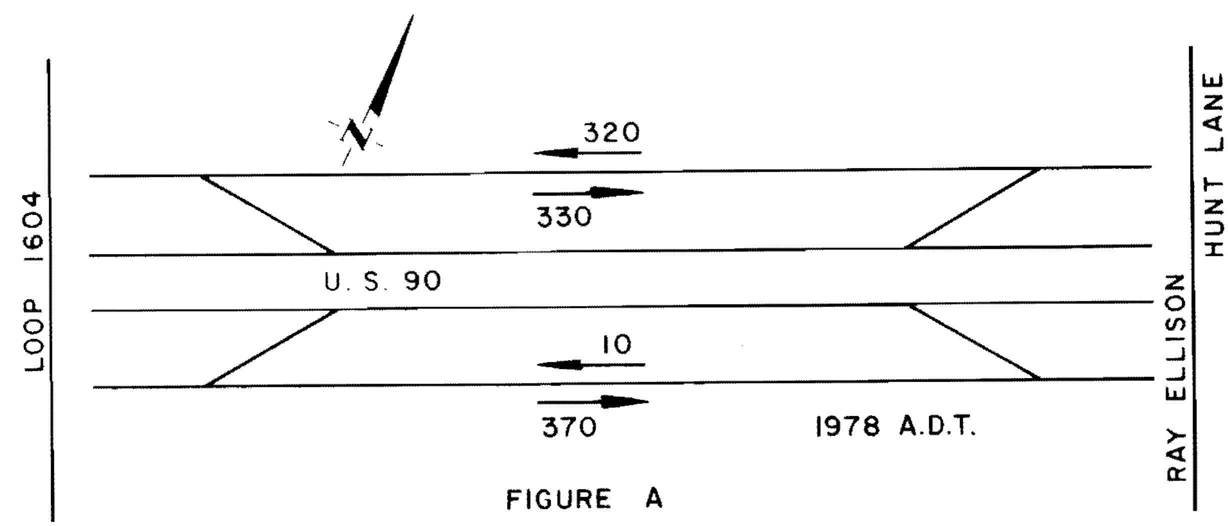


FIGURE A

The westbound entrance hook ramp, west of the Hunt Lane-Ray Ellison Dr. Interchange, should be removed and a slip ramp installed west of Kriewald Rd. to allow Kriewald Rd. traffic to gain earlier access to the U.S. 90 mainlanes. This ramp relocation will also provide better geometrical alignment to the mainlanes without interference from the Medio Creek Bridge structures. Although not shown on the layouts, the hook ramps just east of the Loop 1604 Interchange should also be changed to slip ramps. Of course, changing these frontage roads to one-way will result in a two mile section without an interchange. However, as further development occurs between Hunt Lane and Loop 1604, it is anticipated that an arterial street will be added to connect US 90 with Marbach Rd., and therefore provide an ideal location to add a new interchange in this area.

As an additional measure to combat wrong way accidents on freeway mainlanes, this Office is engaged in an ongoing joint effort with the San Antonio Police Department to investigate each wrong way accident in an attempt to determine the location of, and the possible reason for, the wrong way entry. If a pattern can be established for these movements, then perhaps better methods can be found to reduce them.

PROBLEM: Congested Weaving Section at Interchange with I.H. 410

The weaving section on the eastbound frontage road between the entrance ramp from I.H. 410 Southbound and the Exit Ramp to I.H. 410 Northbound was a Level of Service "E" which is forced flow. This is because of the high volume in such a short weaving section.

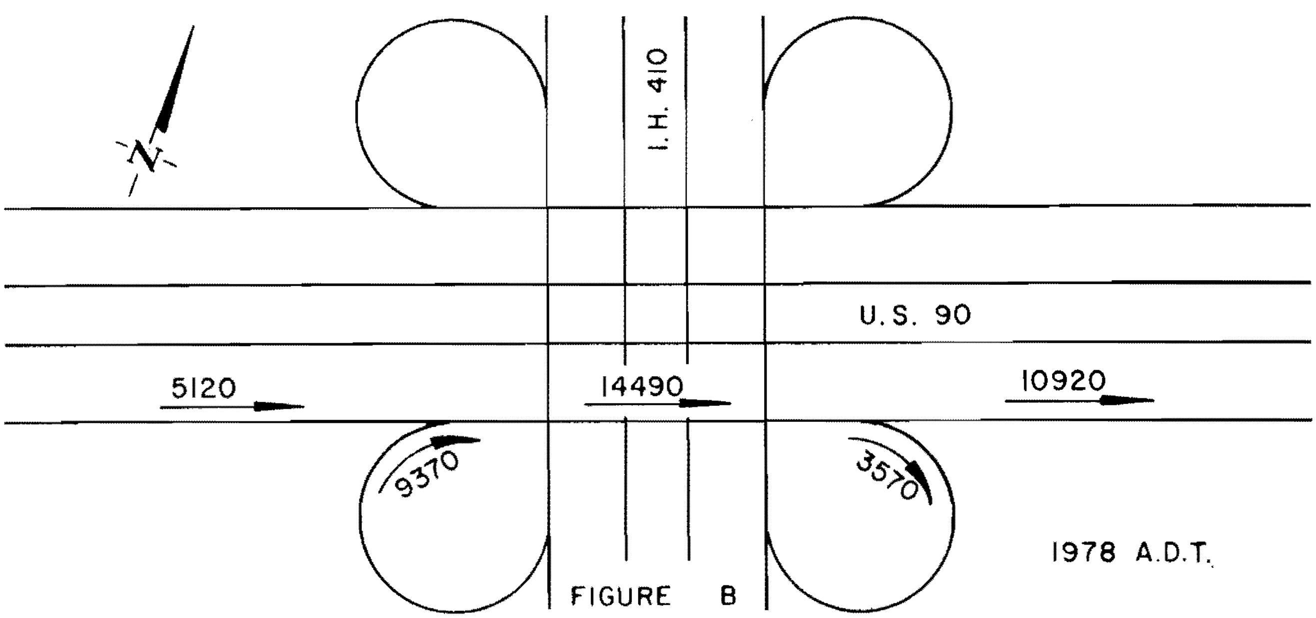


FIGURE B

By replacing the existing exit ramp with an entrance ramp just west of this interchange, the traffic volume in the weaving section on the frontage roads can be reduced by 1050 vpd, and this will allow easier access to the mainlanes for traffic from the Hunt Lane-Ray Ellison Dr. Interchange. This addition should improve the flow of traffic through this weaving section without penalizing the traffic exiting for I.H. 410. This traffic can be accommodated by the Hunt Lane Exit.

PROBLEM: Congestion and High Accident Rate at Loop 13 Interchange

Using 1978 traffic volumes, the U.S. 90-Loop 13 Interchange is at capacity, and the frontage road approaches to Loop 13 experienced 50 accidents in 1978.

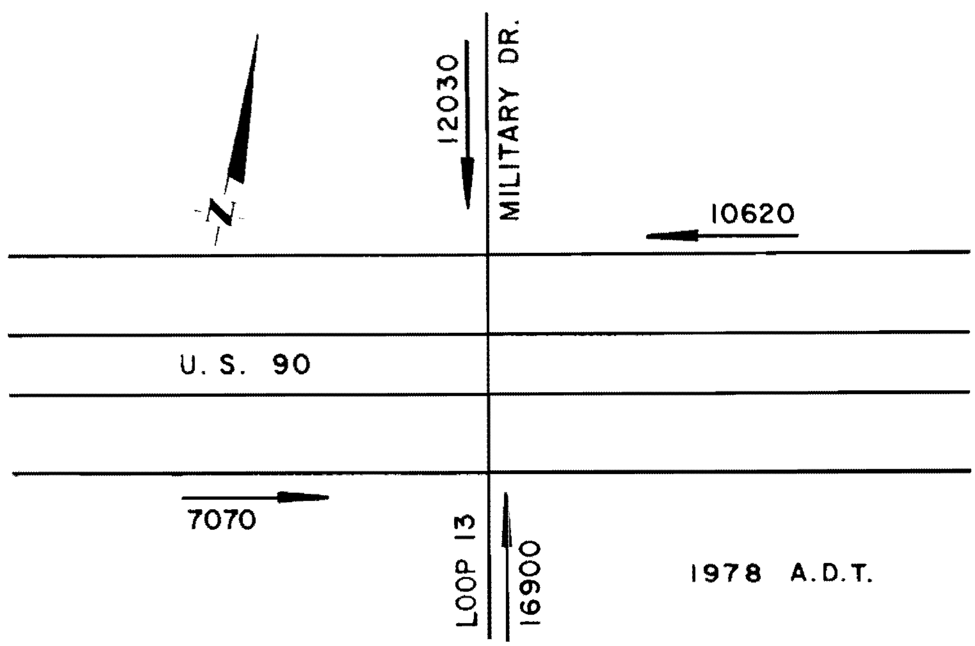


FIGURE C

Turnarounds for both frontage roads and a free right turn lane for the westbound frontage road approach were constructed and opened to traffic in early 1980. These improvements have provided a better and safer traffic operation although the interchange still shows some congestion during the peak hours. To relieve this condition the traffic signal equipment at the interchange is scheduled to be modernized in the near future. However, some delays will still be experienced in the peak hours because tremendous traffic volumes are generated from Lackland Air Force Base and the commercial businesses north of the interchange. With such large traffic volumes being controlled by a traffic signal, the only other effective way to improve the operation and relieve the congestion and delay is to reduce the amount of traffic which must be controlled by the traffic signal. The following recommendations should help achieve this goal.

1. Construct a free right turn lane on southbound Military Dr. at the approach to the Westbound Frontage Road. This lane should be similar to the right turn lane recently installed on the westbound approach.

2. Construct a westbound entrance ramp east of Loop 13. This entrance ramp will serve traffic from Old Hwy. 90 and will allow vehicles to gain earlier access to the mainlanes without being unnecessarily forced to travel through the Loop 13 Interchange.

3. Construct an eastbound exit ramp east of Loop 13 which will serve traffic desiring to gain access to Old Hwy. 90. The exit ramp will allow U.S. 90 eastbound traffic direct access to Old Hwy. 90 without having to travel through the Loop 13 Interchange.

<u>PROBLEM</u>: <u>Anticipated Congestion to be Generated by Planned Expansion of Levi Strauss Plant</u>

Levi Strauss Company is located on the north side of U.S. 90 just east of Leon Creek. Its employment is over 500 and presently the facility is being enlarged and plans to employ an additional 1,000 employees. The existing freeway system will geometrically accommodate the increased traffic desiring to travel in the easterly direction because of the turnaround at Leon Creek, although the resulting increase in traffic on the eastbound frontage road will require an entrance ramp just east of Callaghan Road. This entrance ramp will provide direct access to the eastbound mainlanes for the existing and additional Levi Strauss Company traffic and will also benefit the traffic from Callaghan Road by eliminating the need for them to travel through the Acme Road Interchange which was recently signalized because of the increased traffic.

The increased traffic generated by Levi Strauss Company in the westbound direction will require an entrance ramp where the exit to Old Hwy. 90 now exists. This entrance ramp will remove the Levi Strauss traffic from the intersection of Old Hwy. 90 at the westbound frontage road. It will also eliminate the delay time caused by the high eastbound volume on Old Hwy. 90. The westbound exit to Old Hwy. 90 should be relocated eastward in order to continue to provide access to Old Hwy. 90.

Presently, westbound mainlane traffic desiring to gain access to Levi Strauss Company and Callaghan Road must do so via Acme Road and Castroville Hwy. There is no easier access. Therefore, a westbound exit to Callaghan Road is recommended to prevent this extra delay and inconvenience.

The installation of these ramps will accommodate the expected increased traffic and provide a continuous and safer and smoother ingress and egress system with less delay at the intersections.

As further development occurs north of the freeway in the Pinn Road area, it may be necessary to extend the westbound frontage road and remove the existing exit to Loop 13 (See Figure D). This design would eliminate the weaving section in the Pinn Road area and would not penalize the traffic exiting to Loop 13 since they would be able to use the presently proposed exit to Old Hwy. 90.

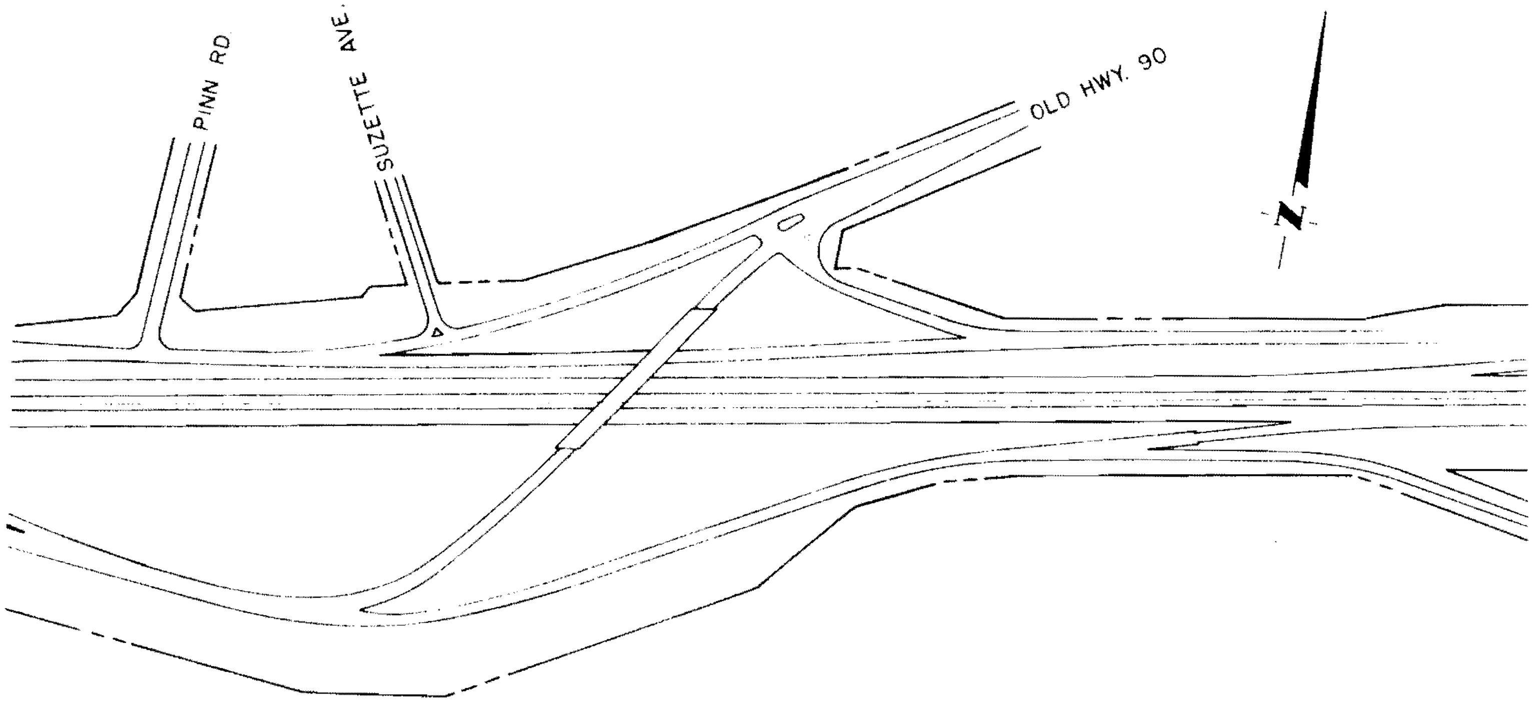


FIGURE D

PROBLEM: Better Access Needed to Cupples Road

Cupples Road is a major north-south throughfare, and it is recommended that an eastbound exit to Cupples Road be constructed along with a westbound entrance from Cupples Road in order to eliminate the circuitous routes on neighborhood streets that now exist. With the addition of these ramps, Cupples Road will become a much needed full diamond interchange to provide the necessary ingress and egress to the bordering neighborhoods. With the existing geometrics, the westbound entrance ramp from Cupples Road will have to be braided with the exit to General McMullen. This procedure is more costly, although it does eliminate all weaving maneuvers on the frontage road and mainlanes which will reduce the probability of accidents. With the braided ramp configuration, it will be necessary for the north frontage road (Brady Blvd.) to become one-way instead of two-way. The geometrics are such that the eastbound exit to Cupples Road cannot be braided with the entrance from Gen. McMullen, therefore eastbound access to Cupples Road will be via General McMullen Interchange.

PROBLEM: Better Access Needed for Zarzamora St.

Zarzamora St. is also a major north-south throughfare. Access to Zarzamora St. can be provided for eastbound traffic with a direct exit ramp from the U.S. 90 mainlanes. Unfortunately, due to the presence of the adjacent railroad and other geometric restraints, it is not feasible to provide direct access to Zarzamora St. from the westbound mainlanes.

STUDY No. 1

SUMMARY OF RECOMMENDED IMPROVEMENTS ON U.S.90 WEST

1. Change the two-way frontage roads from Loop 1604 to Hunt Lane to one-way and remove the hook ramps.

2. Relocate the westbound entrance ramp from Hunt Lane.

3. Remove the eastbound exit ramp to I.H. 410 and replace it with an entrance ramp.

4. Construct a right turn lane on Southbound Military Dr. at the approach to the westbound frontage road.

5. Construct a westbound entrance ramp east of Loop 13.

6. Construct an eastbound exit ramp east of Loop 13.
   Extend the westbound frontage road under Old Hwy 90.
   Replace the westbound exit ramp to Old Hwy 90 with an entrance ramp.

7. Relocate westbound exit ramp to Old Hwy 90 just west of Leon Creek.

8. Construct a westbound exit ramp to Callaghan Rd.

9. Construct an eastbound entrance ramp from Callaghan Rd.

10. Construct a westbound exit ramp to General McMullen over a westbound entrance ramp from Cupples Rd.

11. Construct an eastbound exit ramp to Cupples Rd.

12. Construct an eastbound exit ramp to Zarzamora St.

AIR QUALITY ANALYSIS

The freeway operation study of U. S. 90 West from Hunt Lane to Nogalitos Street was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for U. S. 90 West from Hunt Lane to Nogalitos Street.

U.S. 90 WEST FROM HUNT LANE TO NOGALITOS STREET

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	90,721	43,744	-51.8
Tons/year	36.50	17.60	
Carbon Monoxide (CO)			
Grams/day	686,942	385,630	-43.9
Tons/year	276.39	155.16	
Nitrogen Oxides (NO_x)			
Grams/day	62,383	54,363	-12.9
Tons/year	25.10	21.87	

1978 ACCIDENT HISTORY

U.S. 90

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTA
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	0.1									1				1
EB	ML	0.2	1												1
EB	ML	0.7		1											1
EB	ML	0.8								1					1
EB	ML	1.1									3^{2}				3^{2}
EB	ML	1.7		1											1
EB	ML	1.8	1												1
EB	ML	2.5	1		1										2
EB	ML	2.8	1^{1}		1^{1}										2^{2}
EB	ML	3.0									1				1
EB	ML	3.9										1			1
EB	ML	4.3									1^{1}				1^{1}
EB	ML	4.6										1^{1}			1^{1}
EB	ML	4.8	1		1^{1}										2^{1}
EB	ML	5.4								1					1
EB	ML	5.5									1^{1}				1^{1}
EB	ML	5.7									$1^{①}$				$1^{①}$
EB	ML	6.2									1^{1}				1^{1}

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	①	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures IA-IJ to identify accident locations.

TABLE I-A

1978 ACCIDENT HISTORY

U.S. 90

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	6.3							1^{1}						1^{1}
EB	ML	6.4	1^{1}					1							2^{1}
EB	ML	6.5	1												1
EB	ML	6.8		1							1				2
EB	ML	7.0	2^{1}						1^{1}						3^{2}
EB	ML	7.1									1^{1}				1^{1}
EB	ML	7.6									2^{1}				2^{1}
EB	ML	7.7	1^{1}	1		1						1			4^{1}
EB	ML	7.8		1^{1}	1^{1}										2^{2}
EB	ML	8.1	1												1
EB	ML	8.7			1						1				2
EB	ML	8.9			1^{1}			1							2^{1}
EB	ML	9.0			1^{1}										1^{1}
TOTAL			11^{4}	5^{1}	7^{5}	1	0	2	2^{2}	2	14^{07}	3^{1}	0	0	47^{020}

TABLE I-B

1978 ACCIDENT HISTORY

U.S. 90

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	8.9			1										1
WB	ML	0.8									1^1				1^1
WB	ML	1.2												1^1	1^1
WB	ML	1.5	1												1
WB	ML	1.6									1①			1①	2②
WB	ML	1.8									1①				1①
WB	ML	2.1									1①				1①
WB	ML	2.5									1				1
WB	ML	2.8							1^1		2①1				3①2
WB	ML	3.4		1^1											1^1
WB	ML	3.5									1^1				1^1
WB	ML	3.7								1					1
WB	ML	3.9									1^1				1^1
WB	ML	4.2									1^1				1^1
WB	ML	4.4							1						1
WB	ML	4.5							1^1		1				2^1
WB	ML	4.6							1		1^1				2^1
WB	ML	4.8									1^1				1^1
WB	ML	4.9			1^1										1^1
WB	ML	5.0							1^1						1^1
WB	ML	5.2		1①											1①
WB	ML	5.3							1^1						1^1
WB	ML	5.4							2^2			1			3^2

TABLE I-C

1978 ACCIDENT HISTORY

U.S. 90

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	W	5.5							1^{1}		1^{1}				2^{2}
WB	W	5.6								1					1
WB	W	5.7	1												1
WB	W	6.1		1											1
WB	W	6.2							1						1
WB	W	6.4							1^{1}			1^{1}			2^{2}
WB	W	6.5		1						1					2
WB	W	6.7						1							1
WB	W	6.9								1^{1}					1^{1}
WB	W	7.0									1^{1}				1^{1}
WB	W	7.1	1^{1}												1^{1}
WB	W	7.2							1^{1}						1^{1}
WB	W	7.3								1^{1}					1^{1}
WB	W	7.5							1						1
WB	W	7.6			1^{1}										1^{1}
WB	W	7.7	1^{1}										1		2^{1}
WB	W	8.0		1^{1}					1^{1}				1^{1}		3^{3}
WB	W	8.1		1							1^{1}				2^{1}
WB	W	8.2			2^{2}										2^{2}
WB	W	8.[illegible]								1^{1}					1^{1}
WB	"	[illegible].0	1												1
TOTAL			5^{2}	$6^{(1)2}$	4^{4}	0	0	1	14^{10}	6^{3}	$16^{(4)10}$	2^{1}	2^{1}	$2^{(1)1}$	$58^{(6)3}$[illegible]

TABLE I-D

1978 ACCIDENT HISTORY

U.S. 90

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	FR	0.2			1										1
EB	FR	0.7		1		1						1^1		1	4^1
EB	FR	0.8									1			1^1	2^1
EB	FR	0.9	1					1	1^1						3^1
EB	FR	1.0	1^1												1^1
EB	FR	1.1	1		1^1	1	2^2		1^1			1			7^4
EB	FR	1.5									1^1				1^1
EB	FR	1.6		1											1
EB	FR	1.8			1										1
EB	FR	2.1	5^1	6	2^1	3^1		1	5^1	4	2				28^4
EB	FR	2.2						1							1
EB	FR	2.4		1									1		2
EB	FR	2.7								1					1
EB	FR	3.1												1	1
EB	FR	3.8							1						1
EB	FR	4.6			7^2			1			2^1				10^3
EB	FR	5.4						2^1							2^1
EB	FR	5.6			1										1
EB	FR	6.2											1		1
EB	FR	6.4	1^1												1^1
EB	FR	6.5									1^1				1^1
EB	FR	7.0									1			1	2
EB	FR	8.1		1											1

TABLE I-E

1978 ACCIDENT HISTORY

U.S. 90

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	FR	8.6			1^{1}										1^{1}
TOTAL			9^{3}	10	14^{5}	5^{1}	2^{2}	6^{1}	8^{3}	5	8^{3}	2^{1}	2	4^{1}	75^{20}

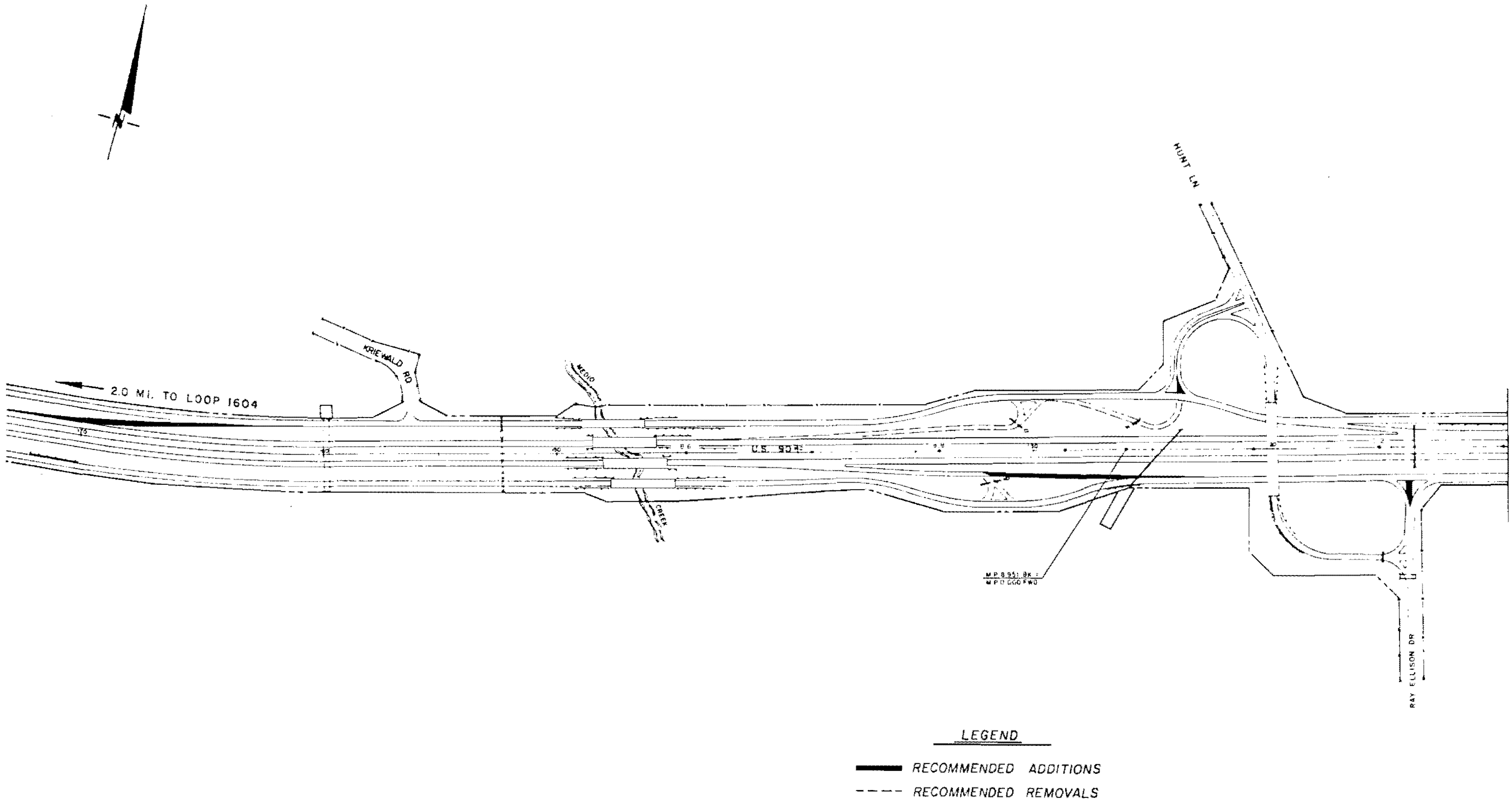
TABLE I-F

1978 ACCIDENT HISTORY

U.S. 90

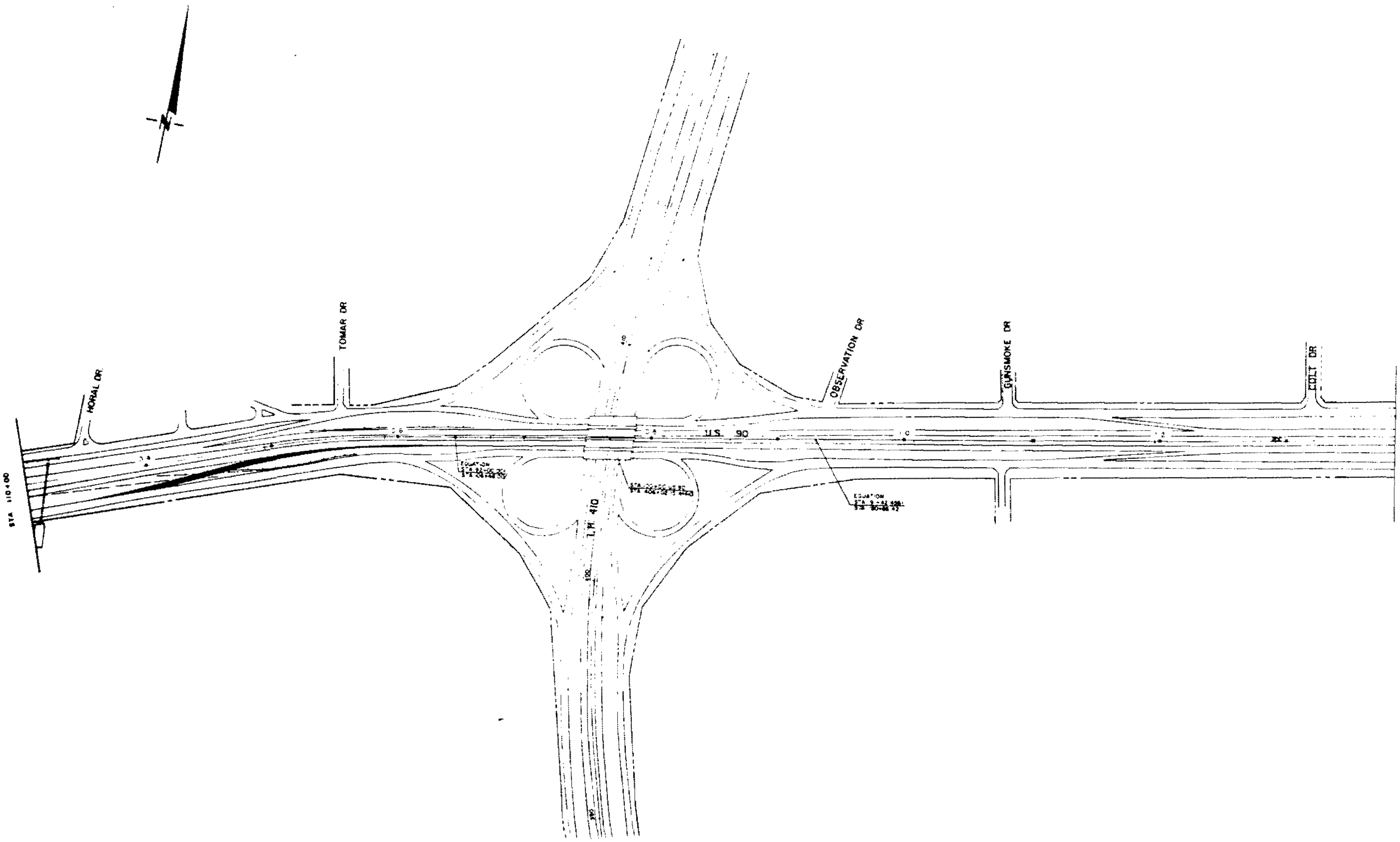
DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	FR	8.8												1	1
WB	FR	0.0									1^1				1^1
WB	FR	0.7									1				1
WB	FR	0.8	1					1^1			1^1			1^1	4^3
WB	FR	1.0		2			1^1	1		1^1	2^2				7^4
WB	FR	1.1	1^1	5^2	1		1^1			2				1^1	11^5
WB	FR	1.2			1										1
WB	FR	1.3												1	1
WB	FR	1.4									1				1
WB	FR	1.6			1						1^1			1	3^1
WB	FR	1.8			2		1				1^1				4^1
WB	FR	2.0	1												1
WB	FR	2.1	3^2	3	1^1			1	1^1	2	3	4	1	3^1	22^5
WB	FR	2.4	1	1	1			1	1^1		1				6^1
WB	FR	2.7		1											1
WB	FR	3.8	1			1^1									2^1
WB	FR	3.9							1						1
WB	FR	4.6			2^1										2^1
WB	FR	6.4							1						1
WB	FR	7.0									1				1
WB	FR	7.1	1												1
WB	FR	9.0			1									1	2
TOTAL			9^3	12^2	10^2	1^1	3^2	4^1	4^2	5^1	13^6	4	1	9^3	75^{23}

TABLE I-G



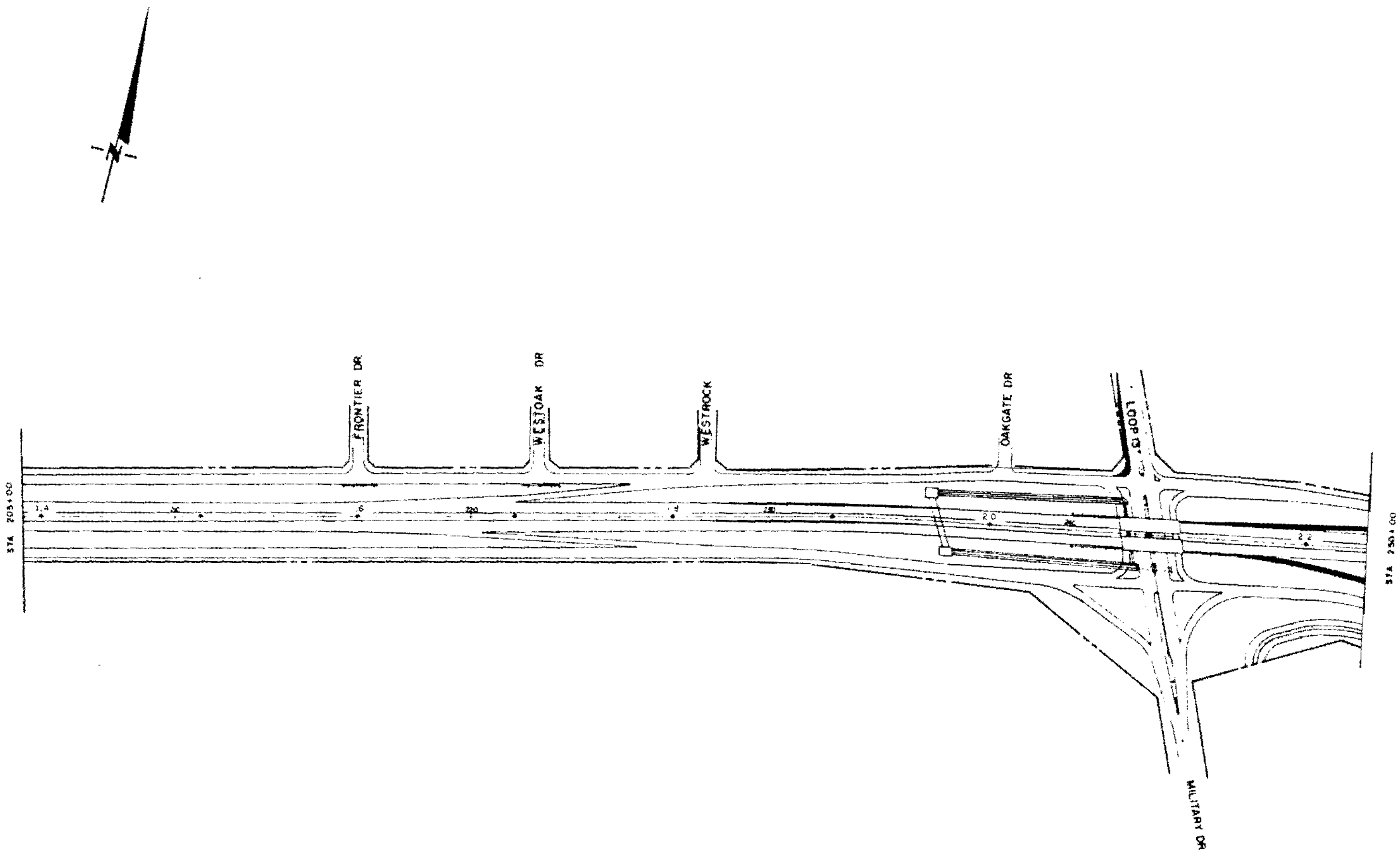
2.0 MI. TO LOOP 1604
KRIEWALD RD
MEDIO
CREEK
U.S. 90
HUNT LN
RAY ELLISON DR
LEGEND
RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS

FIGURE I-A



HORAL DR
TOMAR DR
OBSERVATION DR
GUNSMOKE DR
COLT DR
U.S. 90
I.H. 410
STA 110+00
STA 205+00
EQUATION

FIGURE I - B



STA 205+00
FRONTIER DR
WESTOAK DR
WESTROCK
OAKGATE DR
LOOP 13
MILITARY DR
STA 250+00

FIGURE I-C

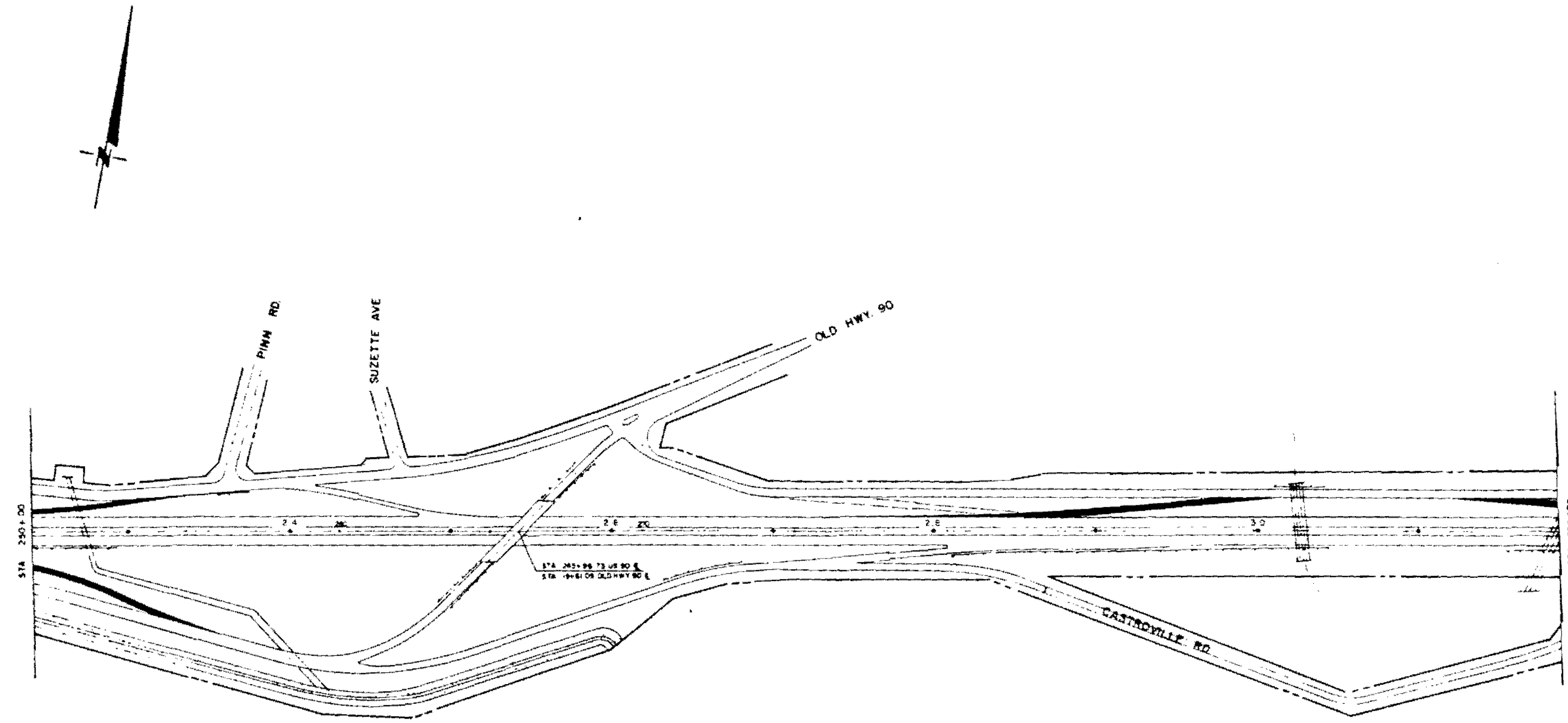

PINN RD.
SUZETTE AVE
OLD HWY. 90
STA 250+00
STA 300+00
CASTROVILLE RD.

FIGURE I-D

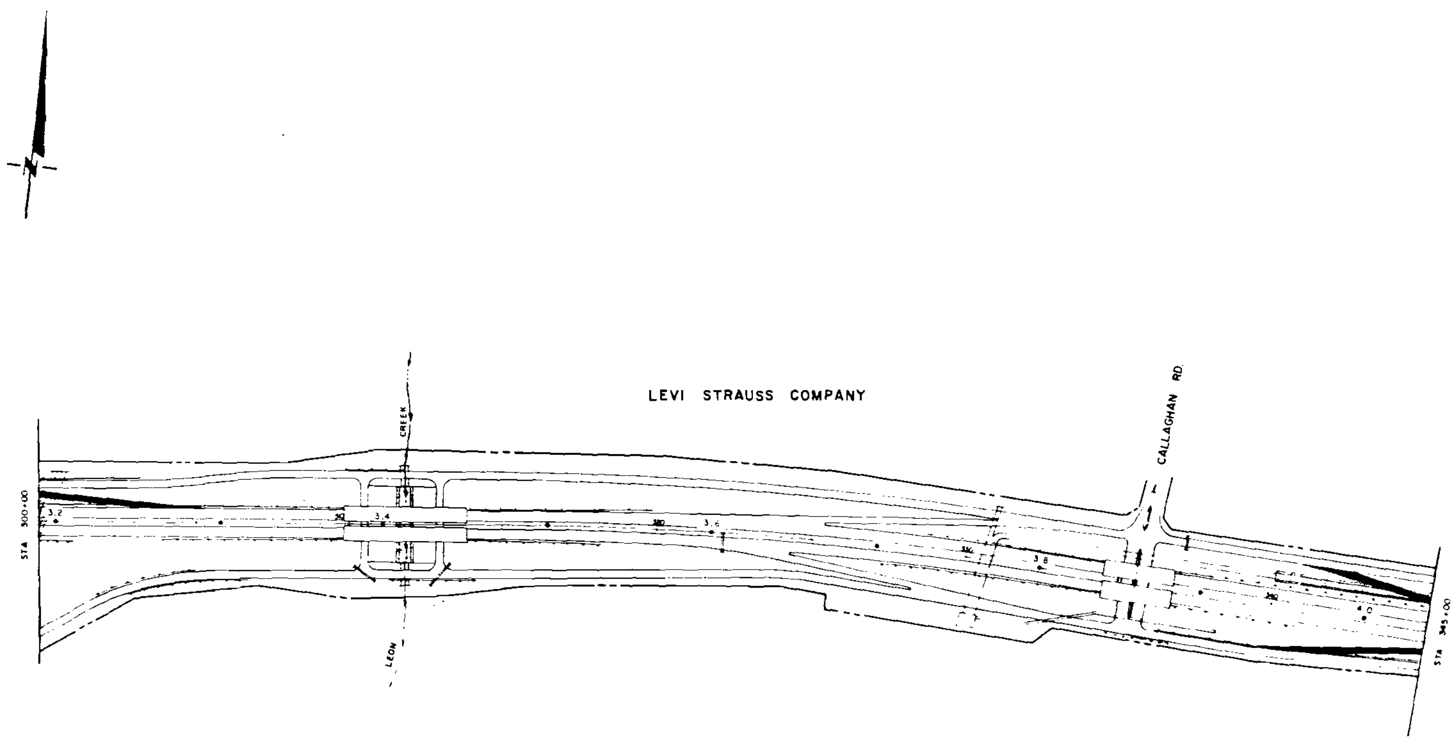

LEVI STRAUSS COMPANY
CALLAGHAN RD
CREEK
LEON
STA 300+00
STA 345+00

FIGURE I-E

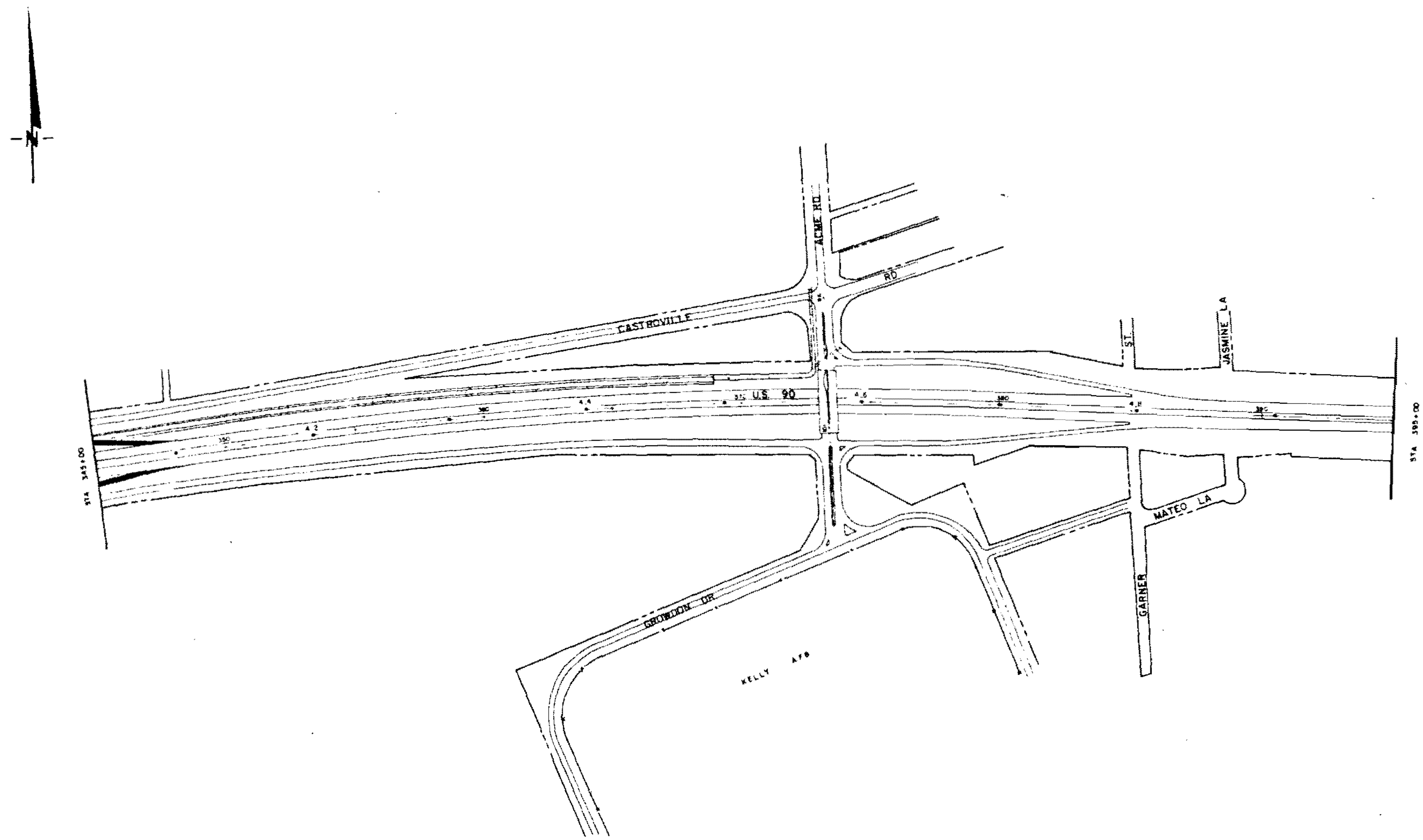
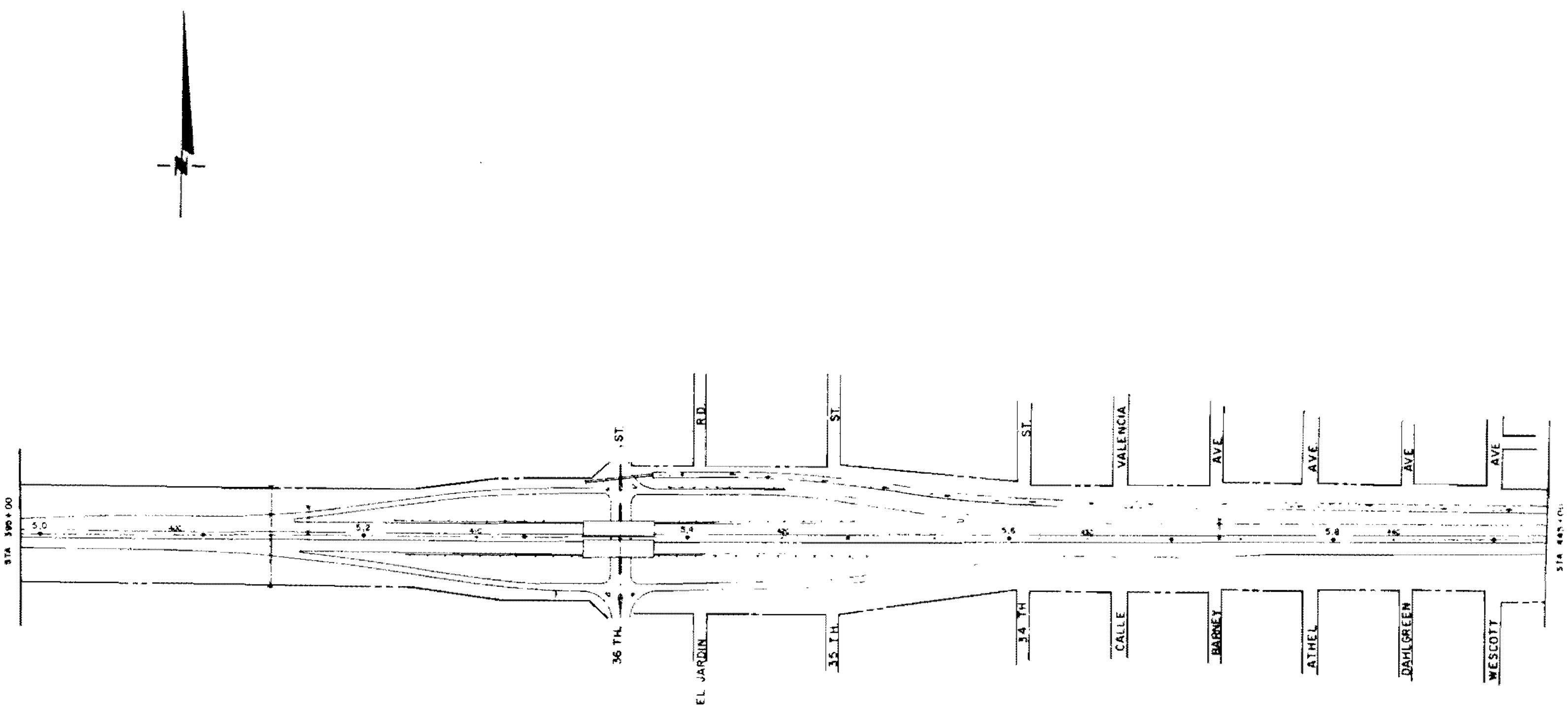

CASTROVILLE
ACME RD
RD
U.S. 90
ST.
JASMINE LA
MATEO LA
GARNER
GROWDON DR
KELLY AFB
STA 345+00
STA 395+00
N

FIGURE I-F



STA 390+00
5.0
5.2
36 TH
ST.
RD
EL JARDIN
5.4
ST.
35 TH
5.6
ST.
34 TH
VALENCIA
CALLE
AVE
BARNEY
AVE
ATHEL
5.8
AVE
DAHLGREEN
AVE
WESCOTT

FIGURE I- G

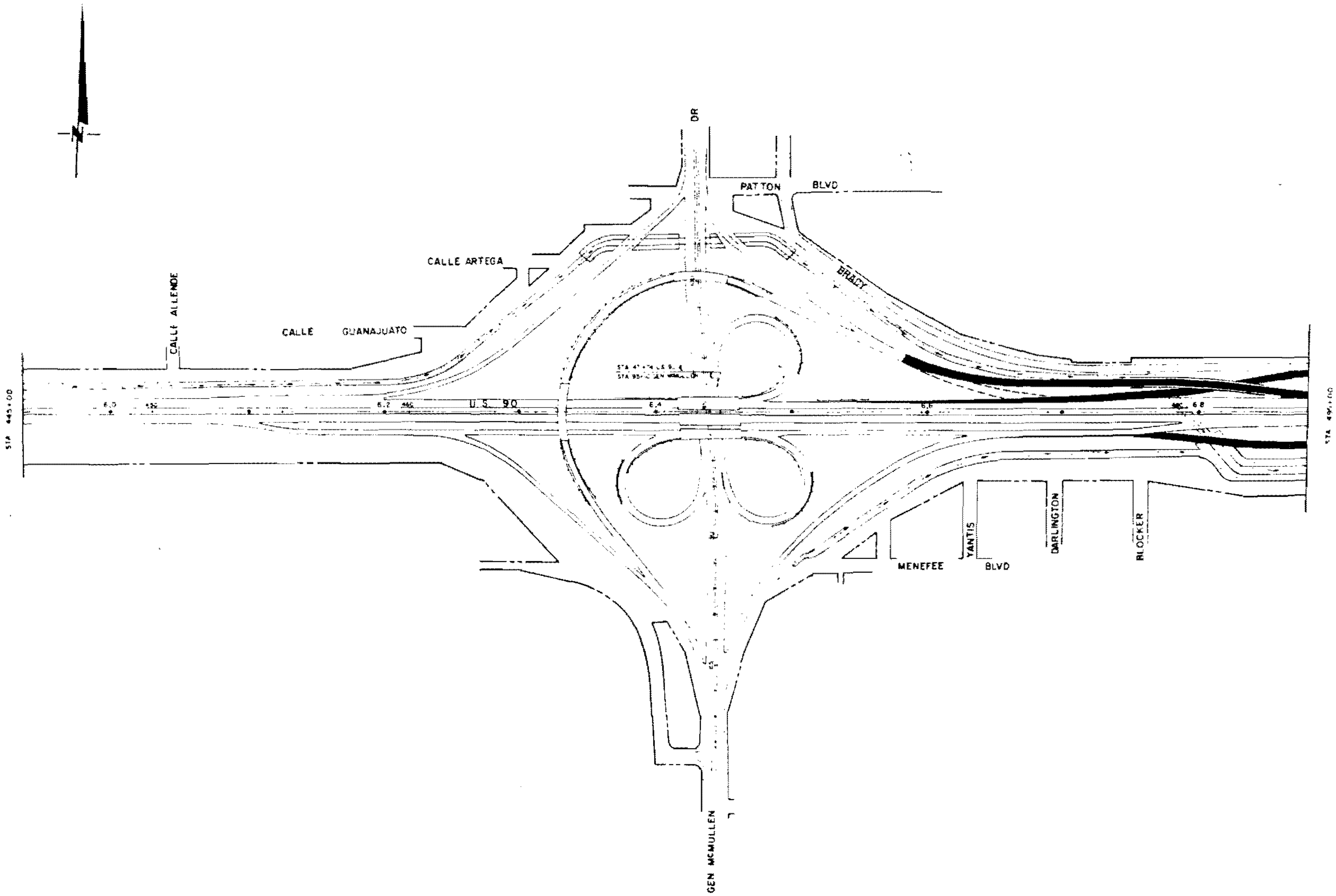
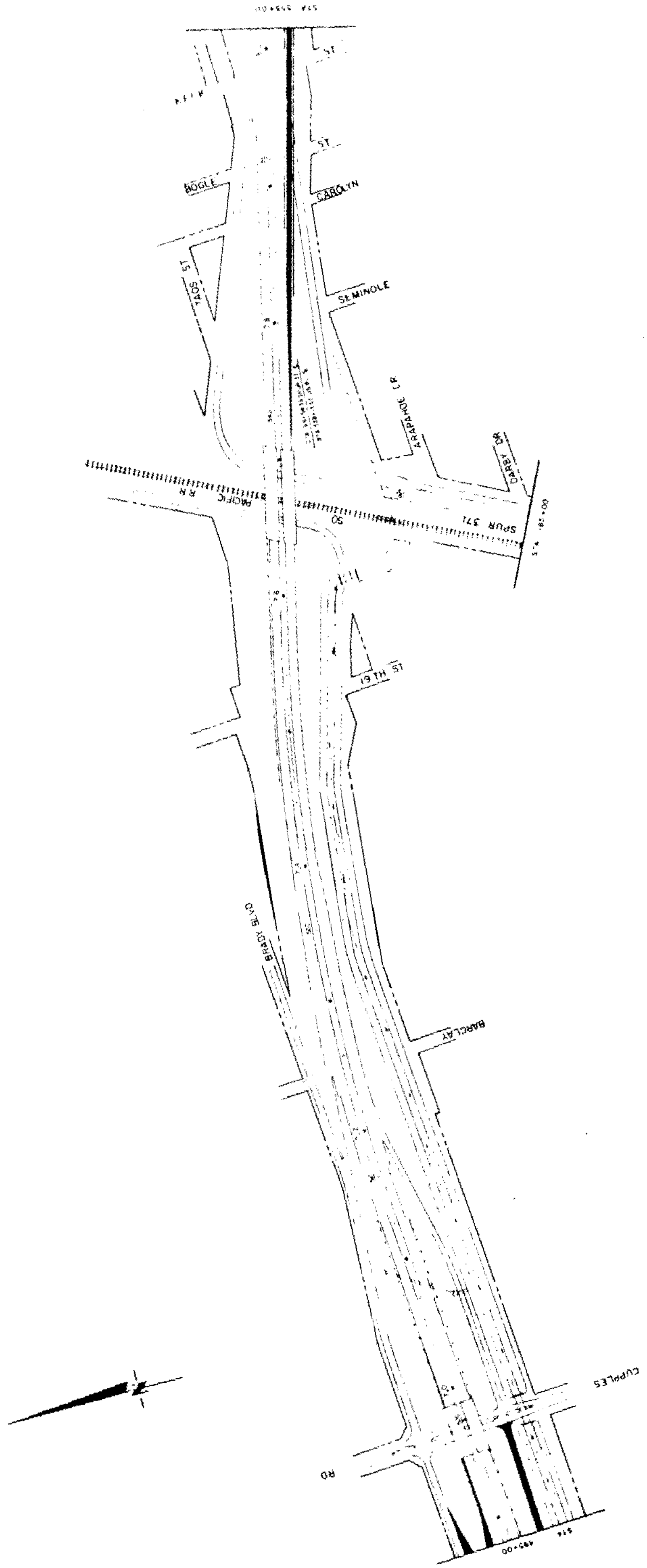

N
DR
PATTON BLVD
BRACY
CALLE ARTEGA
CALLE GUANAJUATO
CALLE ALLENDE
U.S. 90
STA 445+00
MENEFEE
YANTIS BLVD
DARLINGTON
BLOCKER
GEN McMULLEN

FIGURE I-H



BOGLE
CAROLYN
TAOS ST
SEMINOLE
ARAPAHOE CR
DARBY DR
PACIFIC R R
SPUR 371
19TH ST
BRADY BLVD
BARCLAY
CUPPLES
RD

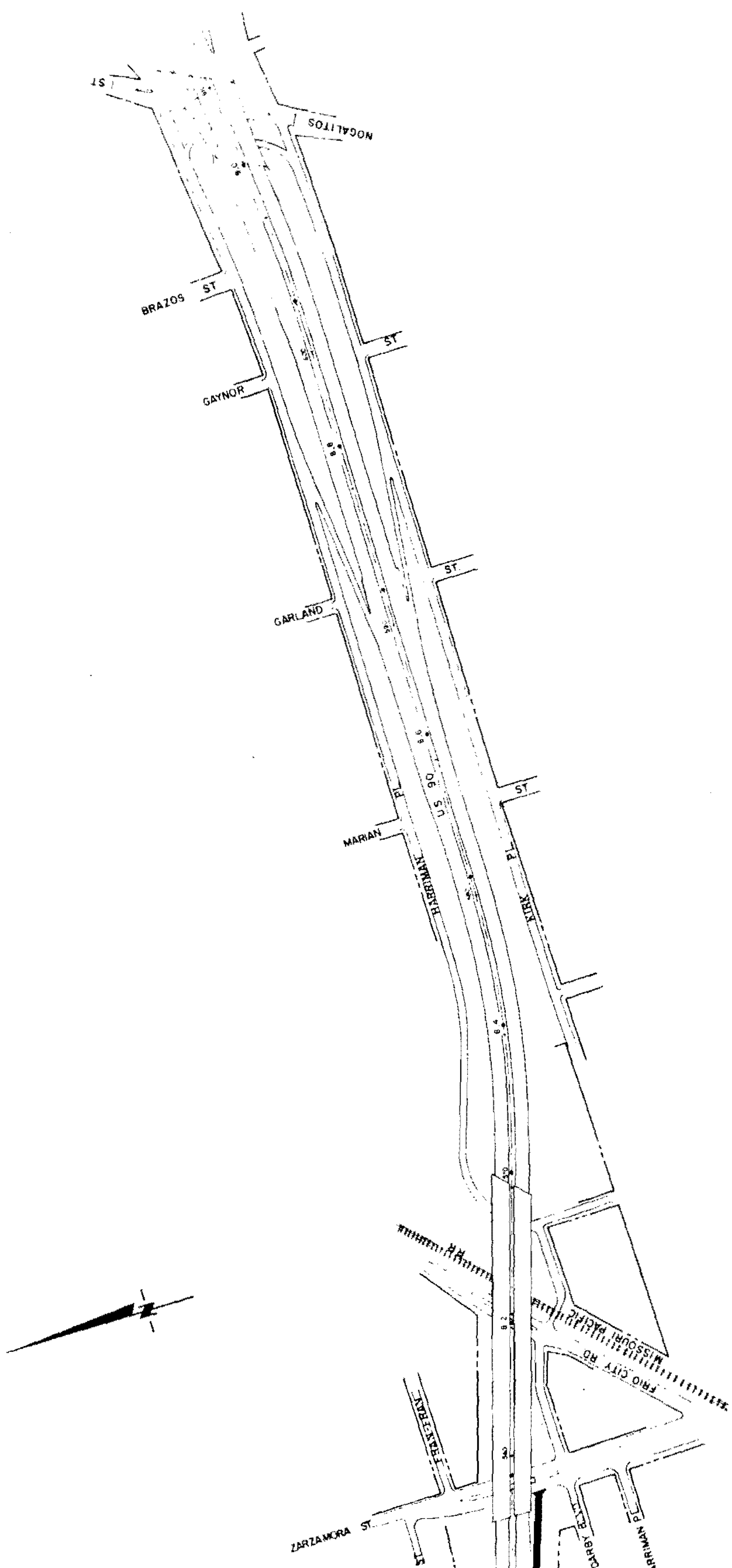
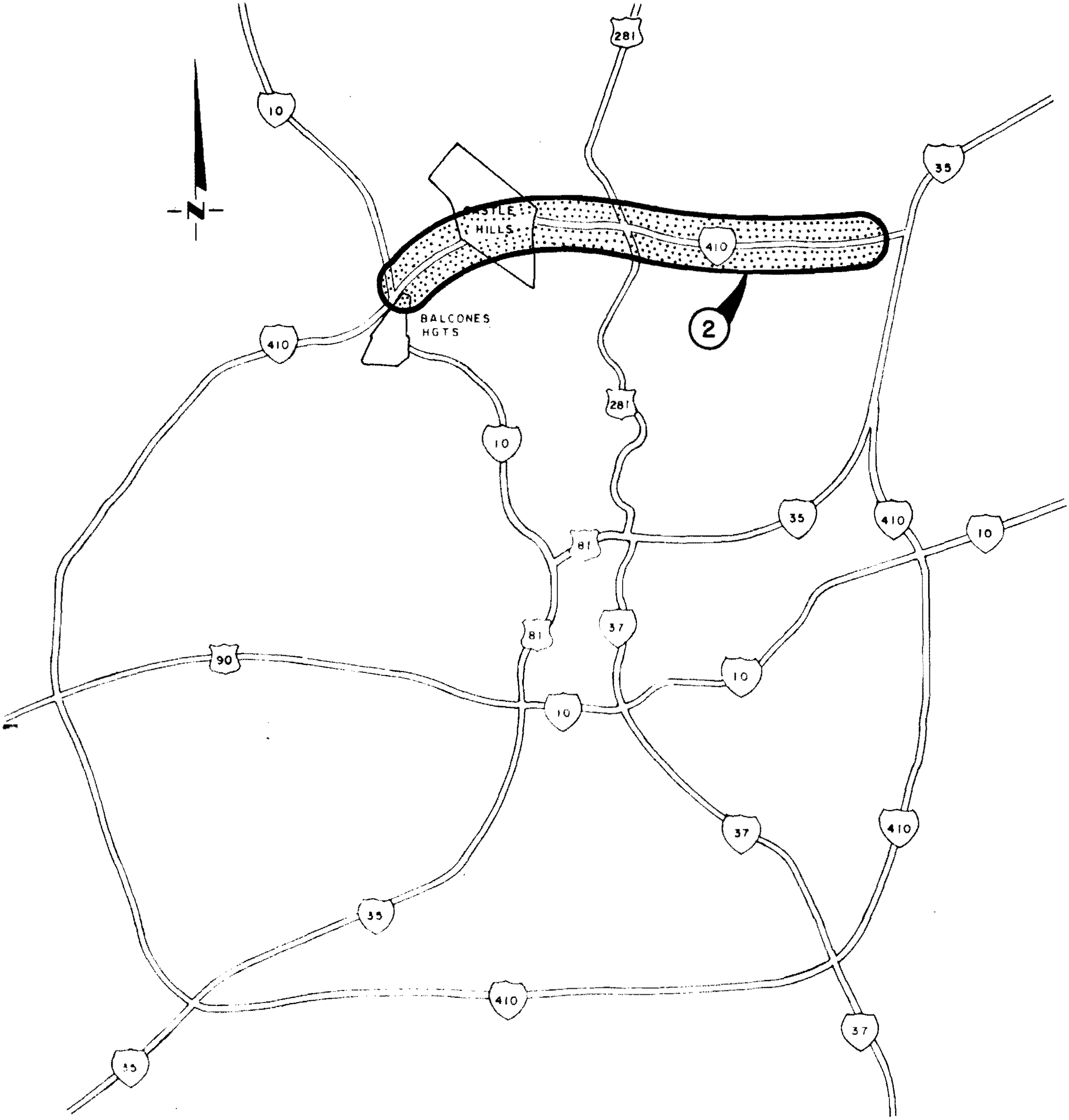

NOGALITOS
ST
BRAZOS ST
ST
GAYNOR
ST
GARLAND
ST
MARIAN
PL
US 90
HARRIMAN
KIRK
PL
RR
MISSOURI PACIFIC
FRIO CITY RD
ZARZAMORA ST
C ST
DARBY BLVD
HARRIMAN PL
STA 555+00

FIGURE I-J



I.H. 410 NORTH

FREEWAY OPERATIONS STUDY

FROM: I.H. 10

TO: F.M. 2252 (PERRIN-BEITEL RD.)

INTRODUCTION

This study will identify the areas that were approaching or at capacity in 1978 and expose the areas where access is not easily available. It will also identify the areas that have become high accident locations.

Once these locations have been identified, the study will provide recommendations as to what measures should be taken to solve the problems.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10, the Department's Planning and Research Division in Austin. They provided volumes for the mainlanes, ramps, frontage roads and turning movements at the interchanges and intersections. Level of Service was calculated for all conditions to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing". The high accident locations could therefore be identified. The accident breakdown can be found in Table I-A through I-N.

The areas where access is not easily available were identified by citizens and police participation and from observations made by this office and the San Antonio Traffic and Transportation Department. This Office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio Traffic and Transportation Department notifies us of any problem areas they have noticed or have received complaints about.

After analysing the problems and proposing solutions, the anticipated impact of the solutions was determined by examining projected data which could be expected if the solutions were implemented. Turning movement counts, and small origin-destination studies were made to determine the extent of improvement each proposal would have on the existing facility. The results are shown in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this report.

GENERAL DISCUSSION

I. H. 410 is a controlled access freeway with three mainlanes in each direction from I.H.10 eastward to Harry Wurzbach Road. Presently there is a construction project underway within the limits of this study. This project consists of adding one mainlane in each direction from Harry Wurzbach Road to Perrin Beitel Road, raising the frontage road bridge structures over Perrin Beitel Creek and Salado Creek and adding frontage road turnarounds at the Perrin Beitel interchange. After these additional lanes are completed there will be three mainlanes in each direction throughout the limits of the study which will provide an acceptable level of service. FIGURES I-A through I-G show the existing roadway and the changes that are presently under construction. Also shown are the recommendations which will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this report.

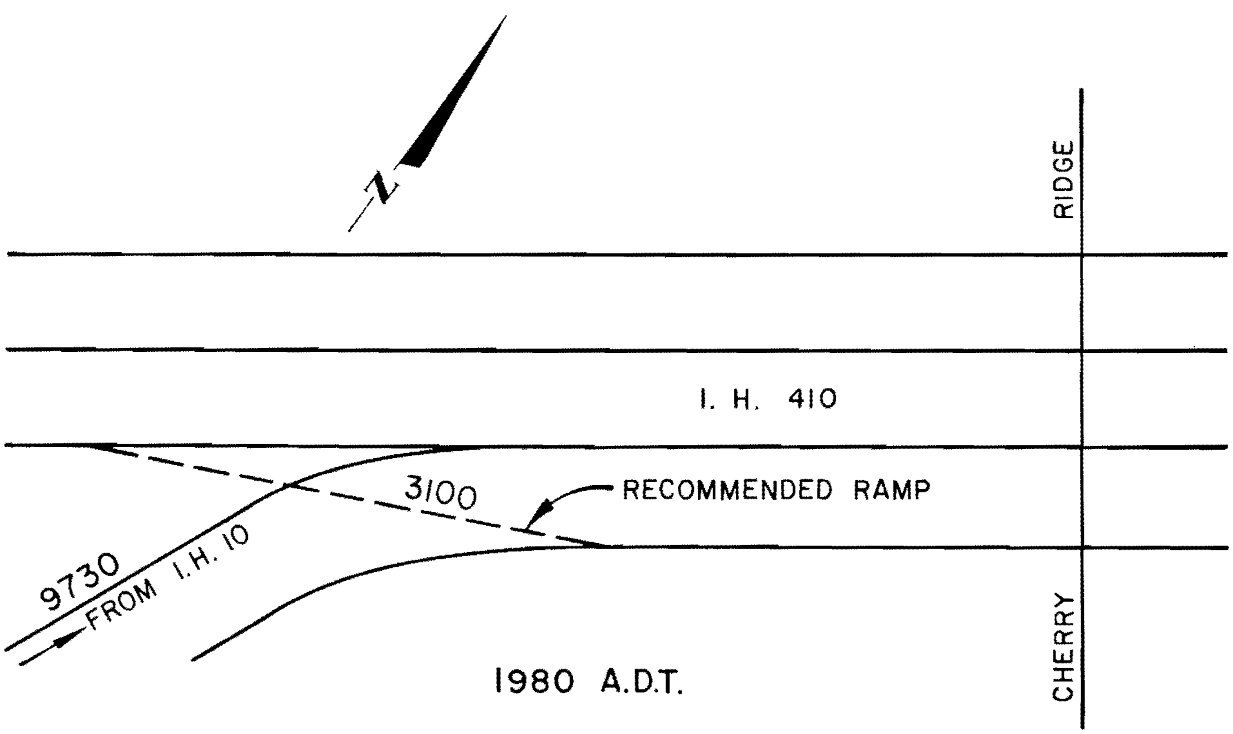
PROBLEMS AND RECOMMENDED SOLUTIONS

Some of the current problems were identified in a Ramp Demand Study conducted by this office in 1975. Some of the solutions recommended by that study have been implemented, although time has not allowed for the construction of all of them. This study will re-evaluate those recommended solutions that have not yet been implemented.

This study will concentrate on improved utilization of the frontage roads and interchanges since the mainlanes provide adequate capacity. The main-lane problems that exist are a result of backups due to capacity deficient interchanges and weaving problems between ramps.

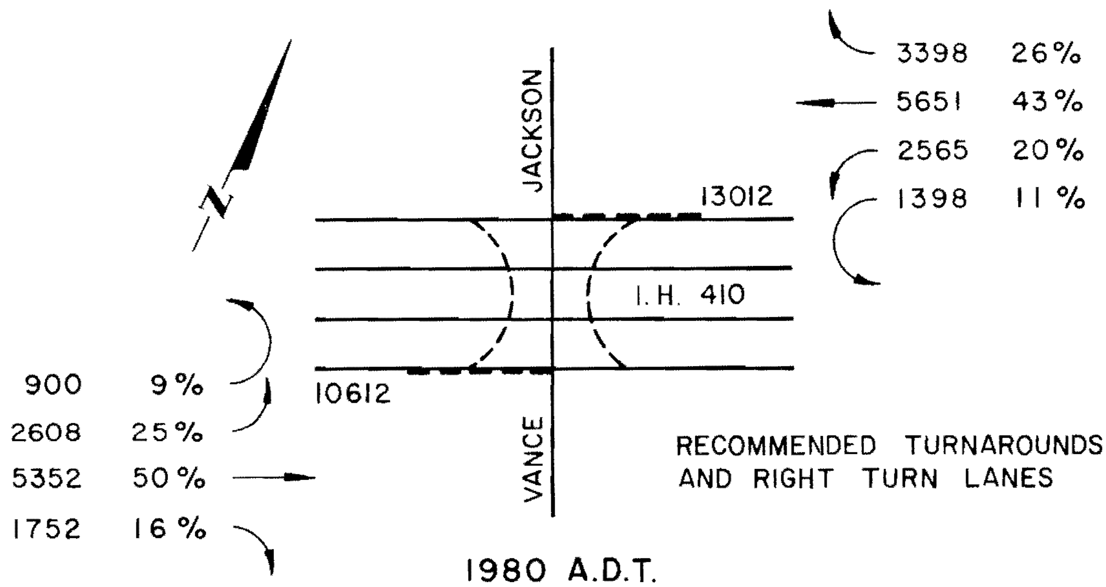
PROBLEM: Better Eastbound Access Needed to Cherry Ridge

The development of the northeast quadrant of the I.H.410 - I.H.10 Interchange has increased the demand for that area, and presently access from I.H.410 east-bound is not directly available. Eastbound I.H.410 traffic desiring to gain access to that area must do so via I.H.10 westbound to Callaghan Road or I.H.410 eastbound exit to Vance Jackson and make a u-turn. This problem can be relieved by providing an eastbound exit to Cherry Ridge. This will also help reduce congestion at the I.H.10 - Callaghan and I.H.410 - Vance Jackson Interchanges as well as providing better access to the adjacent neighborhoods. Because of the restricted distance available, this new ramp will have to be grade separated from the existing connector from I.H.10 westbound.



PROBLEM: Vance Jackson Interchange is at capacity

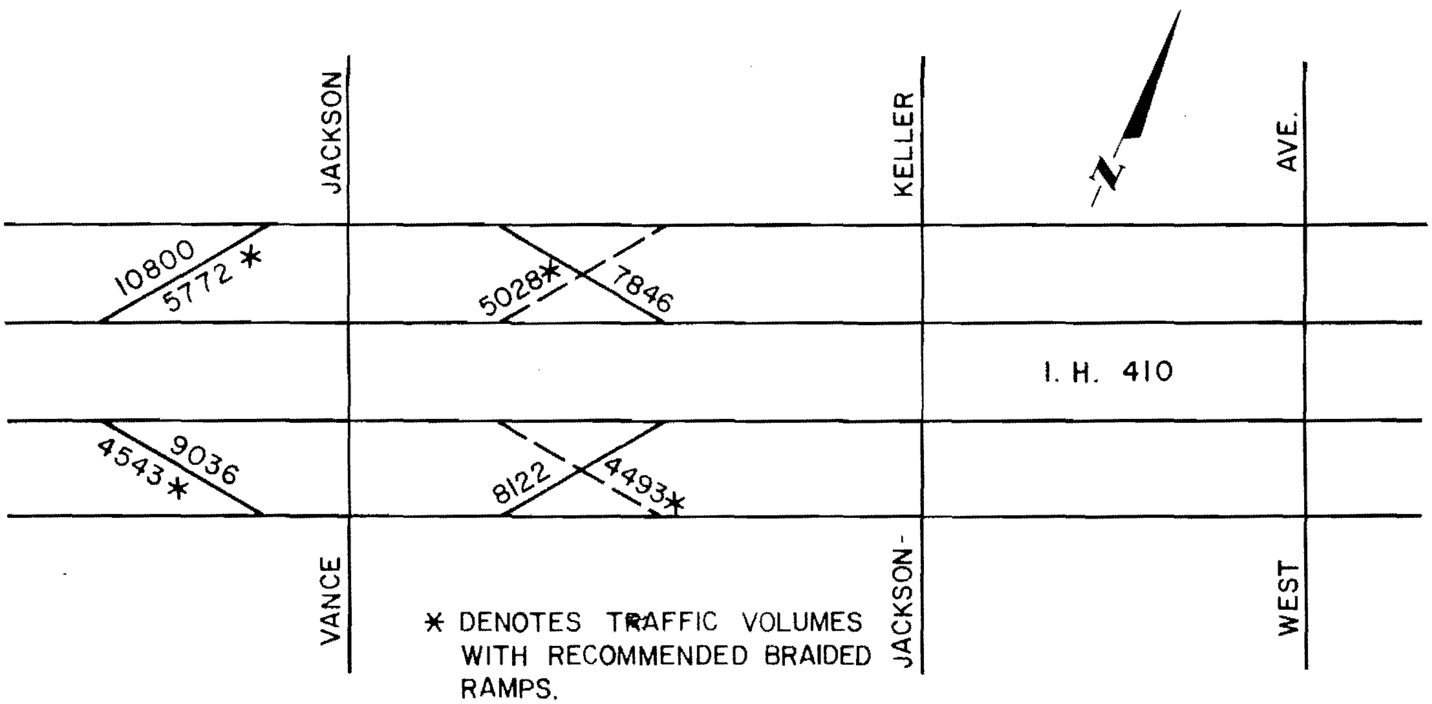
All approaches to the I.H.410 - Vance Jackson Interchange were at capacity during the peak hours in 1978, and there were 34 accidents just on the frontage road approaches. Modernization of the existing traffic signal equipment will improve the operation, and adding turn-arounds and right turn lanes on the frontage road approaches will increase the capacity and reduce the congestion. This should also reduce the number of accidents since many of the accidents at this location are a by-product of the congestion.



1980 A.D.T.

Reducing the westbound frontage road approach volume can also be achieved by adding a grade-separated (braided) entrance and exit ramp between Jackson - Keller and Vance Jackson Streets.

Presently, traffic desiring to travel westbound on I.H.410 from West Ave. and Jackson Keller have to travel through the Vance Jackson interchange on the frontage road to gain access to the mainlanes. The braided ramp configuration will improve the level of service at the Vance Jackson interchange and will provide easier and earlier access to the mainlanes for traffic from West Avenue and Jackson-Keller.

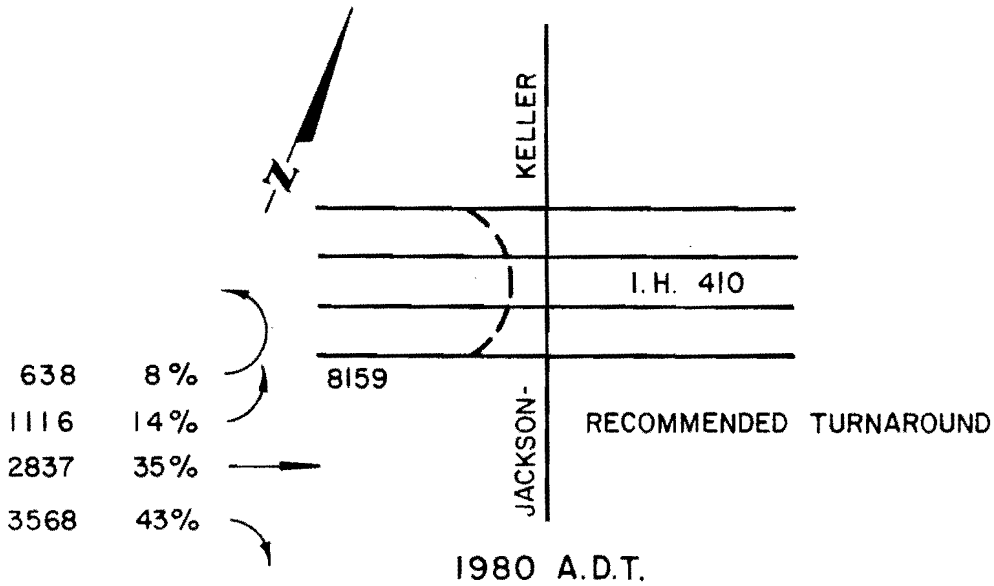


1980 A.D.T.

Reducing the eastbound frontage road approach volume can be achieved by braiding the eastbound entrance ramp from Vance Jackson with an exit ramp to Jackson-Keller. This configuration will also reduce the volume at the Vance Jackson interchange and will provide easier access to Jackson-Keller and West Avenue.

PROBLEM: Inadequate access to westbound I.H.410 from C.P.S.B. Northwest Service Center

C.P.S.B. trucks from the Service Center must travel through the Jackson-Keller intersection to gain access to I.H.410 westbound. Although the eastbound frontage road u-turn volume represents only 8% of the total approach volume, much of it consists of trucks. Due to their slower

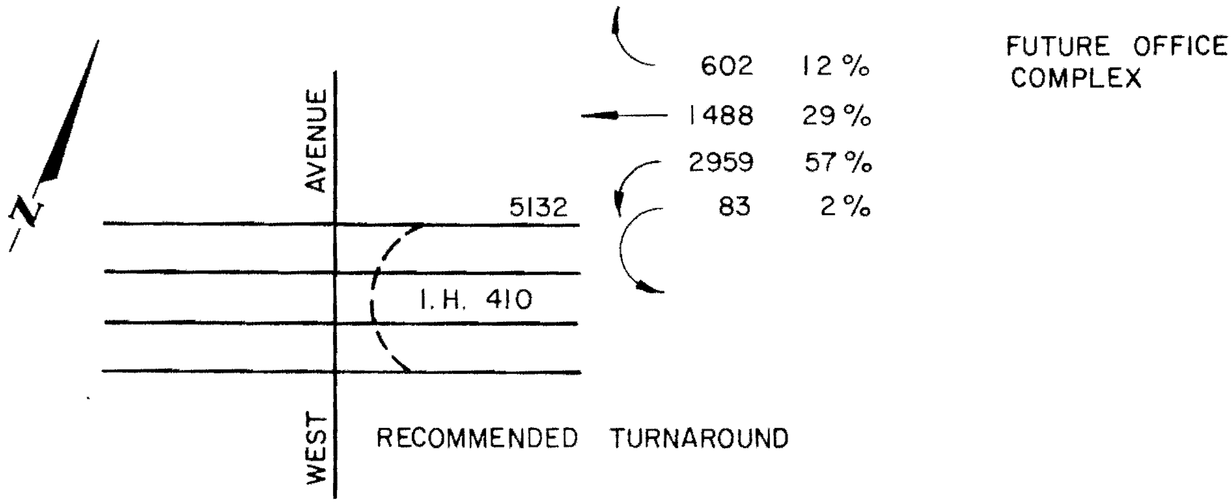


speeds, not all the trucks clear the intersection. Some of them get caught in the interior system of the intersection while attempting to complete the u-turn onto the westbound frontage road. This creates delays, not only to the trucks themselves, but also to other traffic in the interchange. These delays could be eliminated with the construction of a turnaround.

PROBLEM: Anticipated Congestion at the West Ave. Interchange

The West Ave. interchange is at an acceptable level of service because the land adjacent to the interchange is undeveloped. However a 250,000 square foot office complex is being planned for construction on the land north of I.H.410 between West Ave. and Honeysuckle. Once constructed, this complex will generate a high u-turning traffic volume on the east side of West Ave.

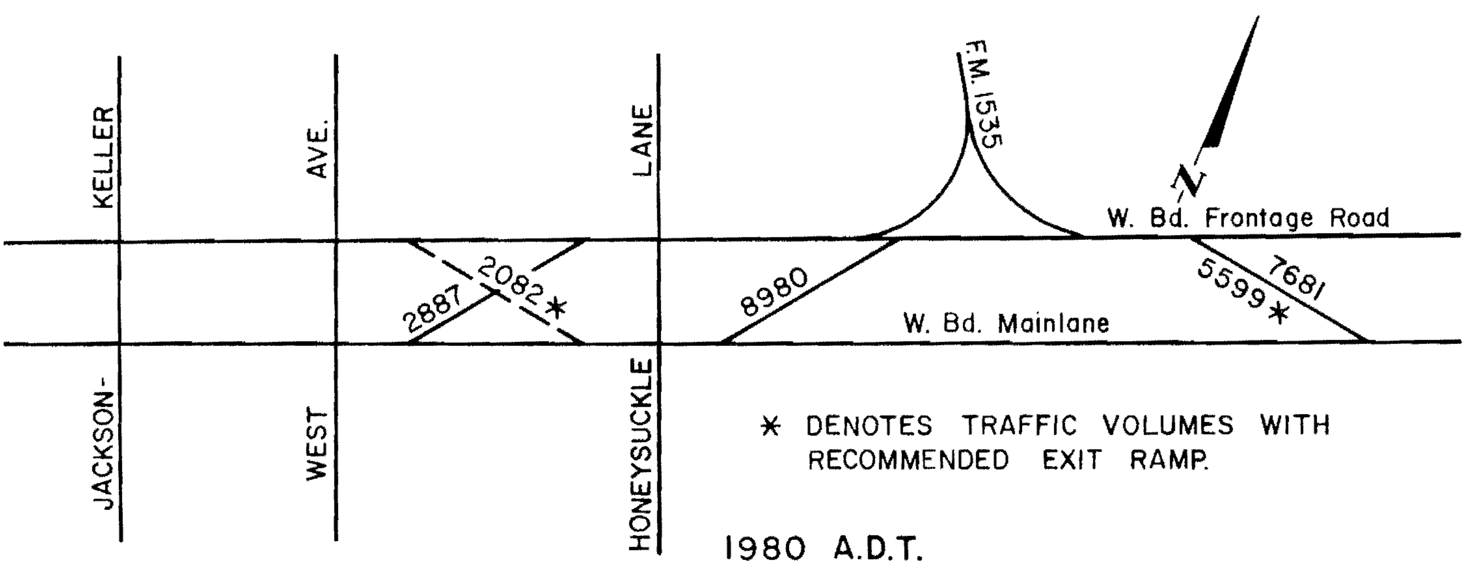
A turnaround will be necessary in order to provide an acceptable level of service. Presently, the existing two-phase signal control equipment handles traffic fairly well, although there are some delays that could be eliminated if the more modern equipment were installed. Once the new office complex is completed, the present equipment will be inadequate. Therefore, signal modernization is recommended.



1980 A.D.T.

PROBLEM: Inadequate Westbound Access to Jackson-Keller and West Ave.

Presently, westbound traffic desiring to gain access to Jackson-Keller and West Ave. have to exit east of F.M.1535 and travel on the frontage road through the F.M.1535 and Honeysuckle interchanges. By braiding a

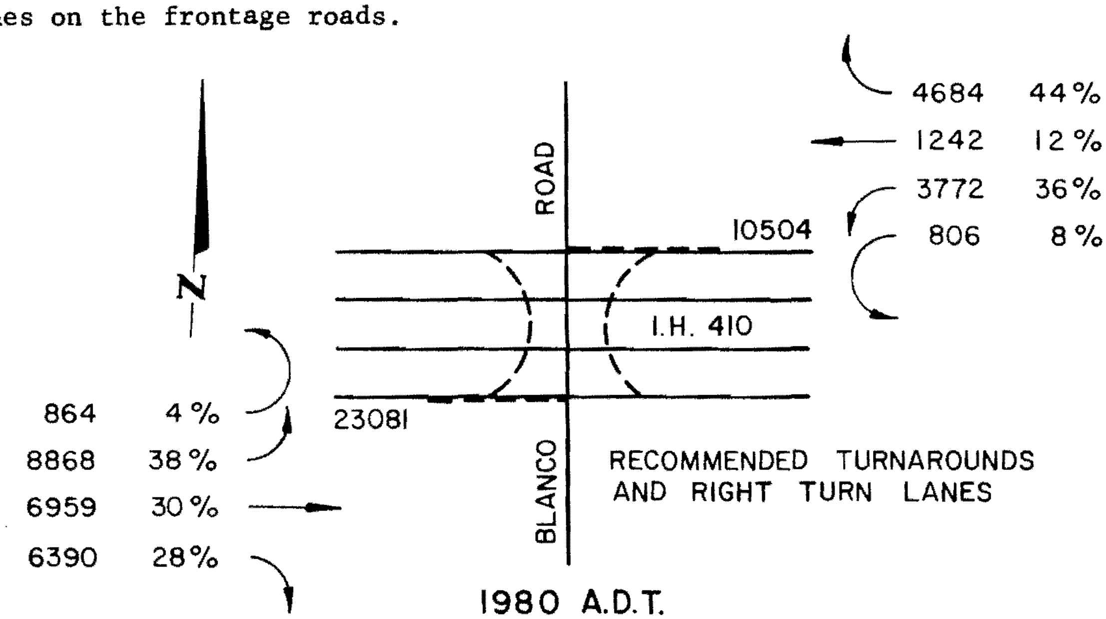


1980 A.D.T.

westbound exit to West Ave. with the westbound entrance from Honeysuckle the improved access will be provided. The weaving level of service on the westbound frontage road in the F.M.1535 interchange will also be improved.

PROBLEM: Blanco Road Interchange is at capacity

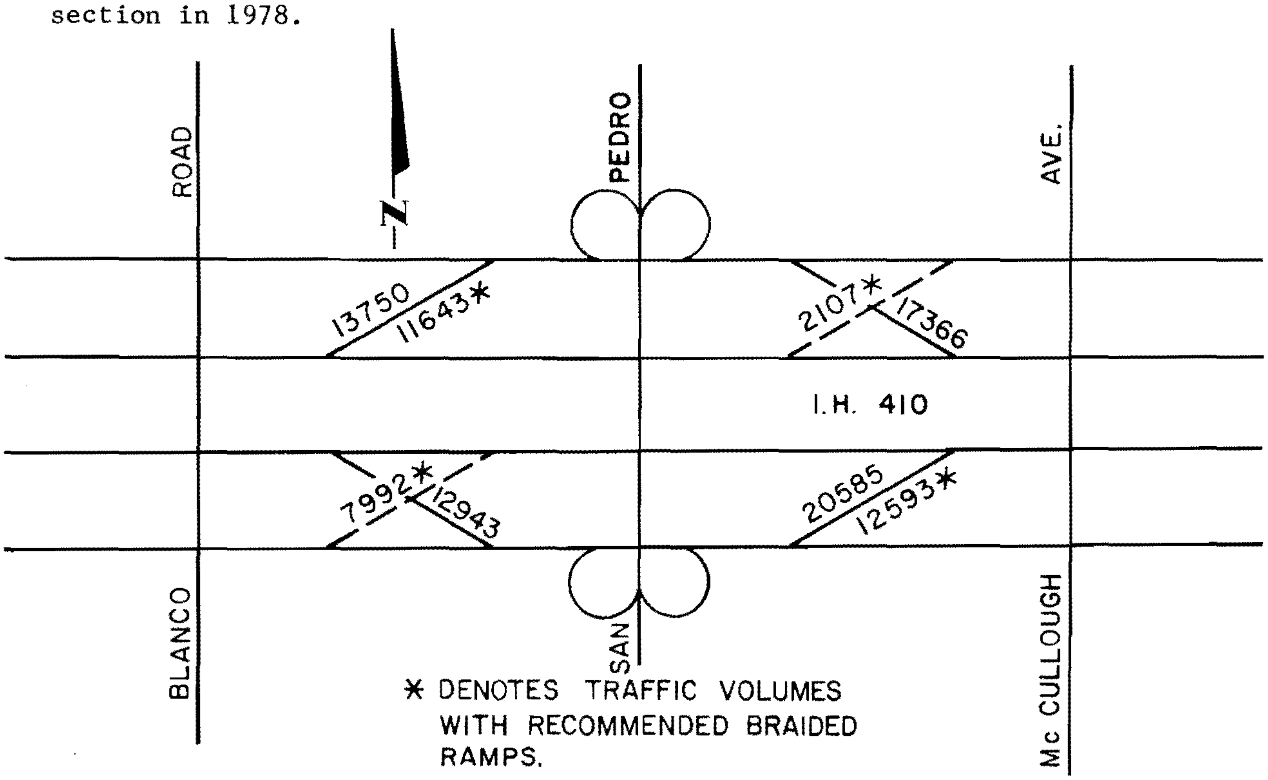
Because of the tremendously high approach volume to the Blanco Road interchange, the interchange is at capacity during the peak hours, and in 1978 forty seven accidents were reported on the frontage road approaches. The most effective method to improve the level of service at this interchange is to decrease the approach volume that travel through the intersection. This can be achieved by the installation of turnarounds and right turn lanes on the frontage roads.



1980 A.D.T.

PROBLEM: Congestion and Weaving Problem at San Pedro Interchange

The eastbound frontage road at the San Pedro interchange is approaching capacity, and in 1978 sixty-six accidents were reported in the short weaving section between the clover leaf connectors. Included in the weaving volume is the traffic traveling from Blanco Road bound for the eastbound mainlanes of I.H.410. The removal of this traffic in the weaving section will improve the level of service. This can be achieved by braiding an eastbound entrance ramp from Blanco Road with the eastbound exit to San Pedro. The braided ramp will also improve the eastbound frontage road weaving level of service between the connector from northbound U.S.281 and the eastbound entrance to I.H.410 because that volume will also be reduced. There were 35 accidents reported in that weaving section in 1978.



1980 A.D.T.

The westbound frontage road at the San Pedro interchange is also approaching capacity, and in 1978, thirty-two accidents were reported in that weaving section between the cloverlead connectors. Included in that weaving volume is the traffic traveling from McCullough that wants to enter the westbound mainlanes of I.H.410. The removal of that traffic in the weaving section can be achieved by braiding a westbound entrance from McCullough with the westbound exit to San Pedro.

PROBLEM: Congestion and high accident rate on the westbound mainlanes near McCullough

The westbound main lanes near McCullough are experiencing congestion and traffic backups during the peak periods. This condition resulted in 34 accidents in 1978, twenty-five of which were rear-end collisions. The problem is caused by large volumes of traffic exiting for San Pedro and having to weave through the large volumes entering from Jones-Maltsberger. To relieve this situation a continuous acceleration-deceleration lane should be installed between the Jones-Maltsberger entrance ramp and the San Pedro exit ramp.

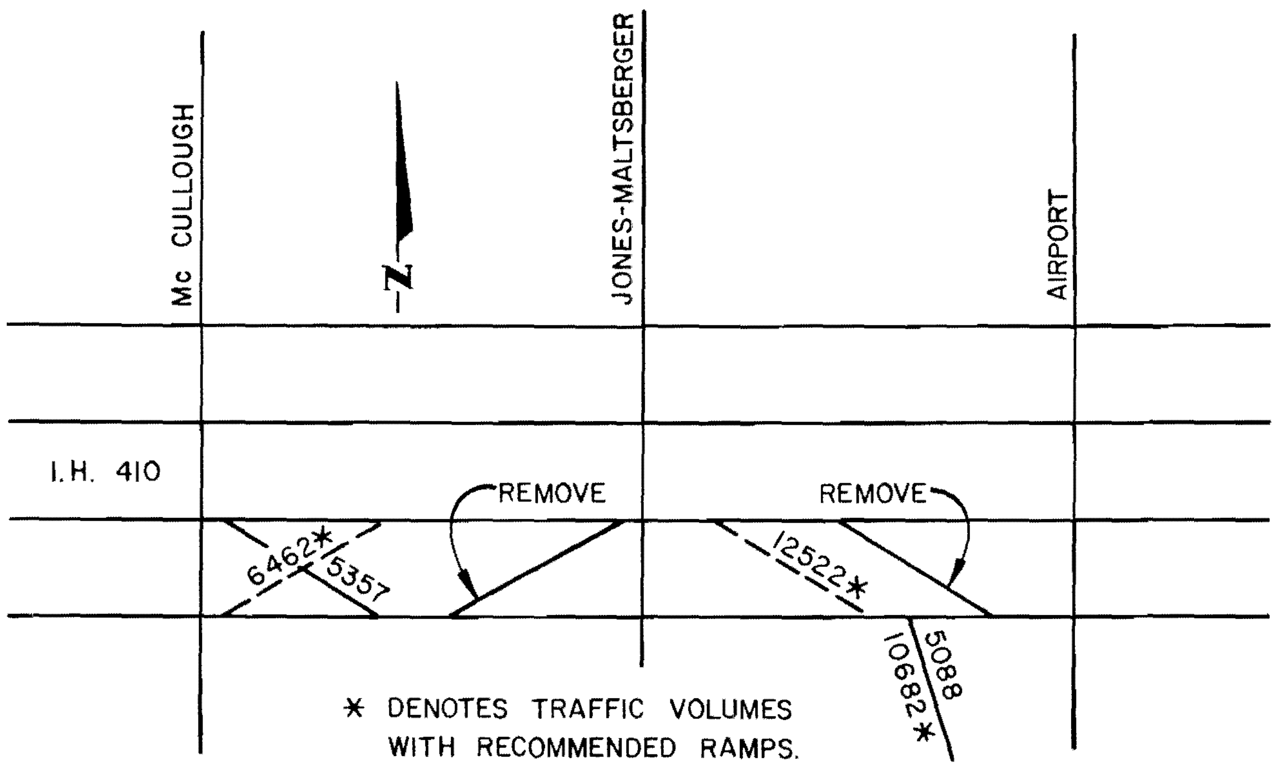
PROBLEM: Congestion and high accident rate on the westbound mainlanes near Jones-Maltsberger

The mainlane section between the westbound entrance from Airport Blvd. and the exit to McCullough had twenty-seven accidents because of the high traffic volume entering the mainlanes from Airport Blvd. A continuous acceleration-deceleration lane here will provide easier mainlane access and should reduce the number of accidents.

PROBLEM: Better Eastbound Access Needed to U.S.281 Southbound

Presently eastbound I.H.410 traffic wanting to gain access to U.S.281 southbound have to exit at Airport Blvd. and travel through the Airport Blvd. intersection. If the eastbound exit was relocated westward, the exiting traffic would be able to use the southbound U.S.281 entrance ramp from the eastbound I.H.410 frontage road. However, the close proximity of the entrance ramp from McCullough to the relocated exit ramp would create a mainlane weaving problem. Therefore it will be necessary to provide a braided ramp design for the eastbound McCullough entrance ramp and the eastbound

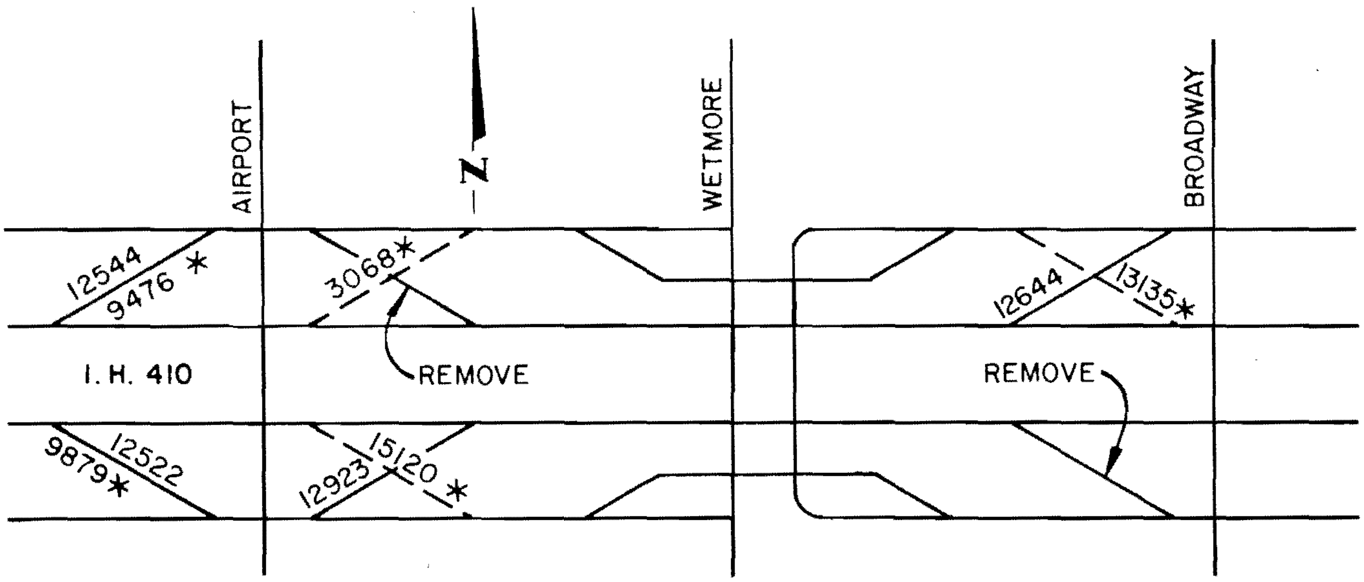
Jones-Maltsberger exit ramp. The braided ramps and the relocated ramp will not only provide better eastbound access to U.S.281 southbound, but they will also reduce the eastbound frontage road approach volume to Airport Blvd. This will improve the level of service of the intersection which is at an unacceptable level of service.



1980 A.D.T.

PROBLEM: Airport Interchange is at capacity

The most modern signal equipment available has recently been installed at the Airport interchange. The signal equipment handles traffic in the most efficient manner possible with the least amount of delay. Frontage road right turn lanes have also recently been installed. In 1978, the interchange was at capacity, and sixty-five accidents were reported on the frontage road approaches. Even with the recent improvements the interchange is still at capacity. The intersection approach volumes have to be reduced in order to improve the level of service at this interchange. The relocation of the eastbound exit to Airport Blvd., previously mentioned, will remove some traffic on the eastbound approach to the intersection. Another effective method to reduce the eastbound approach volume is to braid an eastbound exit to Broadway and Wetmore with the eastbound entrance from Airport Blvd. This will remove the eastbound Wetmore Road exiting traffic from the Airport interchange and will provide better access to Wetmore Road. The braided ramps will also eliminate the mainlane backups on the eastbound exit to Broadway.



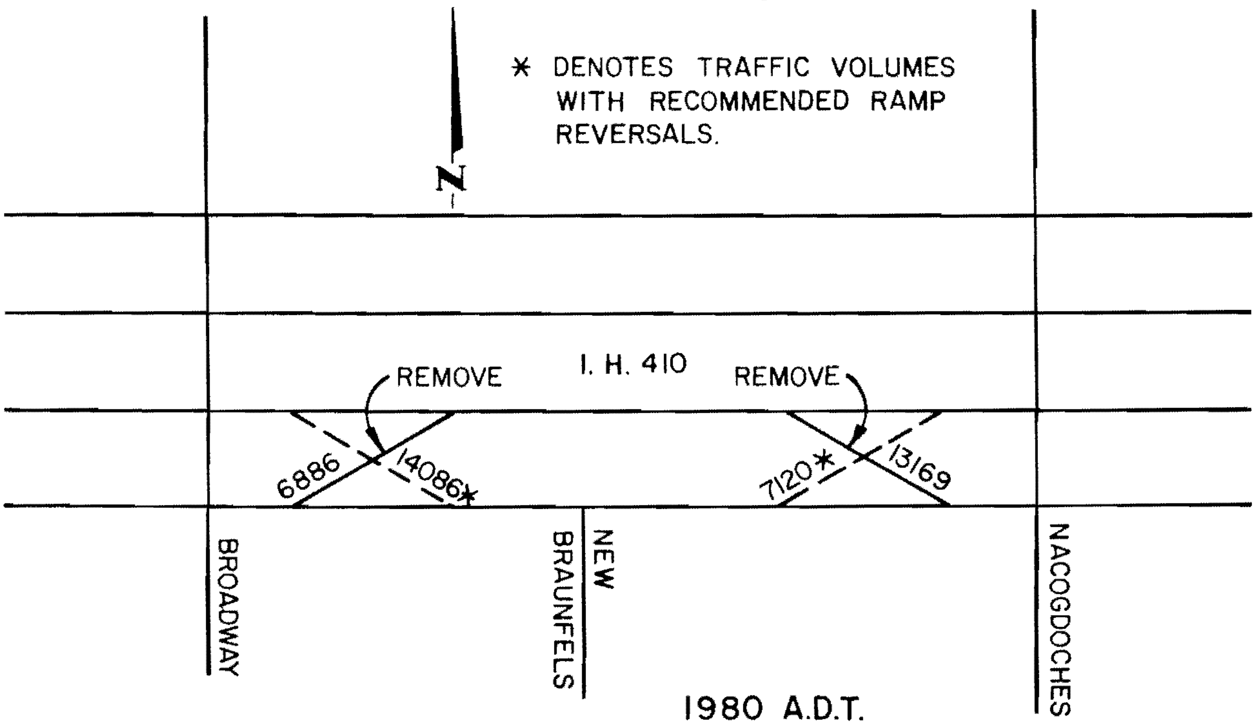
* DENOTES TRAFFIC VOLUMES WITH RECOMMENDED RAMPS.

1980 A.D.T.

The westbound frontage road intersection approach volume at Airport Blvd. can be reduced by braiding a westbound exit to Airport Blvd. with the westbound entrance from Broadway and replace the existing westbound exit to Airport Blvd. with an entrance from Wetmore Road. This modification will remove some of the Wetmore Road traffic from the intersection and will eliminate the mainlane weaving problem and the mainlane backups between the existing entrance from Broadway and the exit to Airport Blvd.

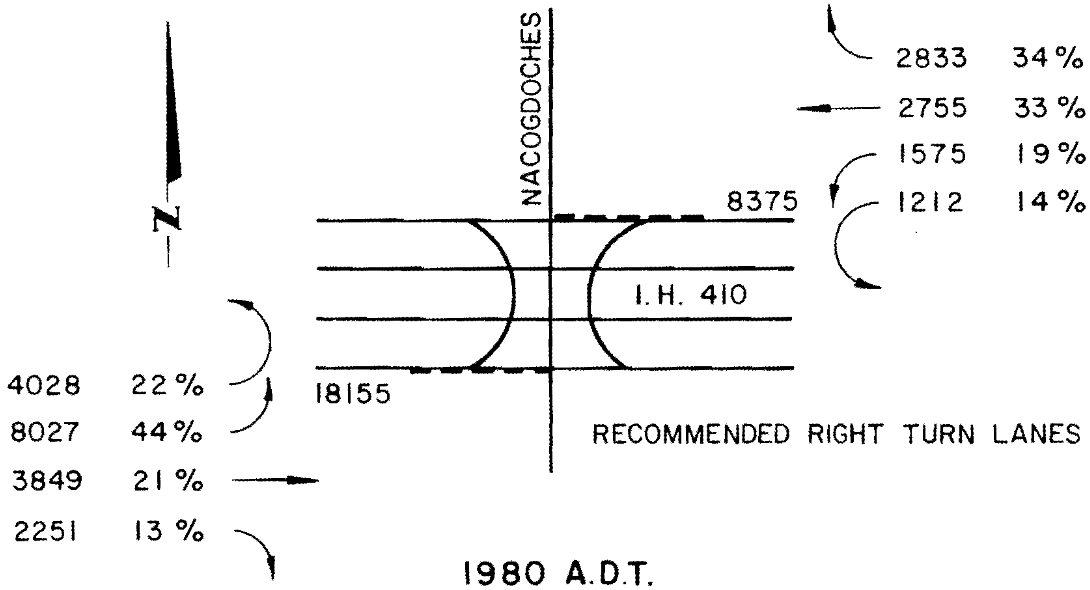
PROBLEM: Eastbound mainlane backups at Nacogdoches exit

The eastbound exit to Nacogdoches Road is a high volume exit and mainlane backups are being experienced in the peak hours which effect the mainlane level of service. Presently, traffic desiring to gain access to New Braunfels Ave. have to exit at Broadway or Nacogdoches. If the ramps between Broadway and Nacogdoches were reversed, traffic would have better access to New Brunfels Ave., the Broadway and Nacogdoches intersection volumes would be reduced, and mainlane backups would be eliminated.



PROBLEM: Congestion at Nacogdoches Interchange

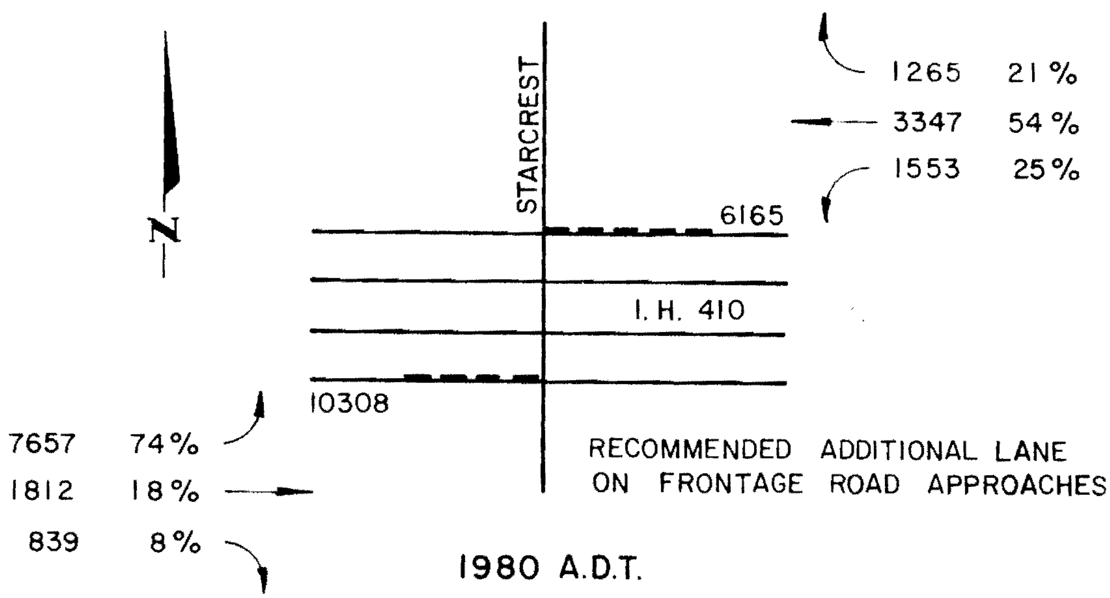
The approach volumes to the Nacogdoches interchange are extremely high in the peak hours, and excessive backups occur on all approaches to the interchange. The recently installed turnarounds, have removed some of the traffic from the interchange. With the construction of the right turn lane on the westbound frontage road approach, the geometrics of the right turn island could be improved and the existing stop sign could be replaced with a yield sign.



1980 A.D.T.

PROBLEM: Congestion at the Starcrest Interchange

In 1978 a traffic signal was installed at the Starcrest Interchange. Using 1978 traffic volumes, the interchange was at an acceptable level of service. Since that time development has occurred in the area, and traffic volumes have increased. It has now become essential to increase the capacity of the frontage road approaches to the intersections which at present have only two lanes each. A third lane should be constructed on both frontage roads from the exit ramps to the intersection to accommodate the increased volume.

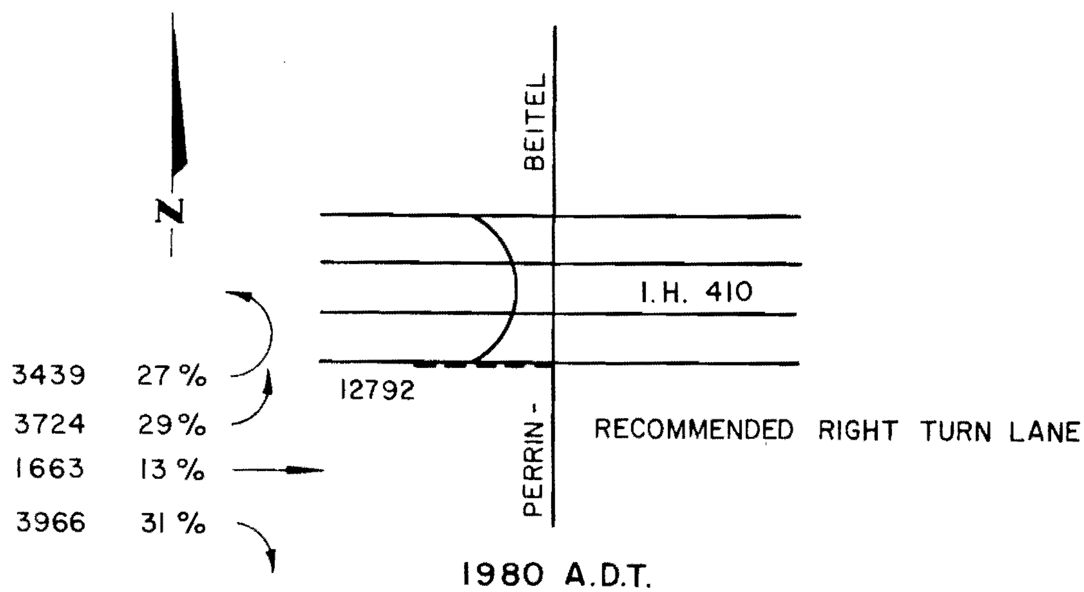


1980 A.D.T.

The increased frontage road capacity will accommodate the additional volume and should eliminate mainlane backups that result from the present two lane frontage roads.

PROBLEM: Eastbound Mainlane Backups at Perrin-Beitel Interchange

Perrin-Beitel Road, north of I.H.410, was recently expanded to two through lanes in each direction with a center left turn lane. The improvement was made to accommodate the increased traffic on this principal urban arterial. With the expanded development north of the interchange, the capacity of the interchange needs to be increased.



1980 A.D.T.

The construction project presently underway includes widening both frontage roads east of the interchange to three lanes and adding turnarounds under the overpass. As traffic volumes increase on the eastbound frontage road approach, it will be necessary to further increase the capacity by providing a third lane on that frontage road approach to the intersection.

PROBLEM: Congestion at Interchanges Due To Inefficient Traffic Signal Control Devices

Technology in traffic signal control hardware has become highly advanced in the past two years. The latest equipment provides minimal delay at diamond interchanges by the use of multiple detection and detector switching. With the exception of the Airport, Starcrest and Honeysuckle interchanges, all other diamond interchanges within the limits of this study are in need of the latest equipment in order to minimize delay and reduce the backups.

CONCLUSION

The recommended improvements will reduce the high frontage road approach volumes to the interchanges, provide additional storage capabilities, provide better access, and reduce the number of accidents. These improvements will also increase the frontage road capacity where necessary. However, where right-turn-only lanes are proposed, there may be a conflict with existing near side bus stops. In these cases, it may be necessary to make some adjustments in the bus stop locations. In cases where adjustments are not feasible, bus pull-outs may need to be installed. Each location will be considered individually before any changes are made.

STUDY NO. 2

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.410 NORTH

1. Construct braided ramps for an eastbound exit to Cherry Ridge with the eastbound entrance from I.H.10 westbound.

2. Construct frontage road turnarounds and right turn lanes at Vance Jackson.

3. Install new traffic signal control equipment at Vance Jackson.

4. Construct braided ramps for an eastbound exit to Jackson-Keller with the entrance from Vance Jackson.

5. Construct braided ramps for a westbound entrance from Jackson-Keller with the exit to Vance Jackson.

6. Construct frontage road turnaround on the west side of Jackson-Keller.

7. Construct frontage road turnaround on the east side of West Avenue.

8. Install new traffic signal control equipment at West Avenue and Jackson-Keller.

9. Construct braided ramps for a westbound exit to West Ave.

10. Construct frontage road turnarounds and right turn lanes at Blanco Road.

11. Install new traffic signal control equipment at Blanco Road.

12. Construct braided ramps for an eastbound entrance from Blanco Road with the exit to San Pedro.

13. Construct braided ramps for a westbound entrance from McCullough with the exit to San Pedro.

14. Construct a continuous acceleration-deceleration lane on the westbound mainlanes between the Jones-Maltsberger entrance ramp and the San Pedro exit ramp.

15. Install new traffic signal control equipment at McCullough.

16. Construct a continuous acceleration-deceleration lane on the westbound mainlanes between the Airport entrance ramp and the Jones-Maltsberger exit ramp.

17. Construct braided ramps for a relocated eastbound entrance from McCullough with the exit to Jones-Maltsberger and relocate the eastbound exit to Airport.

18. Install new traffic signal control equipment at Jones-Maltsberger.

19. Construct braided ramps for an eastbound exit to Broadway and Wetmore with the entrance from Airport and remove the existing exit to Broadway.

20. Replace the westbound exit to Airport with an entrance from Wetmore.

21. Construct braided ramps for a westbound exit to Airport with the entrance from Broadway.

22. Install new traffic signal control equipment at Broadway.

23. Reverse the eastbound ramps between Broadway and Nacogdoches.

24. Construct frontage road right turn lanes at Nacogdoches.

25. Install new traffic signal control equipment at Nacogdoches.

26. Construct an additional frontage road approach lane on both frontage road approaches to Starcrest.

27. Construct an additional eastbound frontage road approach lane to Perrin-Beitel.

28. Install new traffic signal control equipment at Perrin-Beitel.

AIR QUALITY ANALYSIS

The freeway operation study of I. H. 410 North from I.H. 10 West to F. M. 2252 was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for I. H. 410 North from I. H. 10 West to F. M. 2252.

I. H. 410 NORTH FROM I.H. 10 WEST TO F. M. 2252

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	161,435	84,409	-47.7
Tons/year	64.95	33.96	
Carbon Monoxide (CO)			
Grams/day	1,323,071	737,413	-44.3
Tons/year	532.33	296.69	
Nitrogen Oxides (NO_x)			
Grams/day	99,091	97,917	-1.2
Tons/year	39.87	39.40	

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	0.7							1		1^1			1	3^1
EB	ML	0.8	2^1	1^1			1								4^2
EB	ML	1.0			1^1									1	2^1
EB	ML	1.1	2^1			1^1					1				4^2
EB	ML	1.2			1^1	2^1									3^2
EB	ML	1.4					1								1
EB	ML	1.7									1				1
EB	ML	1.8						2			2^1				4^1
EB	ML	2.0		1		1^1									2^1
EB	ML	2.2	1^1												1^1
EB	ML	2.3	1					1				1^1		1	4^1
EB	ML	2.5									1^1	$1^{①}$			$2^{①1}$
EB	ML	2.7	1						1						2
EB	ML	2.8	2^2									2			4^2
EB	ML	2.9	2^1												2^1
EB	ML	3.0	1^1												1^1
EB	ML	3.1	5		1				2^1					1	9^1
EB	ML	3.2							2^1						2^1

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	①	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures IA-IG to identify accident locations.

TABLE I-A

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	3.3	1^{1}												1^{1}
EB	ML	3.4	2	2		1			1		2^{1}				8^{1}
EB	ML	3.5	1^{1}												1^{1}
EB	ML	3.6	8^{3}						2^{2}						10^{5}
EB	ML	3.7	3^{1}												3^{1}
EB	ML	3.8				1				1					2
EB	ML	3.9	2^{1}				2^{1}								4^{2}
EB	ML	4.0	1						1						2
EB	ML	4.3			1						1				2
EB	ML	4.4			1				1^{1}	1	1^{1}				4^{2}
EB	ML	4.5	2						1^{1}						3^{1}
EB	ML	4.6	3												3
EB	ML	4.7	2						2^{1}						4^{1}
EB	ML	4.9							1						1
EB	ML	5.0								1^{1}					1^{1}
EB	ML	5.1							1^{1}		1				2^{1}
EB	ML	5.2							1^{1}						1^{1}
EB	ML	5.6	4^{2}	1			1				1				7^{2}
EB	ML	5.7	2^{1}			1									3^{1}
EB	ML	5.8		1		1					1^{1}				3^{1}
EB	ML	5.9	3^{1}						1						4^{1}
EB	ML	6.0	8^{3}	1	2^{1}	1^{1}									12^{5}
EB	ML	6.1	3^{1}			2^{1}					1^{1}				6^{3}

TABLE I-B

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	6.2	1		1										2
EB	ML	6.3	1		1^1										2^1
EB	ML	6.4		2											2
EB	ML	6.5					1								1
EB	ML	6.7	1^1												1^1
EB	ML	6.8	1^1	2							1				4^1
EB	ML	6.9	2^1	1			1					1^1			5^2
EB	ML	7.0	3^1						1^1						4^2
EB	ML	7.1							1						1
EB	ML	7.2	1	1	1			1^1							4^1
EB	ML	7.3	3^1	1				1							5^1
EB	ML	7.4								2					2
EB	ML	7.6	2^1												2^1
EB	ML	7.7	2^1												2^1
EB	ML	8.0	1										1		2
EB	ML	8.1	1^1		1										2^1
EB	ML	8.2		1											1
EB	ML	8.4		1											1
EB	ML	8.5	1^1					1	1	1					4^1
EB	ML	8.6	1								1				2
EB	ML	8.8	1	1					1						3
EB	ML	8.9	2^2												2^2
EB	ML	9.0						1							1

TABLE I-C

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	9.1	1						1						2
EB	ML	9.3		1						1					2
EB	ML	9.4								1				1^{1}	2^{1}
EB	ML	9.5	2^{2}					1							3^{2}
EB	ML	9.7									1				1
EB	ML	9.8	1	1^{1}	2^{1}				1	1	1				7^{2}
EB	ML	9.9		1							1^{1}				2^{1}
EB	ML	10.0	2	1					1						4
EB	ML	10.1	1^{1}	3^{1}	1^{1}			1^{1}	1^{1}		1				8^{5}
EB	ML	10.2	3^{1}									1^{1}			4^{2}
EB	ML	10.3	1												1
EB	ML	10.4	1												1
TOTAL			98^{37}	24^{3}	14^{6}	11^{5}	7^{1}	9^{2}	26^{11}	9^{1}	20^{8}	$6^{\textcircled{1}3}$	1	5^{1}	$230^{\textcircled{1}78}$

TABLE I-D

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	0.5	2	1					1^{1}	1	1^{1}				6^{2}
WB	ML	0.6							1^{1}						1^{1}
WB	ML	0.8		1			1^{1}		1						3^{1}
WB	ML	0.9						1^{1}							1^{1}
WB	ML	1.0			1^{1}						1			1	3^{1}
WB	ML	1.1	2^{1}		2		1							2	7^{1}
WB	ML	1.2				3^{1}									3^{1}
WB	ML	1.3		1^{1}	1^{1}										2^{2}
WB	ML	1.7	2								1				3
WB	ML	1.8	1								2^{1}				3^{1}
WB	ML	1.9									1^{1}				1^{1}
WB	ML	2.1	1												1
WB	ML	2.2			1										1
WB	ML	2.3	1^{1}		1				1^{1}					2	5^{2}
WB	ML	2.4		1^{1}							2^{1}				3^{2}
WB	ML	2.5			1^{1}	1^{1}					1^{1}			1	4^{3}
WB	ML	2.7							1	1					2
WB	ML	2.9			$1^{①1}$					1^{1}					$2^{①2}$
WB	ML	3.3	2	1^{1}		1			1						5^{1}
WB	ML	3.5	1							1				1	3
WB	ML	3.6	1	2	1						1^{1}				5^{1}
WB	ML	3.9	1		2^{1}										3^{1}
WB	ML	4.0							1^{1}						1^{1}

TABLE I-E

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	4.2	1^{1}								1	1			3^{1}
WB	ML	4.4	3^{1}												3^{1}
WB	ML	4.6												1^{1}	1^{1}
WB	ML	4.7	3^{1}	1							2^{1}				6^{2}
WB	ML	4.8	2			1^{1}					1^{1}				4^{2}
WB	ML	4.9	2^{1}		1^{1}									1^{1}	4^{3}
WB	ML	5.0	1		1				2	1^{1}					5^{1}
WB	ML	5.1	4^{1}		1^{1}						1^{1}				6^{3}
WB	ML	5.2	1^{1}		1^{1}				2^{1}						4^{3}
WB	ML	5.4	2^{1}	2^{1}	2						$1^{\emptyset}$				$7^{\emptyset 2}$
WB	ML	5.5	7^{1}	1		1^{1}									9^{2}
WB	ML	5.6	3	3^{1}	1				1	1	1^{1}			1^{1}	11^{3}
WB	ML	5.7	1^{1}								1^{1}				2^{2}
WB	ML	5.8	1	1											2
WB	ML	5.9	6^{2}						1						7^{2}
WB	ML	6.0	10^{4}	5^{3}	1	2			4^{1}		1				23^{8}
WB	ML	6.1	2	1^{1}											3^{1}
WB	ML	6.3									1^{1}				1^{1}
WB	ML	6.4		1^{1}											1^{1}
WB	ML	6.5	3^{2}						1	1					5^{2}
WB	ML	6.6	1												1
WB	ML	6.7	1												1
WB	ML	6.8	1^{1}		1^{1}					1					3^{2}

TABLE I-F

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	6.9	1^1	1	1										3^1
WB	ML	7.0			1^1					1^1					2^2
WB	ML	7.1									1^1				1^1
WB	ML	7.2	1^1												1^1
WB	ML	7.3								1^1					1^1
WB	ML	7.5							1^1		1^1				2^2
WB	ML	7.6		1											1
WB	ML	7.7		1							1^1			1	3^1
WB	ML	7.8			1										1
WB	ML	7.9									1				1
WB	ML	8.0	2^1						1						3^1
WB	ML	8.1				1			1	1					3
WB	ML	8.2			1^1										1^1
WB	ML	8.3	1								1^1				2^1
WB	ML	8.4	2												2
WB	ML	8.5							1		1				2
WB	ML	8.6	1												1
WB	ML	8.7								1					1
WB	ML	8.8	3^1							1	1^1				5^2
WB	ML	9.0			1^1				1^1						2^2
WB	ML	9.1								1					1
WB	ML	9.2									1^1				1^1
WB	ML	9.4	4						2						6

TABLE I-G

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	9.5									$1^{1\;1}$				$1^{1\;1}$
WB	ML	9.6							1^{1}						1^{1}
WB	ML	9.7			1					1					2
WB	ML	9.8	2^{1}						2^{1}	1				1^{1}	6^{3}
WB	ML	9.9	3	1^{1}	1^{1}				2^{1}						7^{3}
WB	ML	10.0	3^{1}		1^{1}										4^{2}
WB	ML	10.1	4	1					1^{1}						6^{1}
WB	ML	10.2							1		1				2
WB	ML	10.4	1						1						2
TOTAL			97^{26}	27^{11}	$28^{1\;14}$	10^{4}	2^{1}	1^{1}	33^{12}	16^{4}	$30^{2\;19}$	1	0	12^{4}	$257^{3\;96}$

TABLE I-H

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	FR	0.8			1										1
EB	FR	0.9	1												1
EB	FR	1.1	2	1	2^{1}	1				3	3	1			13^{1}
EB	FR	1.2		1								1^{1}			2^{1}
EB	FR	1.4								1				1	2
EB	FR	1.7			1^{1}	2									3^{1}
EB	FR	1.8	2	4	1	2^{2}	1^{1}		2^{1}	1			1		14^{4}
EB	FR	2.0								1					1
EB	FR	2.1							1^{1}						1^{1}
EB	FR	2.6	1												1
EB	FR	2.7	1	1					1		1^{1}				4^{1}
EB	FR	2.8	1		1	1			1^{1}					1	5^{1}
EB	FR	2.9	1											1	2
EB	FR	3.6	1		1						1^{1}				3^{1}
EB	FR	3.7			1	1									2
EB	FR	3.8	1^{1}	1			1								3^{1}
EB	FR	4.0	1											1^{1}	2^{1}
EB	FR	4.1				1									1
EB	FR	4.3	1	1											2
EB	FR	4.4	6^{2}		2^{1}			2^{1}	1		1				12^{4}
EB	FR	4.7									1^{1}				1^{1}
EB	FR	4.8							1						1
EB	FR	5.0	1^{1}								1^{1}				2^{2}

TABLE I-I

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	FR	5.1	13^{2}	3	10^{2}	1	1	1		1	5^{1}		1	3^{2}	39^{7}
EB	FR	5.2		1		1									2
EB	FR	5.3		3^{2}						1					4^{2}
EB	FR	5.5						1^{1}							1^{1}
EB	FR	5.6	5^{1}		4^{3}	1					3^{2}	2^{1}		2^{1}	17^{8}
EB	FR	5.9		1	2			2			1^{1}				6^{1}
EB	FR	6.0	3^{1}	1	4^{2}	1		1	1		2	2^{2}			15^{5}
EB	FR	6.1	1		1			1							3
EB	FR	6.3	26^{5}	1		2^{2}			4^{1}	1^{1}		1			35^{9}
EB	FR	6.4	4^{2}						1^{1}						5^{3}
EB	FR	6.5	48^{9}		1	3^{1}		1	10^{3}		1^{1}	2^{1}			66^{15}
EB	FR	6.6	1^{1}				1	2							4^{1}
EB	FR	6.7	8^{2}		1^{1}	1			1		1				12^{3}
EB	FR	6.8	2						1^{1}						3^{1}
EB	FR	6.9	7^{3}	1	8		1				4^{2}				21^{6}
EB	FR	7.0	2		2										4
EB	FR	7.2	1												1
EB	FR	7.7			1										1
EB	FR	8.0		1											1
EB	FR	8.1	2	2	12^{4}			2^{2}				1^{1}		1	20^{7}
EB	FR	8.3			4^{3}						1^{1}				5^{4}
EB	FR	8.6							1^{1}						1^{1}
EB	FR	8.8	4^{2}	2	2	1	1								10^{2}

TABLE I-J

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	FR	8.9	1^{1}							1					2^{1}
EB	FR	9.0					1								1
EB	FR	9.5	1^{1}												1^{1}
TOTAL			149^{34}	25^{2}	62^{18}	19^{5}	7^{1}	13^{4}	26^{10}	10^{1}	26^{12}	10^{6}	2	10^{4}	359^{97}

TABLE I-K

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	FR	1.0									1^1				1^1
WB	FR	1.1	2^1		5^2					1	3			2^1	13^4
WB	FR	1.2	1		2^1						1^1			1	5^2
WB	FR	1.4									1				1
WB	FR	1.7										2		1	3
WB	FR	1.8		1	1	3^1		1	2^1	2^1	1	1		4^2	16^5
WB	FR	2.0			1			1^1				1		1	4^1
WB	FR	2.1			1										1
WB	FR	2.2	2												2
WB	FR	2.3	1												1
WB	FR	2.5												1	1
WB	FR	2.6						1							1
WB	FR	2.7			1^1	1	1	3			1				7^1
WB	FR	2.8						1^1				1	1^1		3^2
WB	FR	2.9	1												1
WB	FR	3.1							1^1	1					2^1
WB	FR	3.4						1			1^1				2^1
WB	FR	3.5	3				1								4
WB	FR	3.6	3^1	1	3^2	1					1^1			1	10^4
WB	FR	3.7			1									1	2
WB	FR	3.8		1	1										2
WB	FR	4.2	1^1	2	2										5^1
WB	FR	4.3	2	1	2										5

TABLE I-1

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	FR	4.4	6^{2}		1		1		1	1				1	11^{2}
WB	FR	5.0	3	3^{1}											6^{1}
WB	FR	5.1	7^{1}		6^{1}	1		1	2^{1}	2	3^{1}	2^{2}		2^{1}	26^{7}
WB	FR	5.2					1								1
WB	FR	5.3		2											2
WB	FR	5.5		1											1
WB	FR	5.6	3^{2}	1	6^{3}	1								1	12^{5}
WB	FR	6.0	2^{1}	1	3^{2}	1^{1}		3	1	1^{1}	1	2^{2}			15^{7}
WB	FR	6.2			1						1				2
WB	FR	6.3	5^{1}	1^{1}	2^{1}	2					1				11^{3}
WB	FR	6.4	1^{1}			1									2^{1}
WB	FR	6.5	20^{5}		1	1			5^{4}	1	4^{1}				32^{10}
WB	FR	6.6	7^{1}		2	1				1					11^{1}
WB	FR	6.9	6^{3}	2	5			2	1	4	3^{1}	1	1	1	26^{4}
WB	FR	7.1	3										1		4
WB	FR	7.2									1				1
WB	FR	7.4		2		1									3
WB	FR	7.7	1		1										2
WB	FR	7.9	2^{1}												2^{1}
WB	FR	8.1		2	13^{2}	1	1	1^{1}							18^{3}
WB	FR	8.3	1^{1}	1	3^{1}										5^{2}
WB	FR	8.6	1												1
WB	FR	8.7	2^{1}								1				3^{1}

TABLE I-M

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	FR	8.8	3	3	7			2^{1}	1	3	3^{1}	2^{1}			24^{3}
WB	FR	9.0	1												1
WB	FR	9.1							1^{1}						1^{1}
WB	FR	10.1												1	1
WB	FR	10.3						1							1
TOTAL			90^{23}	25^{2}	71^{16}	15^{2}	5	18^{4}	15^{8}	17^{2}	28^{8}	12^{5}	3^{1}	18^{4}	317^{75}

TABLE I-N

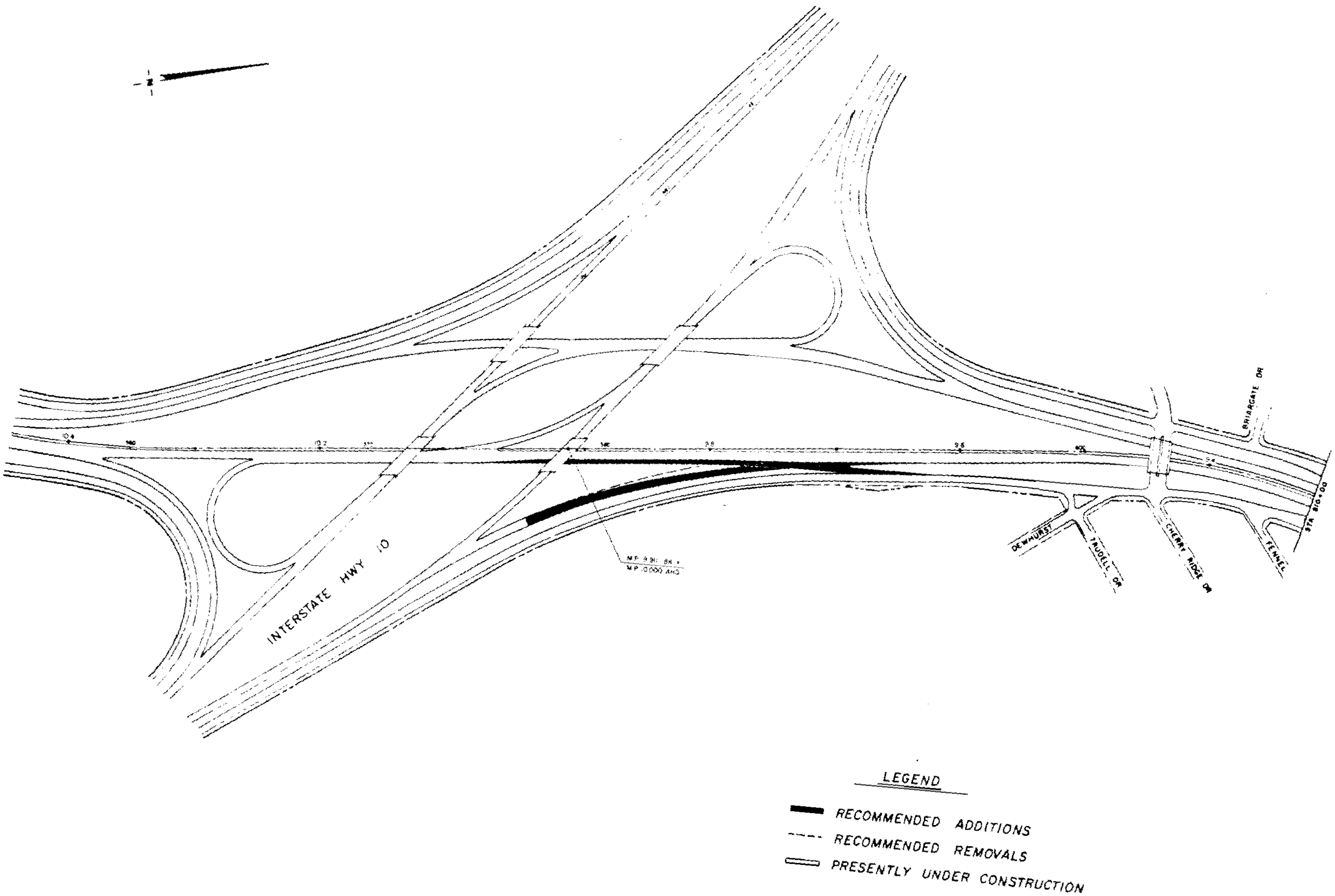

N
INTERSTATE HWY 10
BRIARGATE DR
CHERRY RIDGE DR
TRUDELL DR
DEWHURST
FENNEL
STA 810+00
LEGEND
RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS
PRESENTLY UNDER CONSTRUCTION

FIGURE I – A

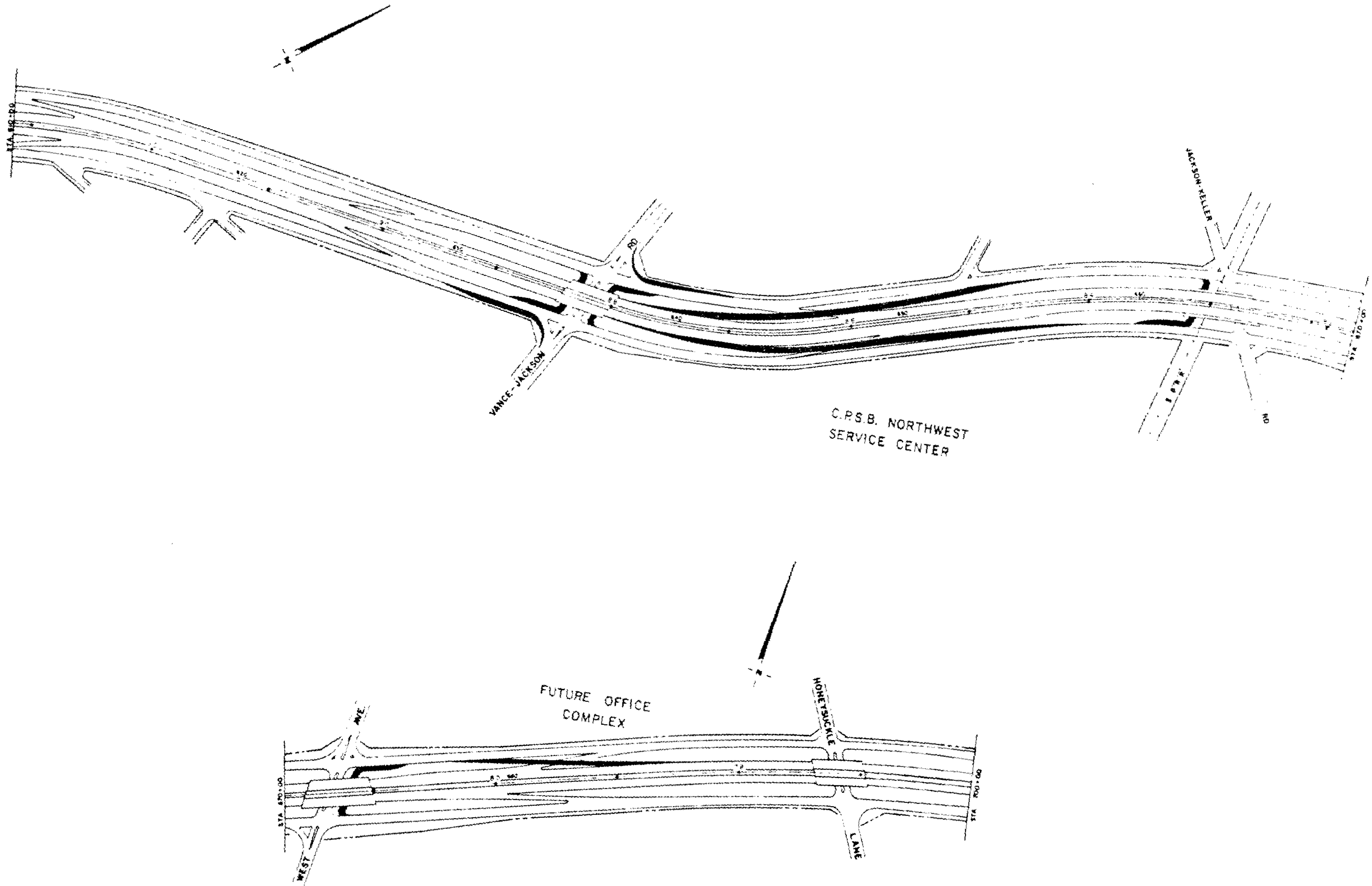

JACKSON-KELLER
RD
VANCE-JACKSON
C.P.S.B. NORTHWEST
SERVICE CENTER
FUTURE OFFICE
COMPLEX
HONEYSUCKLE
LANE
AVE
WEST

FIGURE I - B

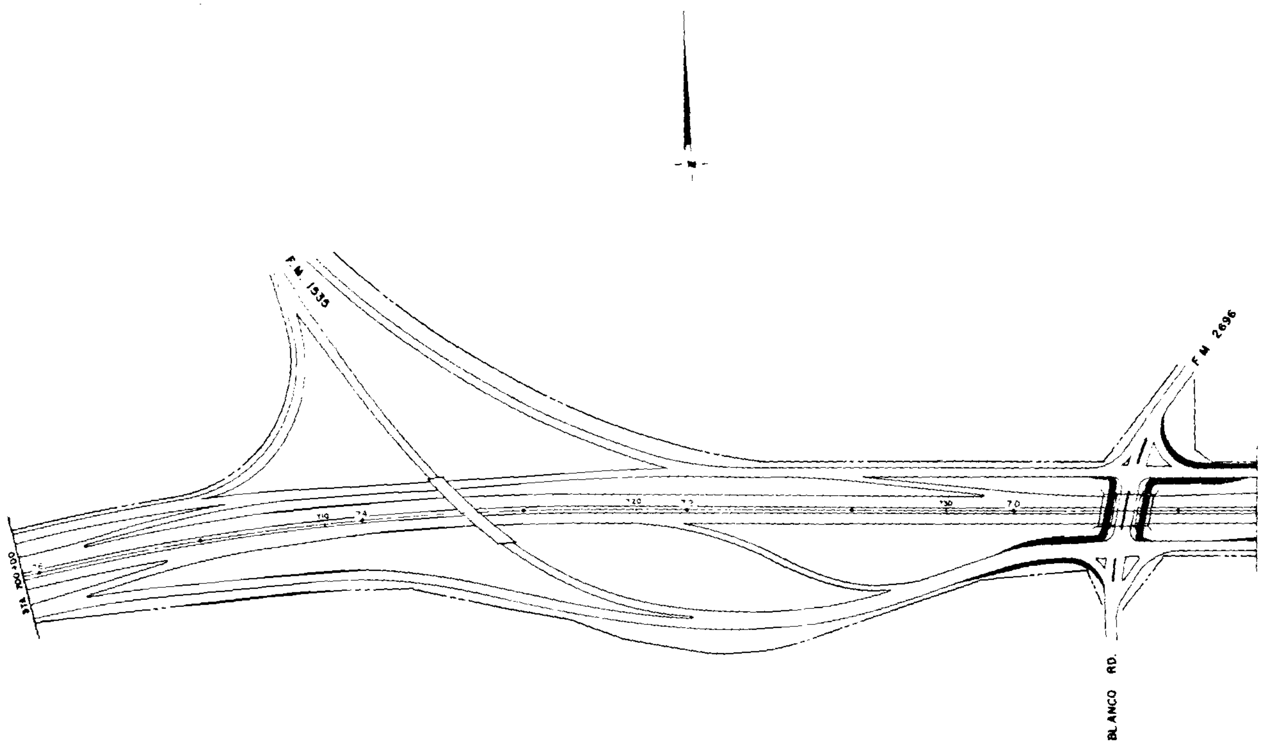


FIGURE I - C

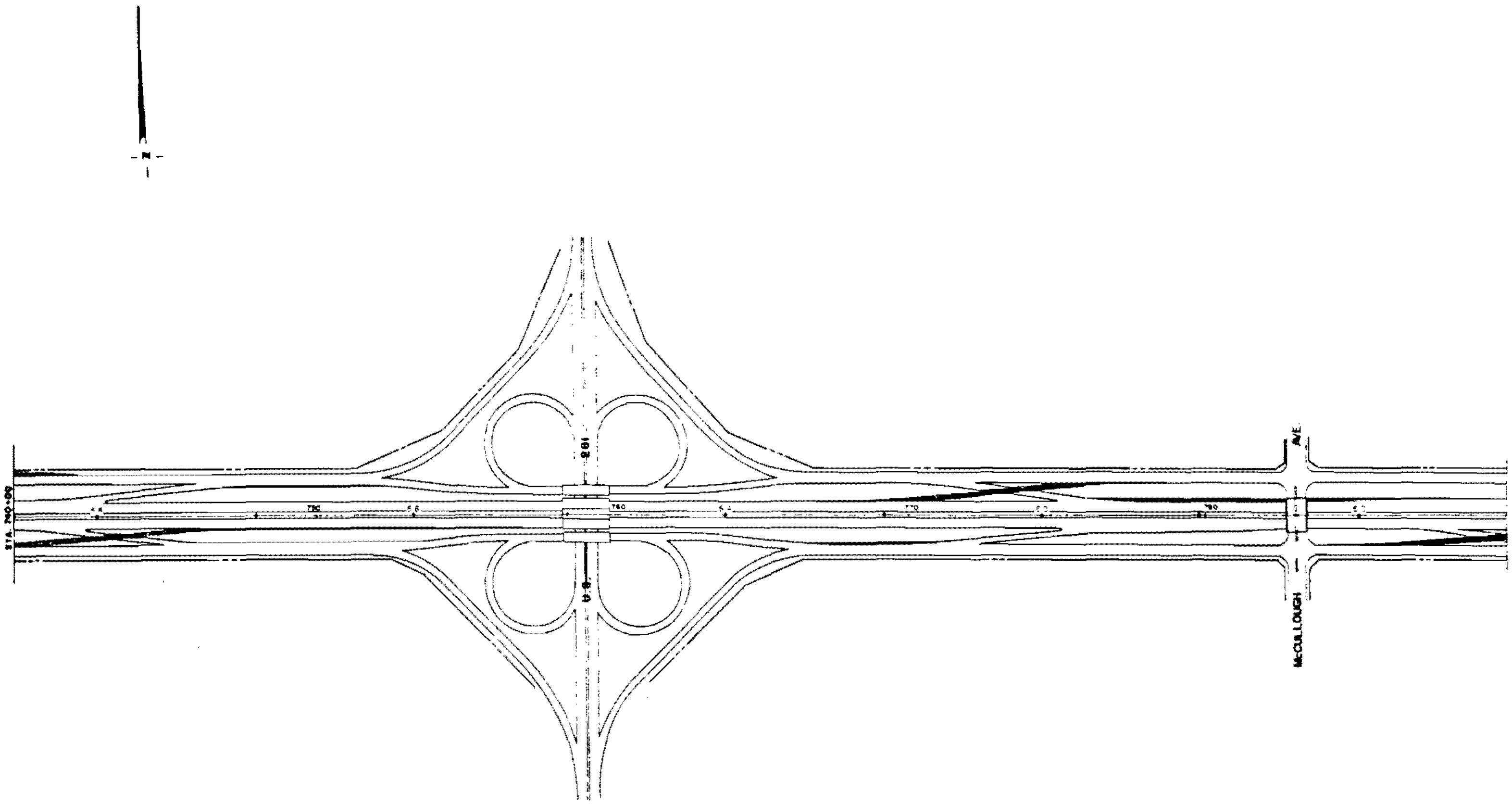


FIGURE I - D

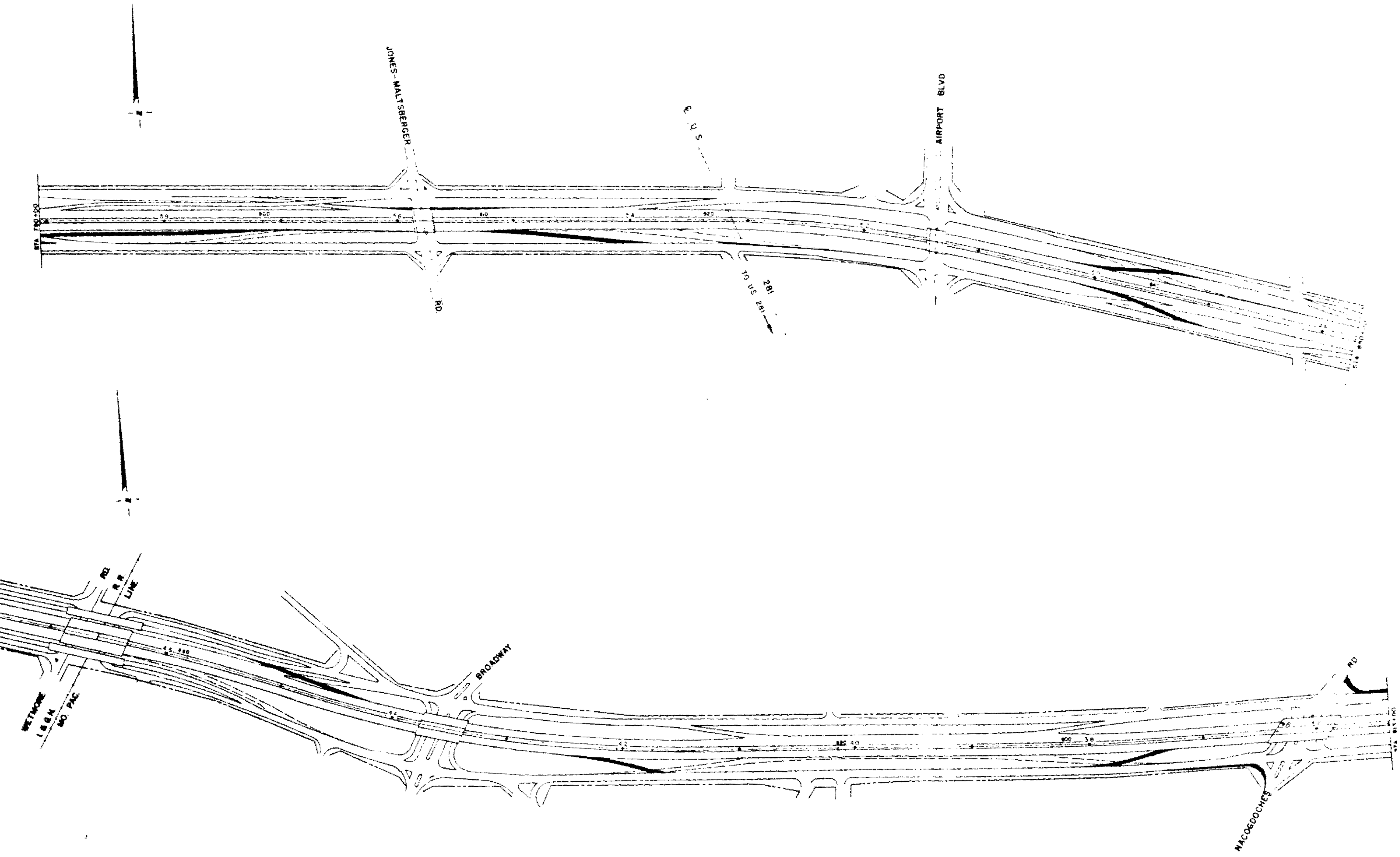

JONES-MALTSBERGER
RD.
℄ U.S.
281
TO US 281
AIRPORT BLVD
R.R.
LINE
WETMORE
I & G N
MO. PAC.
BROADWAY
NACOGDOCHES
RD

FIGURE I - E

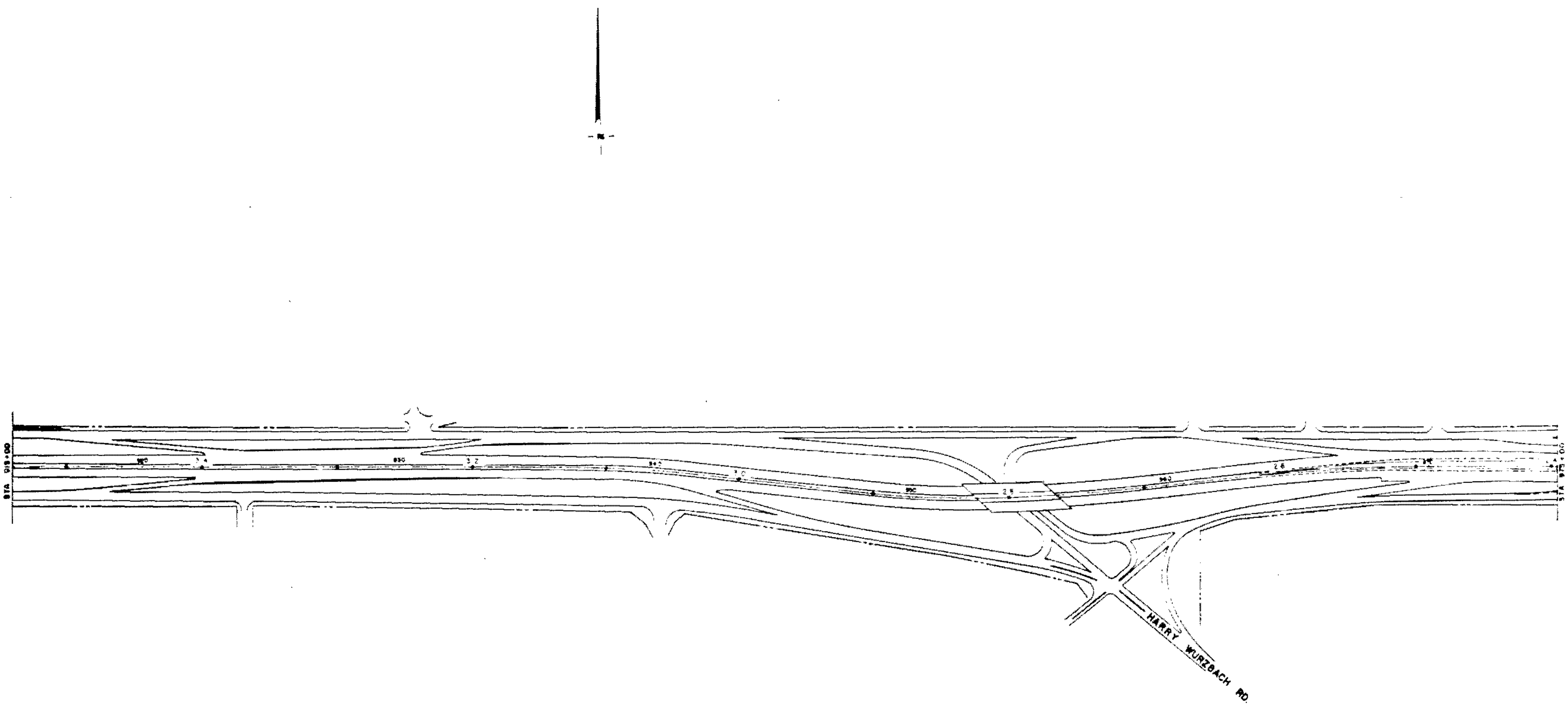


FIGURE I – F

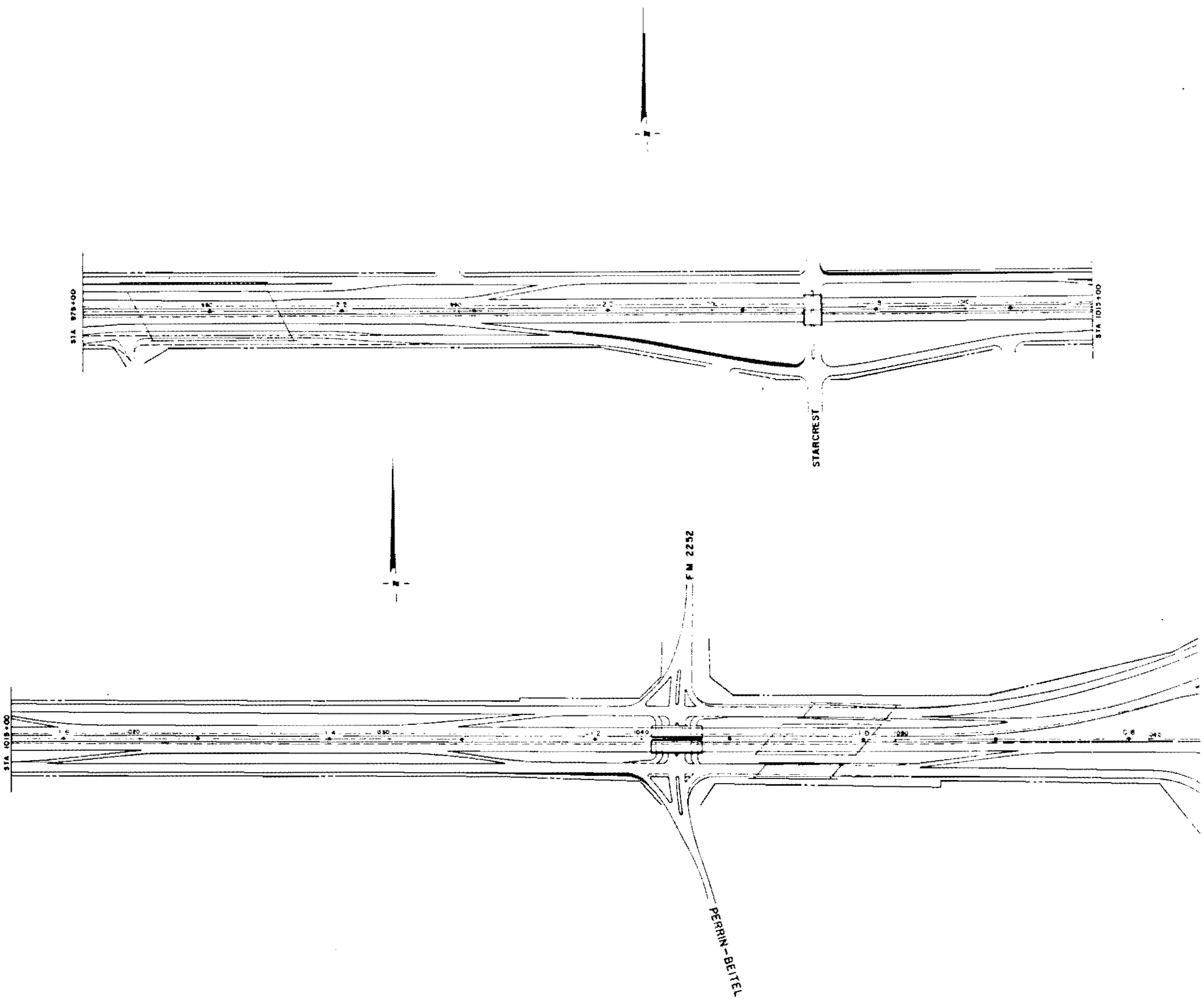
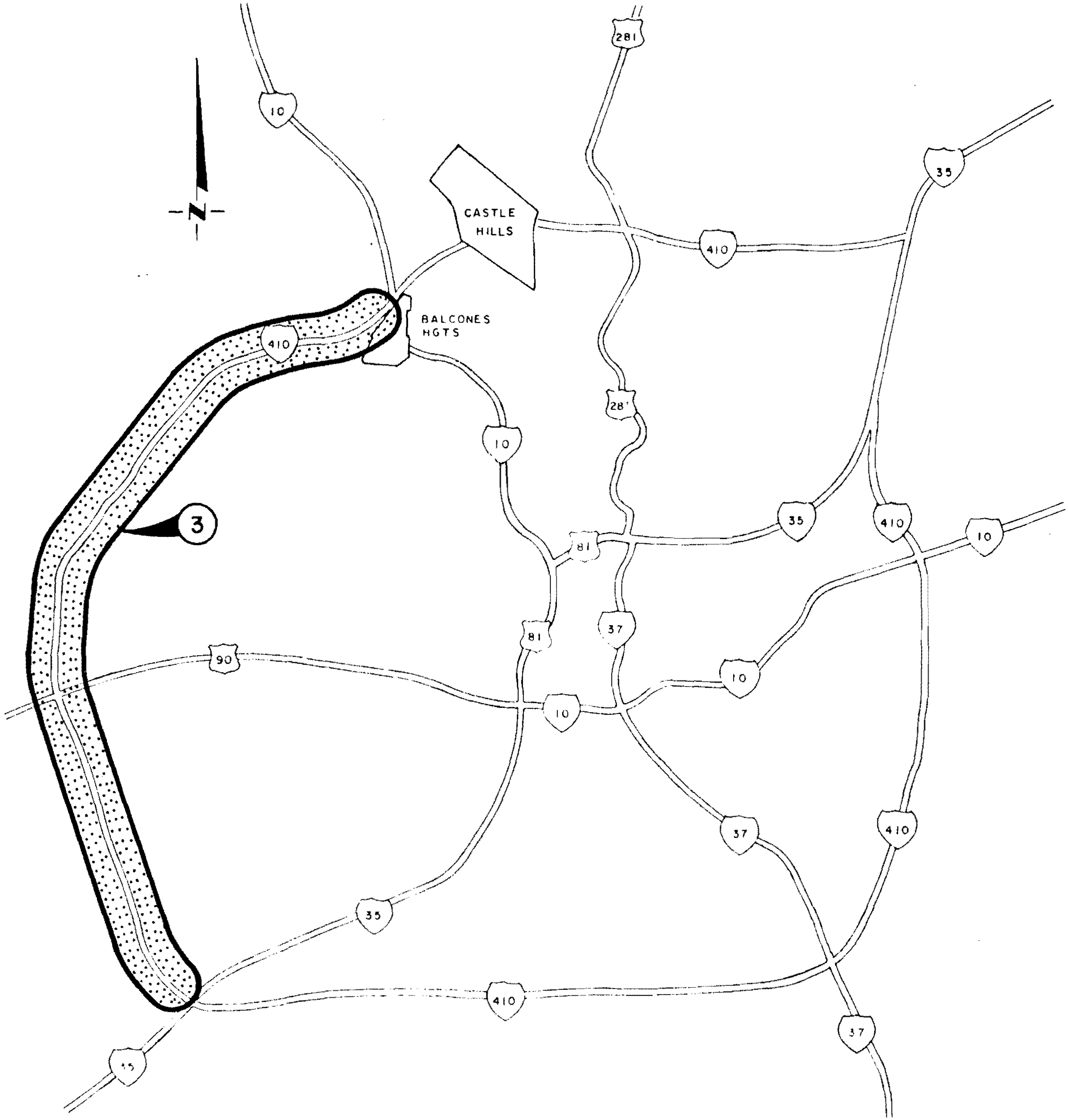

STA 978+00
STA 1015+00
STARCREST
STA 1018+00
F M 2252
PERRIN-BEITEL RD.

FIGURE I - G



I.H. 410 WEST

FREEWAY OPERATIONS STUDY

FROM: I.H. 35 SOUTH

TO: I.H. 10 WEST

INTRODUCTION

This study will identify the areas that were capacity deficient in 1978 and expose the areas where access is not easily available. It will also identify the areas that have become high accident locations.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10, the Department's Planning and Research Division in Austin. They provided volumes for the mainlanes, ramps, frontage roads and turning movements at the interchanges and intersections. Level of Service was calculated for all conditions to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing". The high accident locations could therefore be identified. The accident breakdown can be found in Table I-A through I-K.

The areas where access is not easily available were identified by citizens and police participation and from observations made by this office and the San Antonio Traffic and Transportation Department. This office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio Traffic and Transportation Department notifies us of any problem areas they have noticed or have received complaints about.

After analyzing the problem areas and proposing solutions, the anticipated impact of the solutions was determined by making turning movement counts and small origin-destination studies. Present volumes were then applied to the proposed solutions to determine the extent of improvement each proposal would have on the existing facility.

GENERAL DISCUSSION

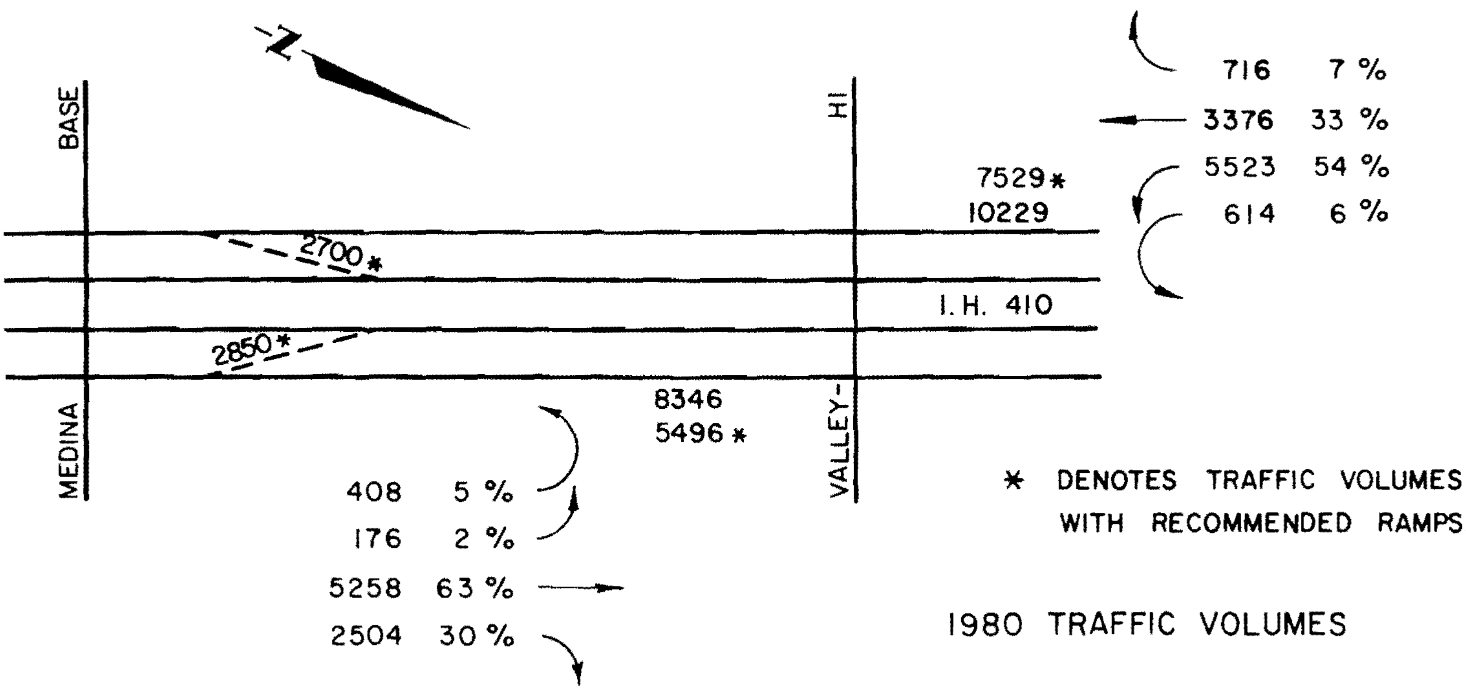
The limits of this study on I.H.410 are from I.H.35 south to I.H.10 west. The 1975 Ramp Demand Study, conducted by this office, identified the problem areas and recommended solutions from I.H.10 to Ingram Road. The solutions recommended in that study are presently under construction. Also under construction, is a southbound exit ramp to Medina Base Road and a northbound entrance ramp from Medina Base Road. FIGURES A through I show the existing roadway and the roadways that are presently under construction. Also shown are the recommendations which will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this study.

PROBLEMS AND RECOMMENDED SOLUTIONS

The mainlanes, frontage roads and intersections of I.H.410 are at an acceptable level of service from I.H.35 to Ray Ellison Drive. The land adjacent to the freeway in that area is generally undeveloped, which generates small volumes of traffic. However, the traffic volumes at the I.H.410 - Pearsall Road interchange are increasing at a rate that may require the installation of traffic signals in the near future. No other recommendations will be made in this area at this time, since no obvious problems exist from a traffic volume or accident standpoint.

PROBLEM: Valley-Hi Interchange is at capacity

Valley-Hi Drive carries a high volume of traffic to and from Lackland Air Force Base during the peak hours. This high volume of traffic has created an unacceptable level of service at this interchange. Also, traffic desiring to gain access to Medina Base Road have to use the Valley-Hi interchange, which adds to the congestion. Presently, the southbound exit ramp to Medina Base Road and the northbound entrance ramp from Medina Base Road are under construction. The addition of these two ramps will remove the Medina Base Road traffic from the Valley-Hi interchange and thereby provide an acceptable level of service at the Valley-Hi interchange.



1980 TRAFFIC VOLUMES

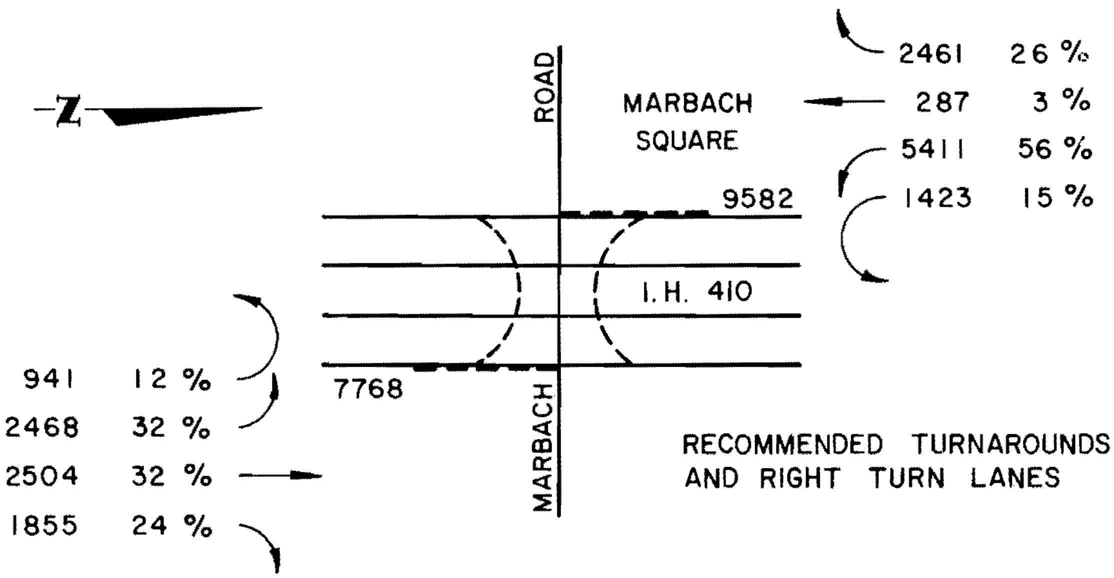
The existing signal equipment is presently being modernized at Valley-Hi, which will also improve the flow of traffic through this interchange. As traffic volumes increase at the Medina Base Road interchange, it will be necessary to install a traffic signal.

PROBLEM: Congestion on the mainlanes

The construction project presently underway is widening the existing two mainlanes in each direction to three mainlanes in each direction, from Fredericksburg Road to Ingram Road. Some mainlane sections between Ingram Road and Valley-Hi Drive are reaching an unstable flow condition. As traffic volumes increase, it will be necessary to provide three mainlanes in each direction, from Ingram Road to Valley-Hi Drive. The increased mainlane capacity will provide an acceptable mainlane level of service. At the time the mainlanes are widened, continuous lighting should be provided. To provide a safer operation for present traffic at night, lighting of the interchanges should be installed as soon as possible.

PROBLEM: Marbach Interchange is at capacity

Marbach Road, west of I.H.410, is presently being widened to two through lanes in each direction with a center left turn lane. The widening is being done to accommodate the increased traffic volume in that area. Marbach Square, a shopping center, on the northwest quadrant of the interchange is planned to open in the fall of 1982. The interchange is presently at capacity and with the expected increase in traffic volume from Marbach Square and other development in the area, it will be necessary to provide frontage road turnarounds and right turn lanes to improve the level of service of this interchange. As the traffic volumes increase on the southbound exit ramp and backups occur, it will be necessary to relocate the exit ramp further north. The relocated exit ramp will provide the necessary storage on the frontage road and the elimination of the exit



1980 TRAFFIC VOLUMES

ramp traffic backing up onto the main lanes, and thereby improve the quality of flow on the mainlanes.

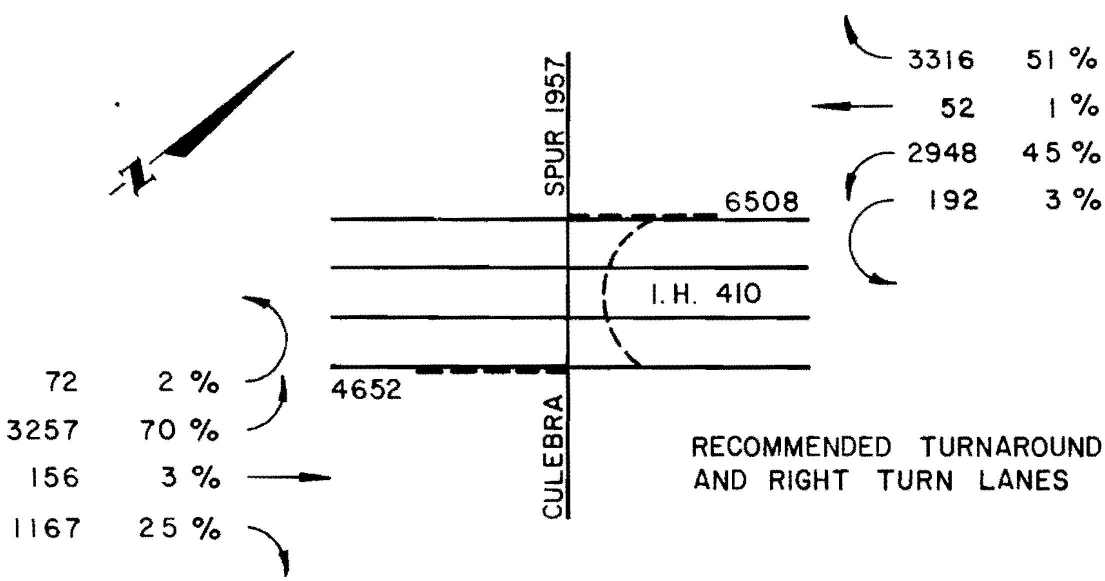
<u>PROBLEM</u>: <u>Interchange needed at Military Drive</u>

With the recent extension of Military Drive to tie into both frontage roads on I.H.410 and the continual increase in traffic volumes from this fast developing commercial and residential area, it has created a need for an interchange at Military Drive. In order to provide continuity of movement between this new interchange and the existing interchanges on either side of it, the frontage roads should be made continuous over Slick Ranch Creek and Leon Creek.

When the southbound frontage road is made continuous over Slick Ranch Creek, the existing short weaving distance on the southbound main lane can be eliminated by reversing the existing exit and entrance ramps.

PROBLEM: Anticipated congestion at Culebra Road interchange

The Culebra Road interchange has reached an unstable flow condition in the peak hours. In 1978, nineteen accidents were reported on the southbound frontage road approach. Traffic signals were installed in early 1980 to help accommodate the increased volume. A three hundred acre business park is now under construction on the land adjacent to Northside Stadium in the northeast quadrant of the interchange.

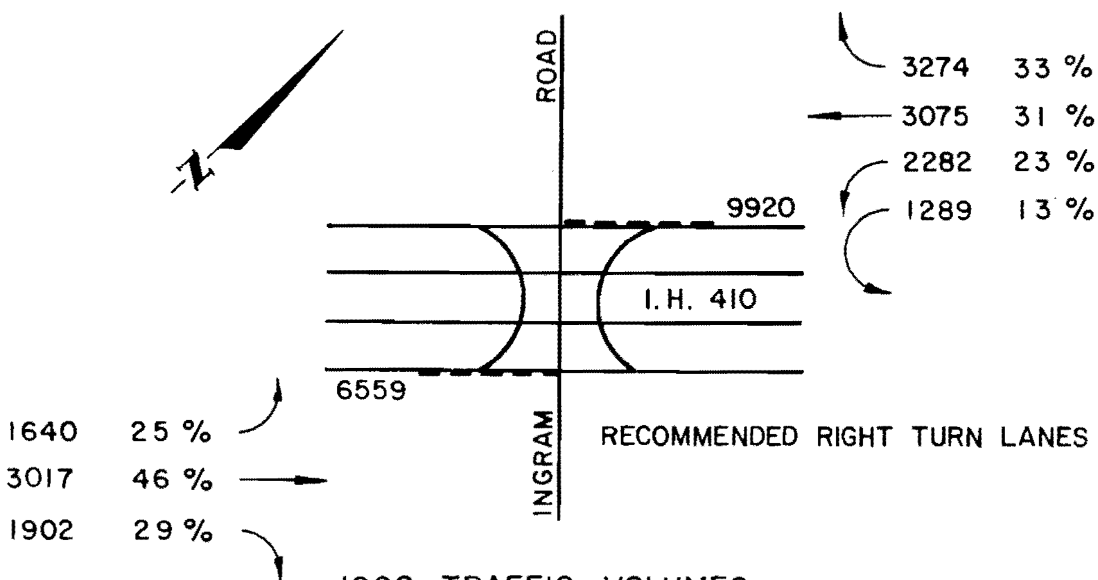


1980 TRAFFIC VOLUMES

Once constructed, the business park will generate a high u-turning volume on the north side of Culebra Road. A turnaround will be necessary in order to remove this high u-turning volume from the signalized approach. Right turn lanes on the frontage road approaches will also improve the level of service of the interchange.

PROBLEM: Congestion at Ingram Road

The frontage road turnaround on the south side of Ingram Road is presently under construction, and the turnaround on the north side is open to traffic. These turnarounds will improve the level of service of the interchange but the high traffic volumes generated by the mall and other business developments in the area will continue to create congestion.

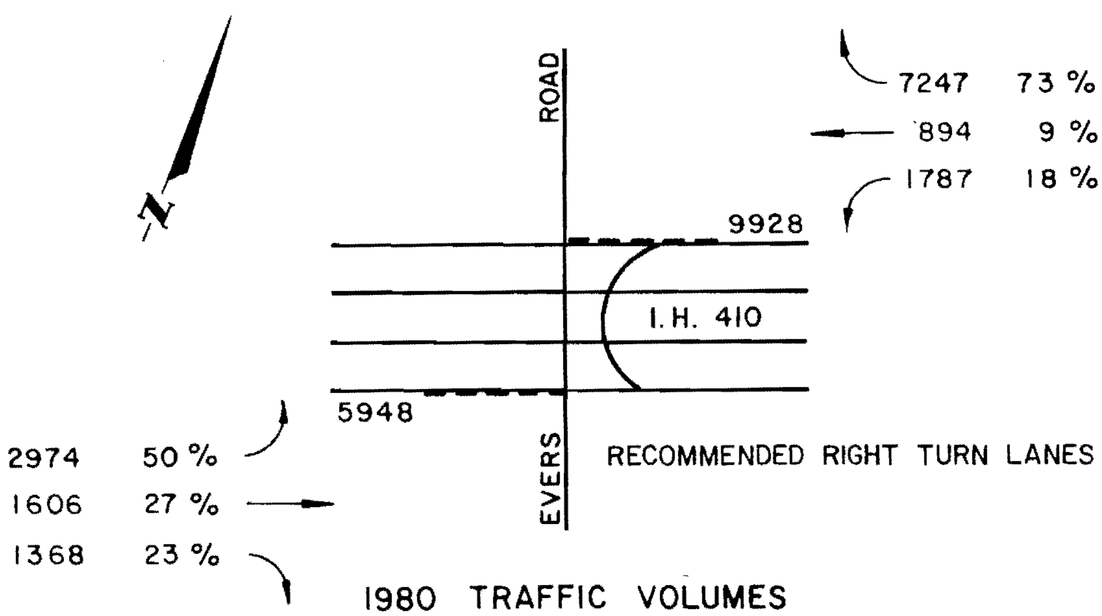


1980 TRAFFIC VOLUMES

In 1978, twenty-three accidents were reported on the frontage road approaches. The construction of right turn lanes on the frontage road approaches will remove additional traffic from the signalized approaches and thereby reduce this congestion.

<u>PROBLEM</u>: <u>Evers Road is at capacity</u>

The Evers Road interchange is at capacity during the peak hours. The turnaround on the north side is opened to traffic which has removed some of the frontage road approach traffic. Another effective method to decrease the approach volume and improve the level of service is to install frontage road right turn lanes.



1980 TRAFFIC VOLUMES

STUDY NO. 3

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.410 WEST

1. Install new traffic signal at the Pearsall Road interchange.
2. Construct frontage road turnarounds and right turn lanes at Marbach Road.
3. Relocate the existing southbound exit to Marbach Road further north.
4. Construct a grade-separated interchange at Military Drive.
5. Construct continuous frontage roads over Slick Ranch Creek and Leon Creek and reverse the southbound ramps at Slick Ranch Creek.
6. Construct frontage road right turn lanes at Culebra Road and a turnaround on the north side.
7. Construct frontage road right turn lanes at Ingram Road.
8. Construct frontage road right turn lanes at Evers Road.
9. Install interchange lighting.
10. Construct an additional mainlane in each direction from Ingram Road to Valley-Hi Drive and provide continuous lighting.
11. Install new traffic signal at the Medina Base Road interchange.

AIR QUALITY ANALYSIS

The freeway operation study of I.H. 410 West from I.H. 35 South to I.H. 10 W. was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for I.H. 410 West from I.H. 35 S. to I.H. 10 W.

I.H. 410 WEST FROM I.H. 35 SOUTH TO I.H. 10 WEST

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	408,394	257,571	-36.9
Tons/year	164.32	103.63	
Carbon Monoxide (CO)			
Grams/day	2,928,952	2,294,604	-21.7
Tons/year	1,178.45	923.22	
Nitrogen Oxides (NO_x)			
Grams/day	310,451	306,706	-1.2
Tons/year	124.91	123.40	

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	10.5	24^{15}	3^{2}	4^{1}				4			1^{1}			36^{19}
NB	ML	10.6	2^{1}		1										3^{1}
NB	ML	10.7	2^{1}								1				3^{1}
NB	ML	11.0	1												1
NB	ML	[illegible]												1	1
NB	ML	[illegible]	1		1^{2}	1		1^{1}							4^{2}
NB	ML	[illegible]			1^{1}										1^{1}
NB	ML	[illegible]	2		1			1							4
NB	ML	[illegible]	1									1			2
NB	ML	11.9	4^{1}	1	1	1		1	1		1^{1}				10^{2}
NB	ML	12.0				1									1
NB	ML	12.1	1									1			2
NB	ML	12.2			1			1^{1}			1			1^{1}	4^{2}
NB	ML	12.5									1				1
NB	ML	12.9	2^{1}					1							3^{1}
NB	ML	13.0	3^{2}	1		2^{1}									6^{3}
NB	ML	13.2	1												1
NB	ML	13.4						1							1

<u>LEGEND</u>

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	1	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures A-I to identify accident locations.

TABLE I-A

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	13.6									2^1				2^1
NB	ML	13.9									1^1				1^1
NB	ML	14.2							1^1						1^1
NB	ML	14.9		1											1
NB	ML	15.2												1	1
NB	ML	15.3	1												1
NB	ML	15.4	1								1^1				2^1
NB	ML	15.9		1											1
NB	ML	16.1							1^1						1^1
NB	ML	16.2			1			1^1	1						3^1
NB	ML	16.3			1	1^1			1^1					1^1	4^3
NB	ML	16.4							3^2		1				4^2
NB	ML	16.5				1					1^1				2^1
NB	ML	16.6							1						1
NB	ML	16.7			1						2^2				3^2
NB	ML	17.2							1	1					2
NB	ML	17.3						1^1			2				3^1
NB	ML	17.5				1^1									1^1
NB	ML	17.6												1	1
NB	ML	17.7	1^1												1^1
NB	ML	17.9									1				1
NB	ML	18.2	1^1												1^1
NB	ML	18.9	2^1						1						3^1

TABLE I-B

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S	O.	R.E.	S.S.	O.	
NB	ML	19.0	1'			1									2'
NB	ML	19.7			1'										1'
NB	ML	10.2				1									1
NB	ML	10.3			1					1'					2'
NB	ML	10.4			1						1				2
NB	ML	11.5	1'												1'
NB	ML	11.6								1					1
NB	ML	11.8									1				1
NB	ML	12.3			1'			1'		1'	3			1	7^{3}
NB	ML	12.5							1						1
NB	ML	13.0		1'	1'										2^{2}
NB	ML	14.0	1												1
NB	ML	14.3									1'				1'
NB	ML	14.6												1'	1'
NB	ML	15.5	1												1
NB	ML	16.0												1	1
NB	ML	16.2	2'												2'
NB	ML	16.3		1											1
NB	ML	16.4			1										1
NB	ML	16.5		1							1			1'	3'
TOTAL			56^{47}	10^{3}	19^{6}	10^{3}	0	9^{5}	16^{5}	4^{2}	22^{8}	3^{1}	0	9^{4}	158^{64}

TABLE I-C

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	10.5	2	1^1							1^1				4^2
SB	ML	10.6	4^3								1				5^3
SB	ML	10.7	8^2									1			9^2
SB	ML	10.8			1^1								1		2^1
SB	ML	10.9	1						1						2
SB	ML	11.0							3^1			1^1			4^2
SB	ML	11.1			1^1										1^1
SB	ML	11.2											1		1
SB	ML	11.3					1^1								1^1
SB	ML	11.4							1^1						1^1
SB	ML	11.5	1						1^1		1^1	4^3		1^1	8^6
SB	ML	11.6			1^1										1^1
SB	ML	11.8					1								1
SB	ML	11.9				2									2
SB	ML	12.0						1							1
SB	ML	12.4			1										1
SB	ML	12.7								1^1					1^1
SB	ML	12.9					1					1			2
SB	ML	13.0	1				1		1		1^1				4^1
SB	ML	13.3										1		1	2
SB	ML	13.5									1^1				1^1
SB	ML	13.6	1							1		1			3
SB	ML	13.7										1			1

TABLE I-D

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	13.8	2^1							1^1					3^2
SB	ML	14.0					1								1
SB	ML	14.5										1^1			1^1
SB	ML	14.6												1^1	1^1
SB	ML	14.7									1^1				1^1
SB	ML	14.9							1						1
SB	ML	15.0			1^1										1^1
SB	ML	15.2	3^1						1^1					1	5^2
SB	ML	15.3							1^1						1^1
SB	ML	15.4	1												1
SB	ML	16.0	1												1
SB	ML	16.1							1^1		2^2			1	4^3
SB	ML	16.3				2	1				1^1		1^1	1^1	6^3
SB	ML	16.4						1^1	1^1		1^1				3^3
SB	ML	16.6	1		1^1	1	1^1		1						5^2
SB	ML	16.7		2											2
SB	ML	16.8									1^1				1^1
SB	ML	16.9									1				1
SB	ML	17.2		1							1^1				2^1
SB	ML	17.3								1	1^1				2^1
SB	ML	17.5							1						1
SB	ML	17.7							1						1
SB	ML	18.4												1^1	1^1

TABLE I-E

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	18.6					1		1^{1}		1				3^{1}
SB	ML	18.7							1^{1}		2^{1}				3^{2}
SB	ML	18.8	1												1
SB	ML	19.0										1			1
SB	ML	19.1							1		1^{1}				2^{1}
SB	ML	19.4				1						1^{1}			2^{1}
SB	ML	20.[illegible]									1			1	2
SB	ML	10.2	1								1				2
SB	ML	10.3			2^{1}						1				3^{1}
SB	ML	10.5									1^{1}				1^{1}
SB	ML	10.9									1				1
SB	ML	11.0	1												1
SB	ML	11.4			1^{1}										1^{1}
SB	ML	11.6						1							1
SB	ML	11.9									1^{1}				1^{1}
SB	ML	12.2												1^{1}	1^{1}
SB	ML	12.3									1				1
SB	ML	14.3									1^{1}				1^{1}
SB	ML	16.[illegible]	4^{2}												4^{2}
SB	ML	18.[illegible]	1		1									1^{1}	3^{1}
SB	ML	18.[illegible]	1^{1}		1^{1}						1^{1}				3^{3}
TOTAL			35^{10}	4^{1}	11^{6}	6	8^{2}	3^{1}	18^{9}	4^{2}	27^{18}	13^{6}	3^{1}	10^{8}	142^{64}

TABLE 1-F

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	10.5	1												1
NB	FR	10.6		2^1							1				3^1
NB	FR	10.7	3^1		17^2	1	1	2		1^1	6^2			1	32^6
NB	FR	10.8									1				1
NB	FR	10.9							1^1						1^1
NB	FR	11.5	1			2		1				2^1			6^1
NB	FR	11.6	1												1
NB	FR	11.9	1	1^1	3^1				1	1					7^2
NB	FR	12.8	1												1
NB	FR	13.0	2^1												2^1
NB	FR	13.5						2^1							2^1
NB	FR	13.6	2		4^1	2								1^1	9^2
NB	FR	13.7		1						1^1			1		3^1
NB	FR	13.8				1									1
NB	FR	14.6						1							1
NB	FR	14.7										1			1
NB	FR	15.1									1^1				1^1
NB	FR	15.2	1^1		4	1		2^2			3^2		1		12^5
NB	FR	15.3			1^1										1^1
NB	FR	16.0									1				1
NB	FR	16.3	1		2^1										3^1
NB	FR	17.0									1				1
NB	FR	17.2										1			1

TABLE I-G

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	19.0	1		1^{1}										2^{1}
NB	FR	19.1	2^{2}	2	1^{1}				1		3^{2}				9^{5}
NB	FR	19.2		1	1^{1}						1^{1}				3^{2}
NB	FR	19.7								1					1
NB	FR	19.9						1			1				2
NB	FR	20.2			1^{1}		1							1^{1}	3^{2}
NB	FR	[illegible]	1												1
NB	FR	10.3		1				1			1				3
NB	FR	10.6			1										1
NB	FR	11.3												1	1
NB	FR	11.6	4^{2}		3^{2}	1^{1}		1	1^{1}		1				11^{6}
NB	FR	11.7			1			1							2
NB	FR	12.3			1			1^{1}							2^{1}
NB	FR	13.0			2^{1}										2^{1}
NB	FR	14.6						1							1
TOTAL			22^{7}	8^{2}	43^{13}	8^{1}	2	14^{4}	4^{2}	4^{2}	21^{8}	4^{1}	2	4^{2}	136^{47}

TABLE 1-H

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	10.6	1^1		2						1				4^1
SB	FR	10.7	4^1		8^1				2^1		3	1		1^1	19^4
SB	FR	10.8	1												1
SB	FR	11.5	2	1	2^1	4^1		1^1				1^1			11^4
SB	FR	11.9		1	2			2^1	1^1						6^2
SB	FR	12.5								1					1
SB	FR	12.8							1						1
SB	FR	12.9						1							1
SB	FR	13.0	2		2^1			1			1	1^1			7^2
SB	FR	13.5	1		1										2
SB	FR	13.6		1	1			1			3^1				6^1
SB	FR	13.7			1			1							2
SB	FR	15.0	2^1												2^1
SB	FR	15.1											1^1		1^1
SB	FR	15.2	2^1		4^3	1				1	1			2^1	11^5
SB	FR	15.3							1		1				2
SB	FR	16.3	2^1	1	6^2	3	1^1	3			3^1				19^5
SB	FR	17.6			1^1										1^1
[illegible]	FR	17.7				1									1
SB	FR	17.9		1											1
SB	FR	18.1					1								1
SB	FR	18.5			1^1										1^1
SB	FR	19.1	4^1	2	1	2		1			2^1	2^1	1		15^3

TABLE I-I

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	19.2						1							1
SB	FR	20.1		1											1
SB	FR	20.2		1	1'	1									3'
SB	FR	10.2	2	1	1										4
SB	FR	10.3	7^3		1'	1	1	1	1'		1	1		1	15^5
SB	FR	10.5	1												1
SB	FR	10.7									1'				1'
SB	FR	11.1					1					1'			2'
SB	FR	11.3												1	1
SB	FR	11.5			1'	1			1						3'
SB	FR	11.6	2											1	2
SB	FR	11.8									1				1
SB	FR	11.9						1							1
SB	FR	12.0												1'	1'
SB	FR	12.2			2^2						1				3^2
SB	FR	12.3						1							1
SB	FR	12.6												1	1
SB	FR	13.1									1				1
SB	FR	14.4							1'						1'
SB	FR	14.6			1						1'				2'
SB	FR	16.0									1				1
SB	FR	16.2									1'				1'
SB	FR	16.3			1										1

TABLE I-J

1978 ACCIDENT HISTORY

I.H. 410

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	16.5			1										1
TOTAL			33^{9}	10	41^{15}	14^{1}	4^{1}	15^{2}	8^{4}	2	23^{6}	7^{4}	2^{1}	8^{3}	167^{46}

TABLE I-K


I H 35
RD
R R
I & G N
QUINTANA
LEGEND
RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS
PRESENTLY UNDER CONSTRUCTION
PRESENTLY BEING REMOVED

FIGURE A

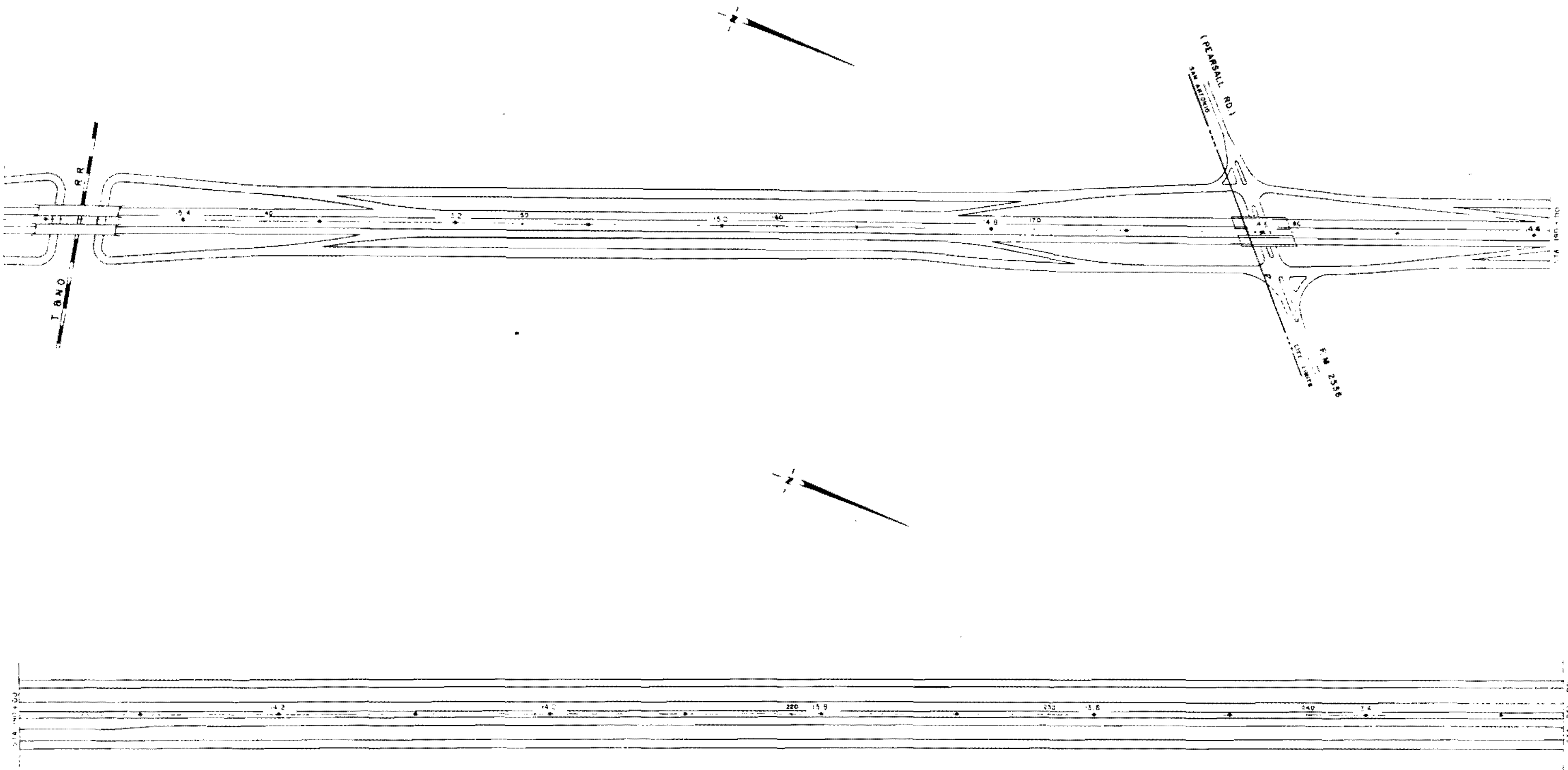


FIGURE 8

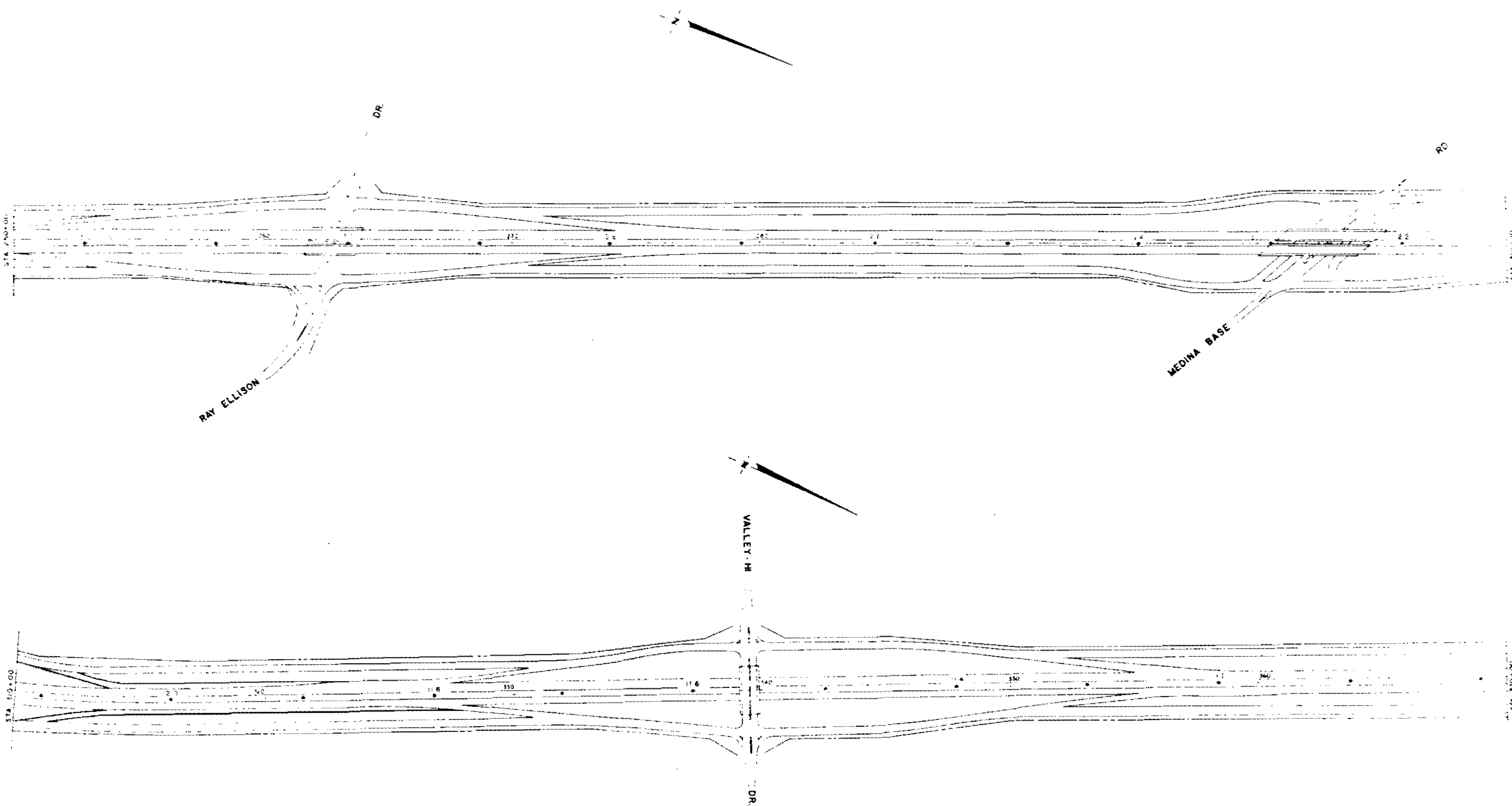


FIGURE C

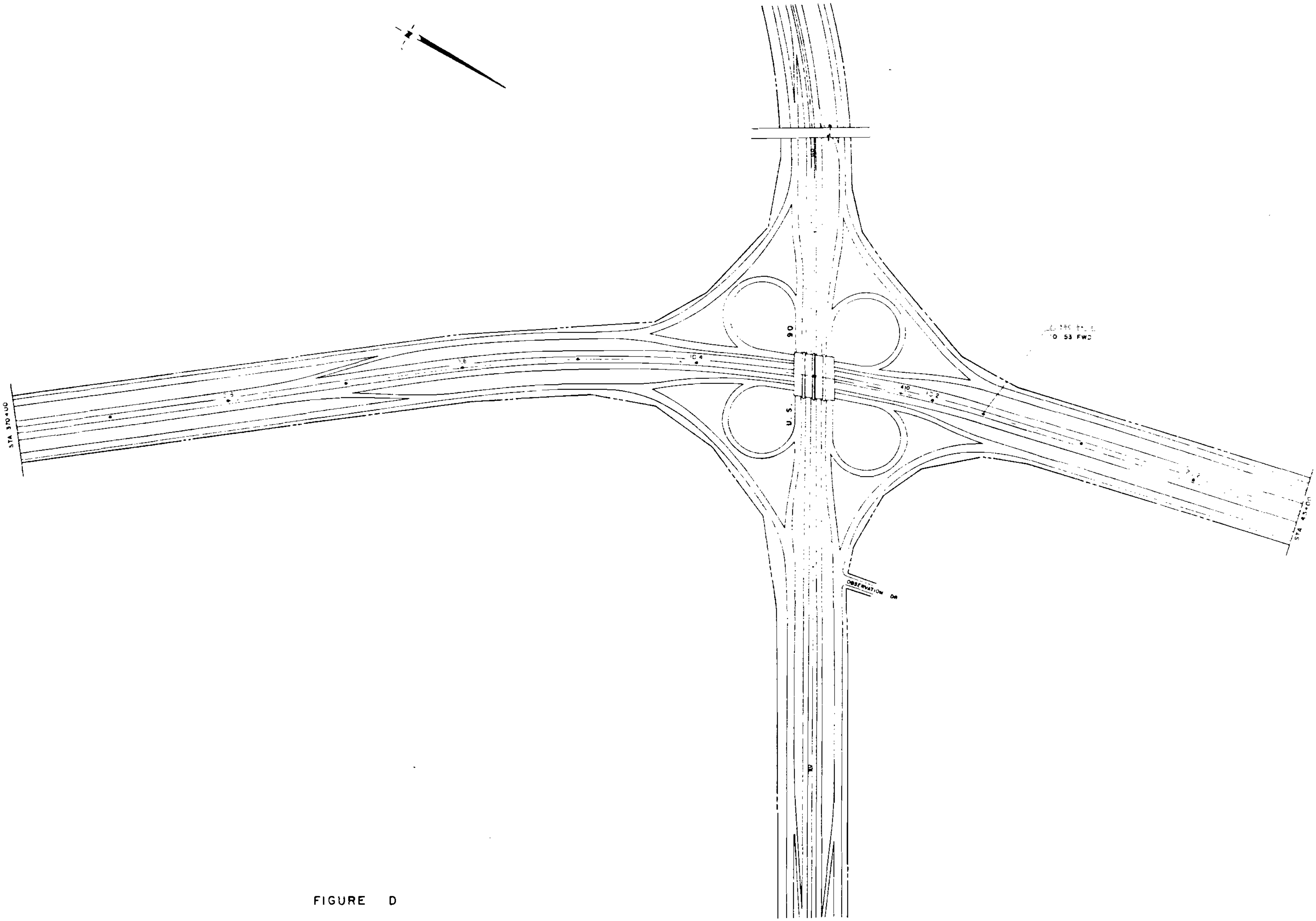


FIGURE D

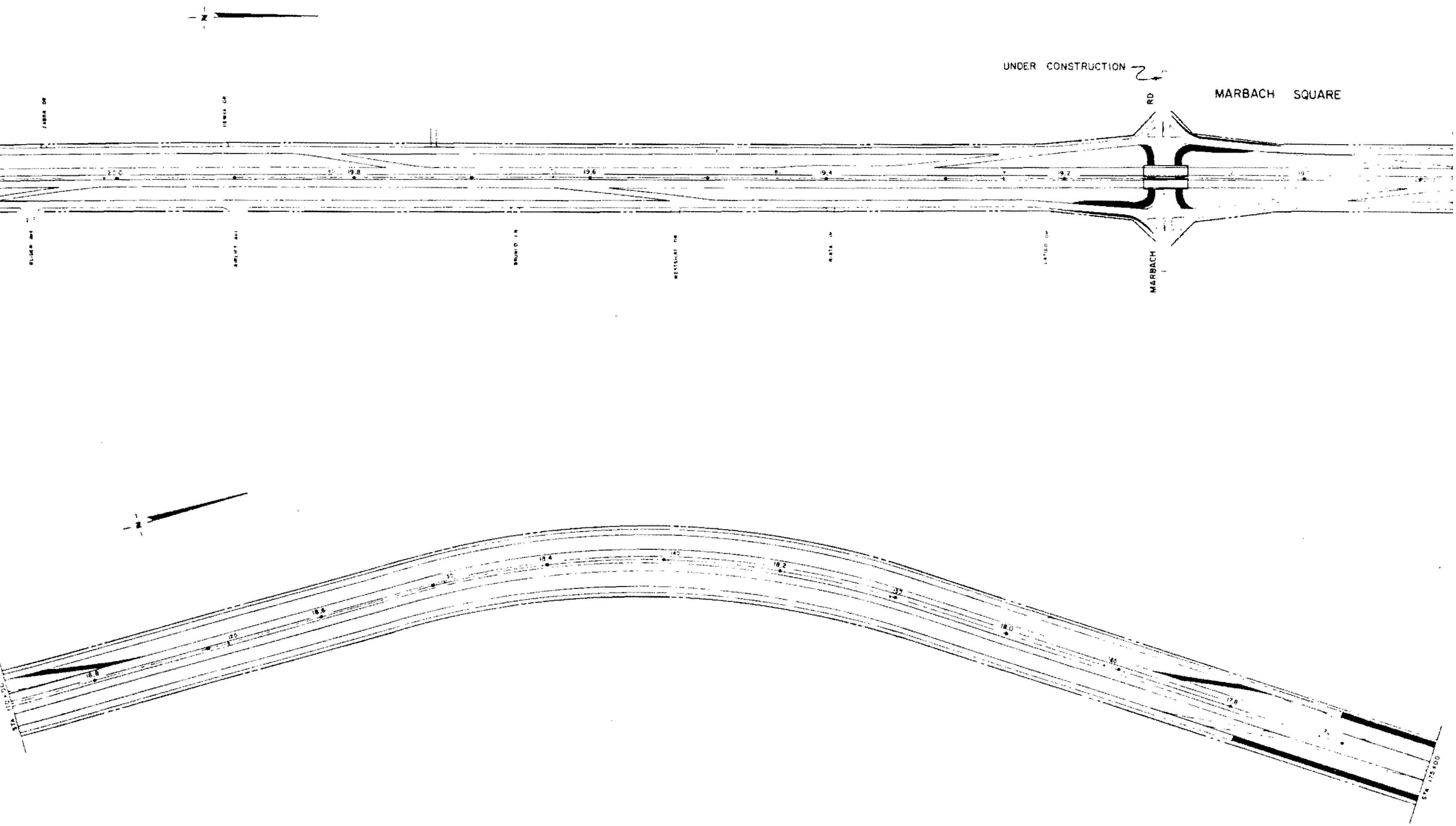

UNDER CONSTRUCTION
MARBACH SQUARE
MARBACH
RD
19.2
19.4
19.6
19.8
20.0
18.8
18.6
18.4
18.2
18.0
17.8

FIGURE E

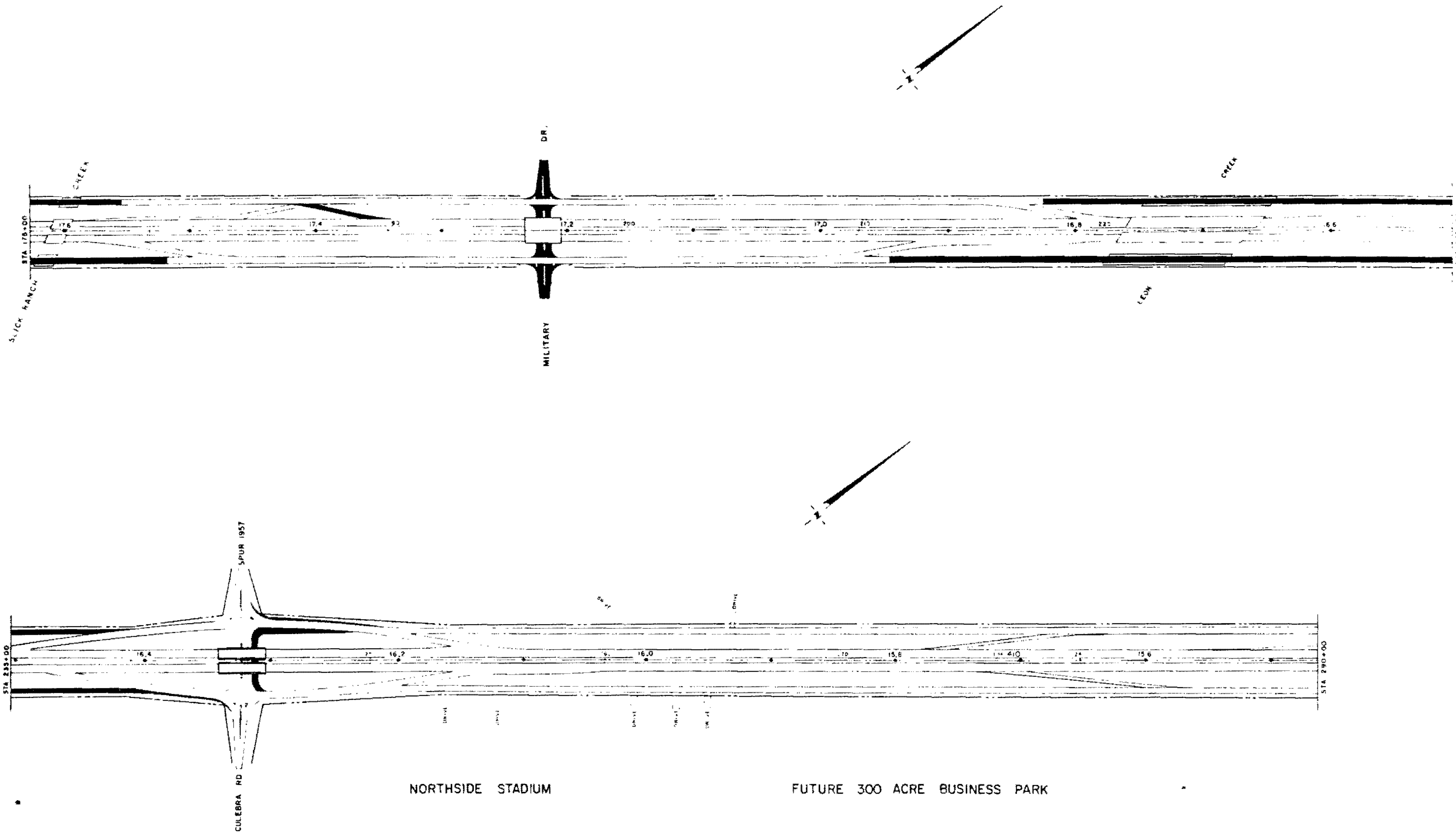
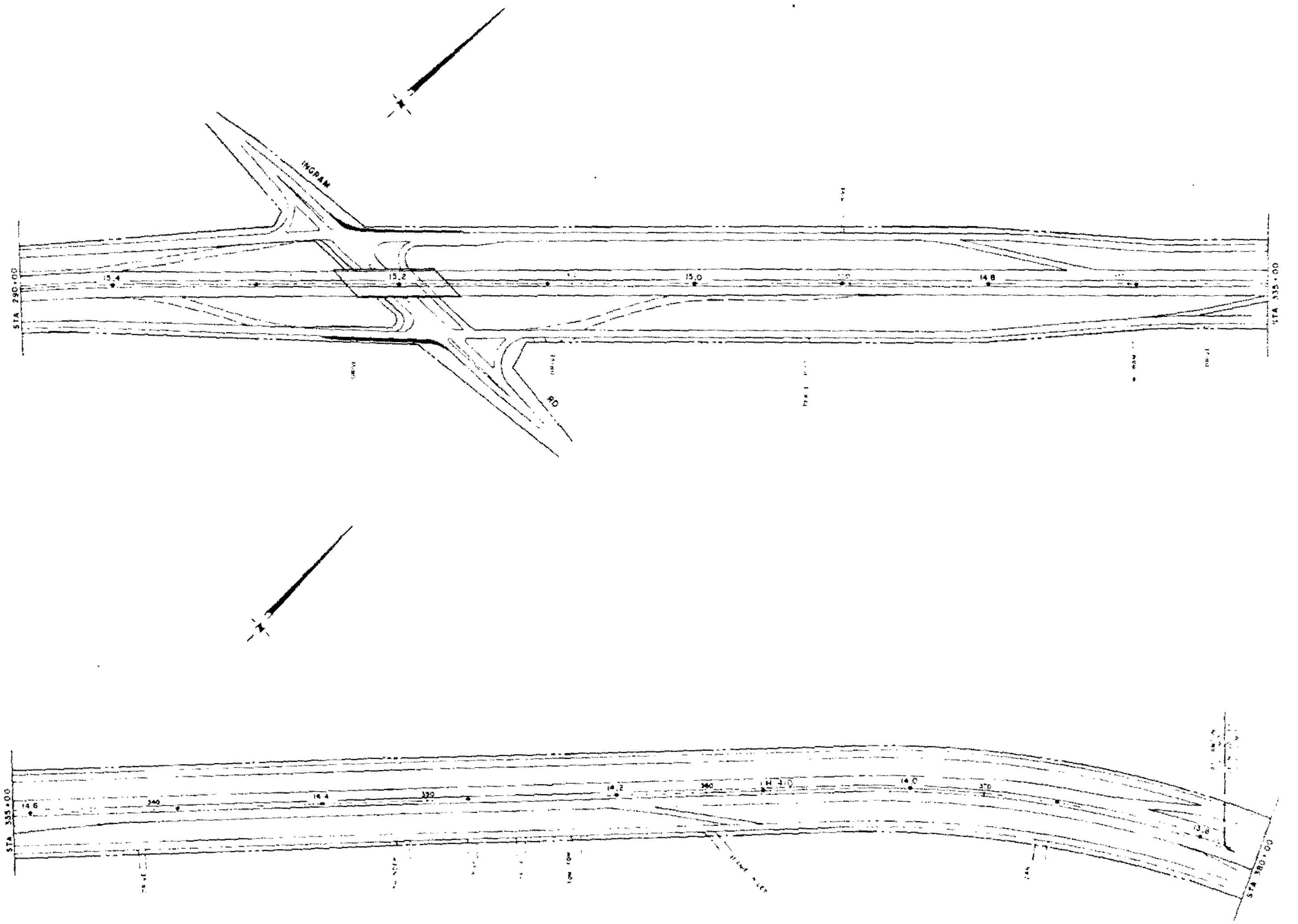
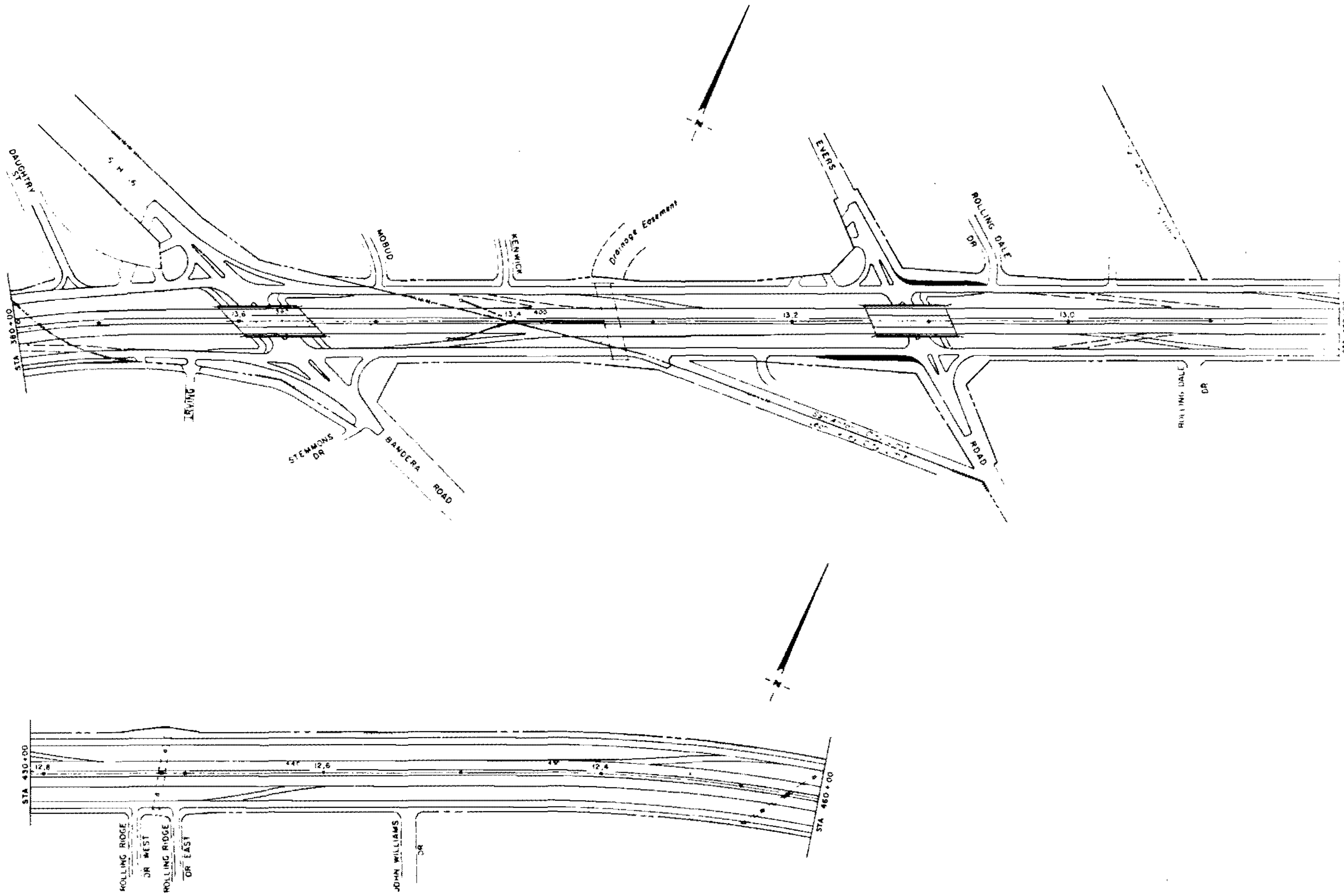

SLICK RANCH
CREEK
STA 178+00
DR.
MILITARY
CREEK
LEON
STA 235+00
SPUR 1957
CULEBRA RD
STA 235+00
STA 290+00
NORTHSIDE STADIUM
FUTURE 300 ACRE BUSINESS PARK

FIGURE F



INGRAM
RD
STA 290+00
STA 335+00
STA 380+00
15.4
15.2
15.0
14.8
14.6
14.4
14.2
14.0
13.8
340
350
360
370

FIGURE G



DAUGHTRY ST
S H 16
MOBUD
KENWICK
Drainage Easement
EVERS
ROLLING DALE DR
IRVING
STEMMONS DR
BANDERA ROAD
ROAD
ROLLING DALE DR
STA 380+00
13.6
13.4
400
13.2
13.0
STA 430+00
12.8
12.6
12.4
STA 460+00
ROLLING RIDGE DR WEST
ROLLING RIDGE DR EAST
JOHN WILLIAMS DR

FIGURE H

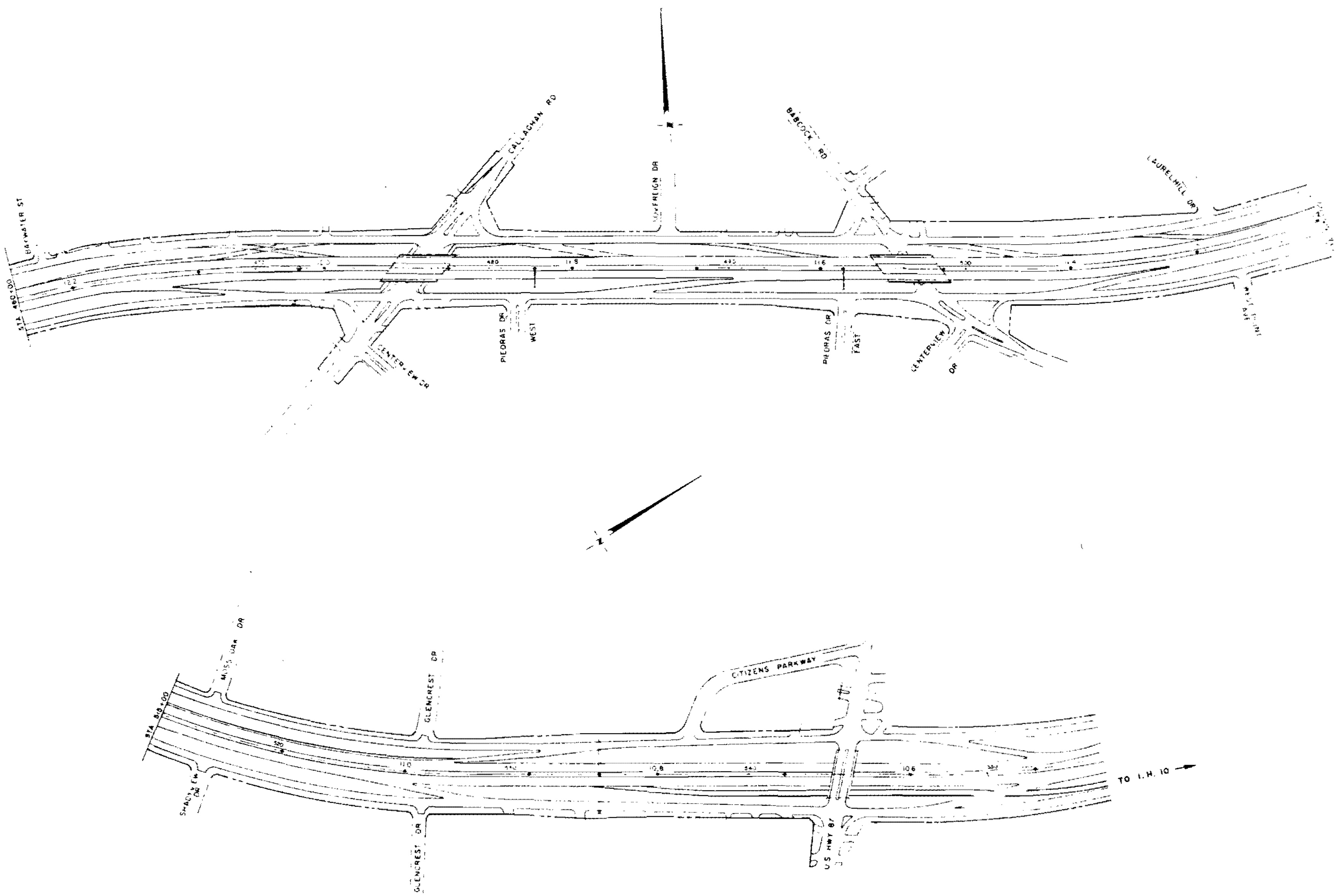
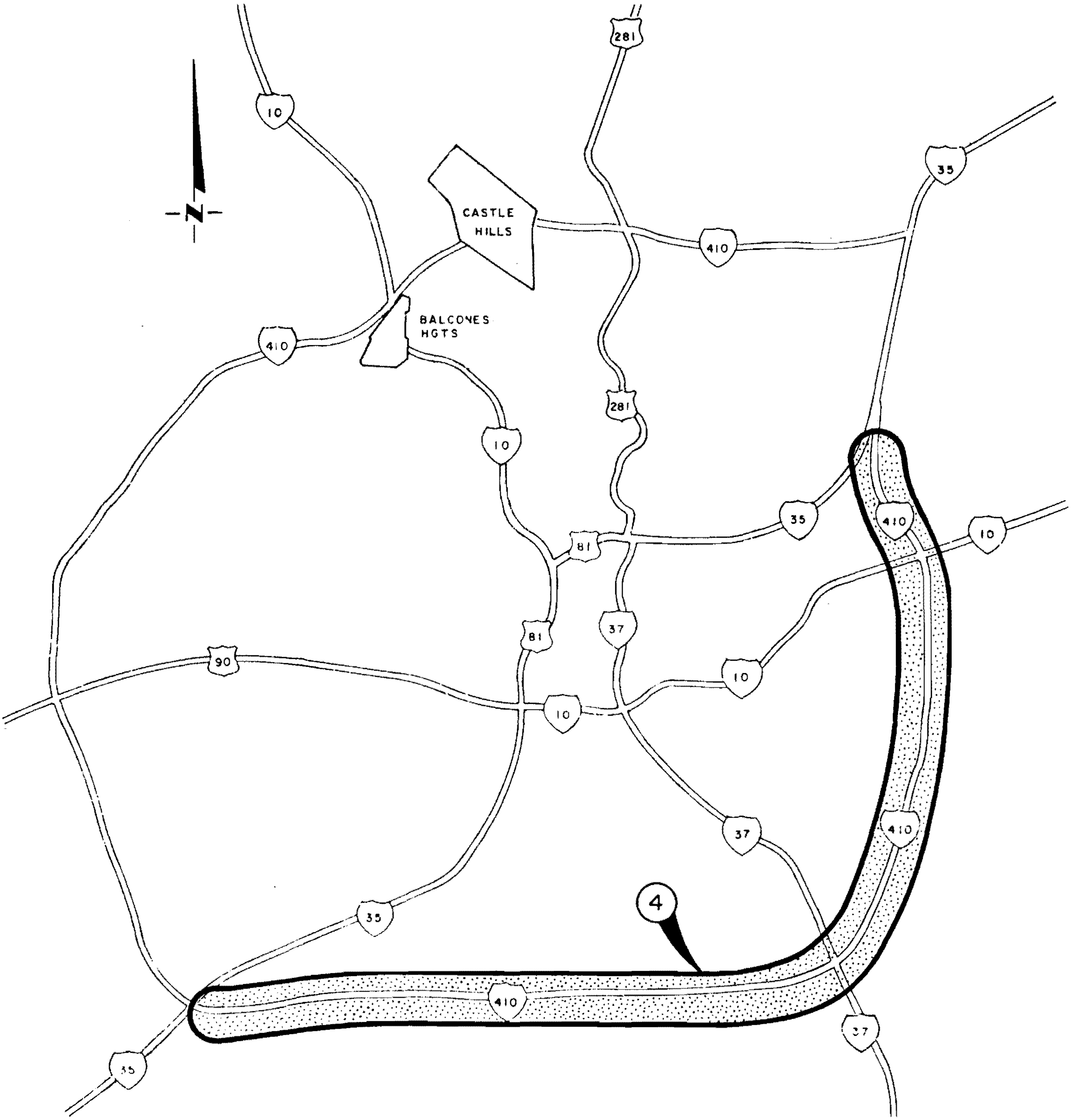

BAYWATER ST
STA 480+00
CALLAGHAN RD
SOVEREIGN DR
BABCOCK RD
LAURELHILL DR
CENTERVIEW DR
PIEDRAS DR
WEST
PIEDRAS DR
EAST
CENTERVIEW
DR
MOSS OAK DR
GLENCREST DR
CITIZENS PARKWAY
STA 510+00
SHADYVIEW DR
GLENCREST DR
US HWY 87
TO I.H. 10

FIGURE I



I.H. 410 SOUTH AND EAST

FREEWAY OPERATIONS STUDY

FROM: I. H. 35 NORTH

TO: I. H. 35 SOUTH

INTRODUCTION

This study will identify the areas that were capacity deficient in 1978 and expose the areas where access is not easily available. It will also identify the areas that have become high accident locations.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10, the Department's Planning and Research Division in Austin. They provided volumes for the mainlanes, ramps, frontage roads and turning movements at the interchanges and intersections. Level of Service was calculated for all conditions to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing." The high accident locations could therefore be identified. The accident breakdown can be found in Table 1 through 6.

The areas where access is not easily available were identified by citizens and police participation and from observations made by this office and the San Antonio Traffic and Transportation Department. This office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio Traffic and Transportation Department notifies us of any problem areas that they have noticed or have received complaints about.

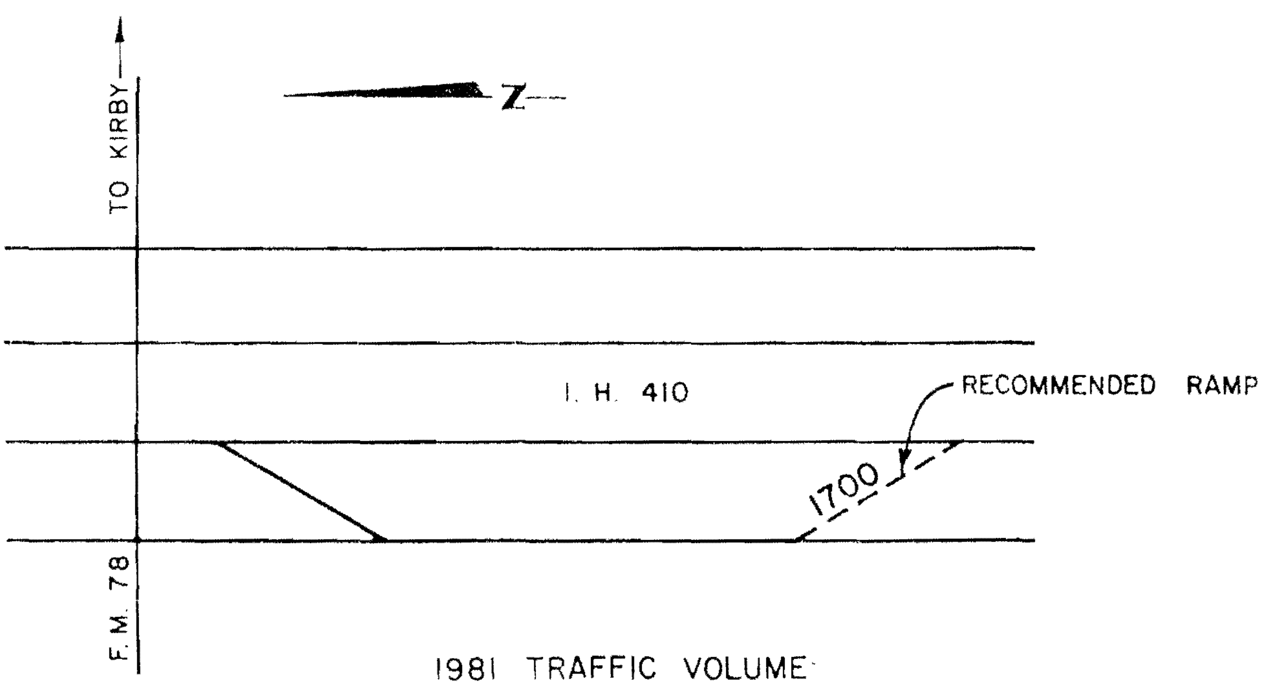
GENERAL DISCUSSION

The limits of this study on I.H.410 are from I.H.35 north to I.H.35 south, in the south and east part of San Antonio. The land adjacent to I.H.410 in this area of the city is generally undeveloped, which generates small volumes of traffic. The mainlanes, frontage roads and intersections are operating at a good level of service throughout the limits of this study and no high accident locations were found. Some access problems exist and will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this study. FIGURES A through N show the existing roadway.

PROBLEMS AND RECOMMENDED SOLUTIONS

PROBLEM: Better I.H.410 southbound access needed from Kirby

Presently, traffic traveling westbound on F.M.78 from Kirby have to travel in a circuitous route to gain access to I.H.410 southbound.



1981 TRAFFIC VOLUME

By providing a southbound I.H.410 entrance ramp from F.M.78 the circuitous routes will be eliminated and the congestion at the F.M.78 - I.H.35 frontage road intersection will be reduced.

PROBLEM: Two-way frontage roads near Moursund Blvd.

As development occurs and traffic volumes increase on the two-way frontage roads near Moursund Blvd., it will be necessary to convert the two-way frontage roads to one-way in order to provide continuity with the rest of the urban interstate system. The one-way frontage roads will also provide a safer traffic operation.

STUDY NO. 4

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.410 SOUTH AND EAST

1. Construct an I.H.410 southbound entrance ramp from F.M.78.

2. Convert the two-way frontage roads near Moursund Blvd. to one-way.

AIR QUALITY ANALYSIS

The freeway operation study of IH 410 S. and E. from IH 35 N. to IH 35 S. was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for IH 410 S. and E. from IH 35 N. to IH 35 S.

IH 410 SOUTH AND EAST FROM IH 35 N. TO IH 35 SOUTH

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	11,887	4,950	-58.4
Tons/year	4.78	1.99	
Carbon Monoxide (CO)			
Grams/day	92,133	44,192	-52.0
Tons/year	37.07	17.78	
Nitrogen Oxides (NO_x)			
Grams/day	7,315	5,968	-18.4
Tons/year	2.94	2.40	

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	16.7	1												1
EB	ML	17.1												1	1
EB	ML	17.9									1				1
EB	ML	18.7		1'											1'
EB	ML	19.2	1												1
EB	ML	19.6			1										1
EB	ML	20.2			1'										1'
EB	ML	20.9									1				1
EB	ML	21.1			1'										1'
EB	ML	22.7									1				1
EB	ML	22.8	1												1
EB	ML	24.1							1						1
EB	ML	25.9							1'						1'
EB	ML	26.1									1				1
EB	ML	26.8			1										1
EB	ML	27.0									1				1
EB	ML	28.0			1						1				2
NB	ML	28.6									1				1

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	1	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures A-N to identify accident locations.

TABLE 1

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	30.0									1				1
NB	ML	30.8						1							1
NB	ML	31.8	1												1
NB	ML	32.5			1										1
NB	ML	33.4			1^1										1^1
NB	ML	33.5							1^1						1^1
NB	ML	33.6			1^1										1^1
NB	ML	33.8									1^1				1^1
NB	ML	35.1							1		2				3
NB	ML	36.0			1										1
NB	ML	36.1			1^1										1^1
NB	ML	36.4		1											1
NB	ML	37.1									1^1				1^1
NB	ML	37.4						1^1							1^1
NB	ML	38.0			1			1	2	1^1					5^1
NB	ML	38.3	1												1
NB	ML	38.4				1^1									1^1
NB	ML	38.6									1				1
NB	ML	38.8	1												1
TOTAL			6	2^1	11^5	1^1	0	3^1	6^2	1^1	13^2	0	0	1	44^{13}

TABLE 2

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTA
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	38.8			1						4^{4}		1	1	7^{4}
SB	ML	38.7		1											1
SB	ML	38.2		1											1
SB	ML	38.0	1^{1}		1										2^{1}
SB	ML	37.9						1^{1}			1^{1}				2^{2}
SB	ML	37.4									1^{1}				1^{1}
SB	ML	37.3	1												1
SB	ML	37.2						1							1
SB	ML	36.8									1				1
SB	ML	36.6		1											1
SB	ML	36.5							1						1
SB	ML	36.4	1												1
SB	ML	36.1	1												1
SB	ML	36.0	2	1											3
SB	ML	35.9												1	1
SB	ML	35.2			1										1
SB	ML	33.9									1^{1}				1^{1}
SB	ML	33.6									1^{1}				1^{1}
SB	ML	33.3												1	1
SB	ML	32.7									1^{1}				1^{1}
SB	ML	32.6			1			1						1^{1}	3^{1}
SB	ML	31.6									1				1
SB	ML	31.5			1^{1}										1^{1}

TABLE 3

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	30.5			1										1
SB	ML	30.1						1							1
SB	ML	28.7												1	1
SB	ML	28.6			1^1										1^1
SB	ML	28.5								1^1					1^1
SB	ML	28.4			1^1										1^1
SB	ML	28.3	1												1
WB	ML	28.1							1^1						1^1
WB	ML	28.0	1												1
WB	ML	27.5									2				2
WB	ML	26.7									1				1
WB	ML	26.0			1										1
WB	ML	24.1						1^1							1^1
WB	ML	23.1			2										2
WB	ML	22.7									1				1
WB	ML	22.1			1^1										1^1
WB	ML	19.9								1					1
TOTAL			8^1	4	12^4	0	0	5^2	2^1	2^1	15^9	0	1	5^1	54^{1}

TABLE 4

1978 ACCIDENT HISTORY

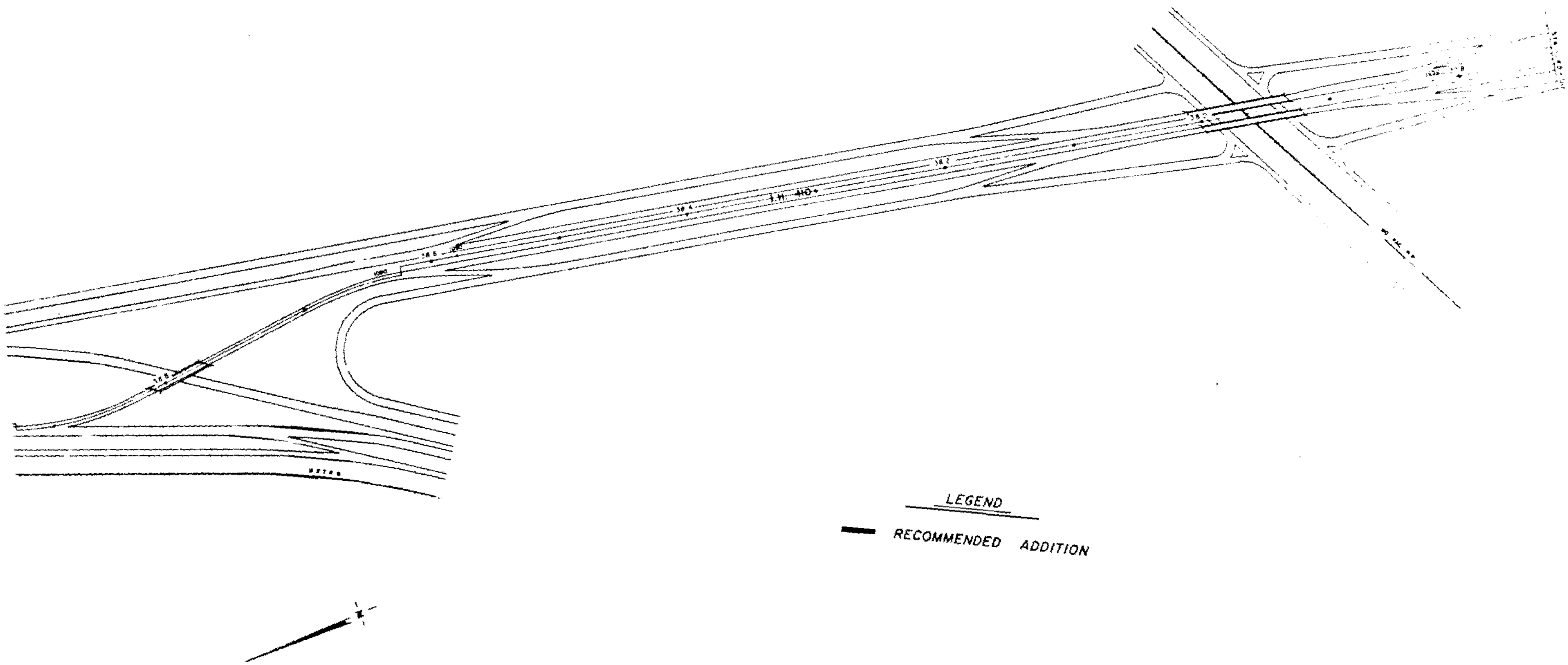
DIR.	LOC.	M.P.	DAY DRY R.E.	DAY DRY S.S.	DAY DRY O.	DAY WET R.E.	DAY WET S.S.	DAY WET O.	NIGHT DRY R.E.	NIGHT DRY S.S.	NIGHT DRY O.	NIGHT WET R.E.	NIGHT WET S.S.	NIGHT WET O.	TOTAL
EB	FR	17.5									1^1				1^1
EB	FR	19.9			1										1
EB	FR	21.1			1										1
EB	FR	22.1			1^1										1^1
EB	FR	22.8			1						1				2
EB	FR	23.4			1^1										1^1
EB	FR	24.4	1		3^2						2^2			1	7^4
EB	FR	27.5			4^4						1				5^4
EB	FR	28.2						1							1
NB	FR	29.8									1				1
NB	FR	30.2		1	1				1			1			4
NB	FR	31.5			1										1
NB	FR	31.6			1^1										1^1
NB	FR	33.4	1^1		2^1						1				4^2
NB	FR	35.8									1^1				1^1
NB	FR	36.0						1^1	1						2^1
NB	FR	37.9						1			2^2				3^2
NB	FR	38.0			1						1				2
TOTAL			2^1	1	18^{10}	0	0	3^1	2	0	11^6	1	0	1	39^{18}

TABLE 5

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	37.9	1												1
SB	FR	37.3		1				1							2
SB	FR	36.0							1^{1}						1^{1}
SB	FR	35.1			2						1				3
SB	FR	33.5												1^{1}	1^{1}
SB	FR	33.4	2^{1}		2^{2}						1^{1}			1	6^{4}
SB	FR	31.6			3^{1}										3^{1}
[illegible]	[illegible]	30.3	1												1
WB	FR	28.2	1^{1}		1^{1}						1				3^{2}
WB	FR	27.5									1				1
WB	FR	24.4	1		8^{3}	2					5^{1}				16^{4}
WB	FR	22.9	1												1
WB	FR	22.8	1		1										2
WB	FR	20.1		1											1
WB	FR	16.8			1										1
TOTAL			8^{2}	2	18^{7}	2	0	1	1^{1}	0	9^{2}	0	0	2^{1}	43^{13}

TABLE 6



LEGEND

RECOMMENDED ADDITION

FIGURE A

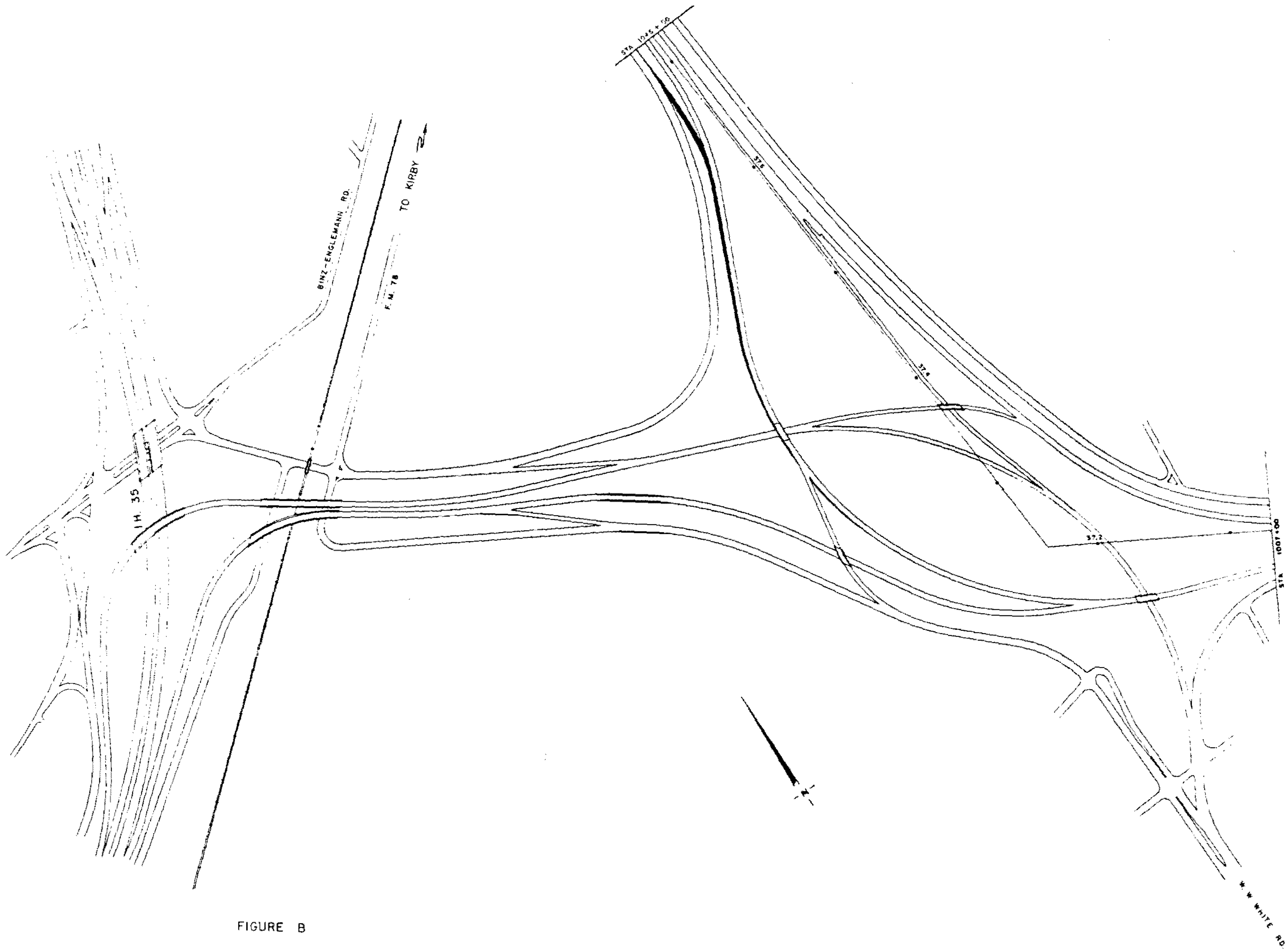

STA 1045+50
TO KIRBY
F. M. 78
BINZ-ENGLEMANN RD.
I H 35
STA 1007+00
W. W. WHITE RD.
N

FIGURE B

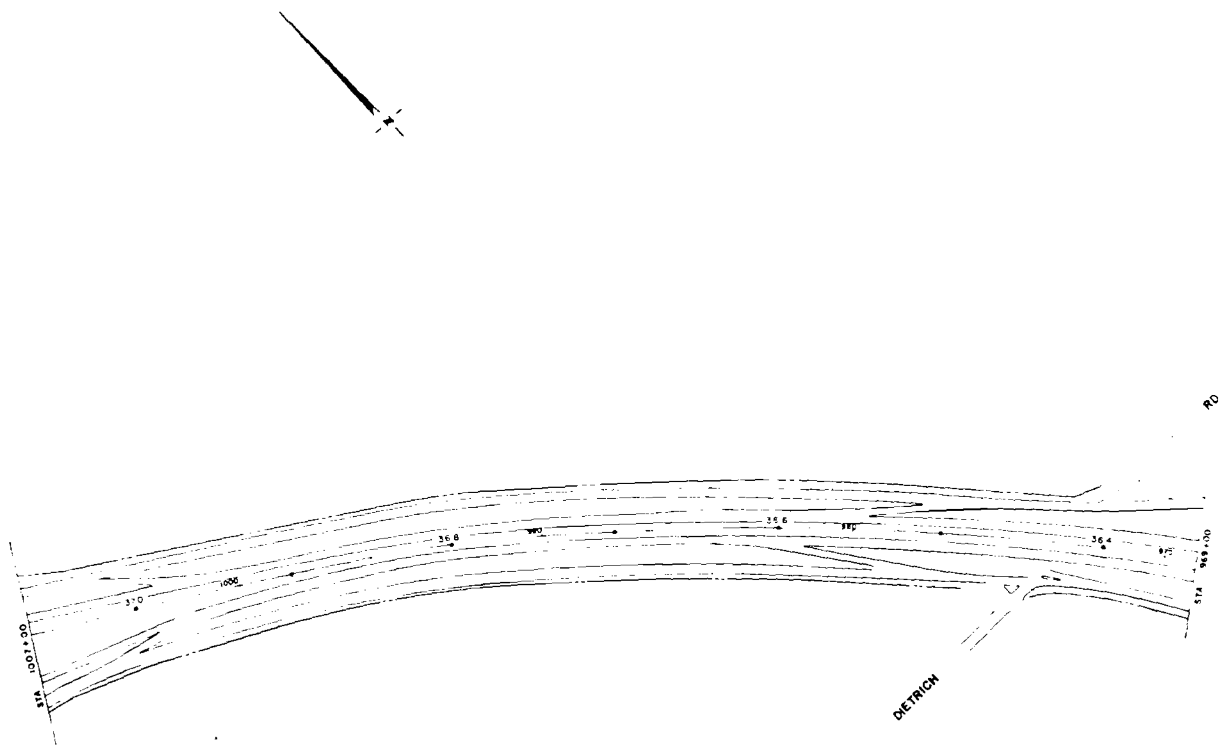


FIGURE C

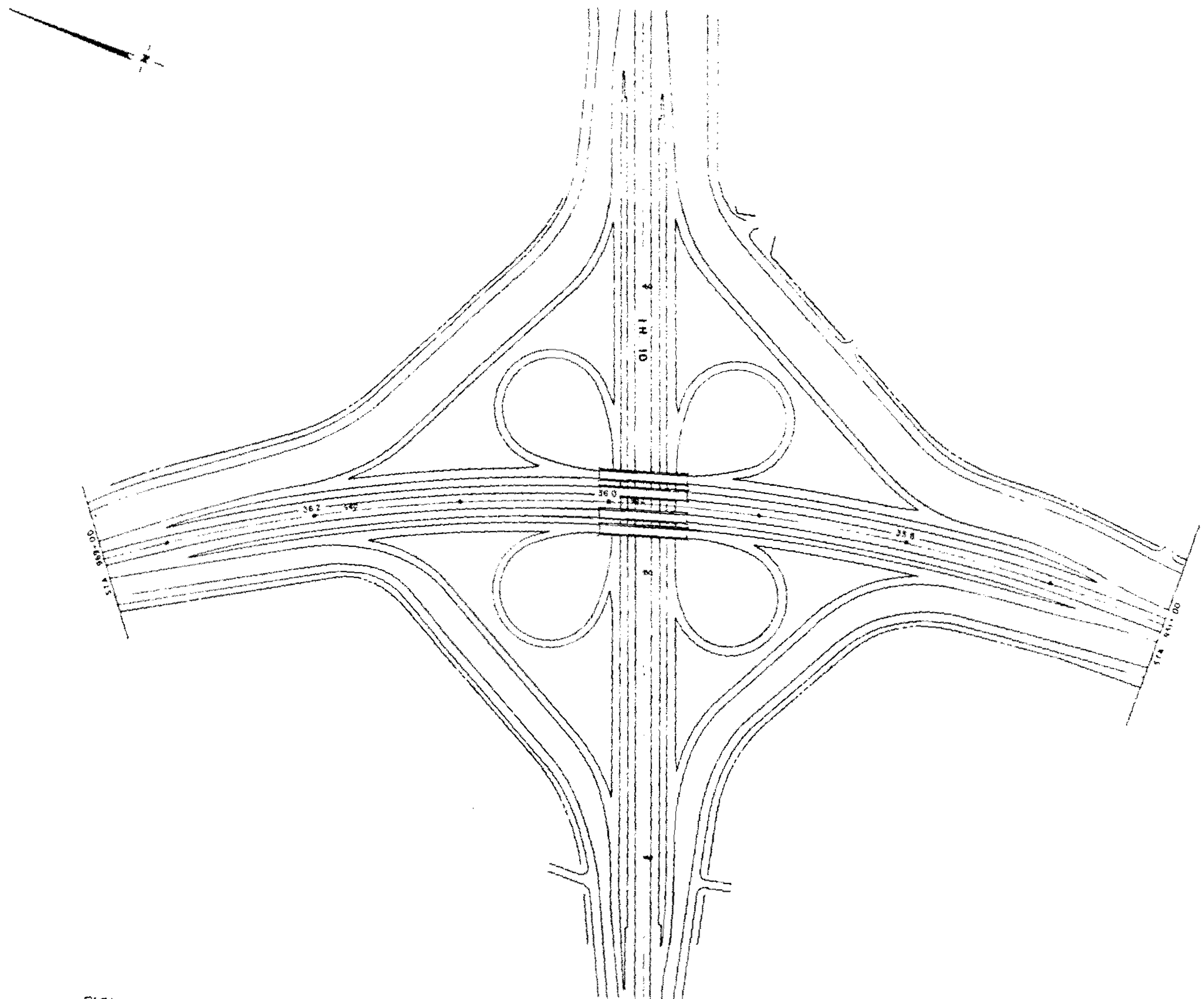
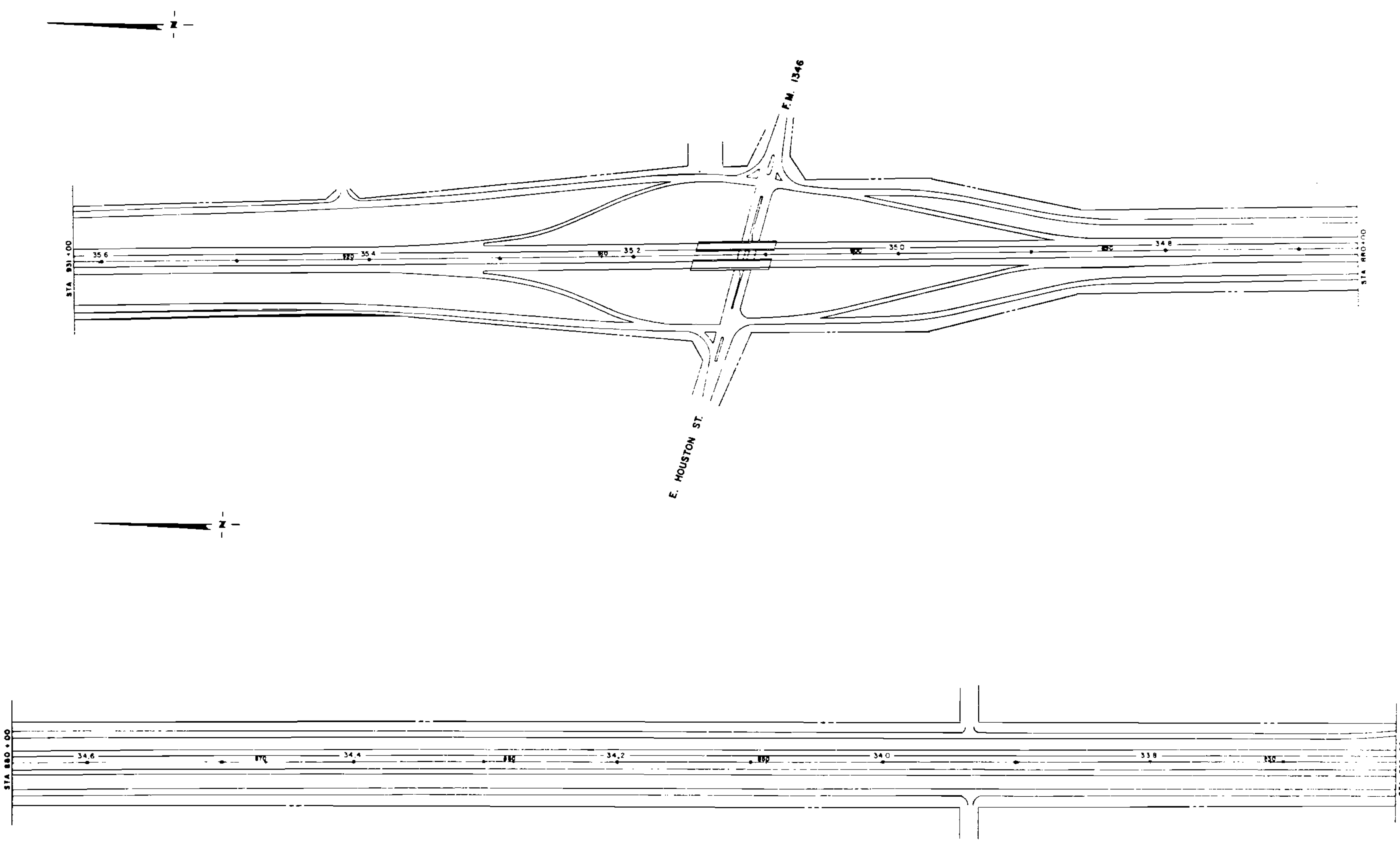


FIGURE D



F.M. 1346
E. HOUSTON ST.
STA 931+00
STA 880+00
35.6
35.4
35.2
35.0
34.8
STA 880+00
STA 825+00
34.6
34.4
34.2
34.0
33.8

FIGURE E

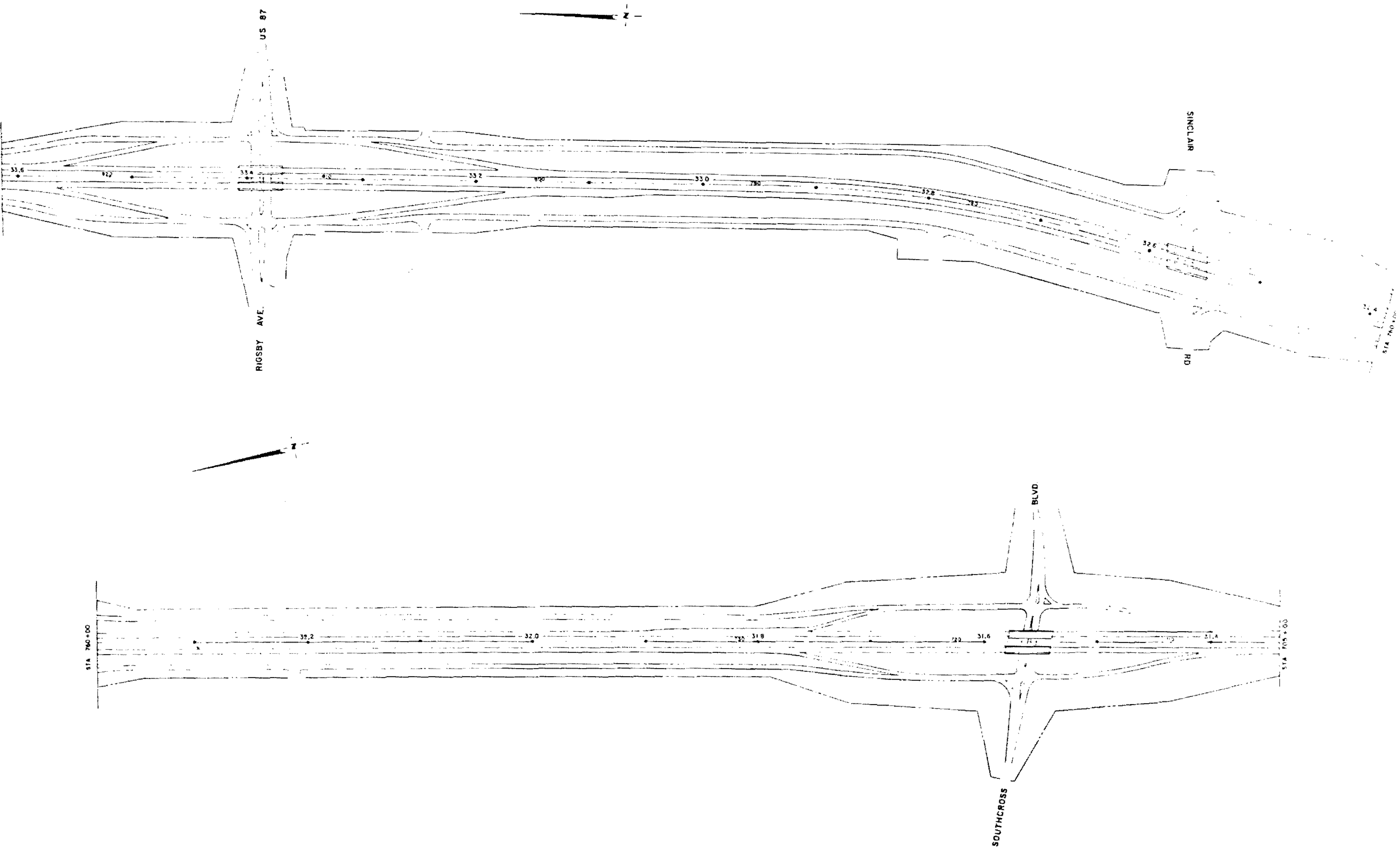

US 87
RIGSBY AVE.
SINCLAIR RD
BLVD
SOUTHCROSS
STA 760+00
STA 705+00

FIGURE F

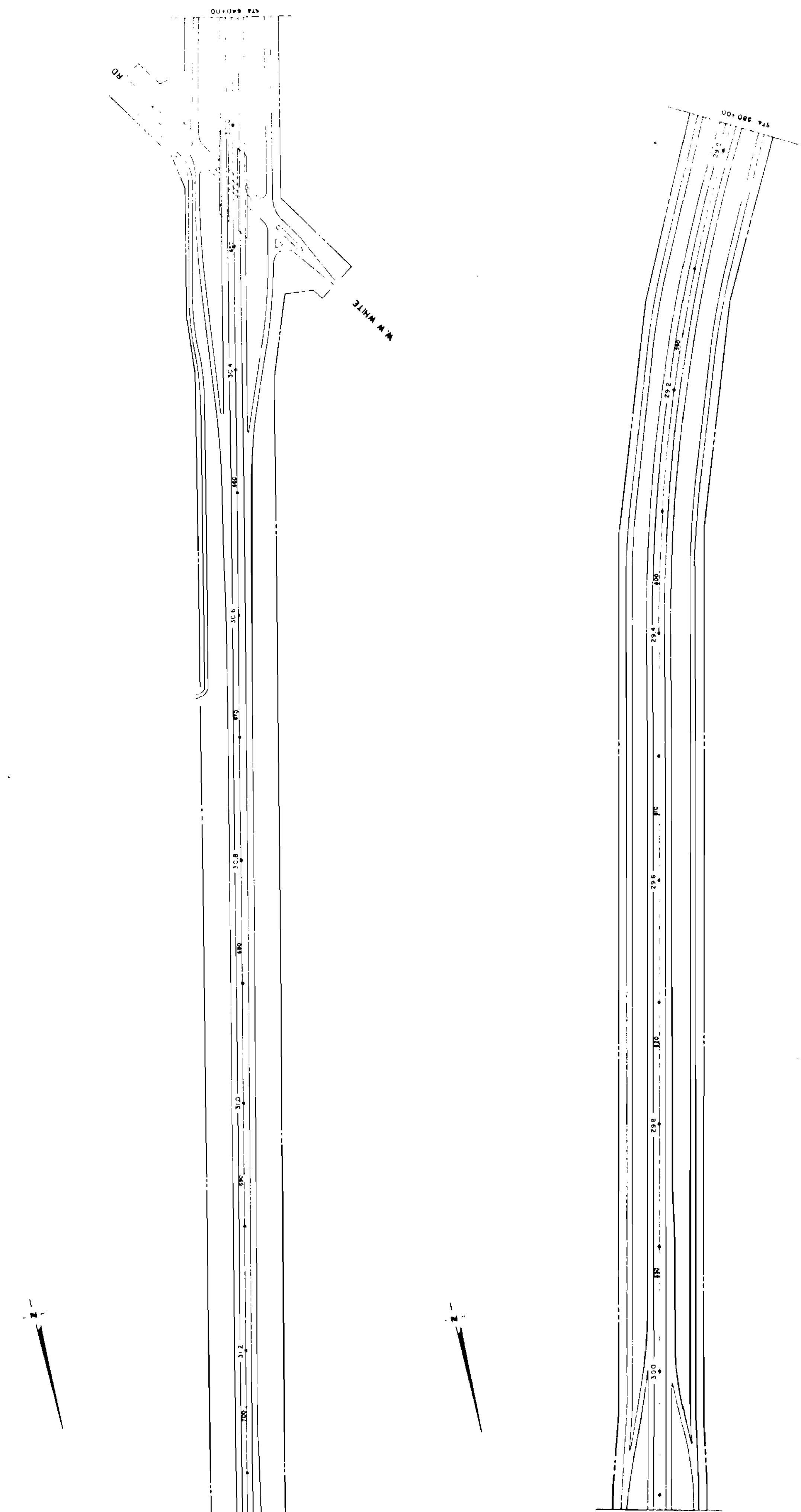


FIGURE G

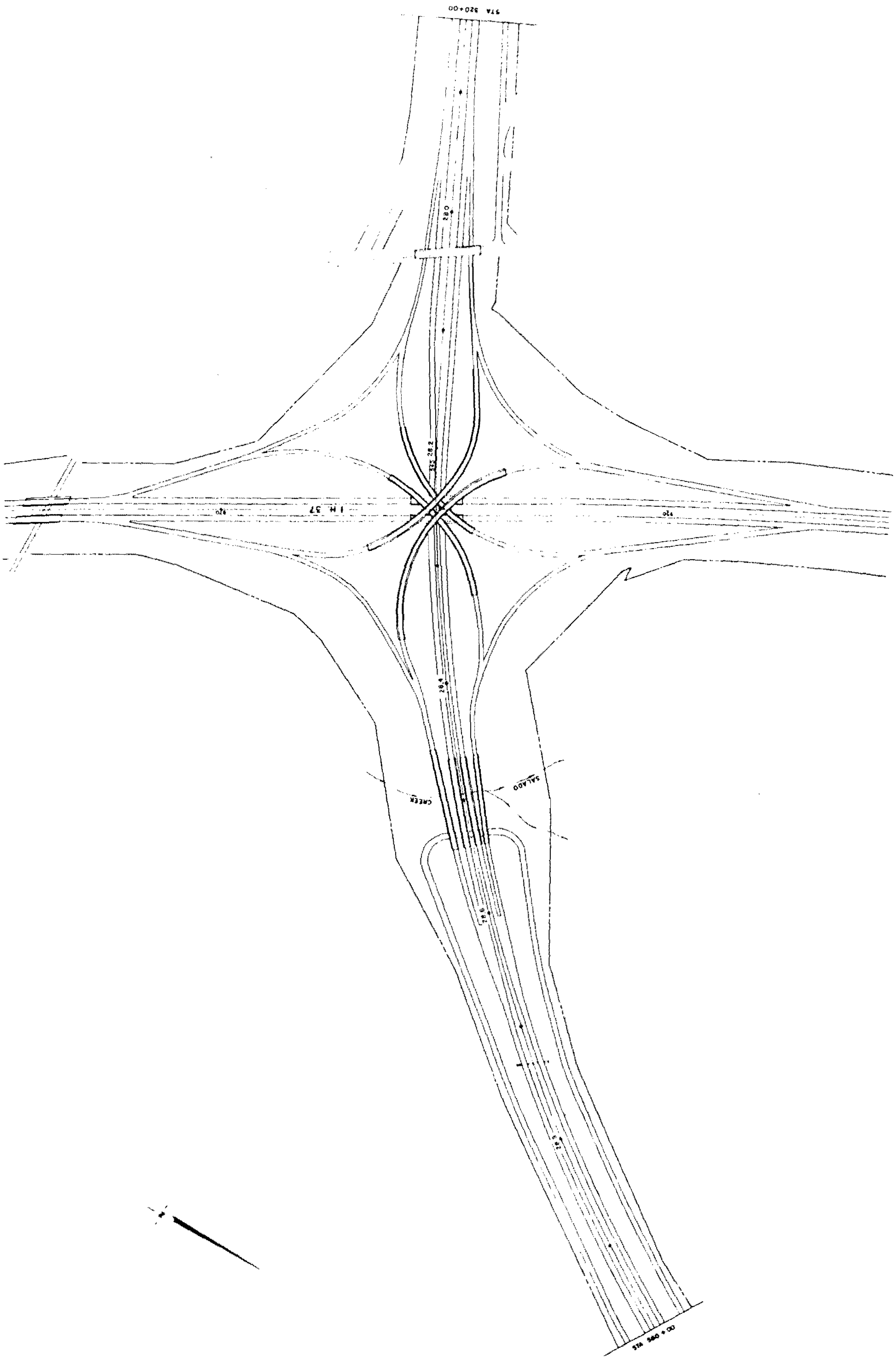


FIGURE H

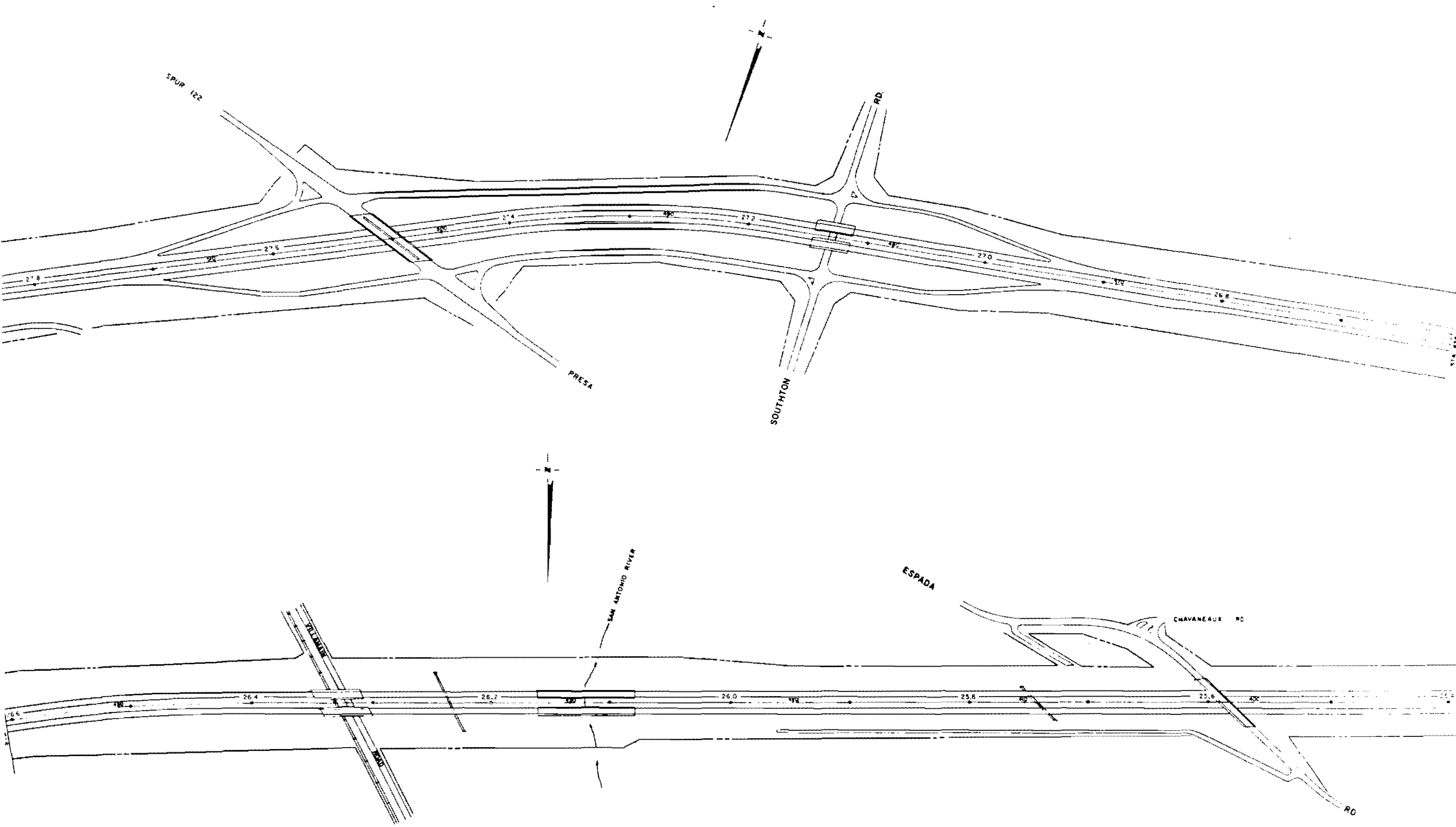
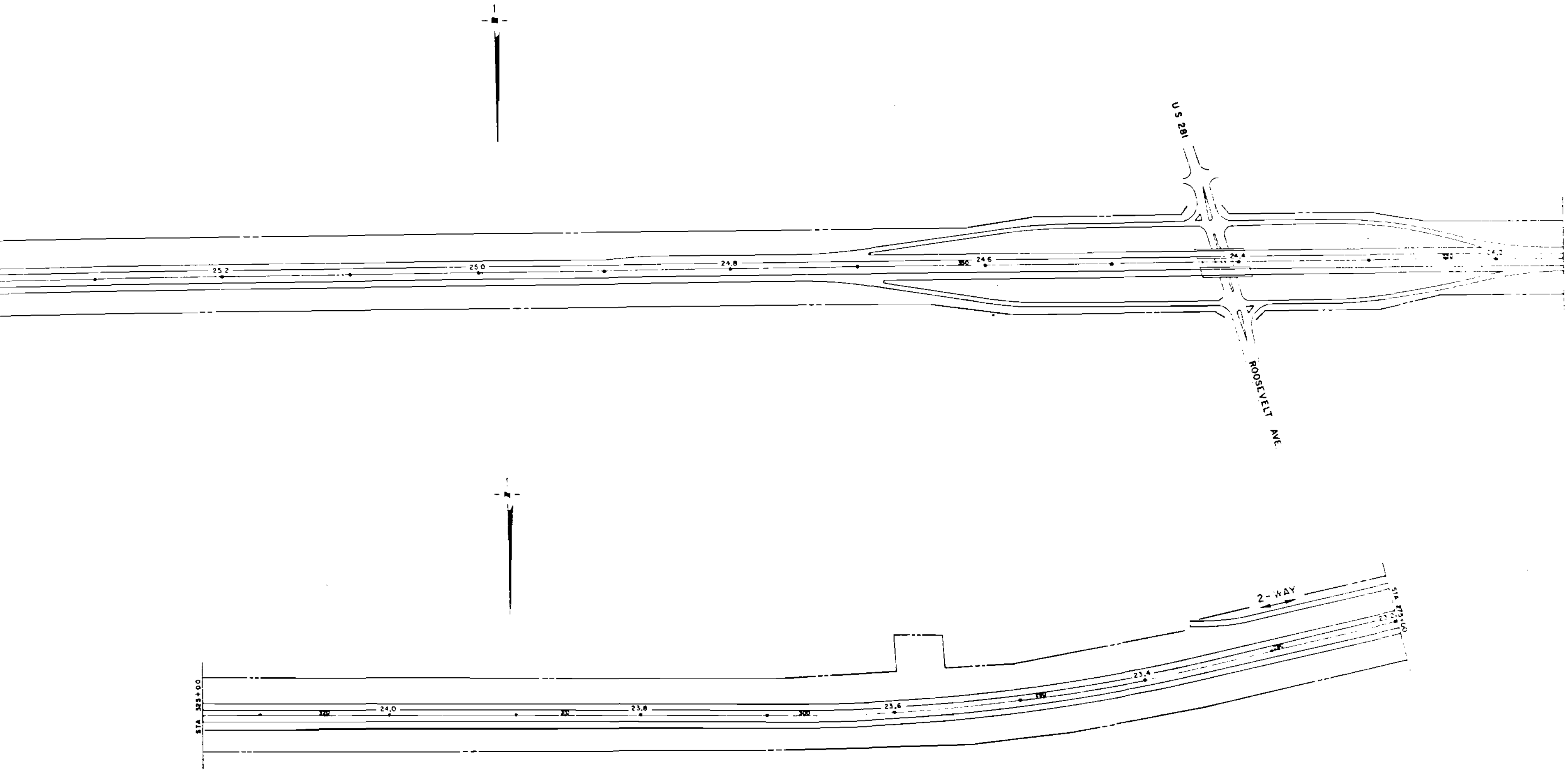
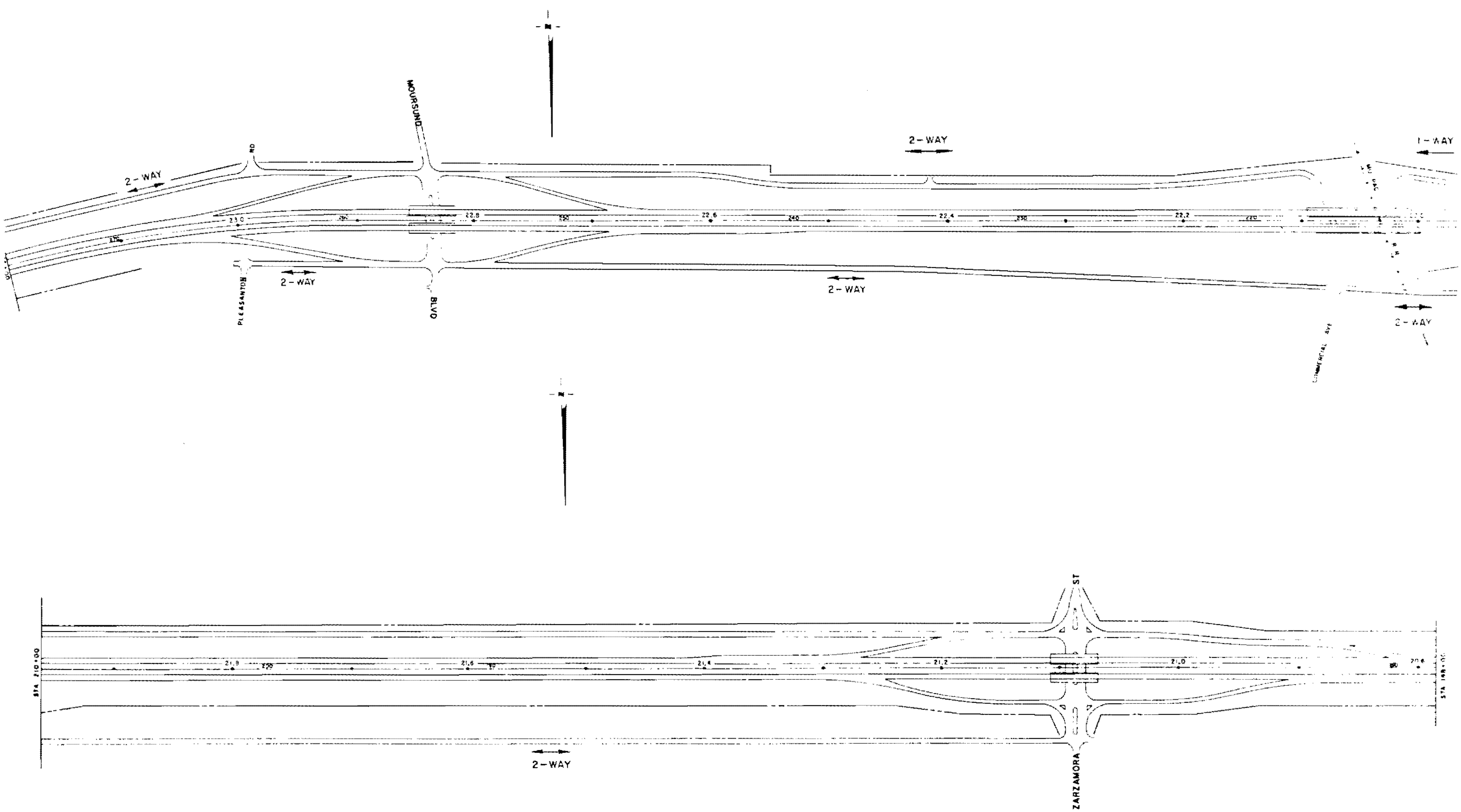

SPUR 122
PRESA
SOUTHTON
RD.
27.8
27.6
27.4
27.2
27.0
26.8
ESPADA
CHAVANEAUX RD
RD
SAN ANTONIO RIVER
26.6
26.4
26.2
26.0
25.8
25.6

FIGURE I



US 281
ROOSEVELT AVE.
24.4
24.6
24.8
25.0
25.2
2-WAY
23.4
23.6
23.8
24.0
STA 325+00

FIGURE J



1-WAY
2-WAY
MOURSUND
BLVD
PLEASANTON
RD
COMMERCIAL AVE
22.2
22.4
22.6
22.8
23.0
2-WAY
ZARZAMORA
ST
STA 210+00
21.0
21.2
21.4
21.6
21.8
20.8

FIGURE K

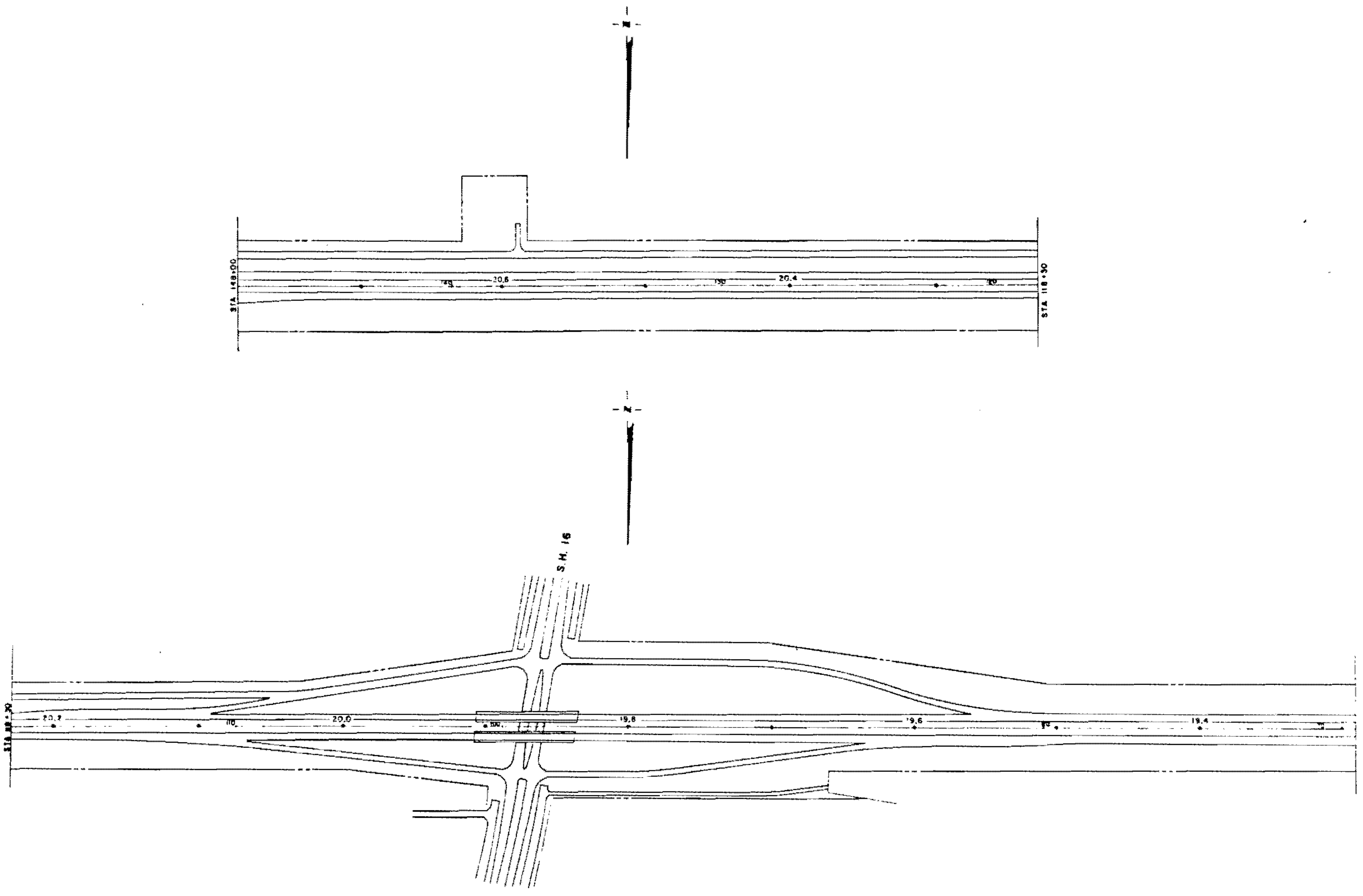


FIGURE L

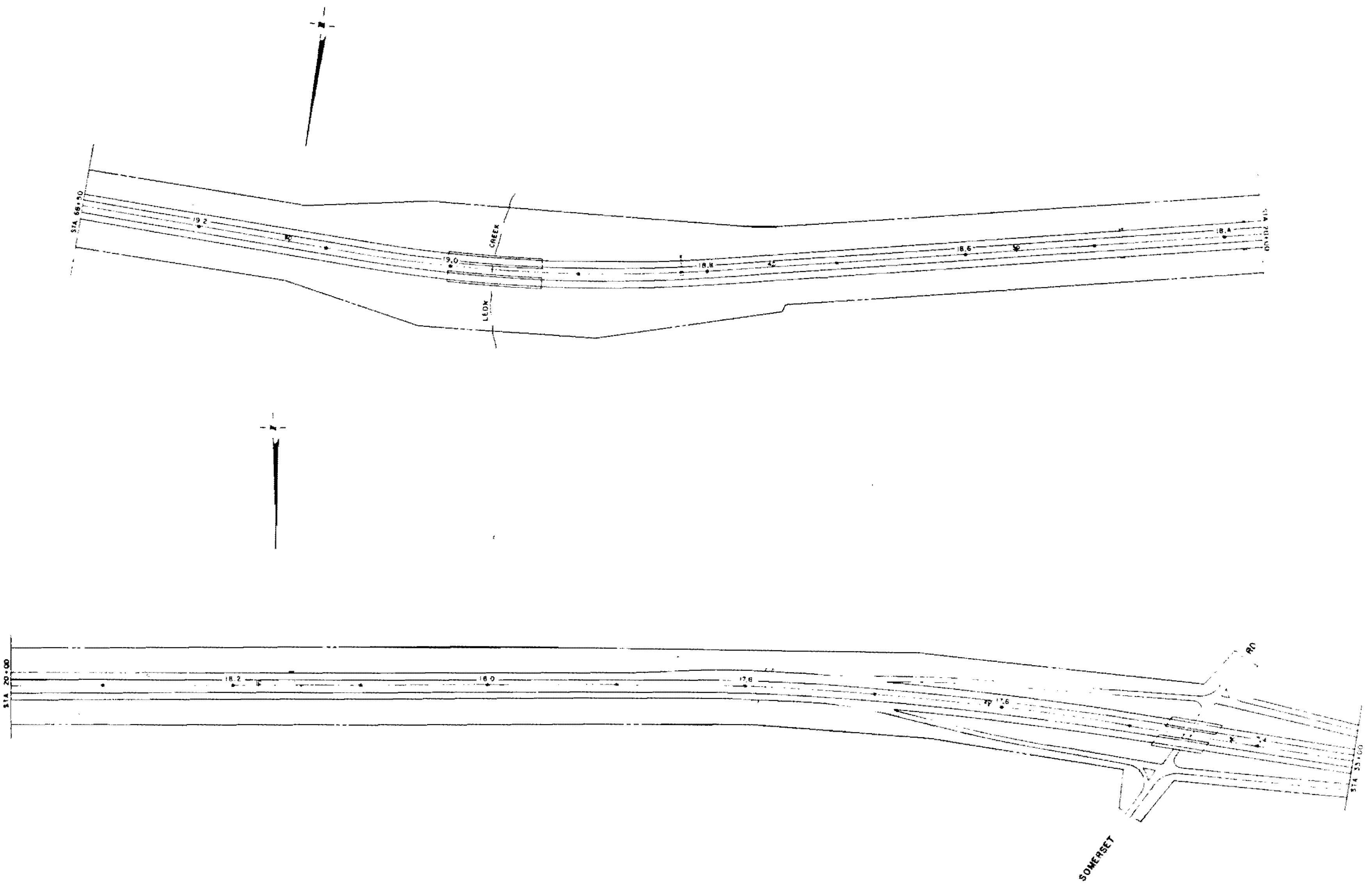

STA 20+00
19.2
19.0
CREEK
LEON
18.8
18.6
18.4
18.2
18.0
17.8
17.6
RD
SOMERSET

FIGURE M

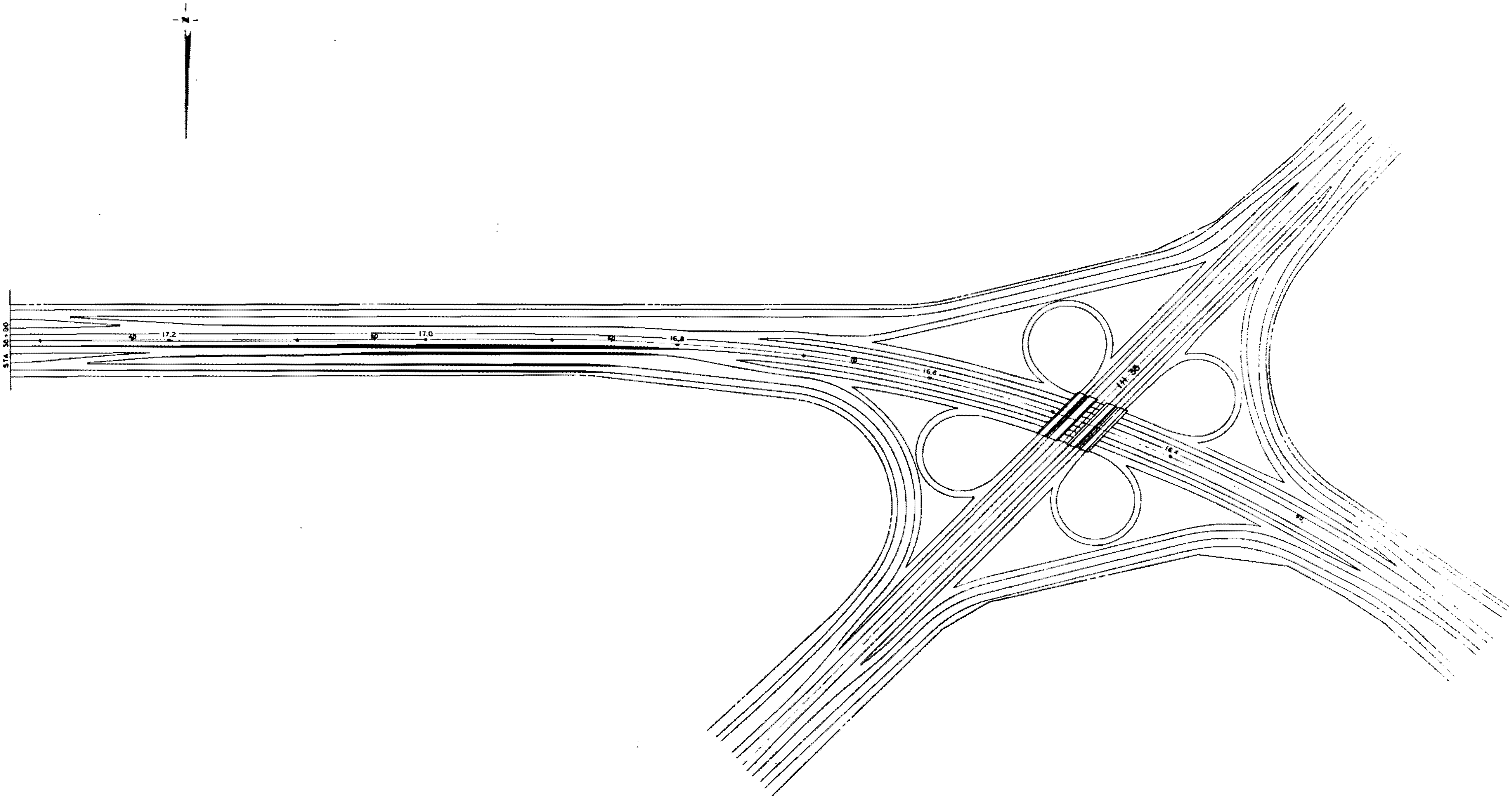
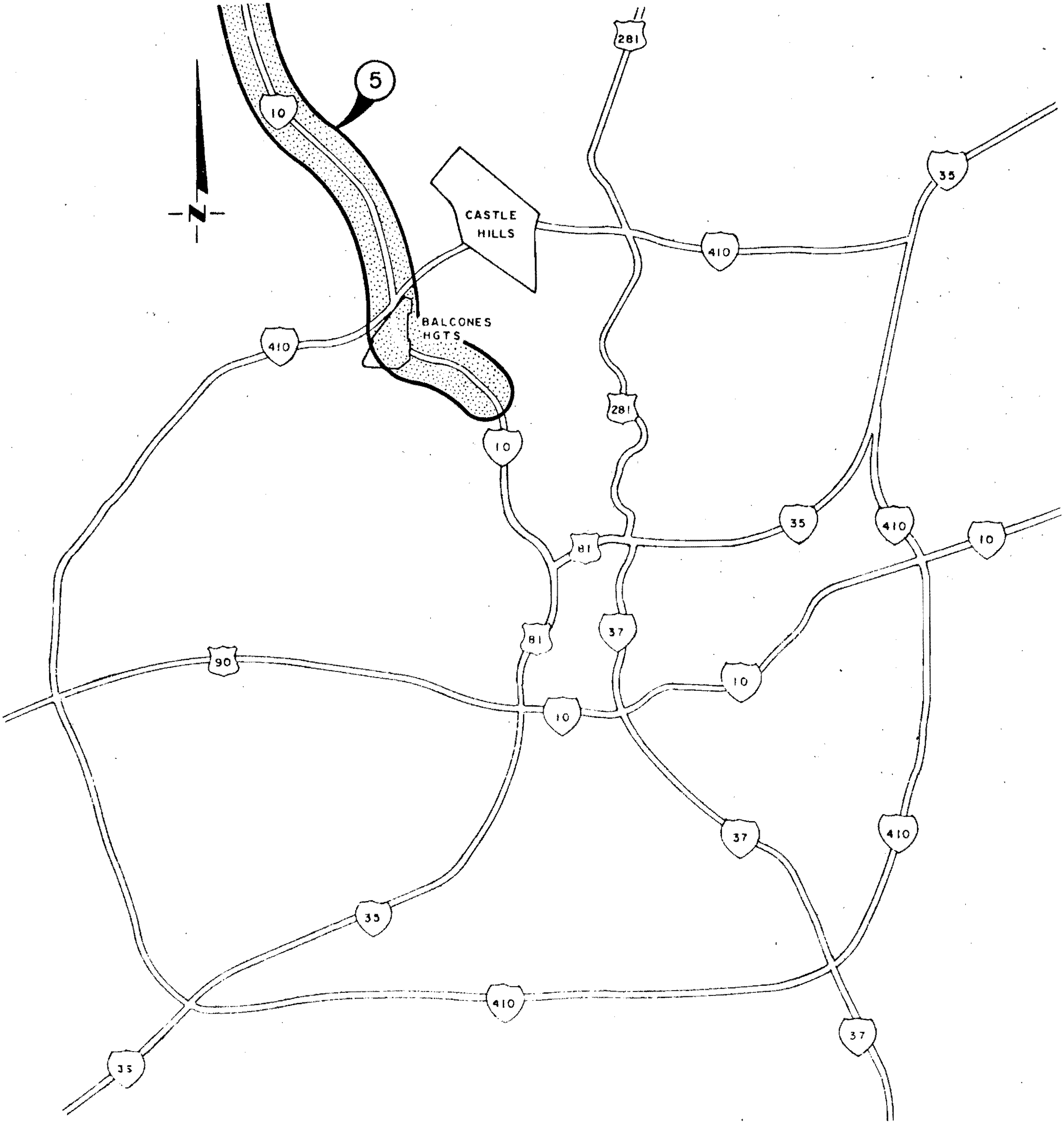


FIGURE N



I.H. 10 WEST

FREEWAY OPERATIONS STUDY

FROM: BEXAR-KENDALL COUNTY LINE

TO: FRESNO DRIVE

INTRODUCTION

This study will identify the areas that were capacity deficient in 1978 as well as present problems. The study will expose the areas where access is not readily available and identify the high accident locations.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10, the Department's Planning and Research Division in Austin. The Division provided traffic volumes for the mainlanes, ramps, frontage roads, and turning movements at the interchanges and intersections. The Level of Service was calculated for all conditions in order to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Analysis Detail Listing". The high accident locations could therefore be isolated. The accident breakdown can be found in Table A through I.

The areas where access was not readily available were identified by citizens, police participation, observations by this office and the San Antonio Public Works Department. This office continually receives complaints and suggestions concerning specific locations from the public. Problem areas are also received through Police Assignment Reports from the San Antonio Police Department encountered by Officers in the field. In addition, the San Antonio Public Works Department notifies us of any problem areas that they have observed or have received complaints about.

After the problem areas were identified and analyzed and the solutions recommended, the anticipated impacts of the solutions were determined by making turning movement counts and small origin-destination studies. Present traffic volumes were then applied to the recommended solutions to determine the extent of improvement each recommendation would have on the existing facility.

GENERAL DISCUSSION

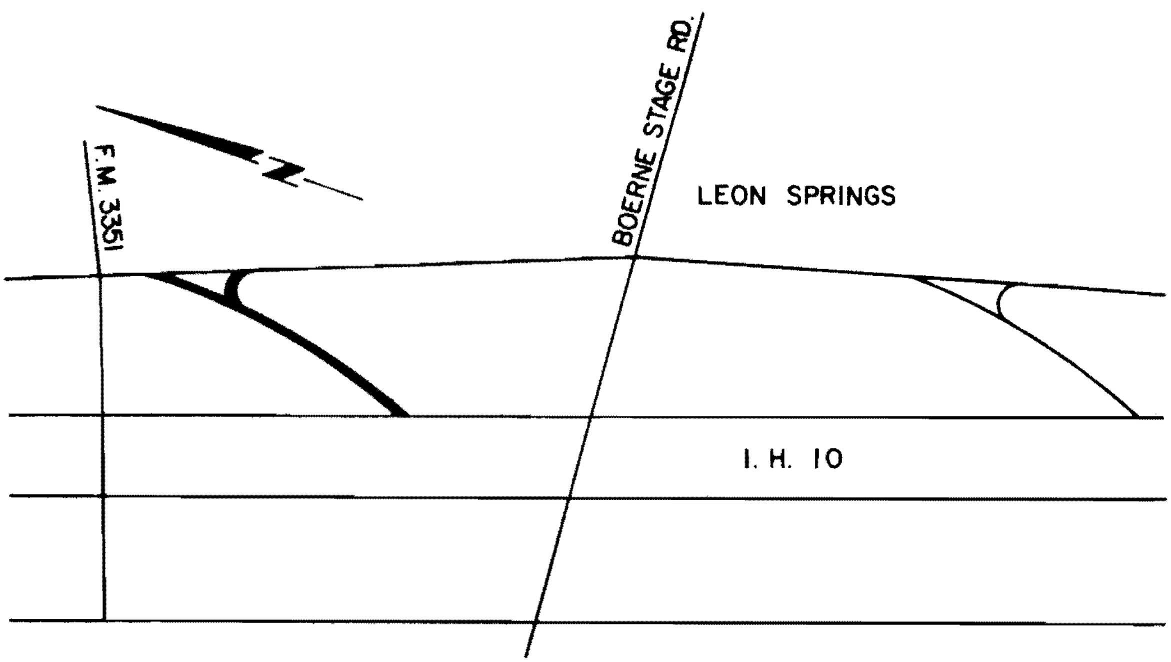
The limits on this study of I.H.10 are from Bexar County Line to Fresno Drive. The area that surrounds I.H.10, from Loop 1604 to I.H.410, is one of the most rapid growing areas in San Antonio with still more heavy development to continue in the near future. The 1975 Ramp Demand Study conducted by this office, identified problem areas and recommended solutions on I.H.410 which affected the surrounding I.H.10 area. At present, there are no problem areas on I.H.10 between the Bexar County Line and F.M.3351. Also, there are no problems in the section of I.H.10 that spans between I.H.410 and Fresno Drive. At present under construction is the I.H.10-Loop 1604 partial cloverleaf interchange. Figures 1 through 10, I-A and I-B, show the existing roadway and the roadways that are presently under construction. Also shown are the recommendations which will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this study.

PROBLEMS AND RECOMMENDED SOLUTIONS

The following discussions will describe the various problems identified by this study and will recommend solutions which may relieve, if not completely solve these problems.

PROBLEM: Access not readily available to F.M. 3351 and Camp Stanley

The need for a more direct access from westbound I.H.10 to F.M.3351 and Camp Stanley is required. F.M.3351 will eventually meet with F.M.3160 which would then be a direct connection to S.H.46 and the town of Bergheim. At present traffic westbound on I.H.10, desiring to use F.M.3351, must use the old U.S.87 roadway through Leon Springs and cross Boerne Stage Road before reaching the F.M.3351 Interchange. This route can be confusing to the motorist. An exit ramp is recommended to obtain direct access. This ramp will not only serve F.M.3351 and Camp Stanley traffic, but also the surrounding area which is currently a growing residential area.



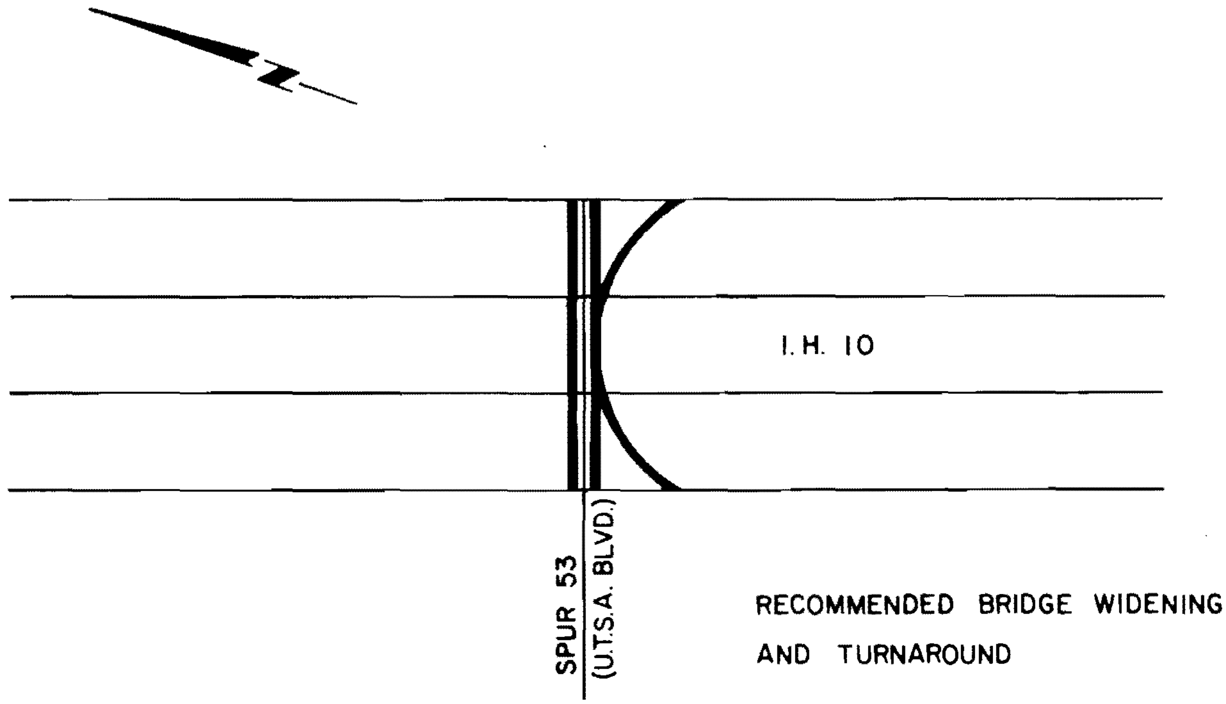
RECOMMENDED EXIT RAMP

PROBLEM: Two-way frontage roads from Beckmann to DeZavala Road

Together with the completion of the I.H.10-Loop 1604 Interchange and the anticipated development, it will be necessary to convert the two-way frontage roads to one-way frontage roads in order to meet the traffic volume increase and to provide continuity with the rest of the urban interstate system. The one-way frontage roads will also provide a safer traffic operation. All ramps are also recommended to be changed in order to conform to the one-way system. However, this conversion cannot be accomplished until UTSA Blvd. (Spur 53) has been realigned to meet the Hausman Road overpass on I.H.10.

PROBLEM: Addition of the Spur 53 Interchange

In conjunction with the proposed construction of Spur 53, it is recommended that the bridge overpass of Spur 53 at I.H.10, be widened to four lanes. Spur 53 will be a four lane road that will link I.H.10 to the U.T.S.A. It will carry traffic to and from the University of Texas at San Antonio as well as traffic from residential areas. It may also be required to construct a turnaround on the south side of Spur 53 to handle the u-turning movements that will be generated by the anticipated development at the Northwest quadrant of the DeZavala interchange.



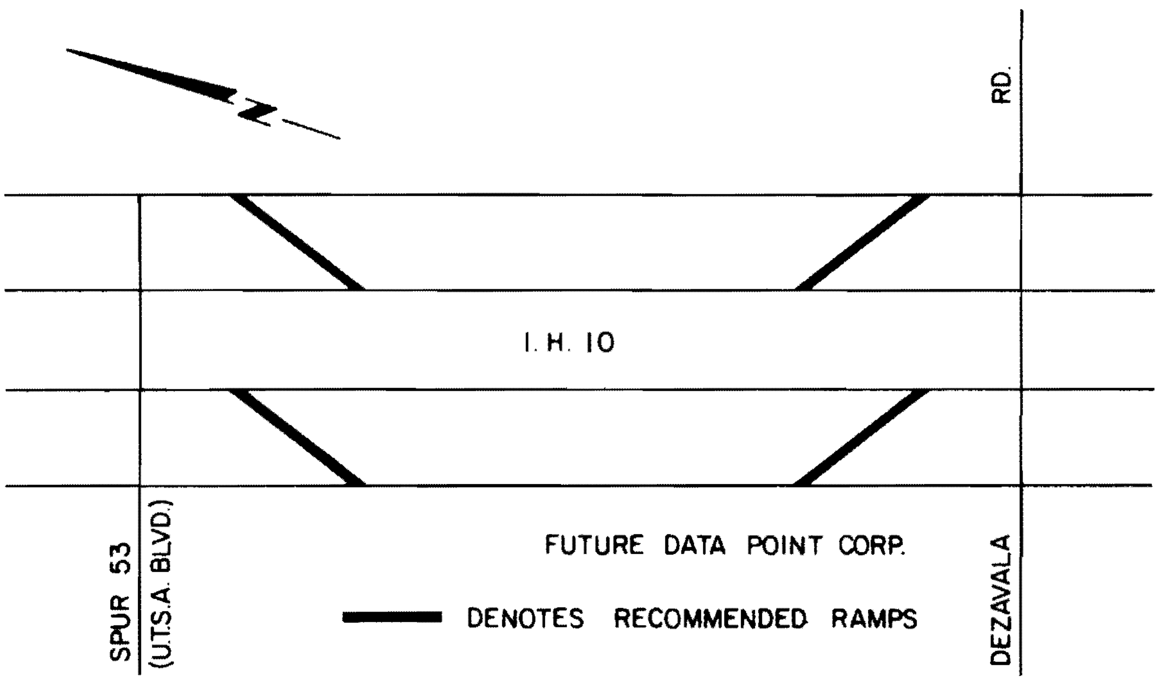
PROBLEM: Inadequate access for the Spur 53 and DeZavala Road Interchanges

Once Spur 53 is completed, it will be necessary to add entrance and exit ramps between the two interchanges. By providing direct access to the interchanges, traffic is prevented from going through the interchanges unnecessarily. The ramps that are recommended are as follows:

1. On eastbound I.H.10, an exit ramp is recommended after the Spur 53 Interchange to the frontage road for DeZavala Road.
2. On eastbound I.H.10, an entrance ramp from the frontage road is recommended before DeZavala Road Interchange for the mainlanes from the Spur 53 Interchange.

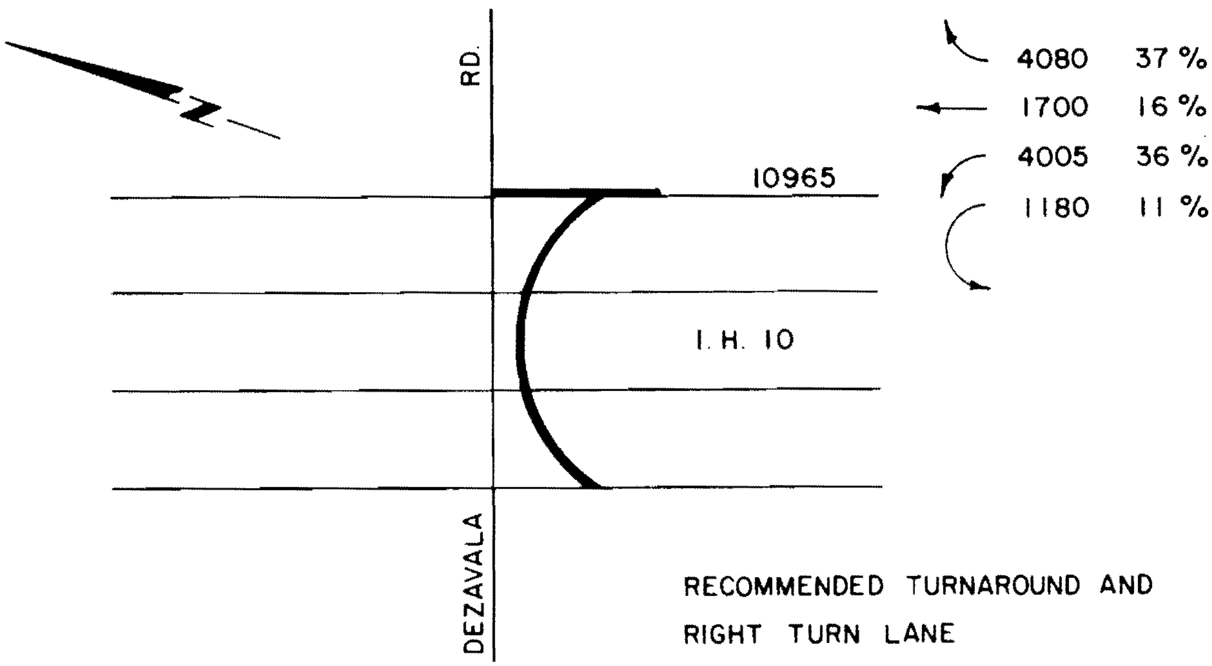
3. On westbound I.H.10, an exit ramp is recommended before the Spur 53 Interchange to the frontage road for the Spur 53 traffic.

4. On westbound I.H.10, an entrance ramp is recommended after the DeZavala Road Interchange to provide access for DeZavala Road.



PROBLEM: <u>DeZavala Road is at capacity</u>

DeZavala Road is experiencing congestion during the peak periods due to the heavy traffic generated by the residential areas and Tom Clark High School. The residential developments are still in the process of construction, so indications are that the traffic will continue to increase, to add to the already congested interchange. Business developments are also expected to begin construction in the near future. As a means of relieving the congestion, it is recommended that a turnaround be constructed on the south side of the interchange to remove the high u-turning movements on the westbound frontage road approach. Also a right turn lane is recommended on the westbound frontage road approach to accommodate the demand for that movement.



1981 TRAFFIC VOLUMES

PROBLEM: Westbound mainlane congestion near DeZavala Road

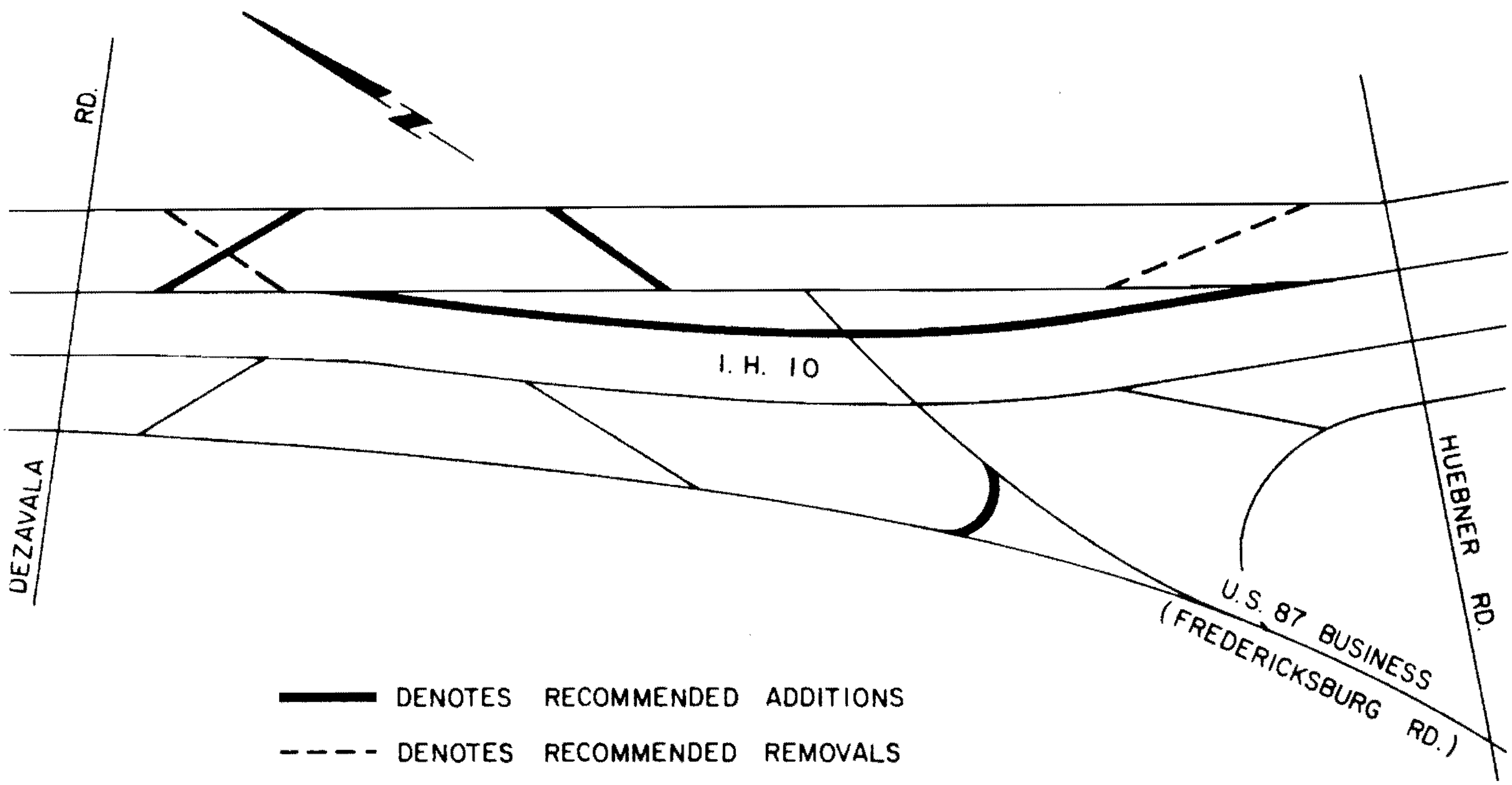
As a result of congestion at the DeZavala Road Interchange, the westbound mainlanes have also become congested at peak hours. The traffic backs up onto the exit ramp and into the mainlanes. The development will continue to add more congestion to the interchange. To keep this traffic from backing up into the mainlanes it is recommended that DeZavala Road exit be moved back to provide more storage space. Due to the grade differential, the DeZavala Road exit must be placed at the Fredericksburg Road Interchange (U.S. 87 Business). To accommodate the DeZavala Road exit and keep a smooth flow of traffic, the following modifications are recommended:

1. The westbound mainlanes at Fredericksburg Road Interchange are to be moved over, to run parallel with the eastbound mainlanes.

2. The existing mainlanes are to be used as a collector-distributor road for the exiting DeZavala Road traffic and the entering Fredericksburg Road traffic.

3. DeZavala Road exit will be off of the collector-distributor road onto the frontage road.

4. Remove the present westbound entrance ramp from Huebner to the present location of the DeZavala Road exit.

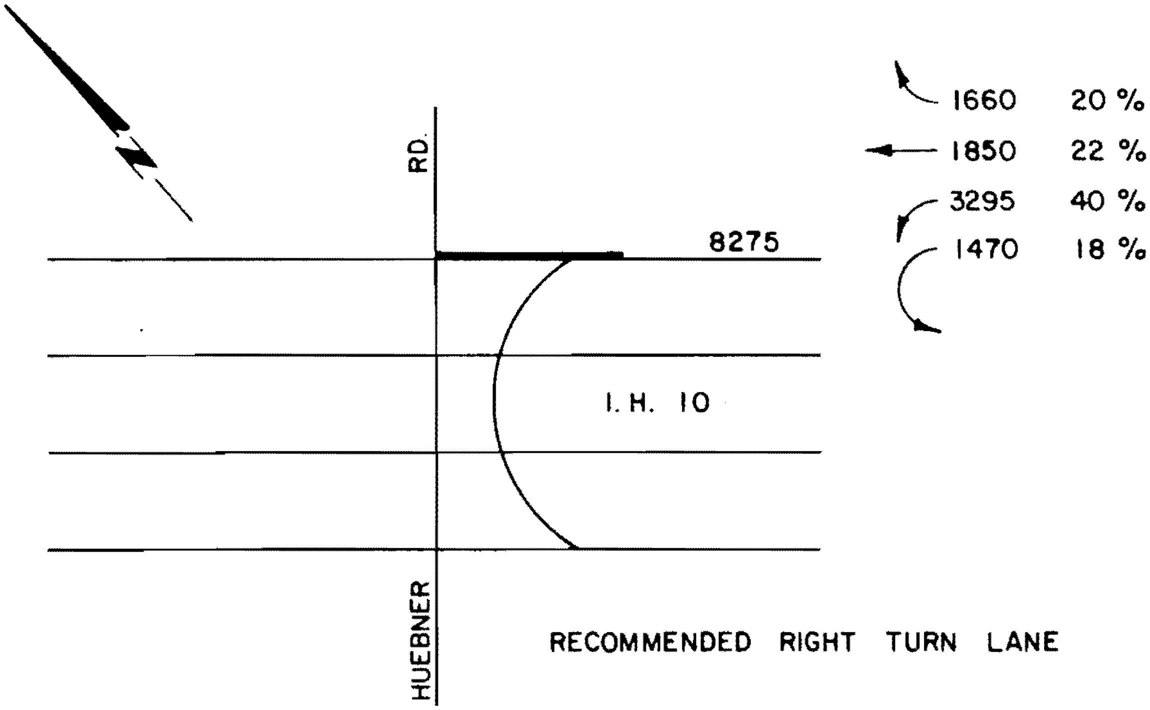


PROBLEM: Access from the eastbound frontage road to I.H.10 westbound mainlanes

The recent development of the area between DeZavala Road and Fredericksburg Road along the eastbound frontage road has generated traffic desiring to go westbound on I.H.10. They have no readily available access and must follow an undesirable route. Currently, they have to travel on the frontage road, go through part of the Fredericksburg Interchange, and then turn around at the Huebner Road Interchange. To obtain better access to westbound I.H.10, it is recommended that a hook ramp be constructed from the eastbound frontage road to the northbound Fredericksburg connector ramp as shown above. The ramp will aid in removing traffic from the Huebner Road Interchange.

PROBLEM: Traffic delays at Huebner Road Interchange

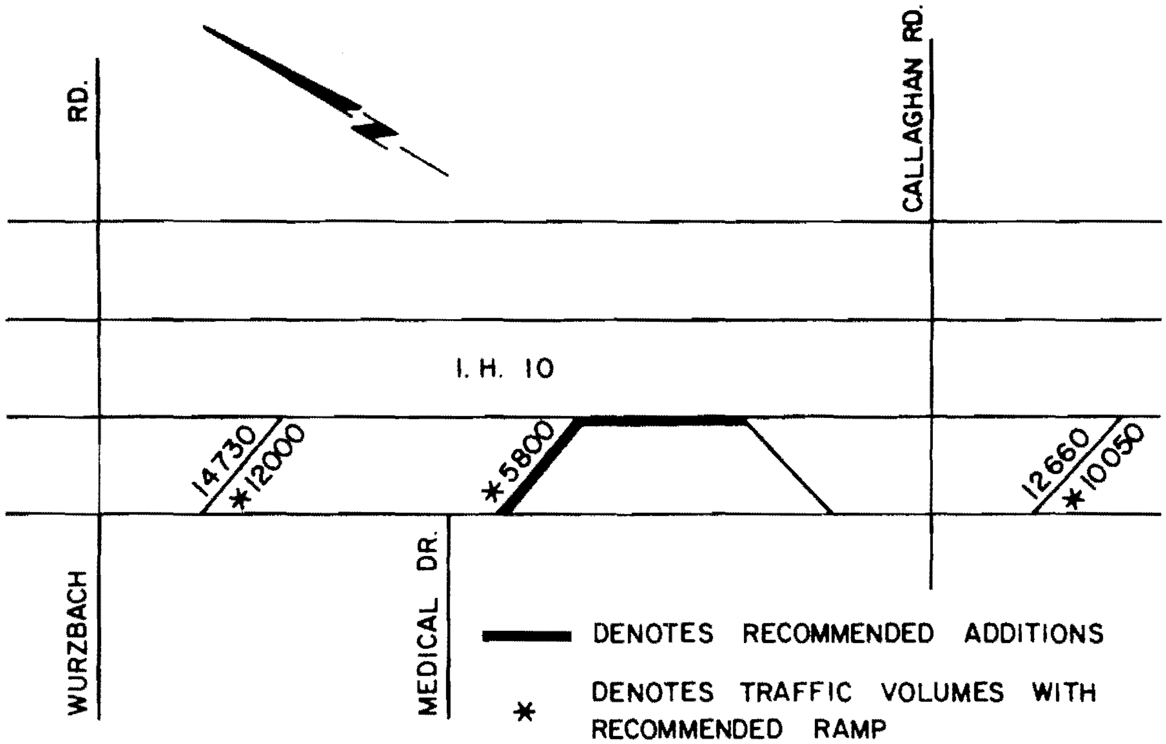
The westbound frontage road at the Huebner Road Interchange has a high right turn movement. They are restricted from making this movement by the straight-through volume which blocks their access. In 1978, there were seven accidents in this intersection of Huebner Road and the westbound frontage road. A right turn lane here would effectively carry all traffic through the approach without causing excessive delays to a considerable amount of traffic.



1981 TRAFFIC VOLUMES

PROBLEM: Wurzbach and Callaghan Roads at Capacity

As a result of the Medical Center traffic and including the development in the area surrounding these interchanges, both have become heavily congested. In 1978, the Wurzbach Road Interchange had fifty-two accidents and Callaghan Road had thirty-four accidents. The addition of turnarounds at Wurzbach Road has helped traffic move through the interchange but during the peak hours the volume of traffic is in excess of the capacity of the interchange. Callaghan Road has the same problem of the volume of traffic being in excess of the capacity of the interchange. Therefore, to remove traffic out of these interchanges, it is recommended that an entrance ramp be constructed to the eastbound mainlanes. This ramp construction will allow for a better distribution of traffic between the Wurzbach and Callaghan Road area.



1981 TRAFFIC VOLUMES

Since Medical Drive already carries a considerable volume of traffic bound for I.H.10, the entrance ramp should be constructed after Medical Drive to allow easier access for that traffic. A continuous acceleration-deceleration lane between the new entrance ramp and the Callaghan Road exit will provide a smoother operating weaving area. The recommended entrance ramp will also attract some of the traffic currently using the congested Fredericksburg Road as access to I.H.410.

The traffic signal control equipment at the Wurzbach Road interchange is not of the latest technology available. The traffic signal should be modernized in order to handle traffic in the most efficient manner possible with the least amount of delay.

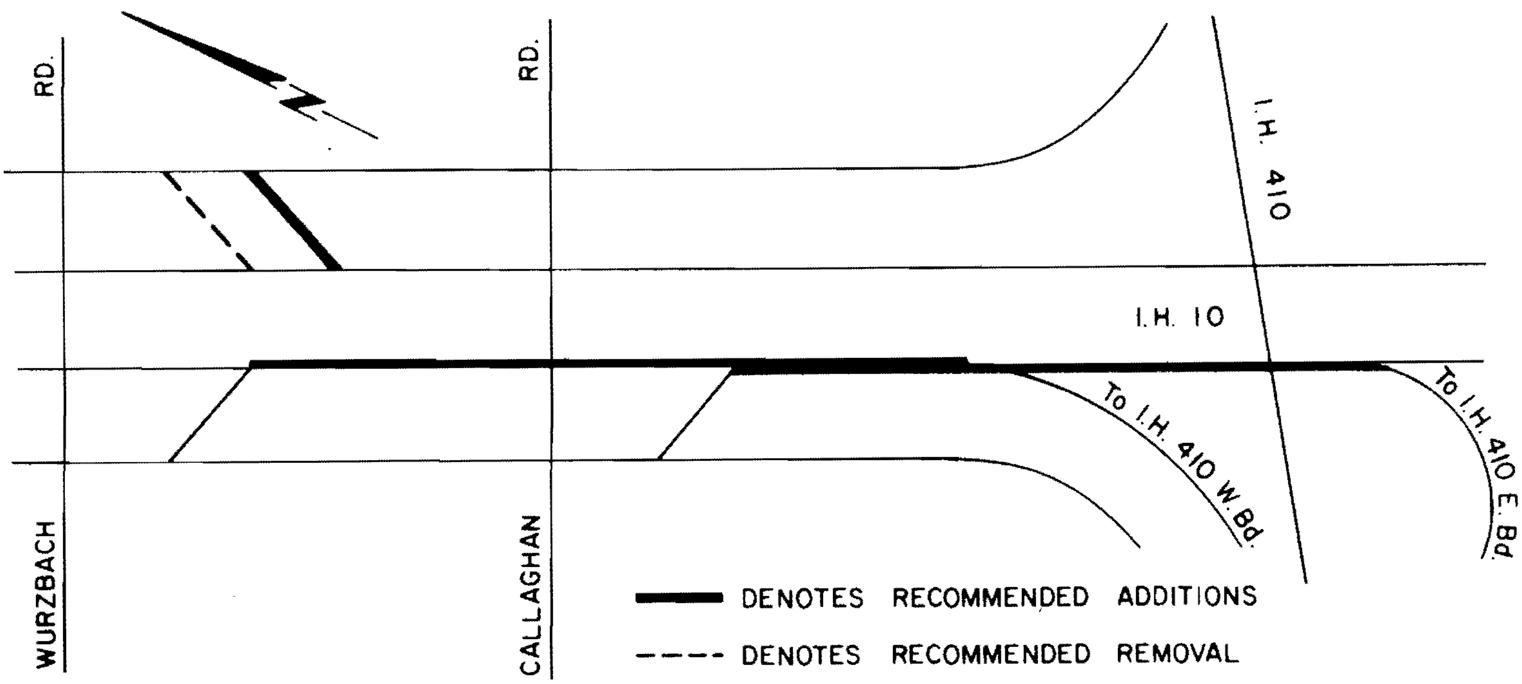
PROBLEM: Congestion on the westbound mainlanes near Wurzbach Road

The congestion at the Wurzbach Road intersection is causing traffic backups onto the mainlanes of I.H. 10. The Wurzbach Road exit ramp should be moved back to provide more storage space for the traffic buildup at the Wurzbach Road intersection. Since the volume of exiting traffic during peak hours is in excess of the capacity of a one lane ramp, the new ramp should be constructed as a two lane exit ramp.

PROBLEM: Congestion on eastbound mainlanes near Wurzbach Road

The mainlane section between Wurzbach Road and the I.H. 410 Interchange is capacity deficient. The high entering volumes at Wurzbach and Callaghan Roads produce an unacceptable level of service throughout this section. To relieve the congestion an additional mainlane, starting at the Wurzbach Road entrance and ending at the exit ramp for I.H.410 eastbound, is necessary. A continuous acceleration-deceleration lane between the Callaghan Road entrance and the exit ramp for I.H. 410 westbound is necessary to provide a smoother operating weaving area.

The continuous acceleration-deceleration lane will provide a safer traffic operation as well as keep the Callaghan Road traffic from unnecessarily entering into the mainlanes of I.H.10 to exit to I.H.410 westbound.



PROBLEM: <u>Congestion on the westbound main lanes near Callaghan Road</u>

The westbound mainlanes near Callaghan Road Interchange are experiencing congestion during peak hours. The congestion is caused by three sources, which are, (1) traffic backups onto mainlanes from the Callaghan Road intersection, (2) the short weaving distance between the entrance connector (I.H.410 westbound to I.H.10 westbound) and the

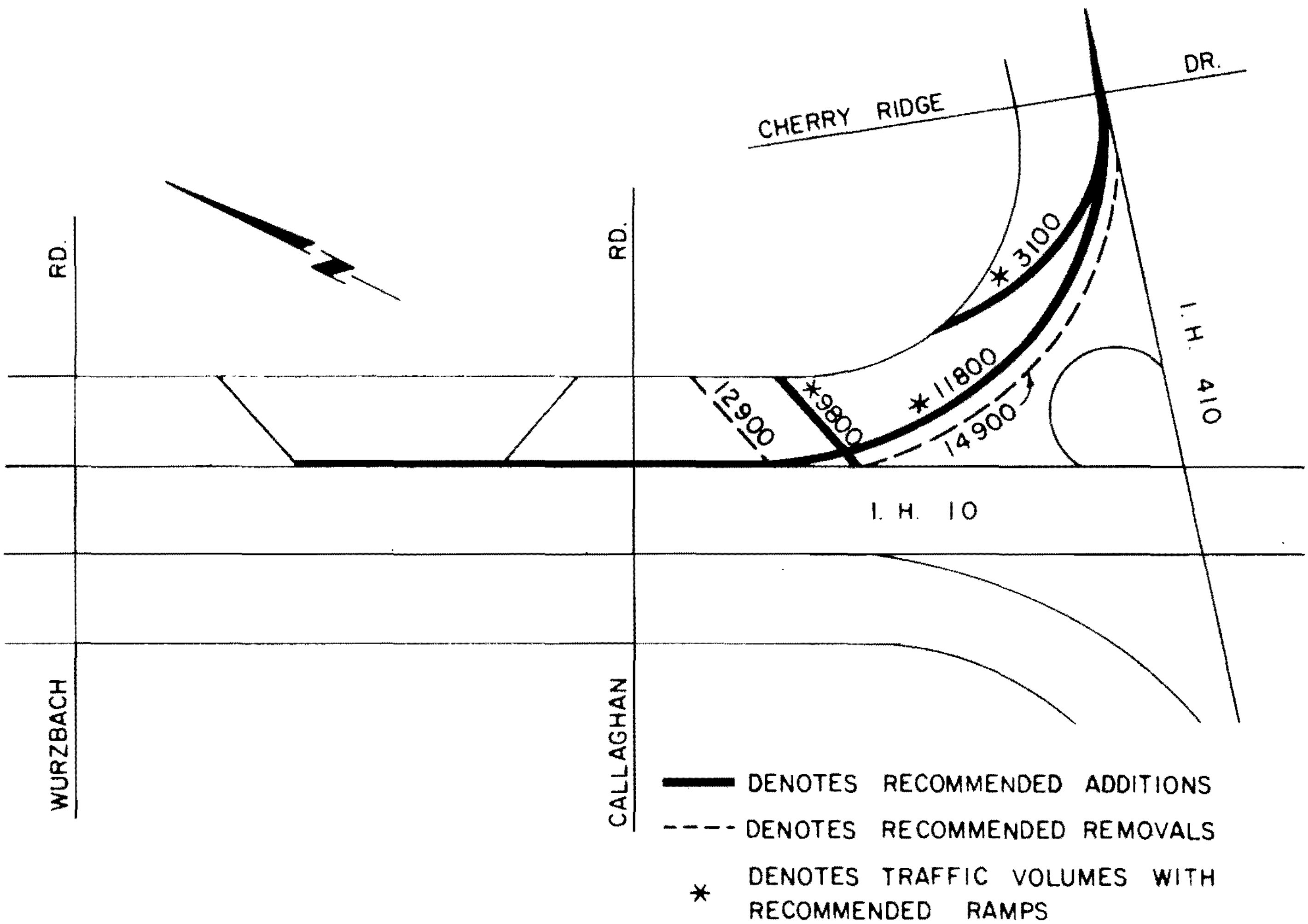
Callaghan Road exit, and (3) the high volume mainlane traffic. The recommendations for solutions are as follows:

1. Remove the existing Callaghan Road exit and construct at a location further away from Callaghan Road.

2. A braided ramp for the Callaghan Road exit and the connector (I.H.410 westbound to I.H.10 westbound)

3. An exit ramp from the connector (I.H.410 westbound to I.H.10 westbound) to the westbound I.H.10 frontage road. The construction of this ramp provides access for I.H.410 westbound traffic now exiting at I.H.10 for Callaghan Road.

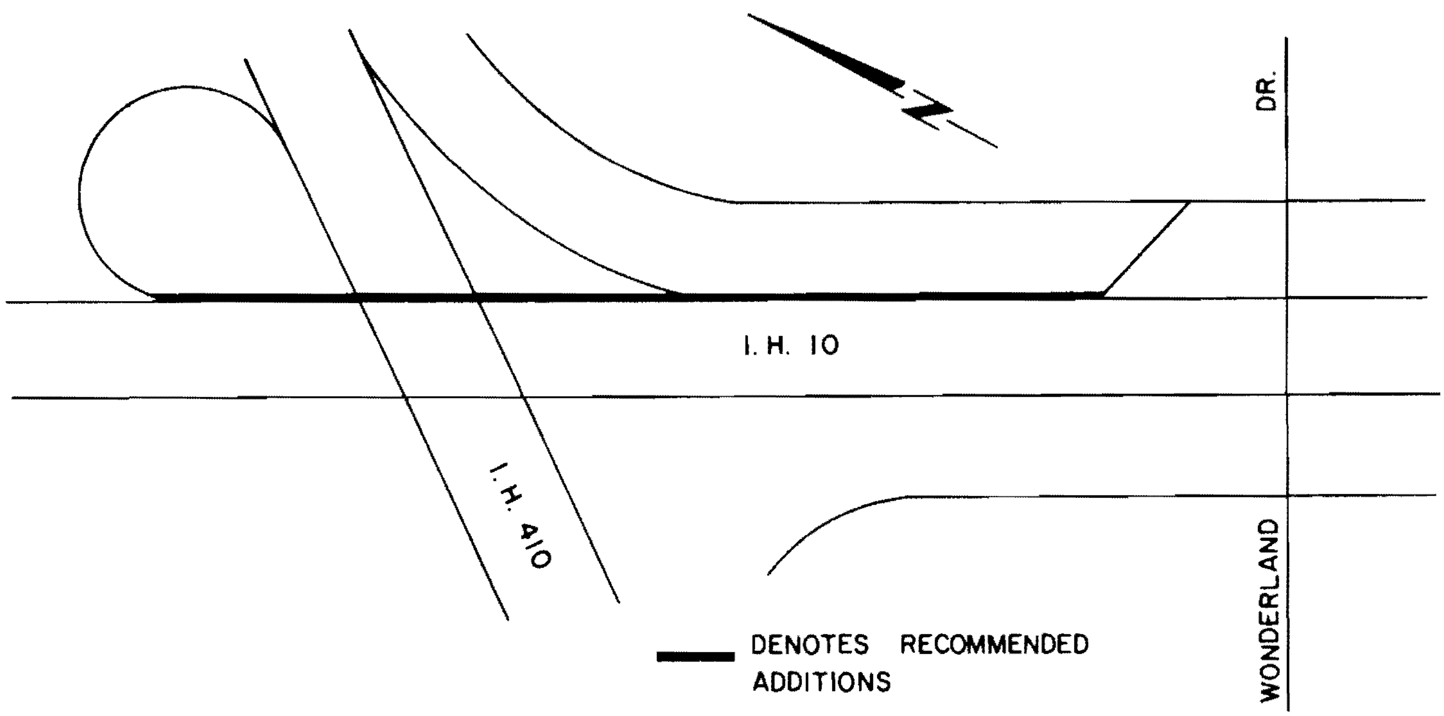
4. A continuous acceleration-deceleration lane between the connector (I.H. 410 westbound to I.H.10 westbound) and the two lane exit at Wurzbach Road previously recommended.



1981 TRAFFIC VOLUMES

PROBLEM: Westbound mainlane congestion at the I.H.410 Interchange

The mainlanes at the I.H.410 Interchange have become capacity deficient due to the rapid traffic volume increase. A lane drop condition at the exit ramp for I.H.410 eastbound reduces the number of mainlanes available to two lanes. The short weaving section between the Wonderland Drive entrance ramp and the exit ramp for I.H.410 eastbound adds to the congestion. It is recommended that the mainlanes be expanded to three lanes, from the exit ramp for I.H.410 eastbound to the exit ramp for I.H.410 westbound. A continuous acceleration-deceleration lane is also recommended in the section between the Wonderland Drive entrance ramp and the exit ramp for I.H.410 eastbound. The continuous acceleration-deceleration lane will provide a smoother operating weaving area, and will also keep the traffic that enters from Wonderland Drive



and exit to I.H.410 eastbound, from entering the mainlanes where it must merge with the higher volume of traffic. The construction of the previous recommendations will allow the westbound mainlanes at the I.H.410 Interchange to operate at an acceptable level of service.

STUDY NO. 5

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H.10 WEST

1. Construct a ramp for a westbound exit to F.M.3351.

2. Convert the frontage roads to one-way from Beckmann to DeZavala Road. All ramps in the same section are to be changed to conform to the one-way system.

3. Construct a frontage road turnaround on the southside of Spur 53. Widen the bridge to four lanes.

4. Construct a ramp for an eastbound exit to DeZavala Road. Construct a ramp for an eastbound entrance from Spur 53.

5. Construct a ramp for a westbound exit to Spur 53. Construct a ramp for a westbound entrance from DeZavala Road.

6. Construct a frontage road turnaround on the southside of DeZavala Road and a right turn lane on the westbound frontage road approach.

7. Remove the westbound exit to DeZavala Road and construct an entrance ramp at the same location. Construct westbound mainlanes to run parallel with the eastbound mainlanes at the U.S.87 Interchange. The existing westbound mainlanes are to be used as a collector-distributor road. Construct a ramp for a westbound exit to DeZavala road from the collector-distributor road. Remove existing westbound entrance ramp from Huebner Road.

8. Construct a hook ramp from the eastbound frontage road to U.S.87.

9. Construct a right turn lane on the westbound frontage road approach at Huebner Road.

10. Install new traffic signal control equipment at Wurzbach Road.

11. Construct a ramp for an eastbound entrance from Medical Drive between Wurzbach and Callaghan Roads; and construct a continuous acceleration-deceleration lane between the recommended ramp and the Callaghan Road exit.

12. Remove the westbound exit ramp for Wurzbach Road and construct at a site further back. Construct a continuous acceleration-deceleration lane between the new Wurzbach Road exit and the I.H.410 westbound to I.H.10 westbound connector.

13. Construct a third lane on the eastbound mainlanes between the entrance ramp from Wurzbach road to the exit for I.H.410 eastbound.

14. Construct a continuous acceleration-deceleration lane on the eastbound mainlanes between the Callaghan Road entrance and the exit for I.H.410 westbound.

15. Construct braided ramps for a westbound exit to Callaghan Road and the entrance ramp of I.H.410 westbound to - I.H.10 westbound connection. Construct an exit ramp from the connector to the frontage road relocate the westbound exit ramp for Callaghan Road.

16. Construct a third lane on the westbound mainlanes between the exit for I.H.410 eastbound and the exit ramp for I.H.410 westbound. Construct a continuous acceleration-deceleration lane between Wonderland Drive entrance ramp and the exit ramp for I.H.410 eastbound

AIR QUALITY ANALYSIS

The freeway operation study of IH 10 W. from Bexar-Kendall Co. Line to Fresno Dr. was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for IH 10 W. from Bexar-Kendall County Line to Fresno Drive.

IH 10 WEST FROM BEXAR-KENDALL COUNTY LINE TO FRESNO DRIVE

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	354,156	224,818	-36.5
Tons/year	142.49	90.45	
Carbon Monoxide (CO)			
Grams/day	2,598,127	2,034,573	-21.7
Tons/year	1,045.34	818.60	
Nitrogen Oxides (NO_x)			
Grams/day	254,364	256,780	+0.9
Tons/year	102.34	103.31	

1978 ACCIDENT HISTORY

I.H.10 WEST

DIR.	LOC.	M.P. *	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	21.8	1^1			1			1		1^1				4^2
NB	ML	21.7	1		1				1^1	1		1			5^1
NB	ML	21.5	1^1		1	1									3^1
NB	ML	21.1									1^1				1^1
NB	ML	21.0							1						1
NB	ML	20.6									1				1
NB	ML	20.5				1					1^1				2^1
NB	ML	20.4	1^1					1^1	1						3^2
NB	ML	20.3					1								1
NB	ML	20.2		2				1		1					4
NB	ML	19.6		1											1
NB	ML	19.4	1			1									2
NB	ML	19.3			1										1
NB	ML	19.1	2^1		1										3^1
NB	ML	19.0	3^1												3^1
NB	ML	18.9	1^1												1^1
NB	ML	18.8					1^1	1	2^1						4^2
NB	ML	18.7	2^1	1^1							$1^{①}$				$4^{2①}$

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	①	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures 1-10 to identify accident locations.

TABLE A

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	18.6									1^1				1^1
NB	ML	18.5									1^1				1^1
NB	ML	18.3	1	1^1	2				1		1^1				6^2
NB	ML	18.2	1						1						2
NB	ML	18.0	1						1^1		1			1	4^1
NB	ML	17.7	1												1
NB	ML	17.6			2^1										2^1
NB	ML	17.5	1												1
NB	ML	17.1						1			1				2
NB	ML	17.0			1										1
NB	ML	16.9	1^1		1^1										2^2
NB	ML	16.8						1^1						1	2^1
NB	ML	16.6							2					1	3
NB	ML	16.5									1^1				1^1
NB	ML	14.7			1^1										1^1
NB	ML	14.6				1									1
NB	ML	14.3		1											1
NB	ML	14.2	1^1											1	2^1
NB	ML	14.0						1							1
NB	ML	13.9			1	1									2
NB	ML	13.7						1			1				2
NB	ML	13.0			1^1										1^1
NB	ML	12.2			1^1										1^1

TABLE B

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	11.2									1				1
NB	ML	11.1		1											1
NB	ML	10.9									1^1				1^1
NB	ML	10.7						1						2^1	3^1
TOTAL			20^9	7^2	$14^{4\textcircled{1}}$	6	2^1	8^2	11^3	2	$14^{8\textcircled{1}}$	1	0	6^1	$91^{30\textcircled{1}}$

TABLE C

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	10.9									1'				1'
SB	ML	11.4									1'				1'
SB	ML	11.5						1							1
SB	ML	11.7							1'						1'
SB	ML	12.1			1'				1						2'
SB	ML	12.2			1										1
SB	ML	12.4							1'					1	2'
SB	ML	13.7			1										1
SB	ML	14.3	1'												1'
SB	ML	14.4									1'				1'
SB	ML	15.2	1												1
SB	ML	15.7									1				1
SB	ML	16.4									1'				1'
SB	ML	16.6	1			1				1					3
SB	ML	16.8				1									1
SB	ML	17.3									1				1
SB	ML	17.7			1'										1'
SB	ML	18.0	1			1									2
SB	ML	18.1				2'									2'
SB	ML	18.2	1		1'										2'
SB	ML	18.3		2'											2'
SB	ML	18.4								1	1'①				2'①
SB	ML	18.5	1						1'						2'

TABLE D

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	18.6							1		1^{1}				2^{1}
SB	ML	18.7		1^{1}											1^{1}
SB	ML	18.8	1						1^{1}						2^{1}
SB	ML	18.9	1^{1}												1^{1}
SB	ML	19.0		1											1
SB	ML	19.1	4		1	1							1^{1}		7^{1}
SB	ML	19.2	6												6
SB	ML	19.4	1		2^{2}										3^{2}
SB	ML	19.5		1											1
SB	ML	19.6	2^{1}											1	3^{1}
SB	ML	19.7									4^{3}				4^{3}
SB	ML	20.2						2							2
SB	ML	20.3	1	1		1^{1}					1^{1}				4^{2}
SB	ML	20.4				1^{1}				1					2^{1}
SB	ML	20.7		1	1^{1}	1^{1}									3^{2}
SB	ML	20.9												2	2
SB	ML	21.0	3^{2}		1				1^{1}						5^{3}
SB	ML	21.3			1^{1}										1^{1}
SB	ML	21.6	1^{1}							1					2^{1}
SB	ML	21.7							1	1					2
SB	ML	21.8		1							1^{1}				2^{1}
TOTAL			26^{6}	8^{2}	11^{7}	9^{4}	0	3	8^{5}	5	14^{11}①	0	1^{1}	4	89^{36}①

TABLE E

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	21.8	1		2^{1}			1			1^{1}				5^{2}
NB	FR	21.7			3^{1}	1									4^{1}
NB	FR	21.0	1		$3^{1(1)}$										$4^{1(1)}$
NB	FR	20.4		1	2^{1}				2^{1}		2^{2}				7^{4}
NB	FR	20.3									1				1
NB	FR	20.0				1^{1}									1^{1}
NB	FR	19.6						1^{1}							1^{1}
NB	FR	19.4	1	1^{1}	2	1			1		$1^{1(1)}$				$7^{2(1)}$
NB	FR	18.4	1												1
NB	FR	18.2		1		1					1				3
NB	FR	18.1	1		4	2		1	1^{1}		3^{2}	1^{1}		2	15^{4}
NB	FR	18.0			1	4				1					6
NB	FR	17.9							1						1
NB	FR	16.8	1			1									2
NB	FR	16.7	2^{1}	1	1			1							5^{1}
NB	FR	16.6	1	1	2^{1}	3^{1}		1			1			1^{1}	10^{3}
NB	FR	16.5	2		1				3^{1}			1^{1}			7^{2}
NB	FR	15.7									1				1
NB	FR	15.6						2^{1}		1					3^{1}
NB	FR	15.4			1				1						2
NB	FR	15.2	1		1	2		1^{1}			2				7^{1}
NB	FR	13.8						1							1
NB	FR	13.7			1	2								1	4

TABLE F

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	13.0						1							1
NB	FR	12.5									1				1
NB	FR	12.4						1							1
NB	FR	12.0			2^1										2^1
NB	FR	11.9			1^1										1^1
NB	FR	11.8	1												1
NB	FR	11.7	1^1		2^1	1					1^1				5^3
TOTAL			14^2	5^1	$29^{8\,1}$	19^2	0	11^3	9^3	2	$15^{7\,1}$	2^2	0	4^1	$110^{29\,2}$

TABLE G

1978 ACCIDENT HISTORY

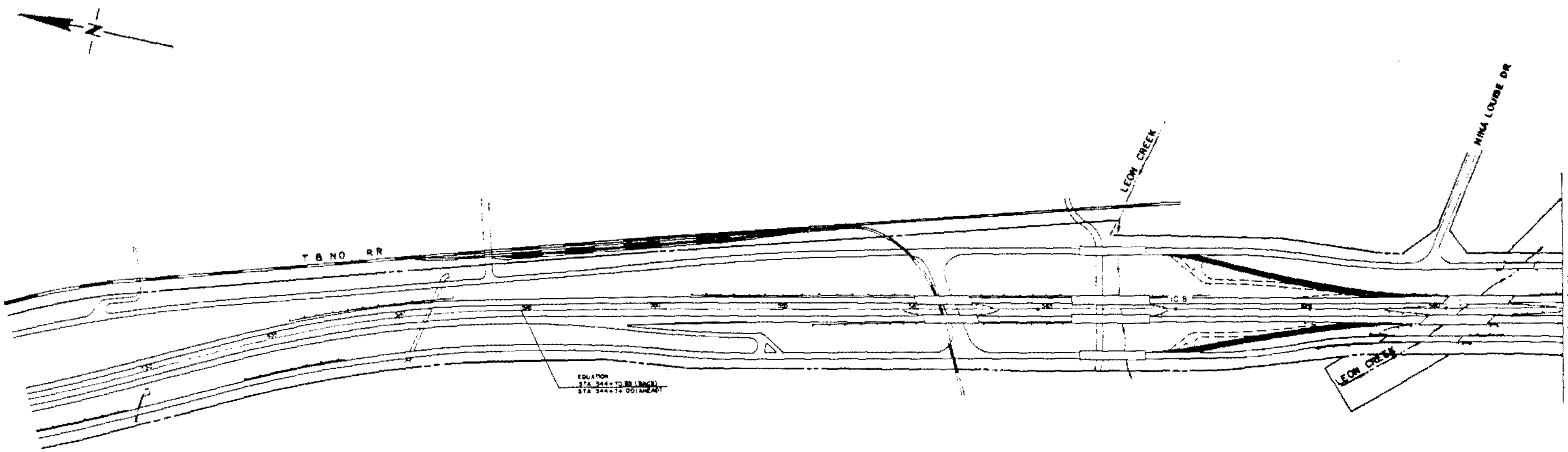
DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	11.7			3						1			1^1	5^1
SB	FR	12.0						2							2
SB	FR	13.1			1										1
SB	FR	13.4			1^1										1^1
SB	FR	13.7				1			1^1						2^1
SB	FR	15.2	1												1
SB	FR	15.9	1												1
SB	FR	16.4			1										1
SB	FR	16.5	4^1		1	1^1			2		2				10^2
SB	FR	16.6	5	1	5	4^2		4^1	3^1		2	1			25^4
SB	FR	16.7			1^1									1	2^1
SB	FR	16.8										1	1		2
SB	FR	17.1	1^1						1						2^1
SB	FR	18.0	1		1	1			1^1						4^1
SB	FR	18.1	5		3			3	2		5^3			1	19^3
SB	FR	18.5									2^2				2^2
SB	FR	18.6	1						1						2
SB	FR	19.2									1				1
SB	FR	19.3	1^1	1					1^1						3^2
SB	FR	19.4	8^2		3									2^1	13^3
SB	FR	19.5	1						1^1						2^1
SB	FR	19.6									1^1				1^1
SB	FR	19.7												1^1	1^1

TABLE H

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	20.1									1				1
SB	FR	20.2			1^{1}										1^{1}
SB	FR	20.4	8^{1}		2	2					1^{1}	1			14^{2}
SB	FR	20.9			2										2
SB	FR	21.0			1	1^{1}						1			3^{1}
SB	FR	21.1								1					1
SB	FR	21.6							1^{1}						1^{1}
SB	FR	21.7			1						1			1^{1}	3^{1}
SB	FR	21.8	3^{1}												3^{1}
TOTAL			40^{7}	2	27^{3}	10^{4}	0	9^{1}	14^{6}	1	17^{7}	4	1	7^{4}	132^{32}

TABLE I



LEGEND

RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS
PRESENTLY UNDER CONSTRUCTION
PRESENTLY BEING REMOVED

FIGURE - 1

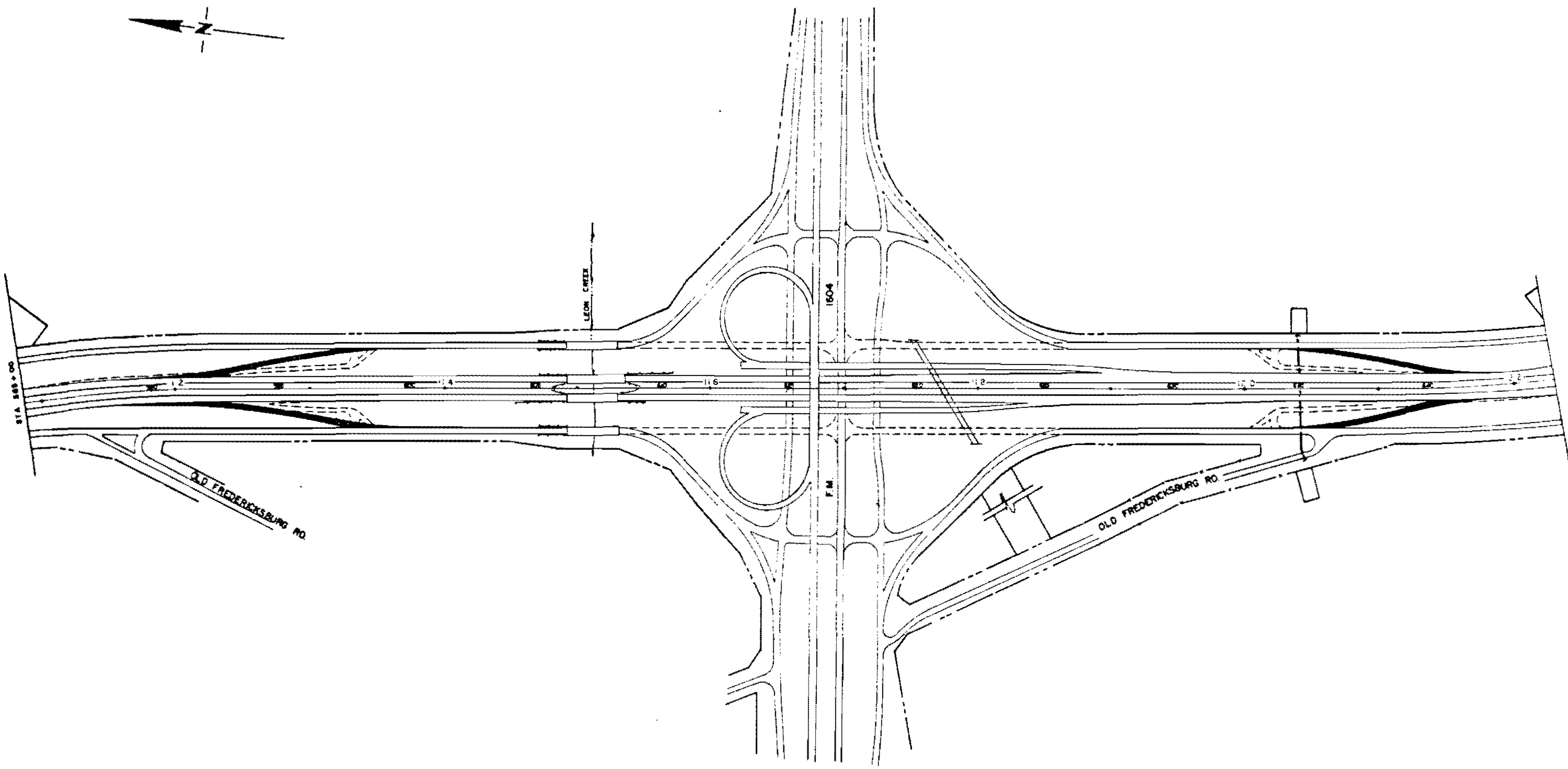
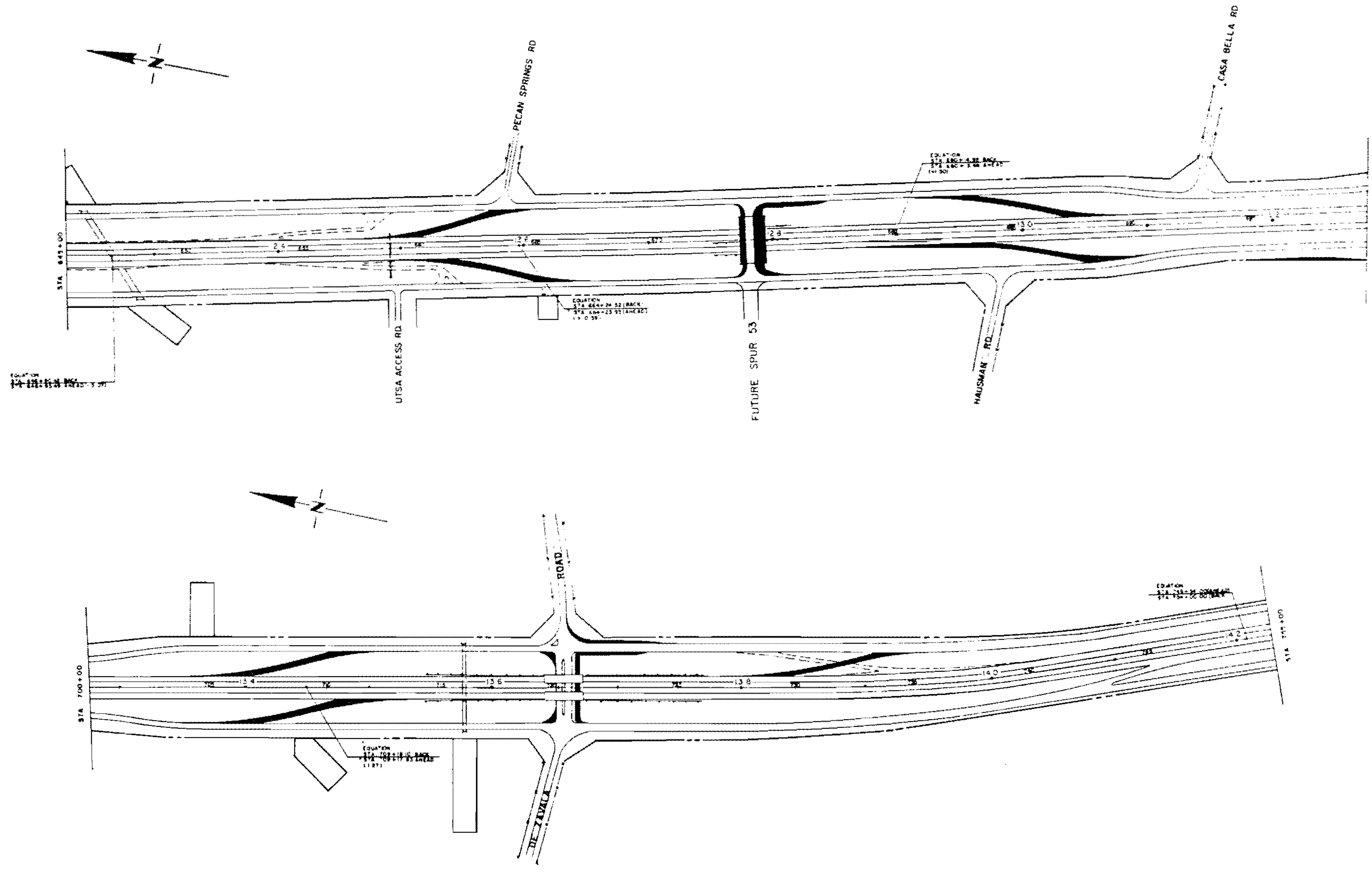

N
STA 585+00
OLD FREDERICKSBURG RD.
LEON CREEK
F.M. 1604
OLD FREDERICKSBURG RD.
STA 645+00

FIGURE - 2



PECAN SPRINGS RD
CASA BELLA RD
UTSA ACCESS RD
FUTURE SPUR 53
HAUSMAN RD
STA 645+00
STA 700+00
ROAD
DE ZAVALA
STA 700+00
STA 755+00

FIGURE - 3

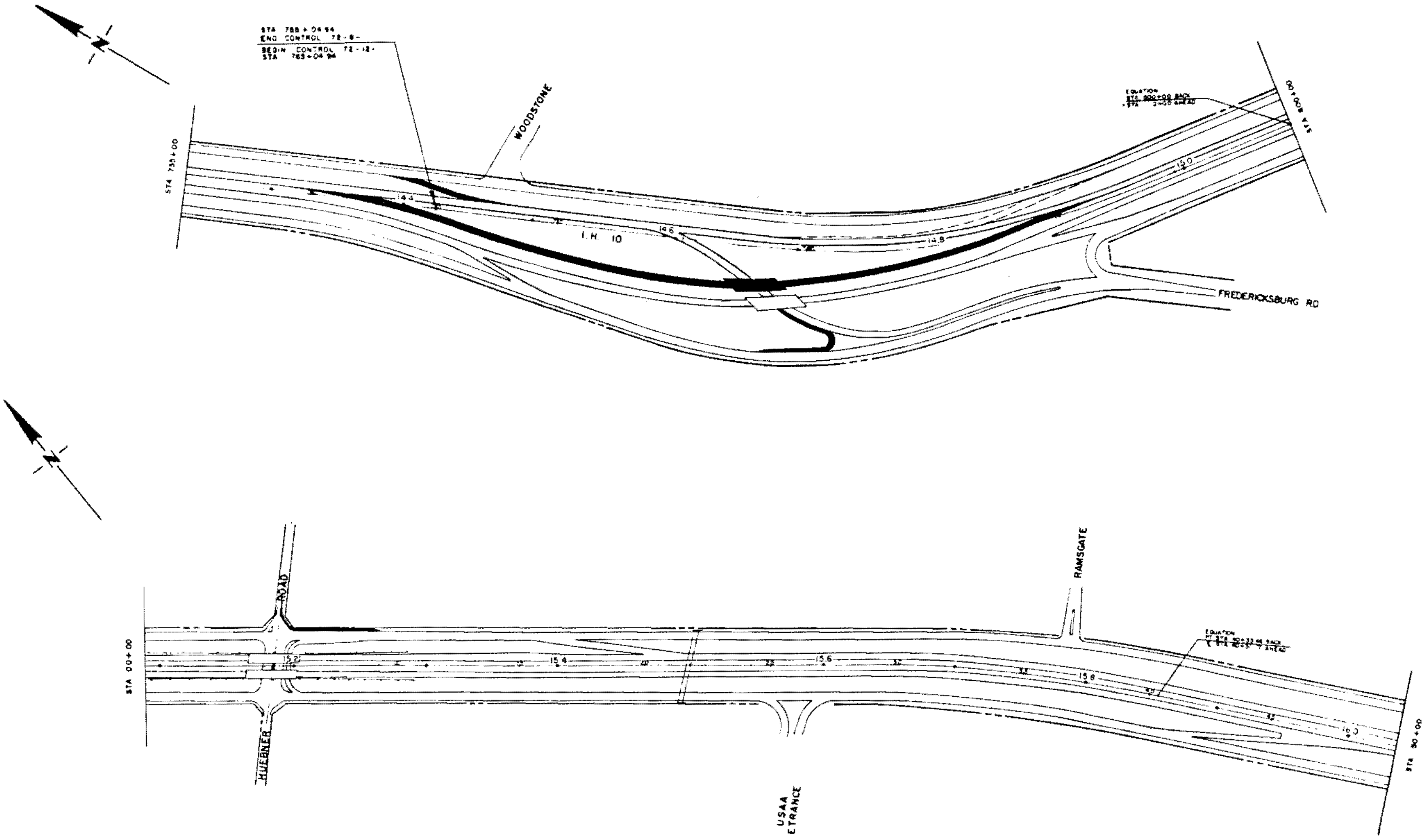

STA 755+00
STA 765+04.94
END CONTROL 72-8-
BEGIN CONTROL 72-12-
STA 765+04.94
WOODSTONE
I.H. 10
14.4
14.6
14.8
15.0
FREDERICKSBURG RD
STA 800+00
STA 00+00
HUEBNER
ROAD
15.2
15.4
15.6
15.8
16.0
USAA
ETRANCE
RAMSGATE
STA 90+00

FIGURE - 4

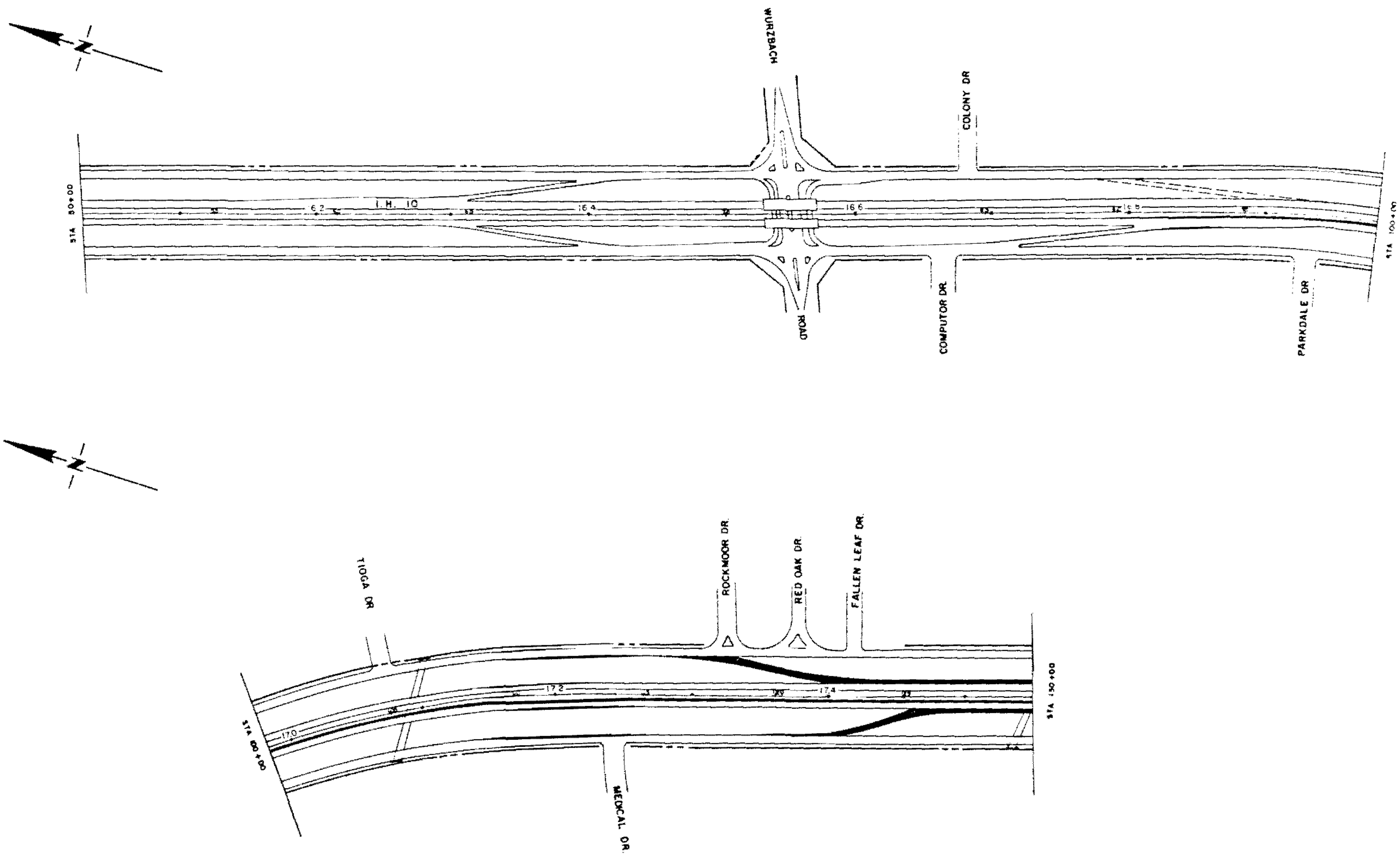

WURZBACH
ROAD
COLONY DR
COMPUTOR DR.
PARKDALE DR
I.H. 10
STA 50+00
STA 100+00
TIOGA DR
ROCKMOOR DR.
RED OAK DR.
FALLEN LEAF DR.
MEDICAL DR.
STA 100+00
STA 150+00

FIGURE-5

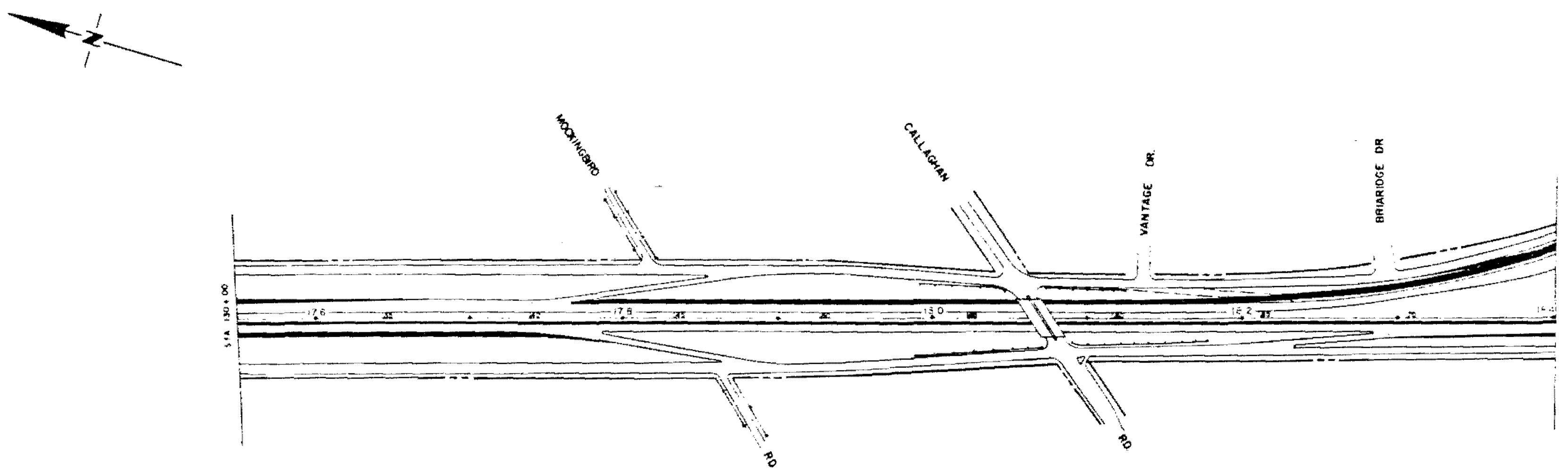


FIGURE- 6

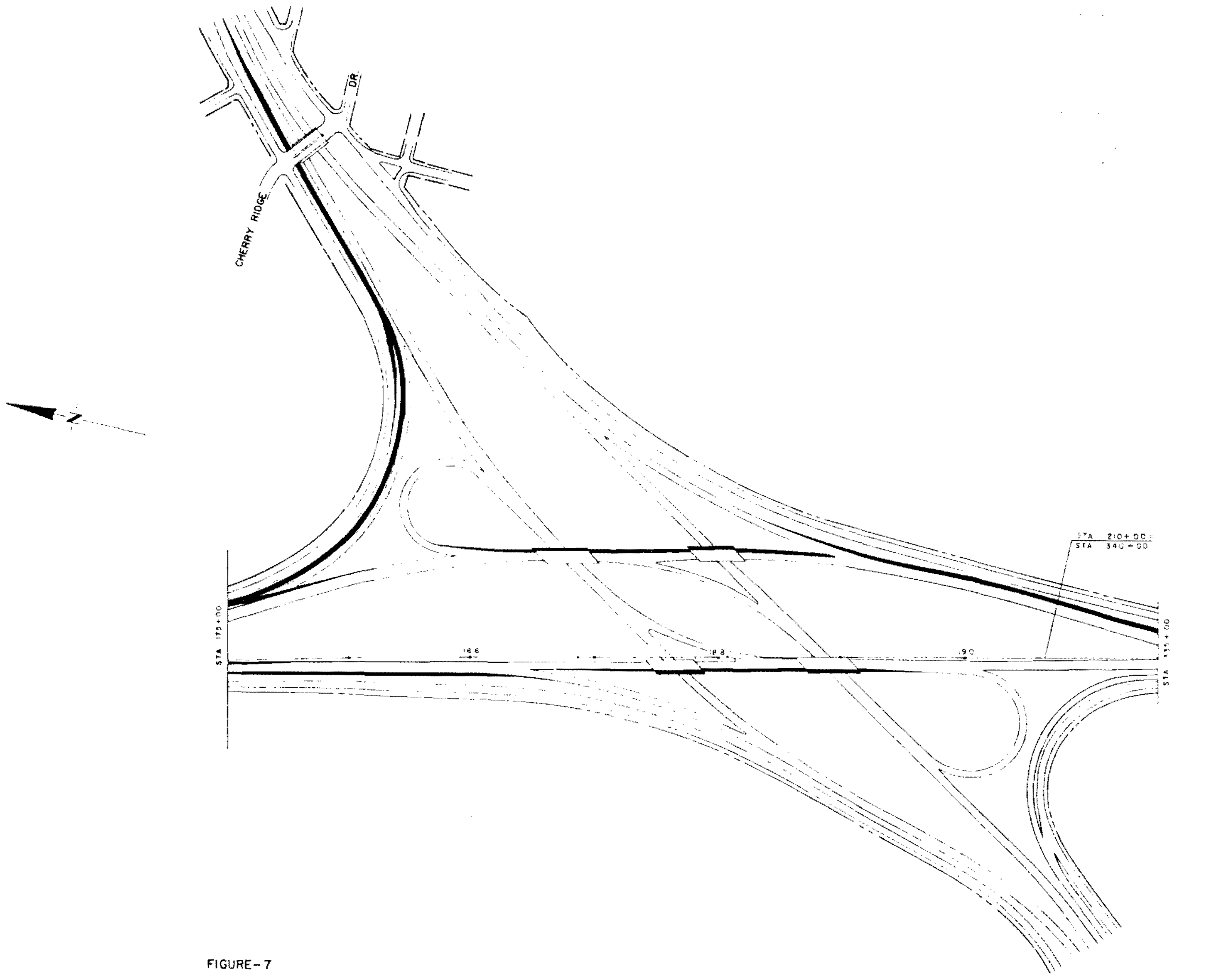

CHERRY RIDGE
DR.
N
STA 210+00=
STA 340+00
STA 175+00
STA 135+00
186
188
190

FIGURE-7

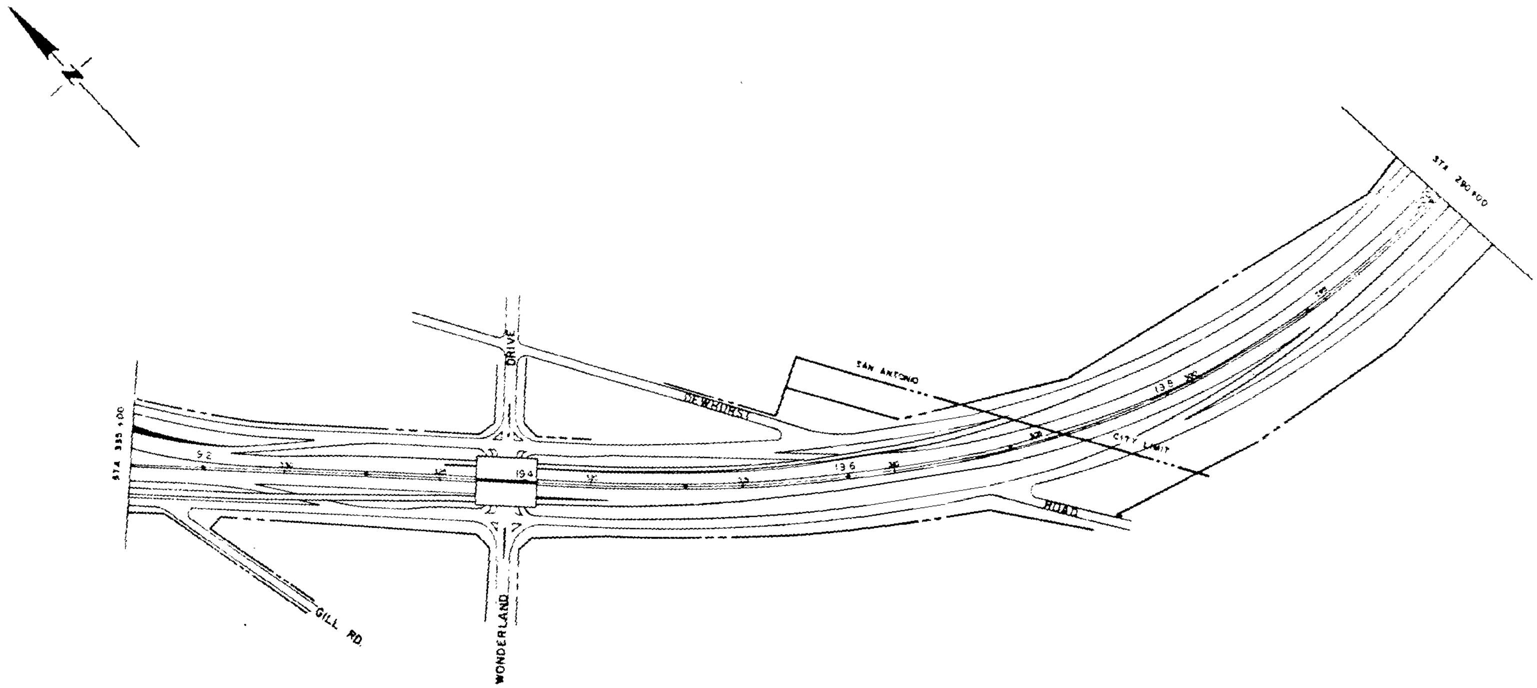

STA 290+00
SAN ANTONIO
CITY LIMIT
ROAD
DEWHURST
DRIVE
WONDERLAND
GILL RD.
STA 335+00
194
136
138
92

FIGURE-8

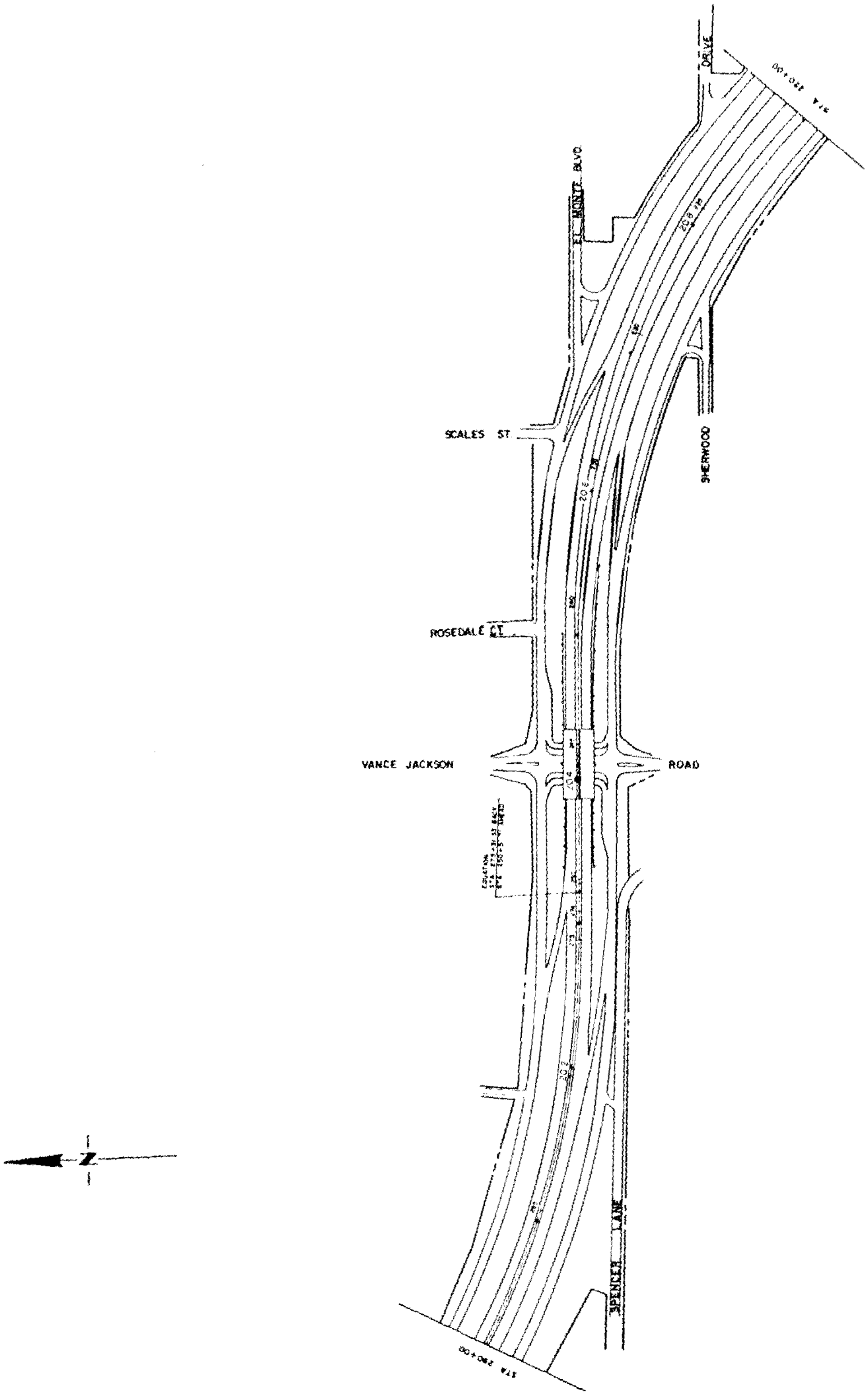
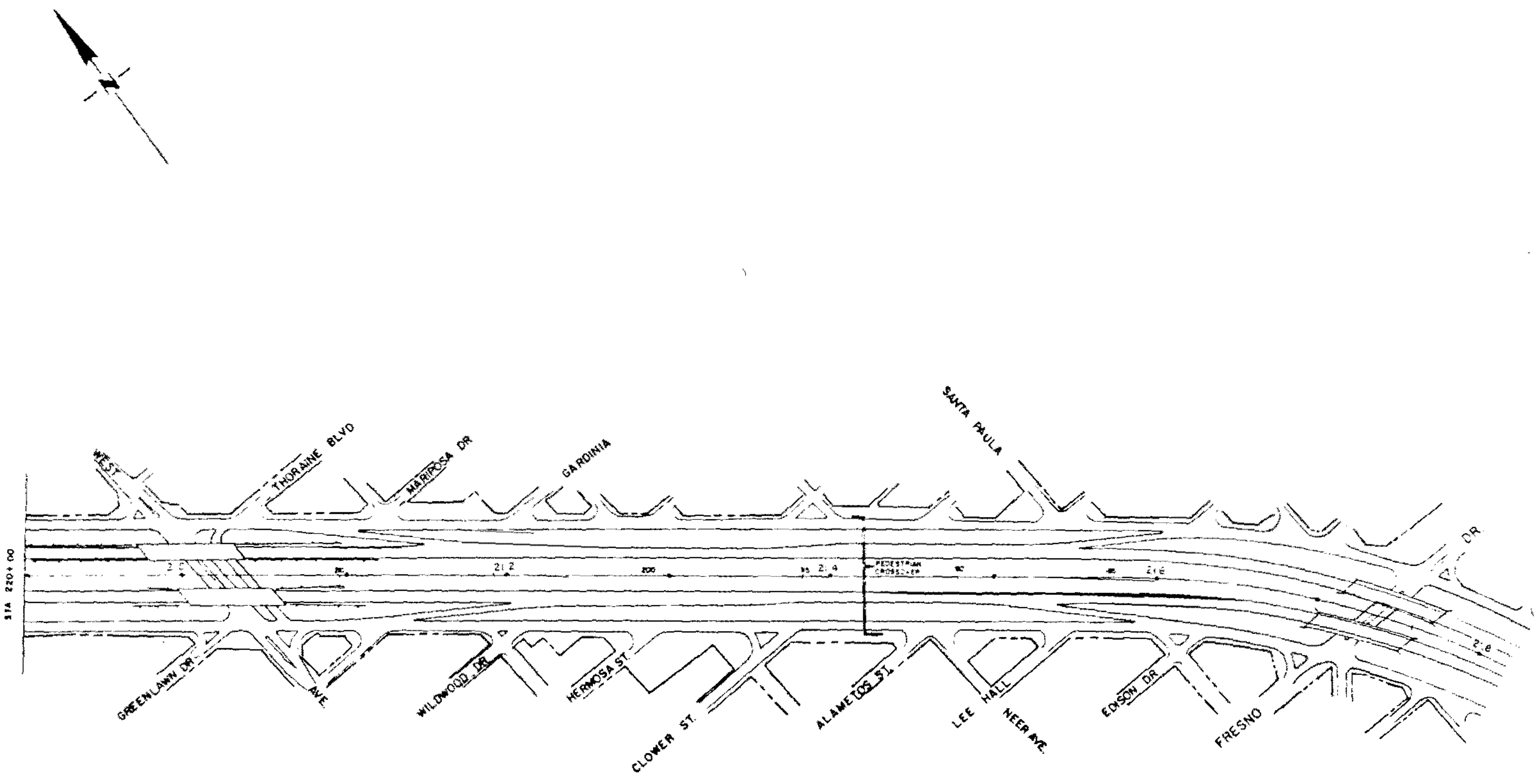

DRIVE
EL MONTE BLVD.
SCALES ST.
SHERWOOD
ROSEDALE CT.
VANCE JACKSON
ROAD
SPENCER LANE
N

FIGURE- 9



N
WEST
THORAINE BLVD
MARIPOSA DR
GARDINIA
SANTA PAULA
DR
STA 220+00
PEDESTRIAN CROSSOVER
GREENLAWN DR
AVE
WILDWOOD DR
HERMOSA ST
CLOWER ST.
ALAMETOS ST.
LEE HALL
NEER AVE.
EDISON DR
FRESNO

FIGURE–10

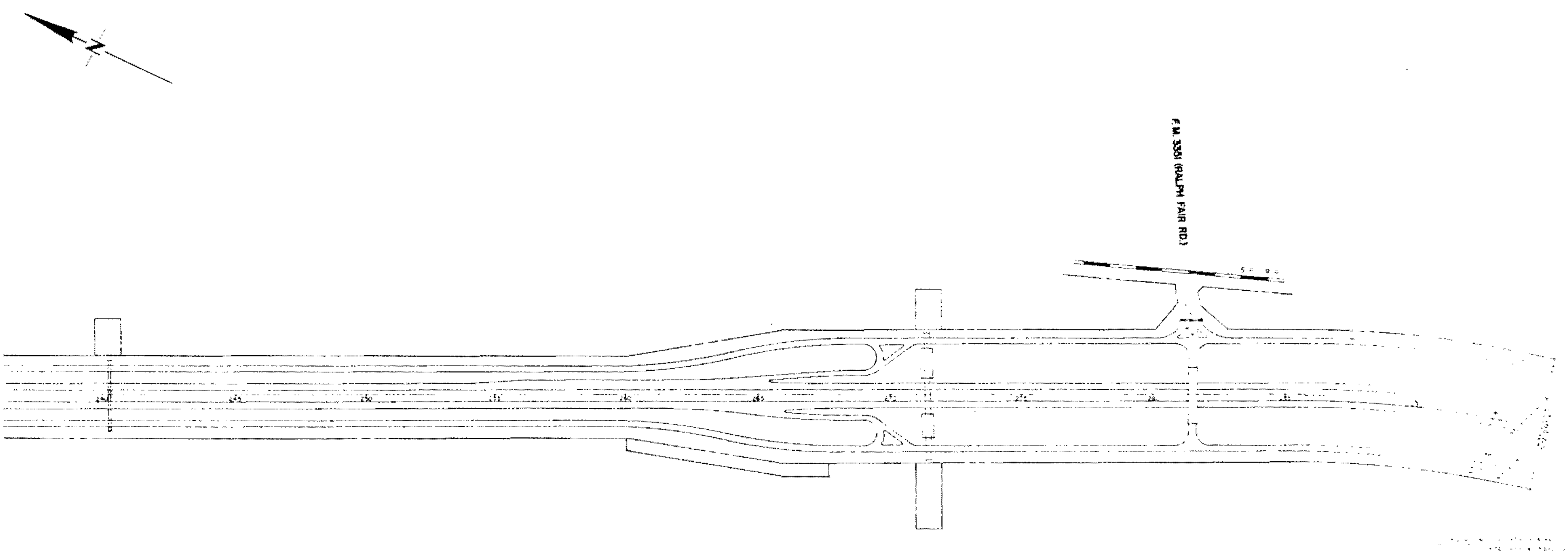
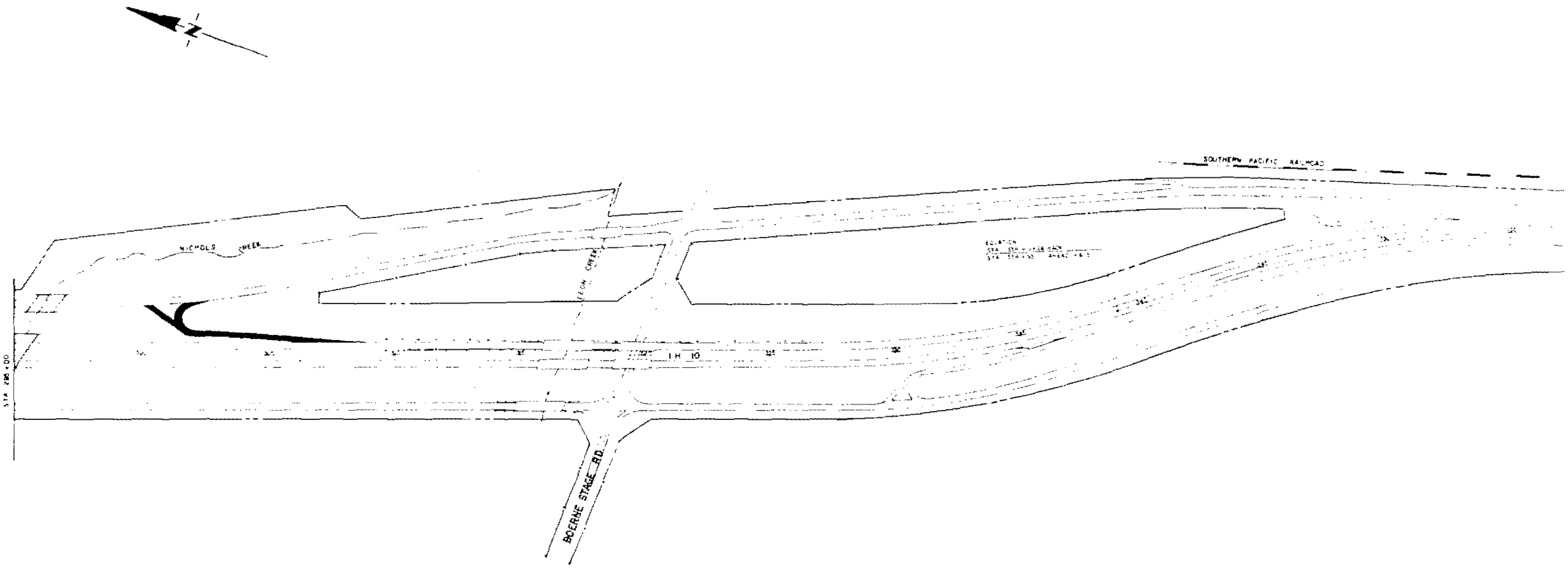
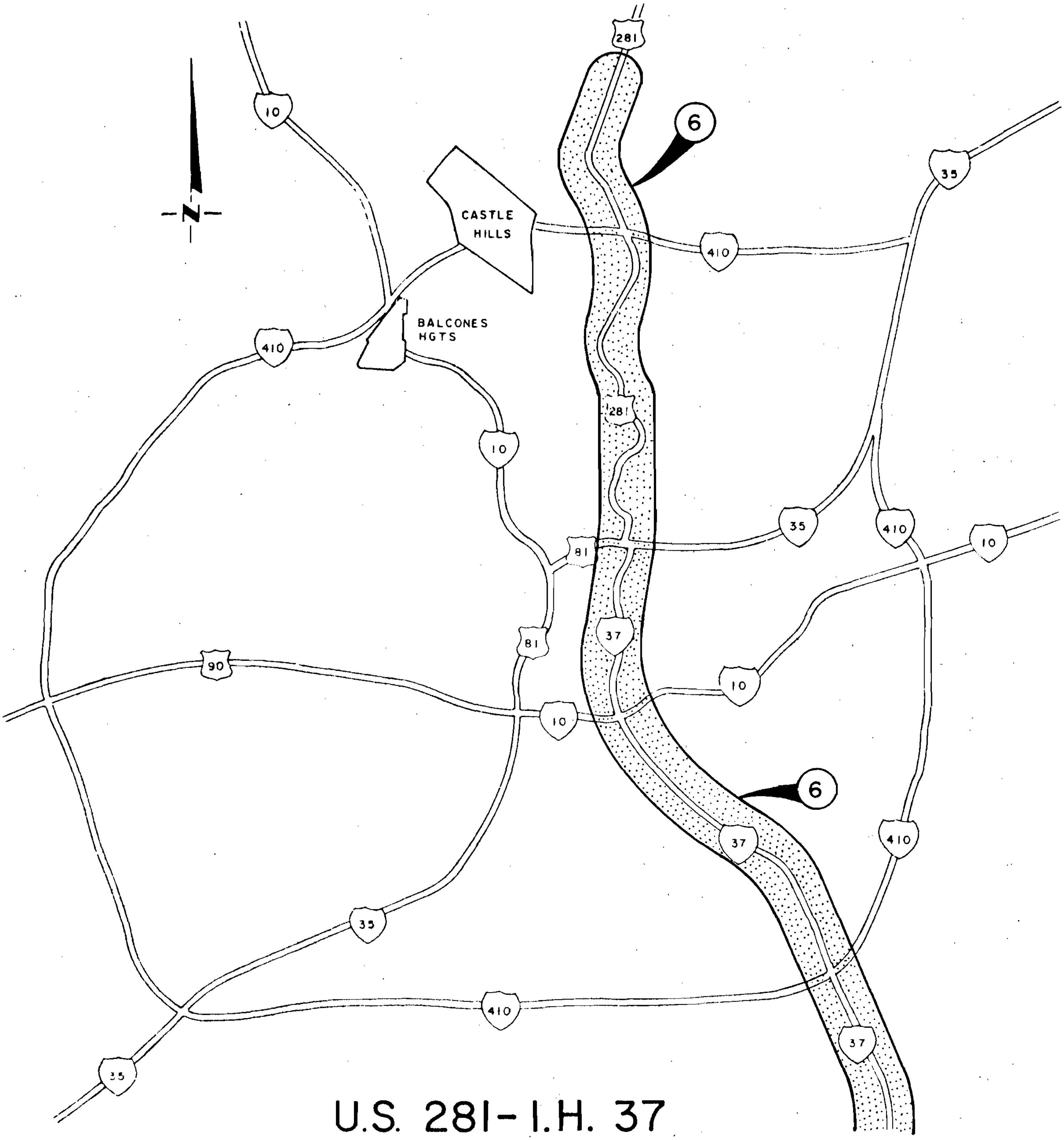


FIGURE I - A



N
SOUTHERN PACIFIC RAILROAD
NICHOLS CREEK
LEON CREEK
I H 10
BOERNE STAGE RD.
STA 295+00

FIGURE I-B



U.S. 281-I.H. 37

FREEWAY OPERATIONS STUDY

FROM: BITTERS ROAD
TO: SOUTH OF I.H. 410

INTRODUCTION

This study will identify the areas that were capacity deficient in 1979 and 1980 and expose the areas where access is not easily available. It will also identify any areas that were high accident locations.

STUDY PROCEDURE

Traffic volume counts were made by this office on the mainlanes and all entrance and exit ramps during 1979 and 1980. Level of service was then calculated to identify the capacity deficient areas.

The accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing". In 1979 the completed section of U.S.281 was opened to traffic from I.H.35 to Sandau Road, therefore 1979 accidents were used for U.S.281 and a breakdown of these accidents can be found in Table A through E. The 1978 accidents were used for I.H.37 and a breakdown of these accidents can be found in TABLE F through L.

The areas where access is not easily available were identified by citizens and police participation and from observations made by this office and the San Antonio Public Works Department. This office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio Public Works Department notifies us of any problem areas they have noticed or have received complaints about.

After analyzing the problem areas and proposing solutions, the anticipated impact of the solutions was determined by making turning movement counts and small origin-destination studies. Present volumes were then applied to the proposed solutions to determine the extent of improvement each proposal would have on the existing facility.

GENERAL DISCUSSION

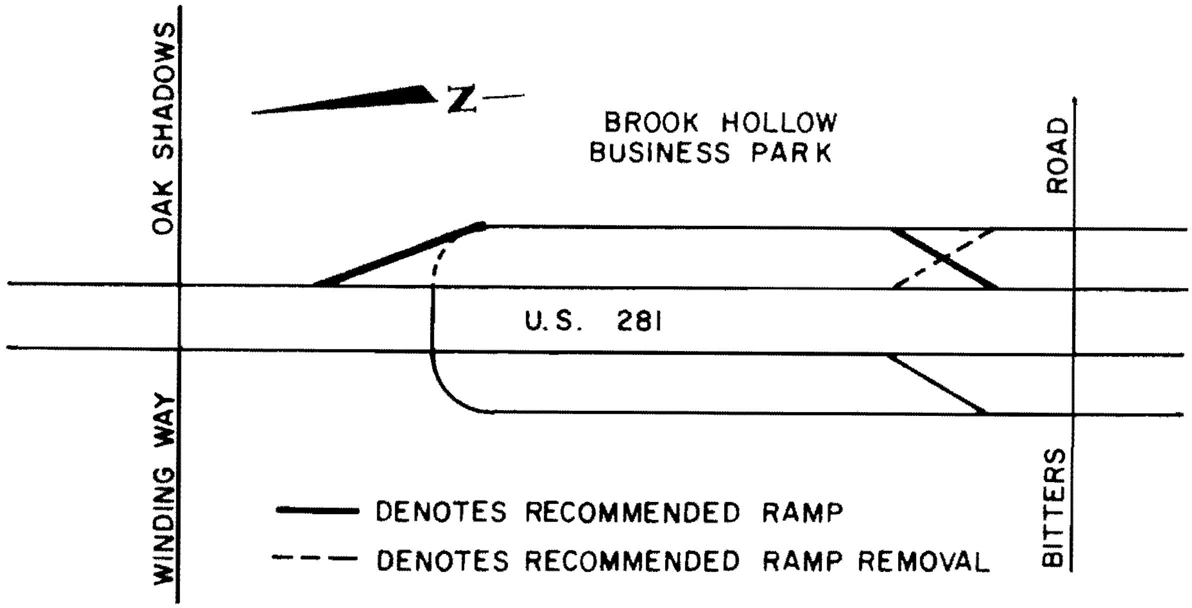
The limits of this study on U.S.281 are from Bitters Road to I.H.35 and on I.H.37 from I.H.35 to south of I.H.410. The existing roadway and the recommended solutions made by this study can be seen in FIGURE 1 through 20. The recommendations will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this study.

PROBLEMS AND RECOMMENDED SOLUTIONS

The problems found were a result of capacity deficient roadways and the lack of access to the local area streets and frontage roads. There were no high accident locations during the years the accident data was obtained.

PROBLEM: Congestion at Bitters Road Interchange

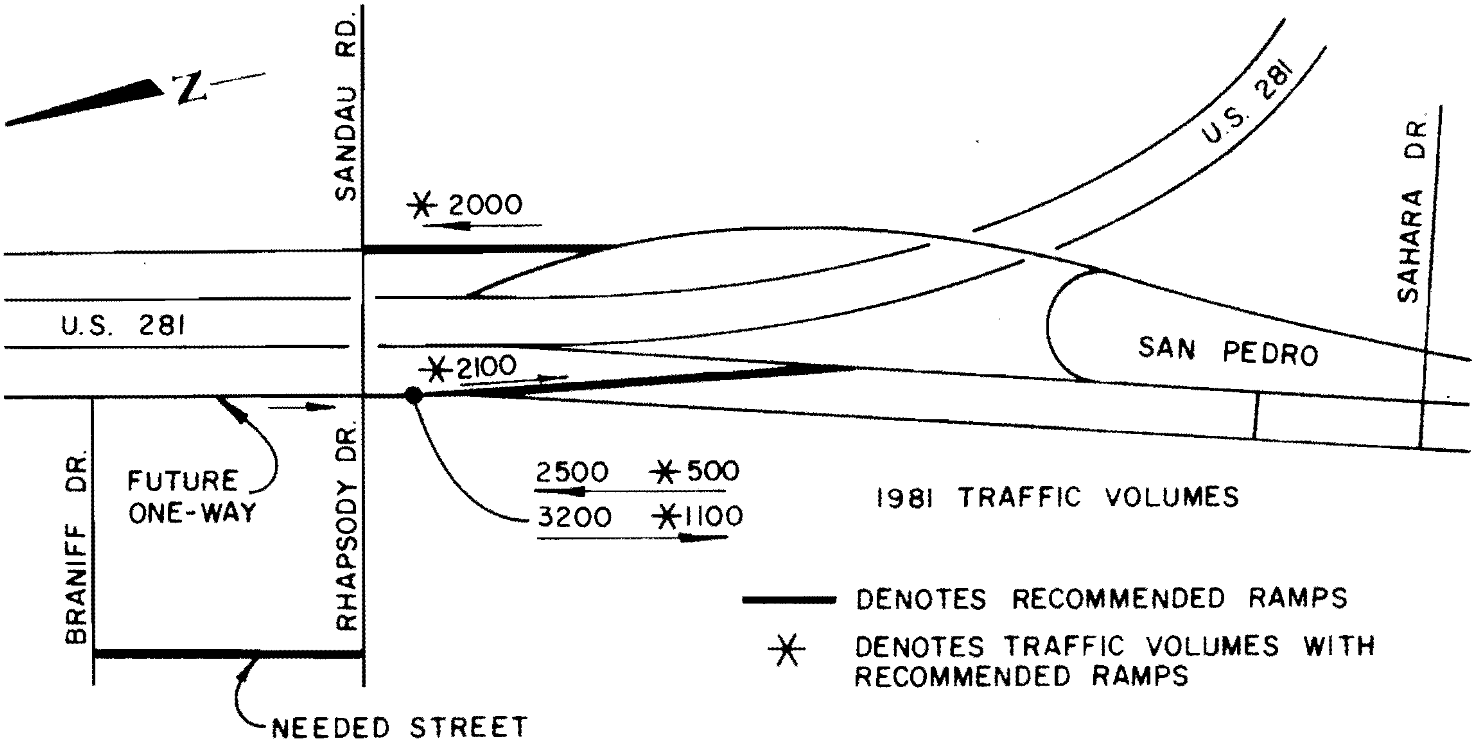
The Bitters Road interchange is experiencing congestion in the peak hours. A new traffic signal was recently installed to help accommodate the increased traffic volume. Brook Hollow Business Park, presently under construction on the land adjacent to U.S. 281 north of Bitters Road, will increase the northbound frontage road approach volume at Bitters Road.



Once the Business Park is completed, it will be necessary to replace the existing northbound entrance ramp from Bitters Road with an exit ramp and replace the existing entrance hook ramp with a slip ramp. The U.S.281 intersection with Winding Way and Oak Shadows is scheduled to be signalized which will help accommodate the U-turning traffic from the Business Park and the ramp revisions will remove traffic from the Bitters road interchange.

PROBLEM: Better Access needed for Braniff Drive and Rhapsody Drive

Presently, northbound San Pedro traffic desiring to gain access to the industrial area on Braniff Drive and Rhapsody Drive have to do so in a circuitous route which causes them unnecessary delay. The circuitous route has also created high traffic volumes on the U.S.281 west frontage road, between Rhapsody Drive and Sahara Drive, which is a residential area. The circuitous routes and the high frontage road traffic volumes

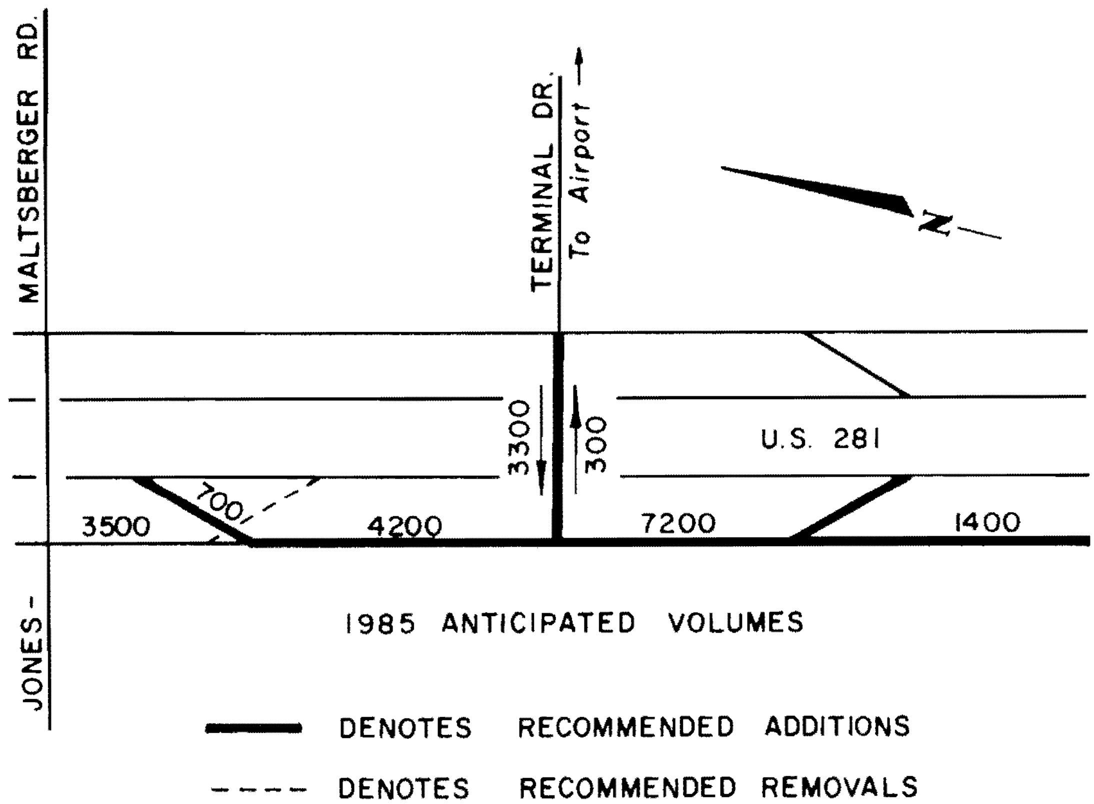


can be eliminated by providing a northbound San Pedro exit to Sandau Road and a southbound San Pedro entrance from Rhapsody Drive. The construction of these ramps will reduce the frontage road volume near Rhapsody Drive by over 70%. A traffic signal was recently installed on the U.S.281 west frontage road at its intersection with Rhapsody Drive. When the northbound San Pedro exit ramp to Sandau Road is constructed it will be necessary to install a traffic signal at its intersection. The two-way frontage road between Braniff Drive and Rhapsody Drive should be converted to one-way in order to provide continuity with the rest of the urban interstate system. In order to provide interior circulation within the industrial area between Braniff Drive and Rhapsody Drive, it will be necessary for the City to provide a city street connecting Braniff Drive with Rhapsody Drive west of

U.S.281. The city street will be necessary prior to converting the frontage road to one-way.

PROBLEM: Better access needed for Airport

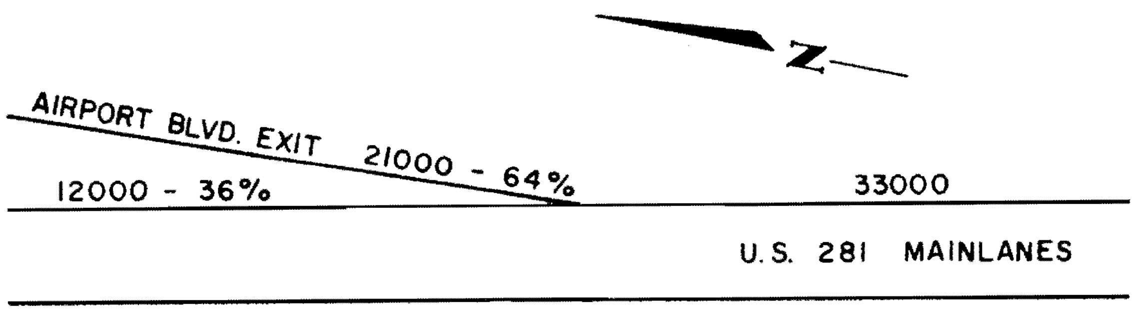
Terminal Drive provides direct access to the San Antonio International Airport. An interchange is needed in order to provide better access to and from the Airport. It will be necessary to provide a grade-separated interchange at U.S.281 and Terminal Drive and continue the southbound frontage road to intersect with Terminal Drive and the I.H.410 westbound frontage road. The U.S.281 northbound entrance



ramp from Jones-Maltsberger should be converted to an exit ramp to Terminal Drive and a southbound entrance ramp from Terminal Drive should be provided. This interchange will provide better access to and from the Airport and it will remove traffic from the I.H.410-Airport Blvd. interchange which is at capacity during the peak hours.

PROBLEM: Congestion and backups on northbound exit to Airport Blvd.

Presently 64% of the total U.S.281 northbound traffic desire to use the Airport Blvd. exit which results in mainlane backups and congestion. With the high volume exit it is necessary to provide a two lane exit to Airport Blvd. to relieve the problem.



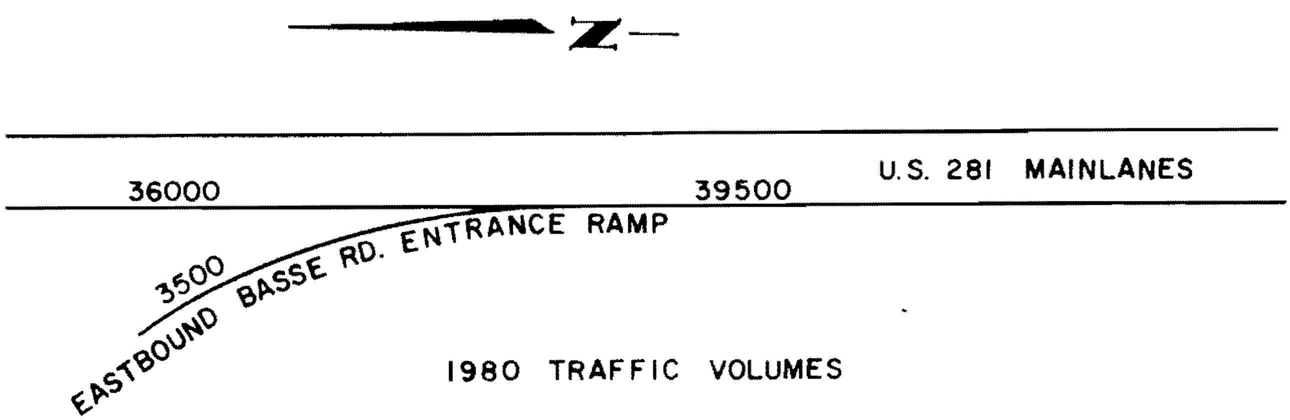
1981 TRAFFIC VOLUMES

PROBLEM: Better U.S.281 southbound access needed for Jones-Maltsberger Road

Presently, traffic using the Jones-Maltsberger Road-Tuxedo intersection and desiring to gain access to U.S.281 southbound have to do so by using the Basse Road cloverleaf connection (See FIGURE 6 and 7). The short weaving section on westbound Basse Road between the U.S.281 northbound exit to west Basse Road and the westbound Basse Road entrance to U.S.281 southbound is at an unacceptable level of service in the peak hours. As the land adjacent to Jones-Maltsberger, north of Tuxedo, becomes developed and additional traffic volumes are generated, it will be necessary to provide access for the northbound traffic to use the existing southbound entrance ramp from Jones-Maltsberger. Prior to providing this access it will be necessary to install a traffic signal at the intersection of U.S.281 northbound exit ramp with Jones-Maltsberger because of the restricted sight distance.

PROBLEM: Mainlane congestion at southbound entrance from eastbound Basse Road.

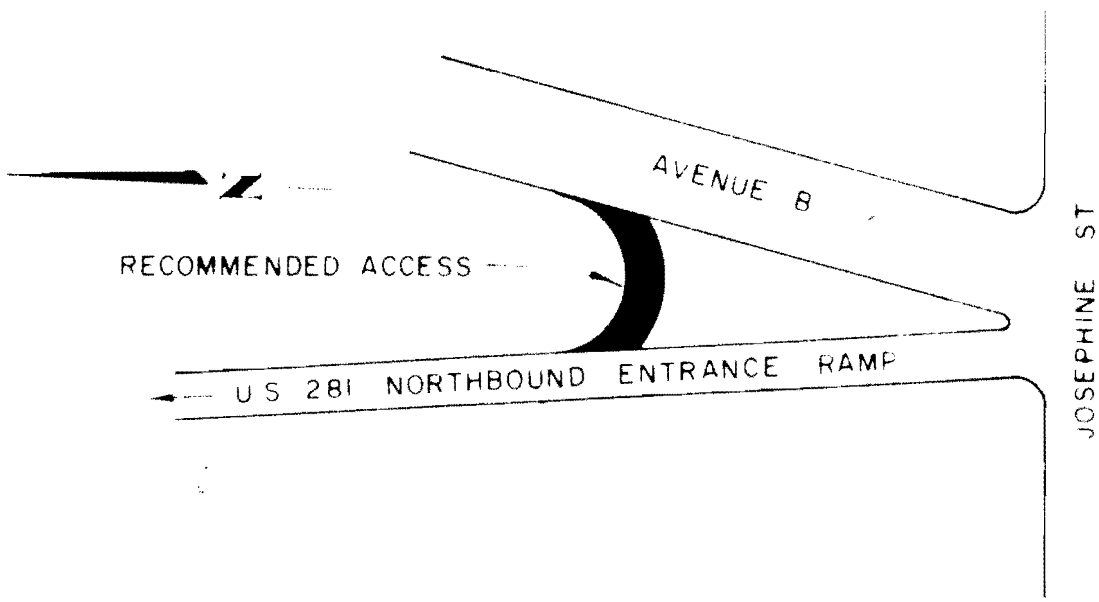
The increasing A.M. peak hour traffic volumes have created an unacceptable mainlane level of service on the U.S. 281 southbound mainlanes near Basse Road.



The traffic volumes on the U.S.281 southbound entrance ramp from eastbound Basse Road have reached the point that warrants the installation of ramp metering signals. When the ramp metering is installed and busses start using this ramp, it may be necessary to construct a bus bypass lane when the delay warrants.

PROBLEM: Better northbound access needed for Avenue B

Avenue B is parallel to the U.S.281 northbound entrance ramp from Josephine Street. Because of the close proximity it is difficult and hazardous for vehicles on Avenue B to gain access to the entrance ramp.



By providing a connection from Avenue B to the entrance ramp the difficulty and hazard will be eliminated.

PROBLEM: <u>Mainlane backups on southbound exit to Commerce Street</u>

Mainlane backups have been occurring on the I.H.37 southbound exit to Commerce Street. The backups are partly the result of the traffic signals at the intersection of Commerce Street with Bowie Street which is two blocks west of I.H.37. One traffic signal controller operates the traffic signals on Bowie Street at the intersections of Market Street and Commerce Street. The traffic signals operate such that when the pedestrian signals allow pedestrians to cross Market Street, the westbound Commerce Street traffic signals are red. This operation creates an unnecessary amount of red signal time to westbound Commerce Street because of the time it takes pedestrians to cross Market Street. Modification of the traffic signal operation should be made to provide more green traffic signal time to westbound Commerce Street. The additional green time will reduce the mainlane backups.

PROBLEM: <u>Better access needed for Tiendas Del Rio</u>

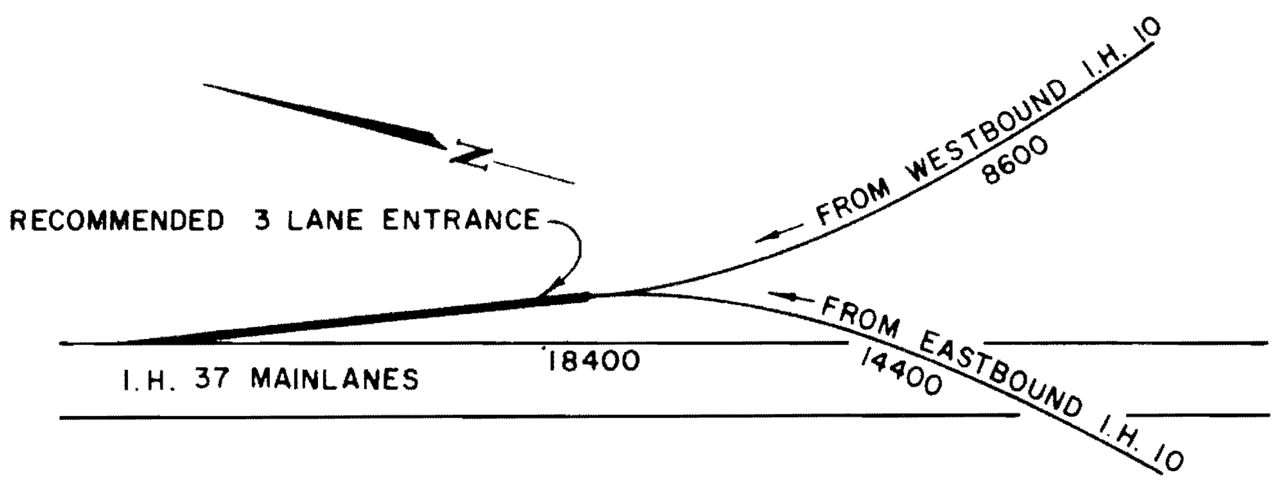
The City is trying to develop the area bounded by East Commerce, North Alamo, East Crockett and Bowie Street. The new complex has been named Tiendas Del Rio. Presently planned is a hotel, office space, retail stores and additional parking facilities. The complex will generate additional traffic volume on I.H.37. When Tiendas Del Rio becomes operational, it will be necessary to construct an I.H.37 southbound exit to Crockett Street. This new exit ramp will provide direct access to the planned complex and will reduce the southbound Commerce Street exiting volume.

PROBLEM: Better access needed for St. Paul Square

The area east of I.H.37 near East Commerce and Hoefgen Street is presently being renovated to become a complex known as St. Paul Square. This complex will consist of retail stores and office space. Once completed, the area will attract additional traffic volumes. Presently there is no easy access to the area. Therefore, it will be necessary to provide a northbound exit to Gonzales Street from the existing I.H.37 northbound exit to Commerce Street.

PROBLEM: Congestion and backups in the I.H.37 - I.H.10 Interchange

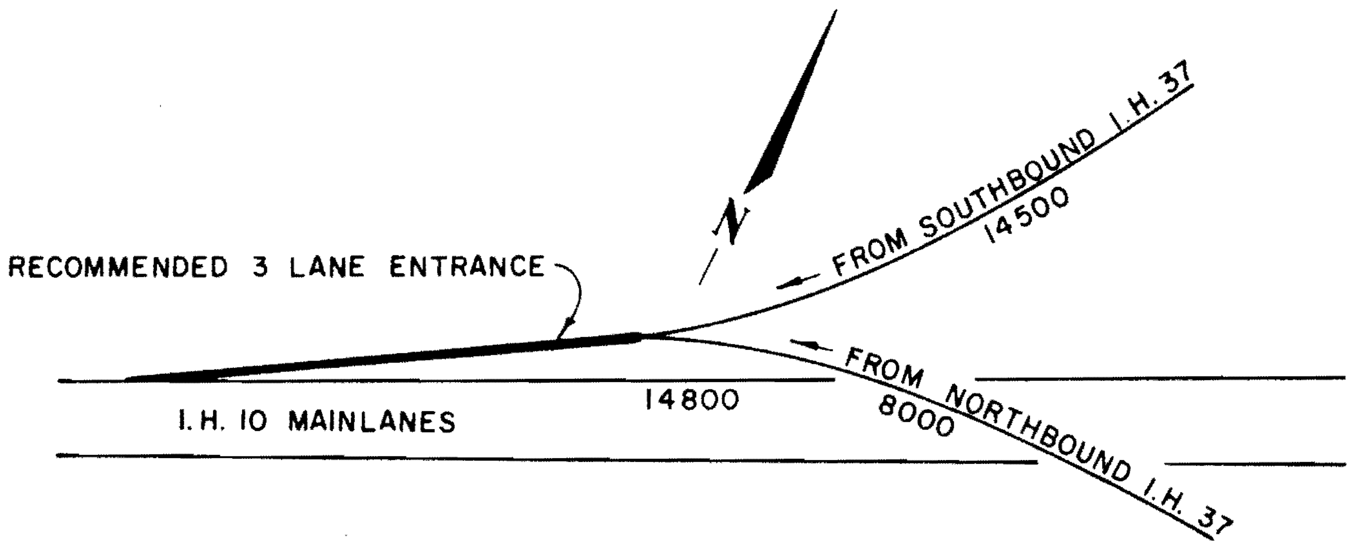
The I.H.37 northbound entrance ramp from I.H.10 eastbound and westbound is experiencing congestion and backups during the peak hours. Presently, the I.H.10 eastbound connector is two lanes and the westbound connector is one lane with a yield condition. A three lane



1981 TRAFFIC VOLUMES

entrance is necessary to remove the yield condition and eliminate the congestion and backups.

The I.H.10 westbound entrance ramp from I.H.37 northbound and southbound is also experiencing congestion and backups during the peak hours. The I.H.37 southbound connector is two lanes and the northbound connector is one lane with a yield condition. A three lane entrance is also necessary here to remove the yield condition and eliminate the congestion and backups.



1981 TRAFFIC VOLUMES

PROBLEM: <u>Traffic signal needed at Pecan Valley</u>

The traffic volumes in the I.H.37 - Pecan Valley interchange are increasing at a rate that will require the installation of traffic signals in the near future.

STUDY NO. 6

SUMMARY OF RECOMMENDED IMPROVEMENTS ON U.S. 281 AND I.H. 37

SUMMARY OF RECOMMENDED IMPROVEMENTS ON U.S. 281

1. Install new traffic signals at Winding Way-Oak Shadows intersection.

2. Replace existing northbound entrance ramp from Bitters Road with an exit ramp.

3. Replace the existing northbound hook ramp from Bitters Road with a slip ramp.

4. Construct a southbound San Pedro entrance ramp from Rhapsody Drive and convert the existing two-way frontage road between Rhapsody Drive and Silver Sands Drive to one-way southbound.

5. Construct a northbound San Pedro exit ramp to Sandau Road and install a traffic signal at the intersection.

6. Convert the existing two-way west frontage road between Braniff Drive and Rhapsody Drive to one-way southbound and construct a city street to connect Rhapsody Drive with Braniff Drive.

7. Construct a grade-separated interchange at Terminal Drive. Provide a continuous southbound frontage road between Jones-Maltsberger and I.H.410. Replace the existing southbound entrance ramp from Jones-Maltsberger with an exit ramp and provide a southbound entrance ramp from Terminal Drive.

8. Provide a two lane exit for the northbound exit to Airport Blvd.

9. Provide a connector for northbound Jones-Maltsberger traffic to use the existing southbound entrance ramp and install a traffic signal at the intersection of U.S. 281 northbound exit ramp with Jones-Maltsberger.

10. Install ramp metering signals on the southbound entrance ramp from eastbound Basse Road and provide a bus bypass lane when warranted.

11. Provide a connector from Avenue B to the northbound entrance ramp from Josephine Street.

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H. 37

12. Construct a southbound exit ramp to Crockett Street.

13. Construct a northbound exit to Gonzales Street.

14. Modify existing traffic signal control equipment at the Commerce Street - Bowie Street intersection.

15. Provide a three lane entrance ramp on the I.H. 37 northbound entrance ramp from I.H. 10 eastbound and westbound. Provide a three lane entrance ramp on I.H. 10 westbound entrance ramp from I.H. 37 northbound and southbound.

16. Install new traffic signals at Pecan Valley interchange.

AIR QUALITY ANALYSIS

The freeway operation study of US 281-IH 37 from Bitters Rd. to South of IH 410 was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for US 281-IH 37 from Bitters Rd. to South of IH 410.

U.S. 281 - I.H. 37 FROM BITTERS ROAD TO SOUTH OF I.H.410

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	88,500	40,923	-53.8
Tons/year	35.61	16.47	
Carbon Monoxide (CO)			
Grams/day	765,708	368,740	-51.8
Tons/year	308.08	148.36	
Nitrogen Oxides (NO_x)			
Grams/day	45,897	42,615	-7.2
Tons/year	18.47	17.15	

1979 ACCIDENT HISTORY

U.S. 281

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	26.0	1					1							2
NB	ML	25.8							1^{1}						1^{1}
NB	ML	25.7							1						1
NB	ML	24.9			1										1
NB	ML	24.7	1												1
NB	ML	24.0							1^{1}						1^{1}
NB	ML	23.9							1					1	2
NB	ML	23.8		1											1
NB	ML	22.3									1				1
NB	ML	21.6										1^{1}			1^{1}
NB	ML	21.5									1				1
NB	ML	21.3							1^{1}						1^{1}
NB	ML	20.8	1												1
NB	ML	20.7	1		1										2
NB	ML	20.4									2^{2}				2^{2}
NB	ML	20.3						2^{1}							2^{1}
NB	ML	20.2			1										1
NB	ML	18.8							1						1

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	1	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures 1-11 to identify accident locations.

TABLE A

1979 ACCIDENT HISTORY

U.S. 281

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	18.4									1^1				1^1
TOTAL			4	1	3	0	0	3^1	6^3	0	5^3	1^1	0	1	24^7

TABLE 8

1979 ACCIDENT HISTORY

U.S. 281

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	18.8									1				1
SB	ML	19.0		1'											1'
SB	ML	19.5	1												1
SB	ML	20.4						1							1
SB	ML	20.6					1								1
SB	ML	20.8								1	1'				2'
SB	ML	21.1									1'				1'
SB	ML	21.3							1'						1'
SB	ML	21.9	1												1
SB	ML	22.0			1'										1'
SB	ML	22.1			1										1
SB	ML	22.5		1'											1'
SB	ML	23.5	1												1
SB	ML	23.7	1												1
SB	ML	23.9			1					1'	1				3'
SB	ML	25.0									1'				1'
SB	ML	25.4								1'	1'				2^2
SB	ML	25.7												1'	1'
SB	ML	26.1	1								1'				2'
TOTAL			5	2^2	3'	0	1	1	1'	3^2	7^5	0	0	1'	24^{12}

TABLE C

1979 ACCIDENT HISTORY

U.S. 281

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	24.8	1												1
NB	FR	23.9			1^{1}										1^{1}
NB	FR	21.3			1^{1}				1^{1}						2^{2}
NB	FR	19.2									1^{1}				1^{1}
NB	FP	18.8		1^{1}											1^{1}
TOTAL			1	1^{1}	2^{2}	0	0	0	1^{1}	0	1^{1}	0	0	0	$6^{5\,1}$

TABLE D

1979 ACCIDENT HISTORY

U.S. 281

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	19.3			1										1
SB	FR	21.1	1'												1'
SB	FR	22.0	2												2
SB	FR	25.2			1										1
SB	FR	25.8	1												1
TOTAL			4'	0	2	0	0	0	0	0	0	0	0	0	6'

TABLE E

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P. *	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	3.0			2										2
NB	ML	3.5			1										1
NB	ML	4.9									1'				1'
NB	ML	5.5										1			1
NB	ML	6.7	2'												2'
NB	ML	6.9	1'												1'
NB	ML	7.1									1'				1'
NB	ML	7.2	1												1
NB	ML	7.3												1	1
NB	ML	7.5			1'			1							2'
NB	ML	8.0					1			1				1	3
NB	ML	8.2						3	1		1'			1	6'
NB	ML	8.3						1'							1'
NB	ML	8.5	1		1					1					3
NB	ML	8.6								1'					1'
NB	ML	9.1		2							1'				3'
NB	ML	9.3				1									1
NB	ML	9.5	1'		1										2'

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	(i)	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figure 11-20 to identify accident locations.

TABLE F

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	9.6	1												1
NB	ML	9.7				1^{1}	1								2^{1}
NB	ML	9.9											1		1
NB	ML	10.0			1										1
NB	ML	10.1	1^{1}												1^{1}
NB	ML	10.2				1									1
NB	ML	10.3						1	1			1			3
NB	ML	10.4	1		1										2
NB	ML	10.5		2			1	3^{2}		1					7^{2}
NB	ML	10.8			1^{1}			1							2^{1}
NB	ML	11.0	1^{1}												1^{1}
NB	ML	11.3	1		1							1			3
NB	ML	11.5	1												1
NB	ML	11.6		1^{1}	1^{1}	1^{1}		1^{1}						1	5^{4}
NB	ML	11.8				1^{1}									1^{1}
NB	ML	11.9				1								1^{1}	2^{1}
NB	ML	12.0	1	2^{1}							1				4^{1}
NB	ML	12.1		1^{1}		1		2			1^{1}				5^{2}
NB	ML	12.3			2^{2}						1			1	4^{2}
TOTAL			13^{5}	8^{3}	13^{5}	7^{3}	3	13^{4}	2	4^{1}	7^{5}	3	1	6^{1}	80^{27}

TABLE G

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	12.3							1'					1'	2^{2}
SB	ML	12.2								1					1
SB	ML	12.1		1				1							2
SB	ML	11.8	1	1	1'			1'			1'			1	6^{3}
SB	ML	11.7			1										1
SB	ML	11.4											1		1
SB	ML	11.3						1						1'	2^{1}
SB	ML	11.2				1	1		1	1					4
SB	ML	11.1		1			1								2
SB	ML	10.8			1'	1'									2^{2}
SB	ML	10.7			1										1
SB	ML	10.6				1'		1							2^{1}
SB	ML	10.5			1'							1'			2^{2}
SB	ML	10.4		1							1'				2^{1}
SB	ML	10.3												1	1
SB	ML	10.0		1'		1'			1'						3^{3}
SB	ML	9.9	3'	1'	1					1					6^{2}
SB	ML	9.8									1				1
SB	ML	9.7	1'												1'
SB	ML	9.6		2											2
SB	ML	9.5	1'	1					1		1'			1	5^{2}
SB	ML	9.2		1							1'			1	3'
SB	ML	9.1							1'						1'

TABLE II

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	8.9	1												1
SB	ML	8.6	1								1				2
SB	ML	8.5												1	1
SB	ML	8.2						1							1
SB	ML	8.0			1'			1			1'			1	4^2
SB	ML	7.8									1'				1'
SB	ML	7.5							1'						1'
SB	ML	7.4							1'		1				2'
SB	ML	7.3		1'											1'
SB	ML	6.9									1				1
SB	ML	6.7		1											1
SB	ML	6.5									1'				1'
SB	ML	5.8						1'							1'
SB	ML	5.7	1												1
SB	ML	5.6			1'					1					2'
SB	ML	5.4								1					1
SB	ML	5.3						1							1
SB	ML	4.5									1'				1'
SB	ML	4.4							1'		1'				2^2
SB	ML	4.1							1'		1				2'
SB	ML	3.1						1'							1'
SB	ML	3.0						1							1

TABLE I

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
TOTAL			9^{3}	12^{3}	8^{5}	4^{3}	2	10^{3}	9^{7}	5	14^{9}	1^{1}	1	8^{2}	83^{36}

TABLE J

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	6.0				$1'$									$1'$
NB	FR	6.3						1							1
NB	FR	7.5	1								1				2
NB	FR	8.2			1	1		1	$1'$						$4'$
NB	FR	9.0			1						1				2
NB	FR	9.1	$1'$		1				$1'$						3^2
NB	FR	9.2			1										1
NB	FR	9.3	$1'$		2										$3'$
NB	FR	9.9			$2^{'(1)}$										$2^{'(1)}$
NB	FR	10.0			$1'$										$1'$
NB	FR	10.5			$3'$										$3'$
NB	FR	11.1						$1'$							$1'$
NB	FR	11.5			1										1
NB	FR	11.8			1										1
NB	FR	12.1						1							1
NB	FR	12.2			$1'$										$1'$
NB	FR	12.3				1									1
TOTAL			3^2	0	$15^{4(1)}$	3^1	0	4^1	2^2	0	2	0	0	0	$27^{10(1)}$

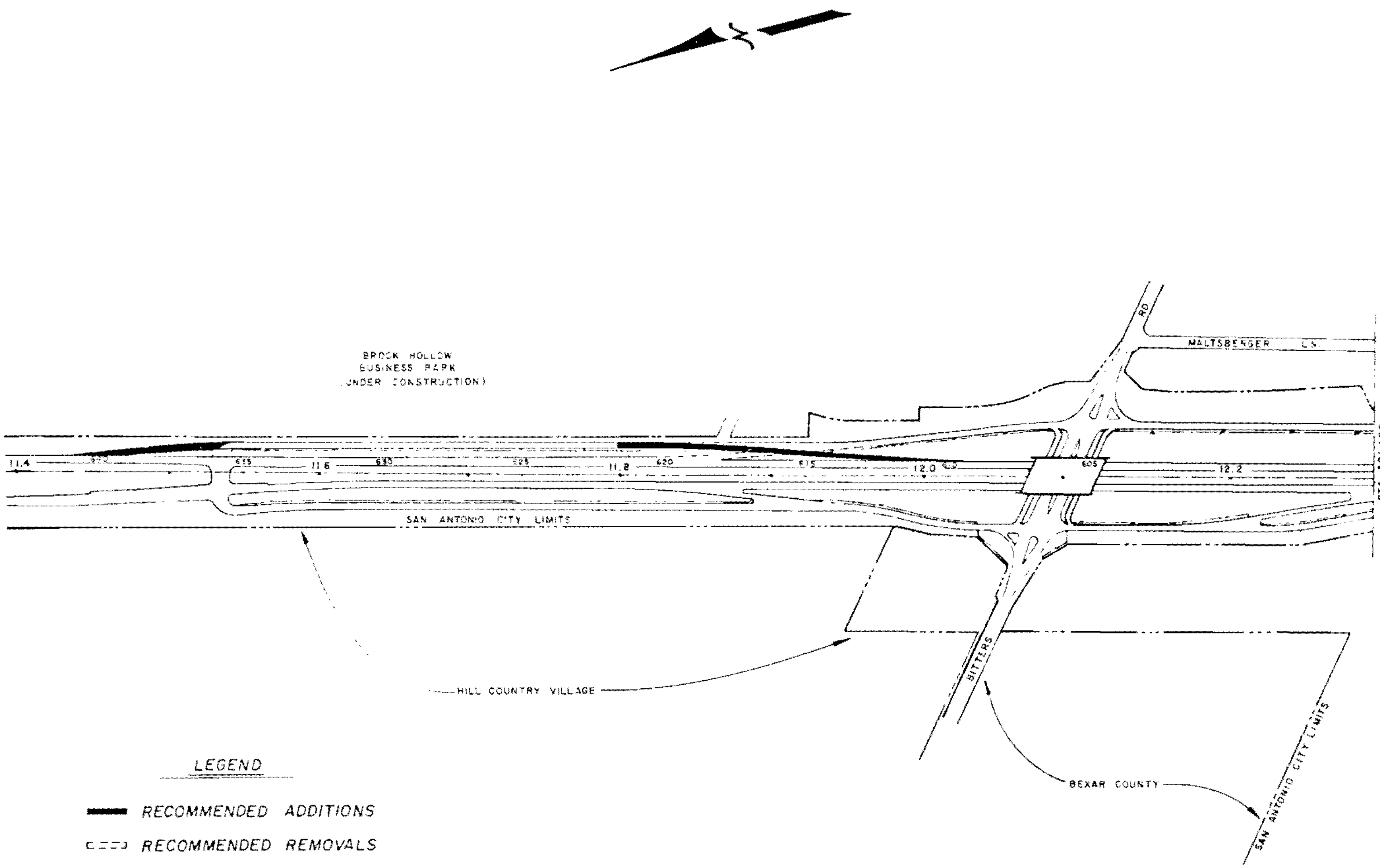
TABLE K

1978 ACCIDENT HISTORY

I.H. 37

DIR.	LOC.	M.P.	DAY						NIGHT						TOT.
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	12.3						3'			1				4'
SB	FR	11.6	2		1'										3'
SB	FR	11.5	1		2										3
SB	FR	11.3	1'												1'
SB	FR	10.5			1										1
SB	FR	10.0			2			1							3
SB	FR	9.9	1	1'	3										5'
SB	FR	9.5	1'												1'
SB	FR	9.3			1										1
SB	FR	9.1						1'							1'
SB	FR	8.9								1					1
SB	FR	8.2							1'		1				2'
SB	FR	7.5			2	2'					1				5'
SB	FR	6.0	2		6^3						1				9^3
SB	FR	4.9						1							1
TOTAL			8^2	1'	18^4	2'	0	6^2	1'	1	4	0	0	0	41^{11}

TABLE I.



LEGEND

RECOMMENDED ADDITIONS

RECOMMENDED REMOVALS

FIGURE 1

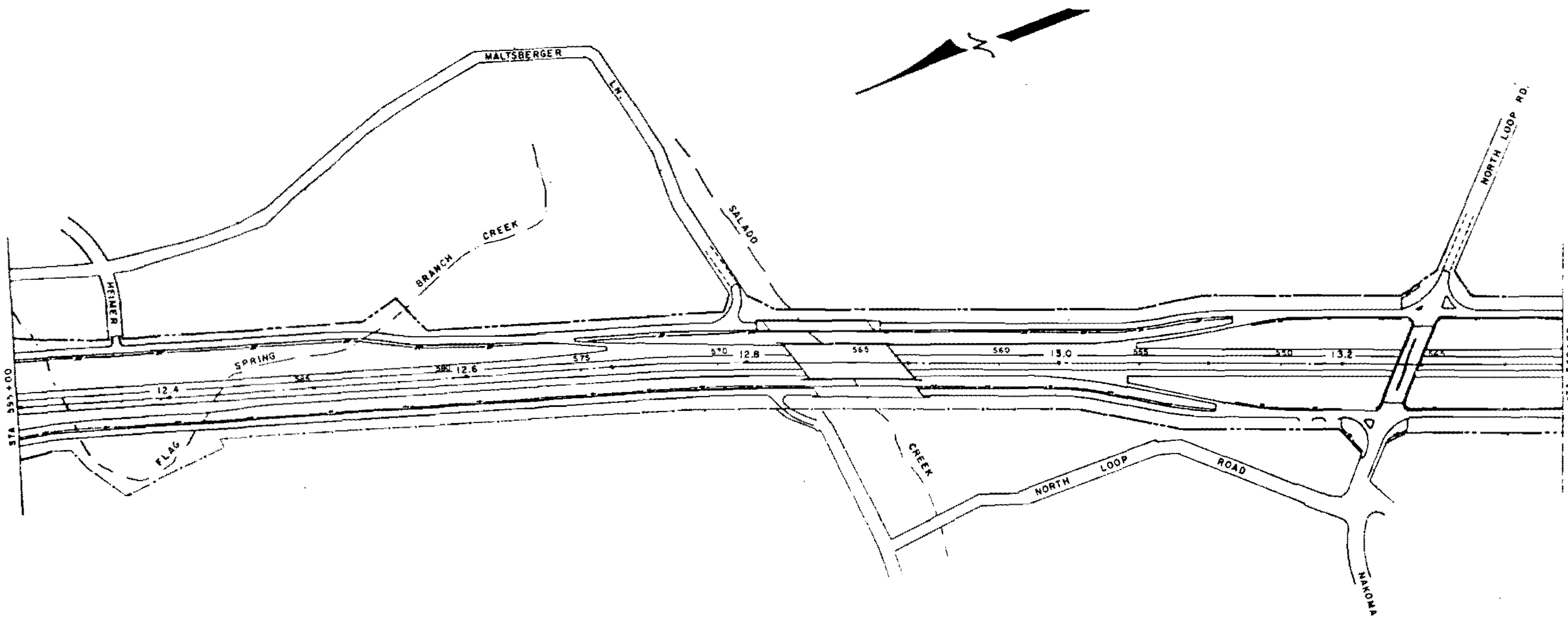

MALTSBERGER
LN.
SALADO
CREEK
BRANCH
CREEK
SPRING
FLAG
HEIMER
NORTH LOOP RD.
NORTH LOOP ROAD
NAKOMA
STA 540+00
12.4
12.6
12.8
13.0
13.2
575
570
565
560
555
550
545

FIGURE 2

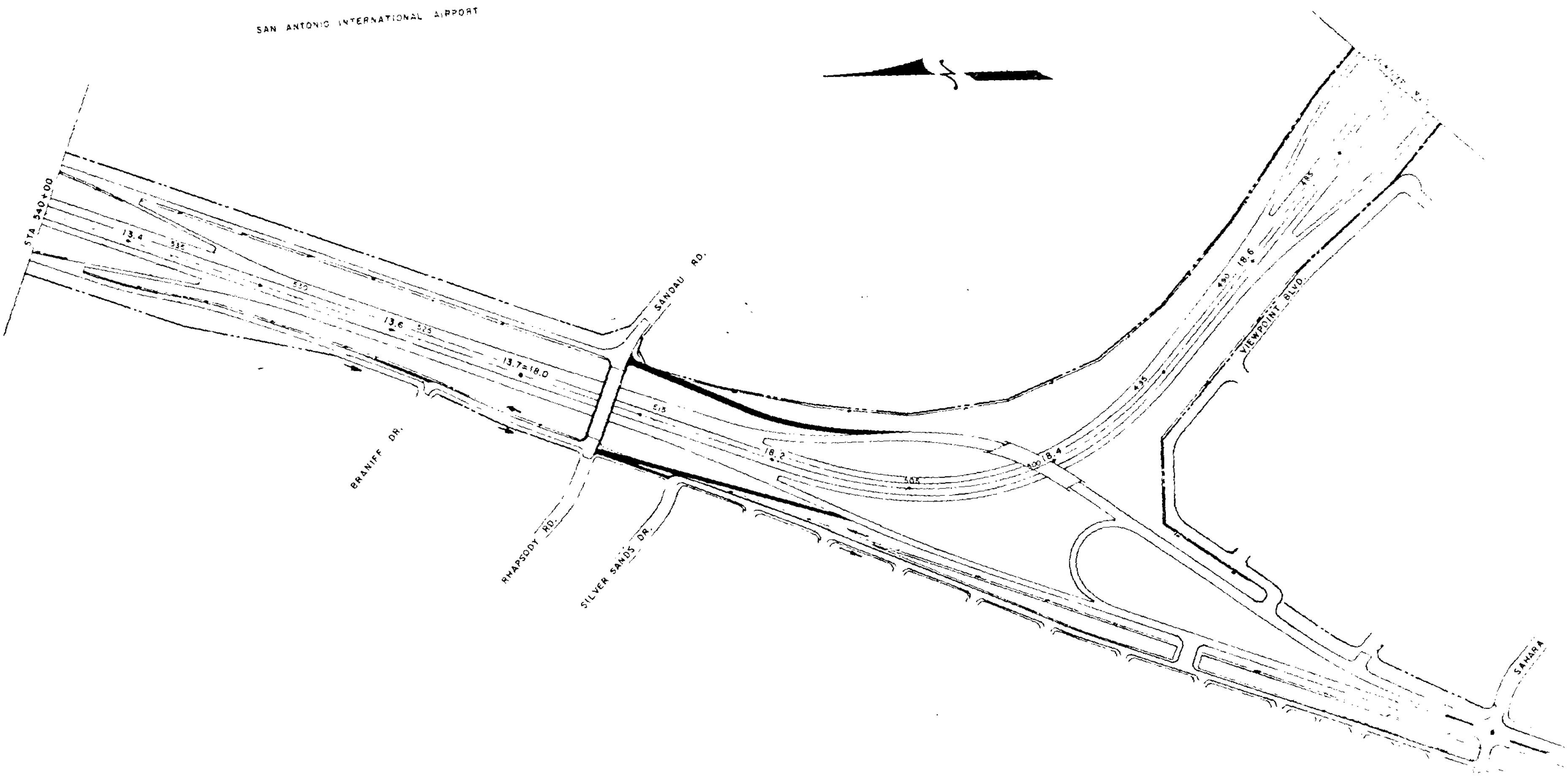

SAN ANTONIO INTERNATIONAL AIRPORT
STA 540+00
13.4
13.6
13.7=18.0
18.2
18.4
18.6
SANDAU RD.
BRANIFF DR.
RHAPSODY RD.
SILVER SANDS DR.
VIEWPOINT BLVD.
SAHARA

FIGURE 3

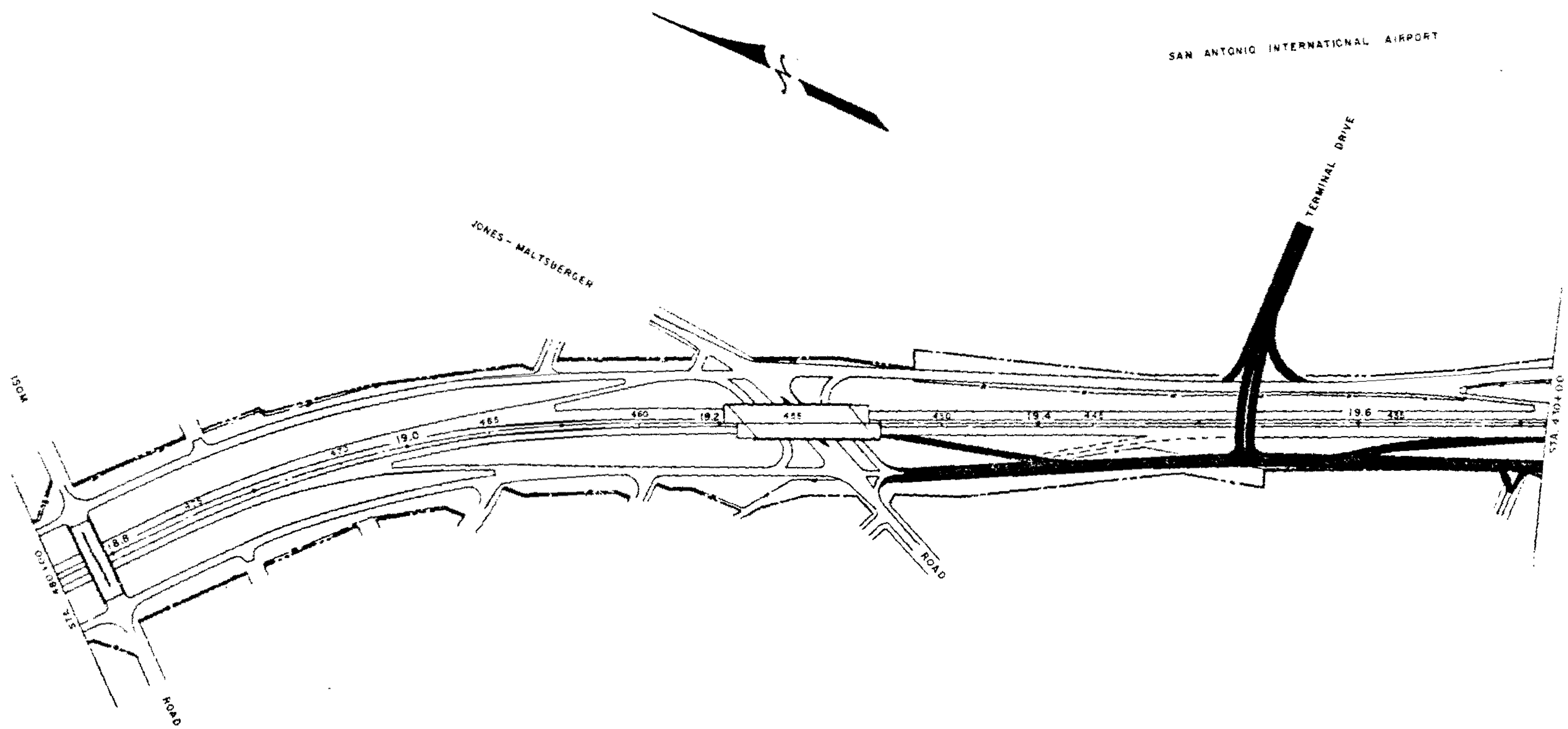

SAN ANTONIO INTERNATIONAL AIRPORT
TERMINAL DRIVE
JONES - MALTSBERGER
ROAD
ISOM
ROAD
STA. 480+00
STA. 430+00
19.6
19.4
19.2
19.0
18.8
460
465

FIGURE 4

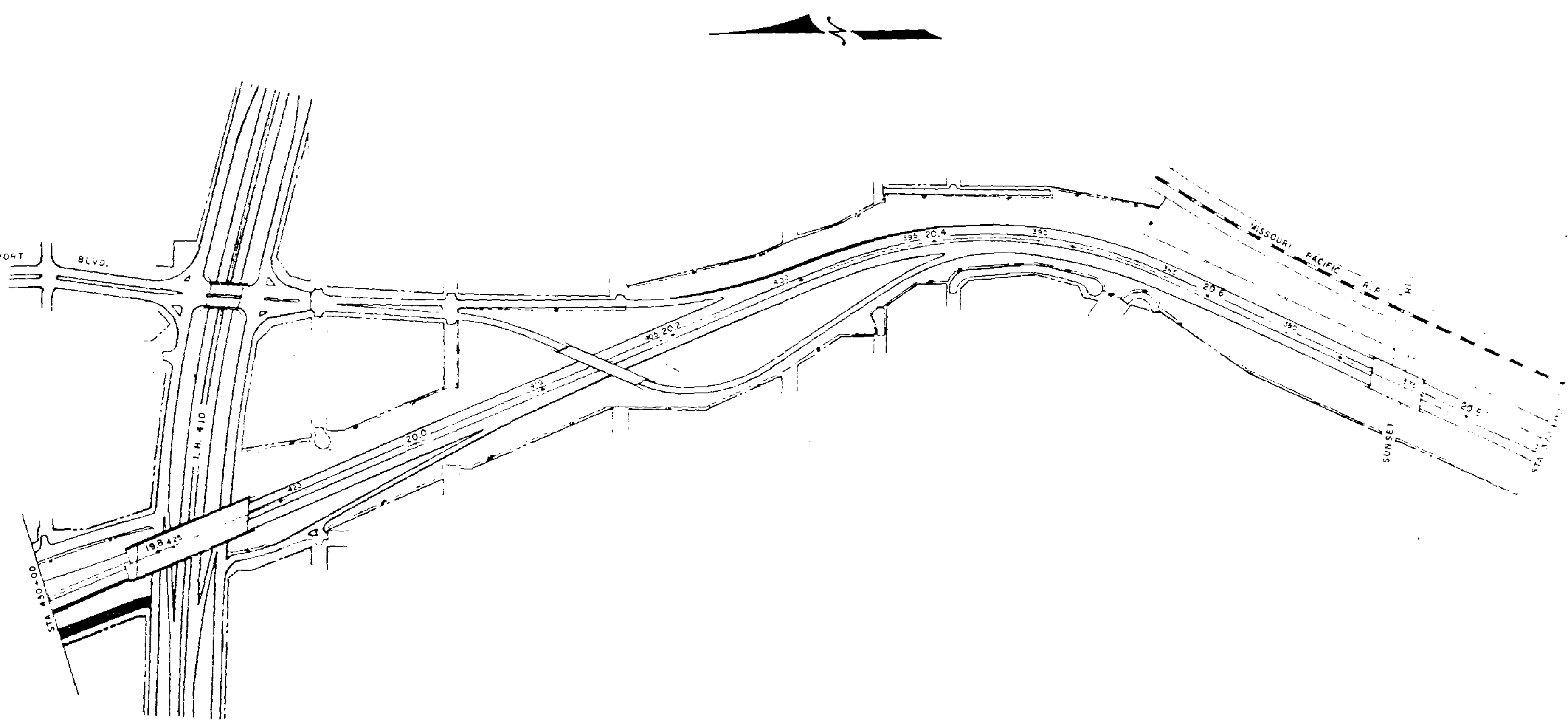

AIRPORT BLVD.
I.H. 410
MISSOURI PACIFIC R.R.
SUNSET
19.8 425
20.0
20.2
20.4
20.6
20.5
STA 430+00

FIGURE 5

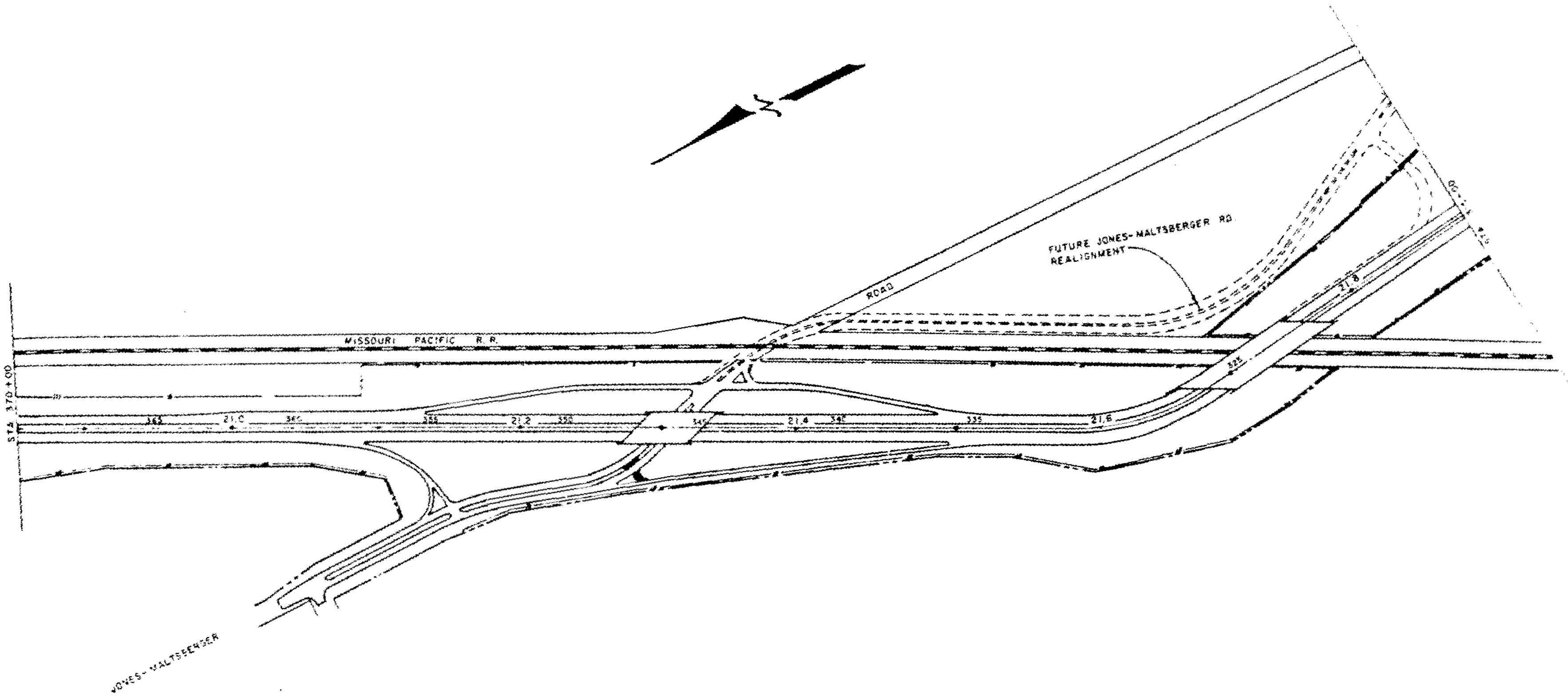

N
ROAD
FUTURE JONES-MALTSBERGER RD. REALIGNMENT
MISSOURI PACIFIC R.R.
STA 370+00
365
21.0
360
355
21.2
350
345
21.4
340
335
21.6
325
21.8
JONES-MALTSBERGER

FIGURE 6

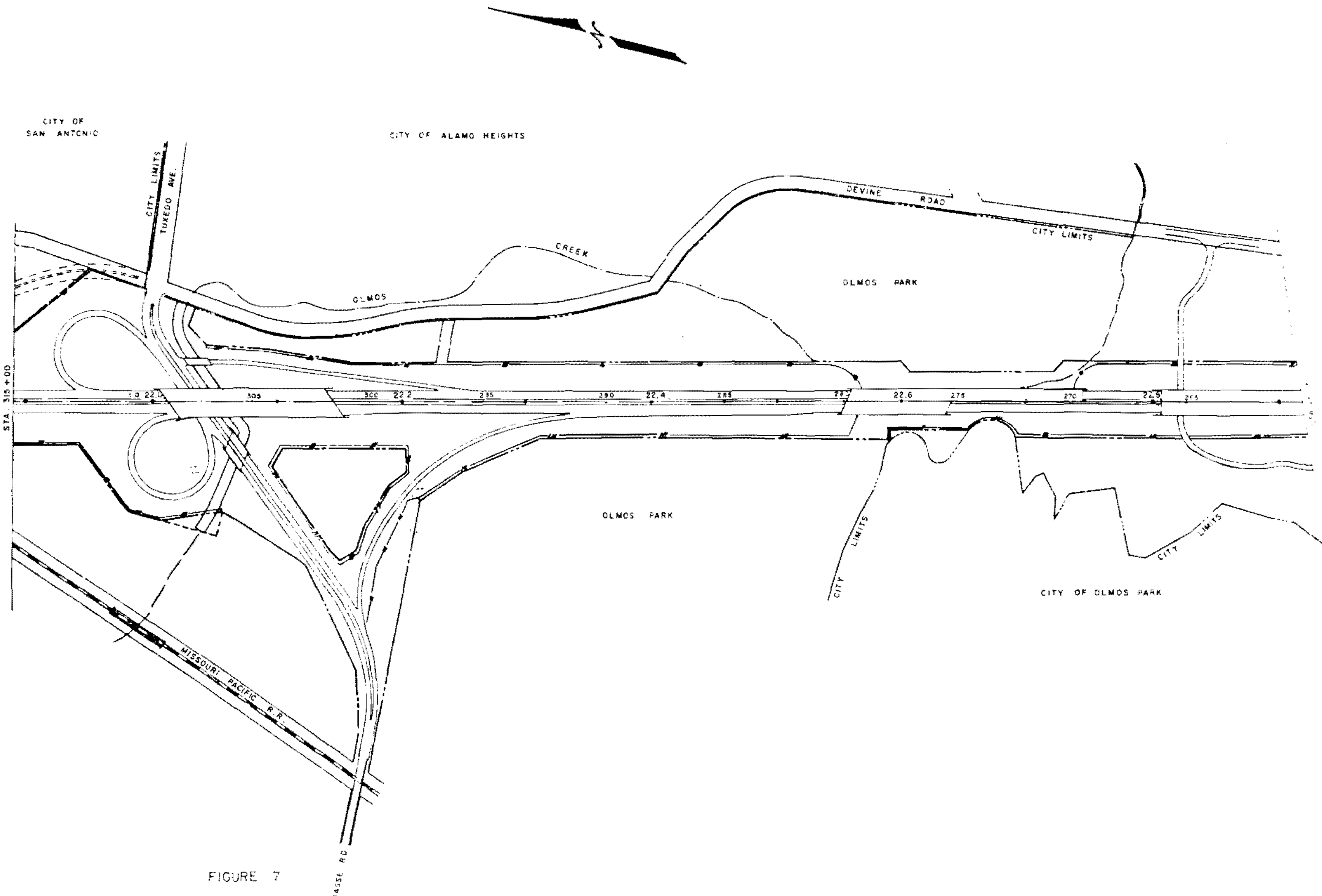

CITY OF SAN ANTONIO
CITY OF ALAMO HEIGHTS
CITY LIMITS
TUXEDO AVE.
DEVINE ROAD
CITY LIMITS
OLMOS CREEK
OLMOS PARK
OLMOS PARK
CITY LIMITS
CITY LIMITS
CITY OF OLMOS PARK
STA 315+00
305
300
22.2
295
290
22.4
285
22.6
275
270
22.5
265
MISSOURI PACIFIC R.R.
BASSE RD

FIGURE 7

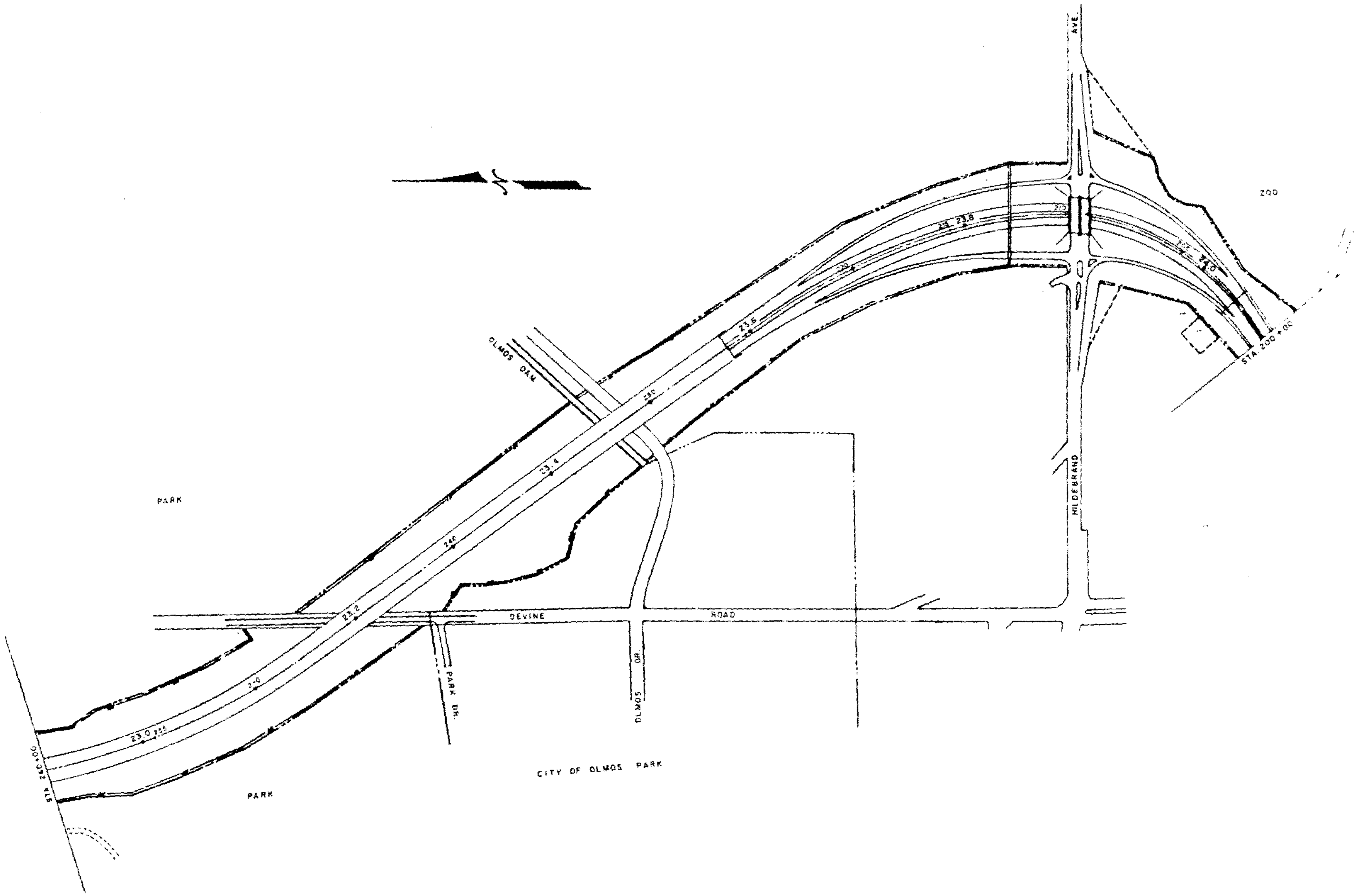

ZOO
STA 200+00
AVE.
HILDEBRAND
23.8
23.6
OLMOS DAM
23.4
23.2
DEVINE
ROAD
PARK DR.
OLMOS DR
23.0
STA 260+00
PARK
PARK
CITY OF OLMOS PARK

FIGURE 8

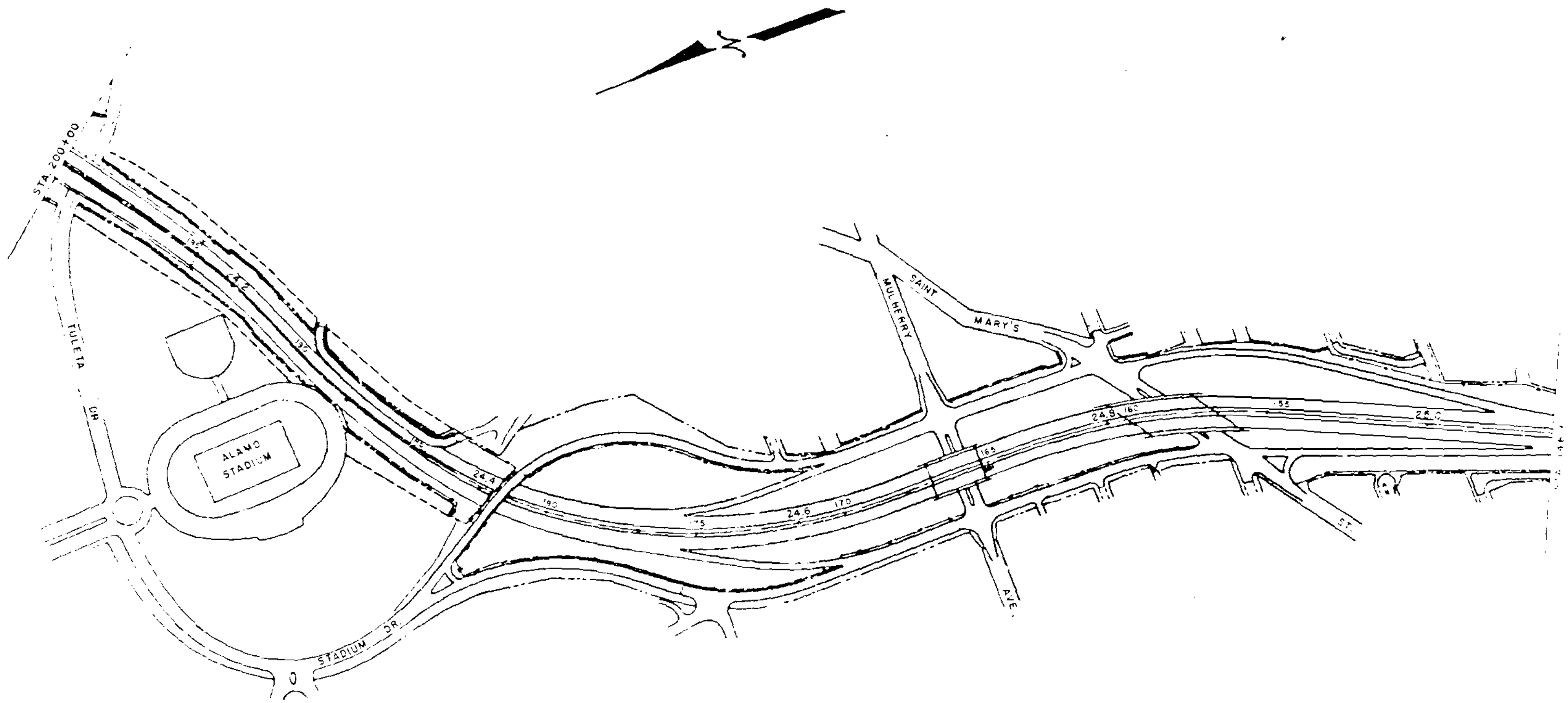

STA 200+00
TULETA DR
ALAMO STADIUM
STADIUM DR
MULBERRY
SAINT MARY'S
AVE.
ST.

FIGURE 9

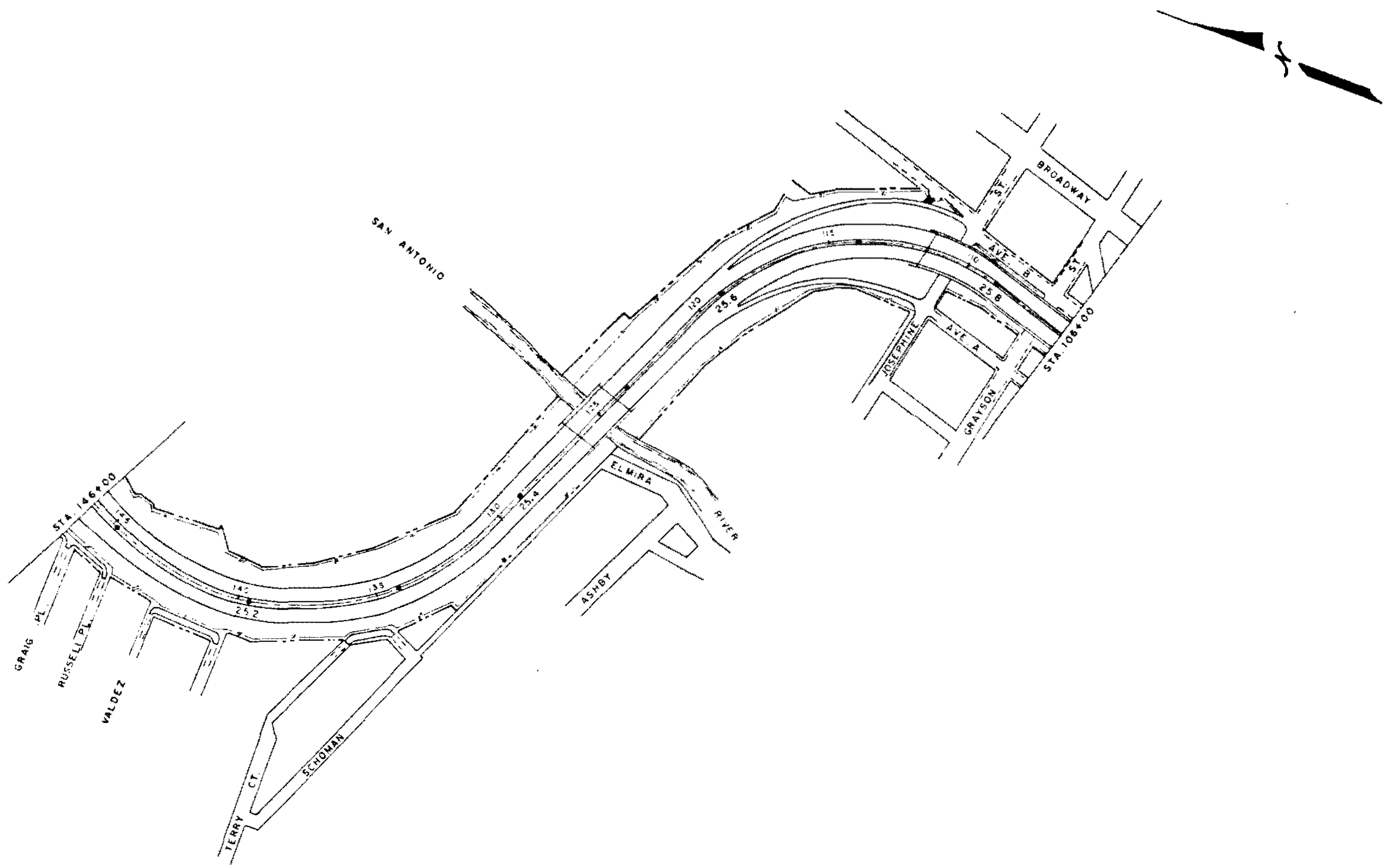

BROADWAY
ST
AVE B
ST
STA 106+00
25.8
AVE A
GRAYSON
JOSEPHINE
25.6
SAN ANTONIO
ELMIRA
RIVER
ASHBY
25.4
SCHOMAN
TERRY
CT
25.2
STA 146+00
GRAIG PL
RUSSELL PL
VALDEZ

FIGURE 10

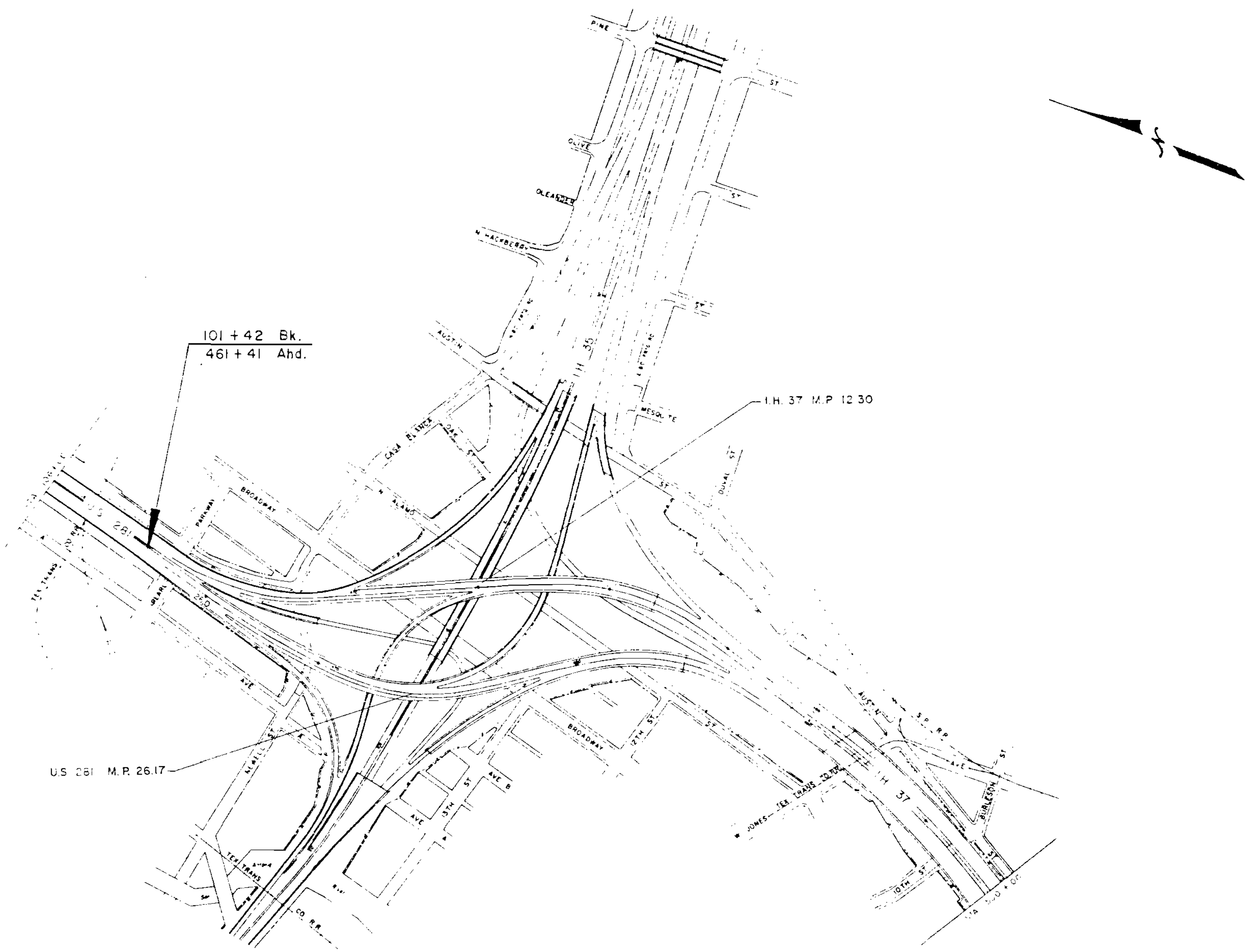

101 + 42 Bk.
461 + 41 Ahd.
I.H. 37 M.P. 12.30
U.S. 281 M.P. 26.17
I.H. 35
I.H. 37
U.S. 281
PINE
OLIVE
OLEANDER
MESQUITE
DUVAL ST
AUSTIN
BROADWAY
PARKWAY
N. ALAMO
CASA BLANCA
OAK ST
AVE B
13TH ST
10TH ST
BURLESON
S.P. RR

FIGURE 11

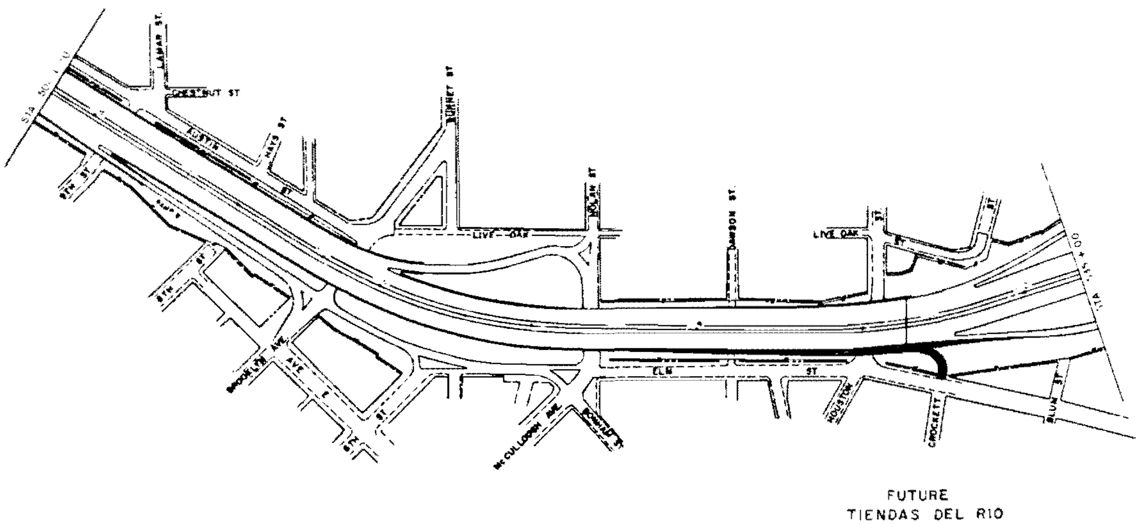

LAMAR ST.
CHESTNUT ST
HAYS ST
BURNET ST
NOLAN ST
DAWSON ST
LIVE OAK
LIVE OAK
ELM ST
HOUSTON
CROCKETT
BLUM ST
McCULLOUGH AVE
BROOKLYN AVE
FUTURE
TIENDAS DEL RIO

FIGURE 12

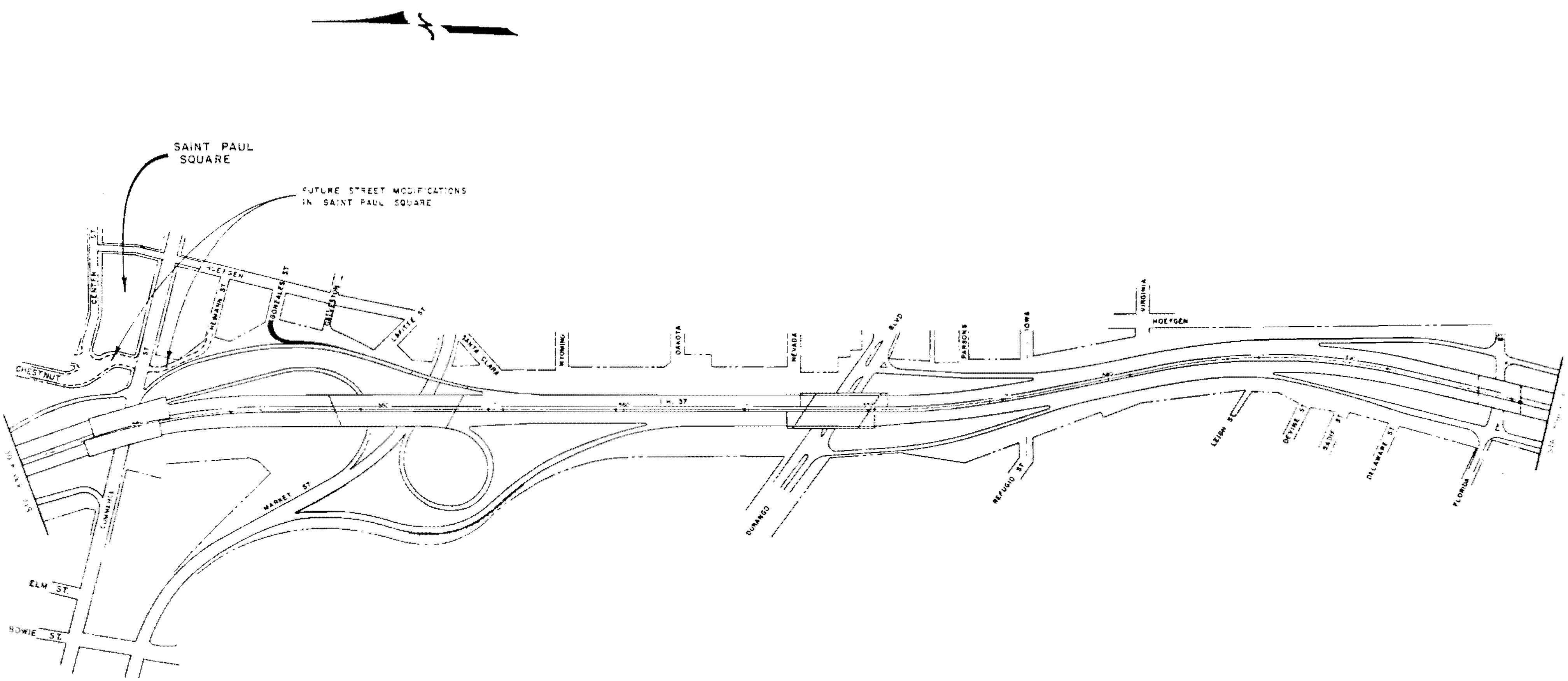

SAINT PAUL SQUARE
FUTURE STREET MODIFICATIONS IN SAINT PAUL SQUARE
CENTER ST
CHESTNUT
HOEFGEN
HEMANN ST
GONZALES ST
LAFITTE ST
SANTA CLARA
WYOMING
DAKOTA
NEVADA
BLVD
PARSONS
IOWA
VIRGINIA
HOEFGEN
I. H. 37
MARKET ST
COMMERCE
ELM ST.
BOWIE ST.
DURANGO
REFUGIO ST
LEIGH ST
DEVINE ST
SADIE ST
DELAWARE ST
FLORIDA

FIGURE 13

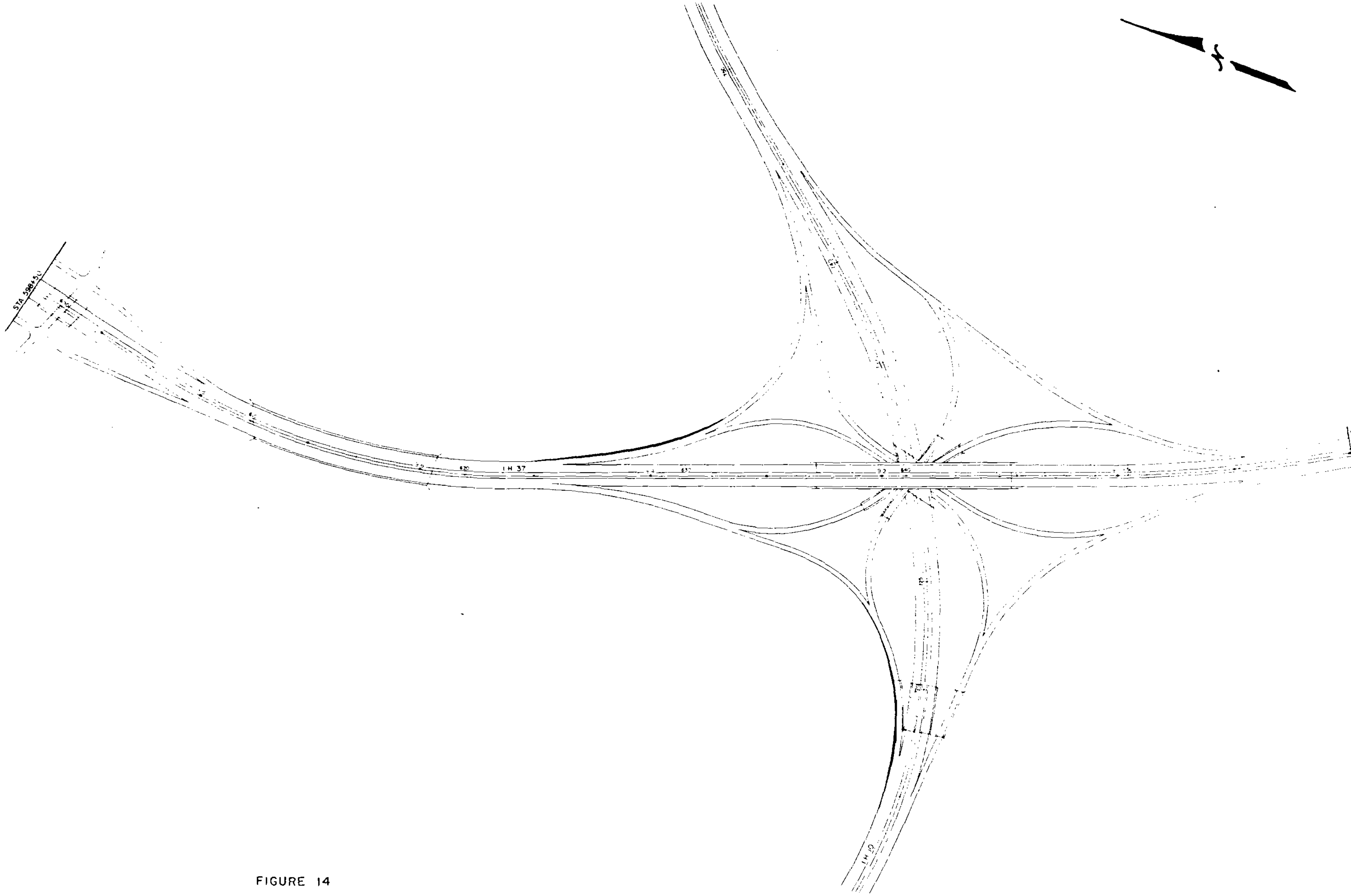
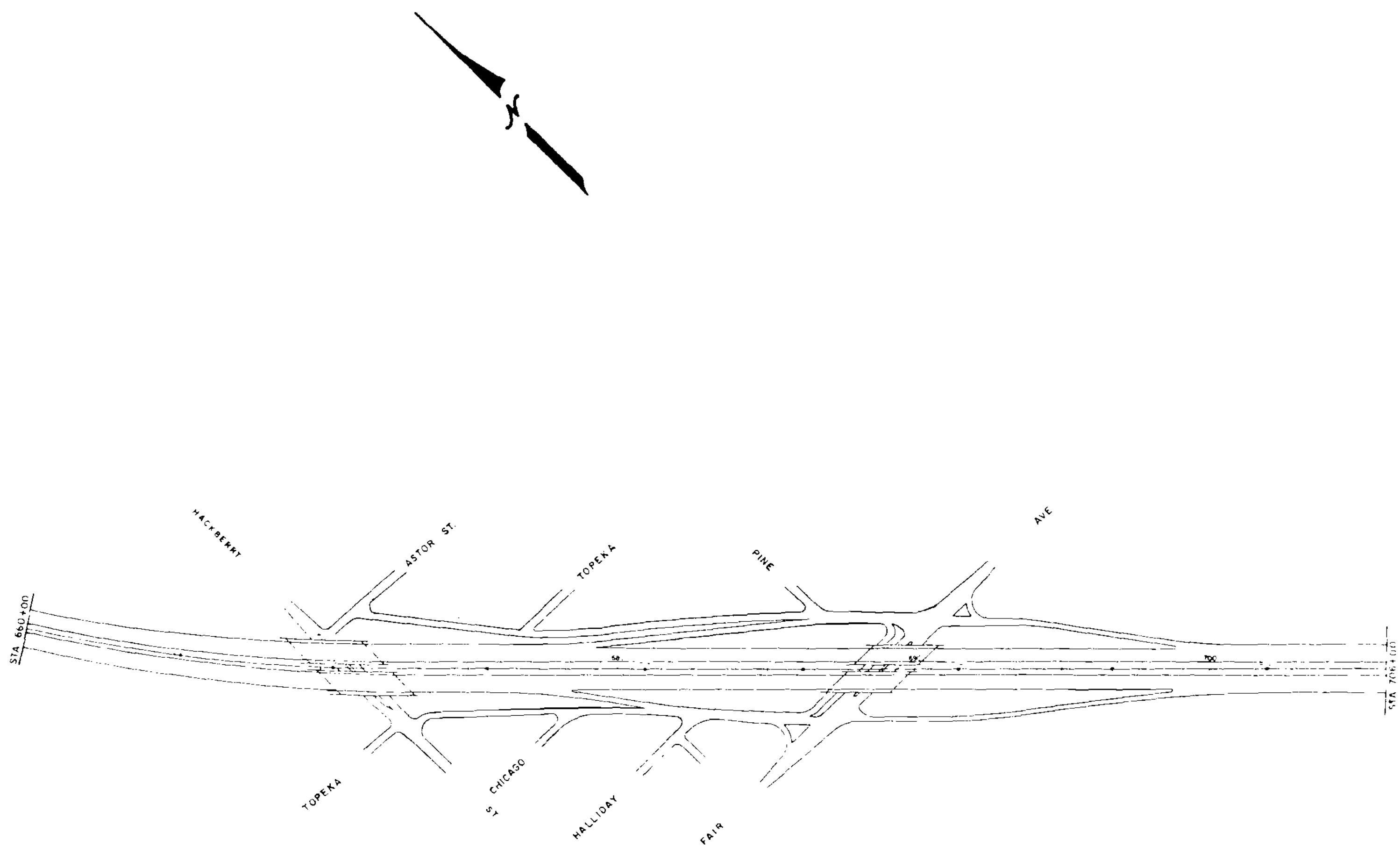
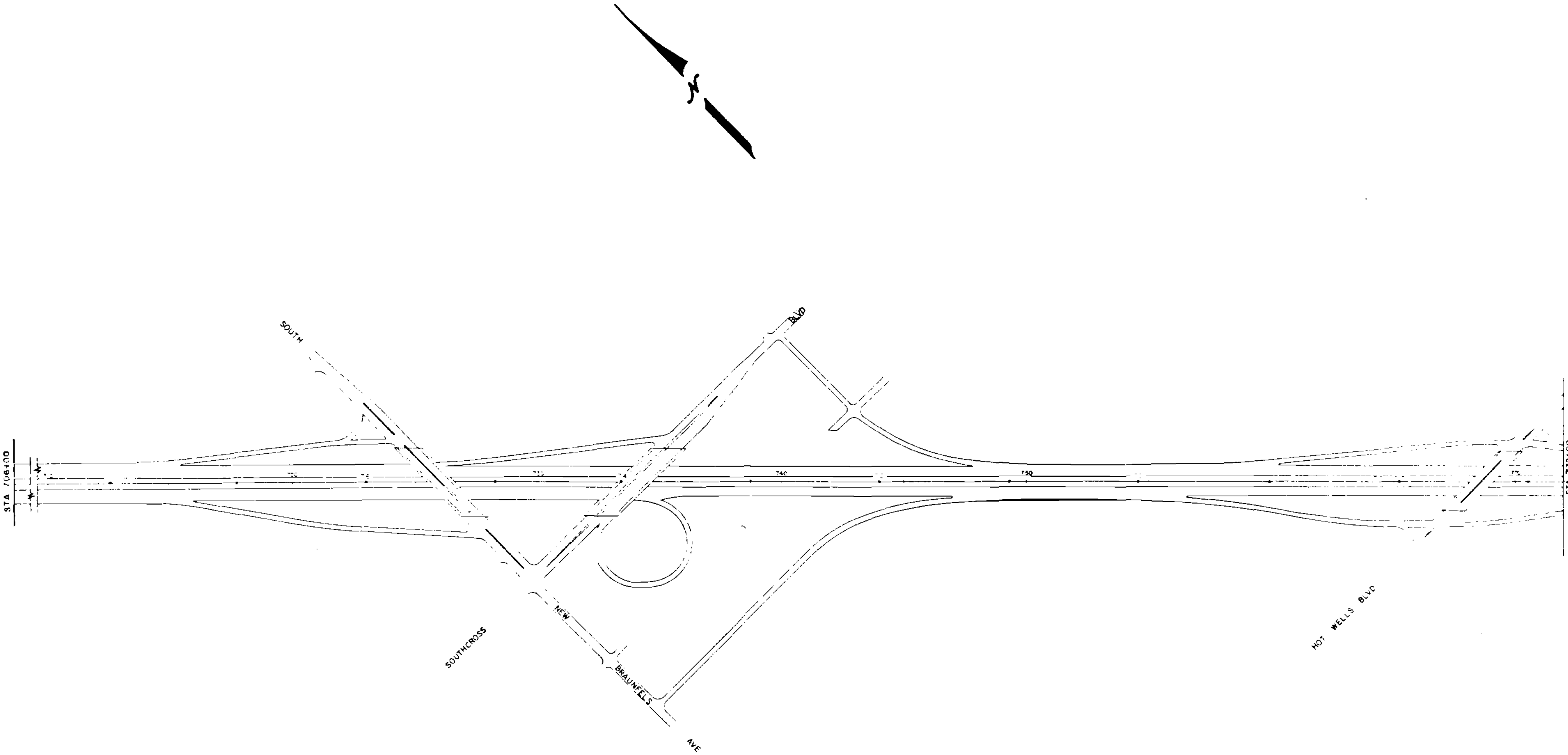


FIGURE 14



N
HACKBERRY
ASTOR ST.
TOPEKA
PINE
AVE
STA 660+00
STA 706+00
TOPEKA
CHICAGO
ST
HALLIDAY
FAIR

FIGURE 15



STA 706+00
STA 772+00
SOUTH
BLVD
SOUTHCROSS
NEW
BRAUNFELS
AVE
HOT WELLS BLVD

FIGURE 16

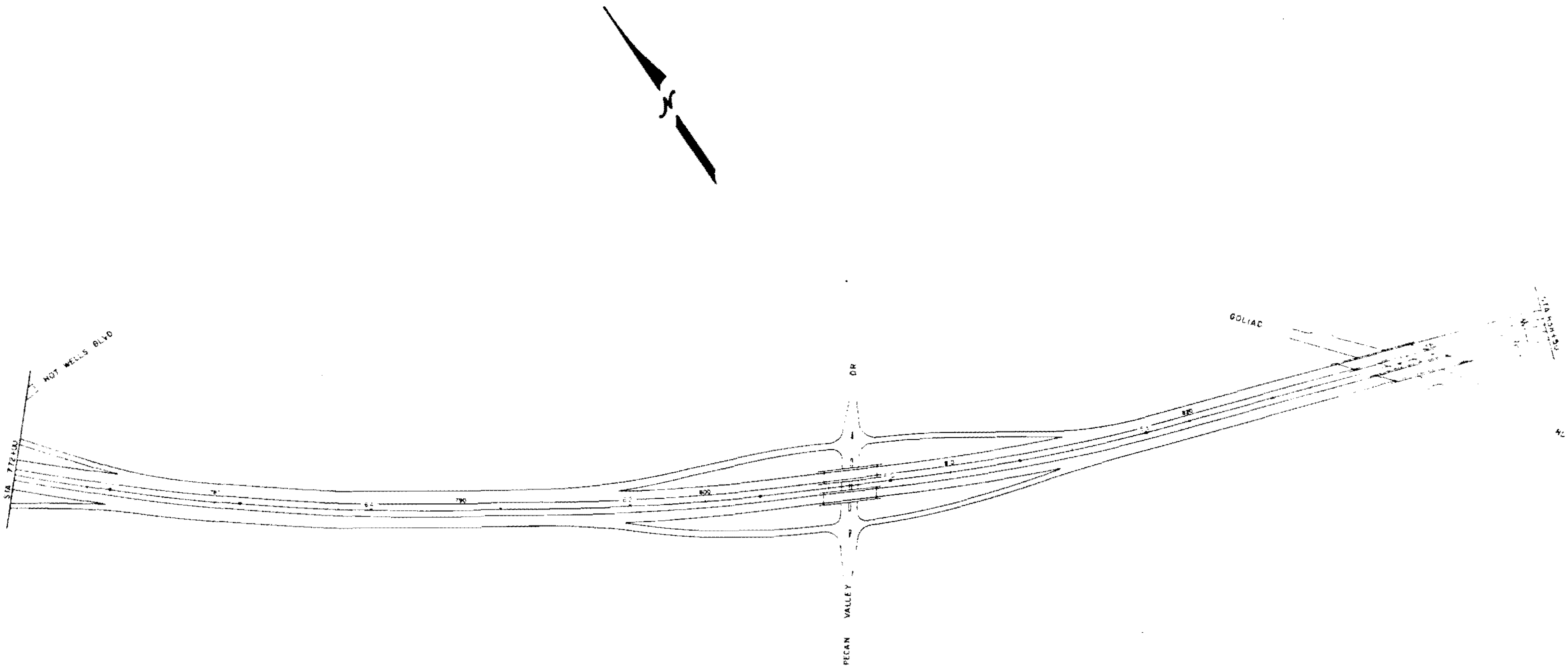


FIGURE 17

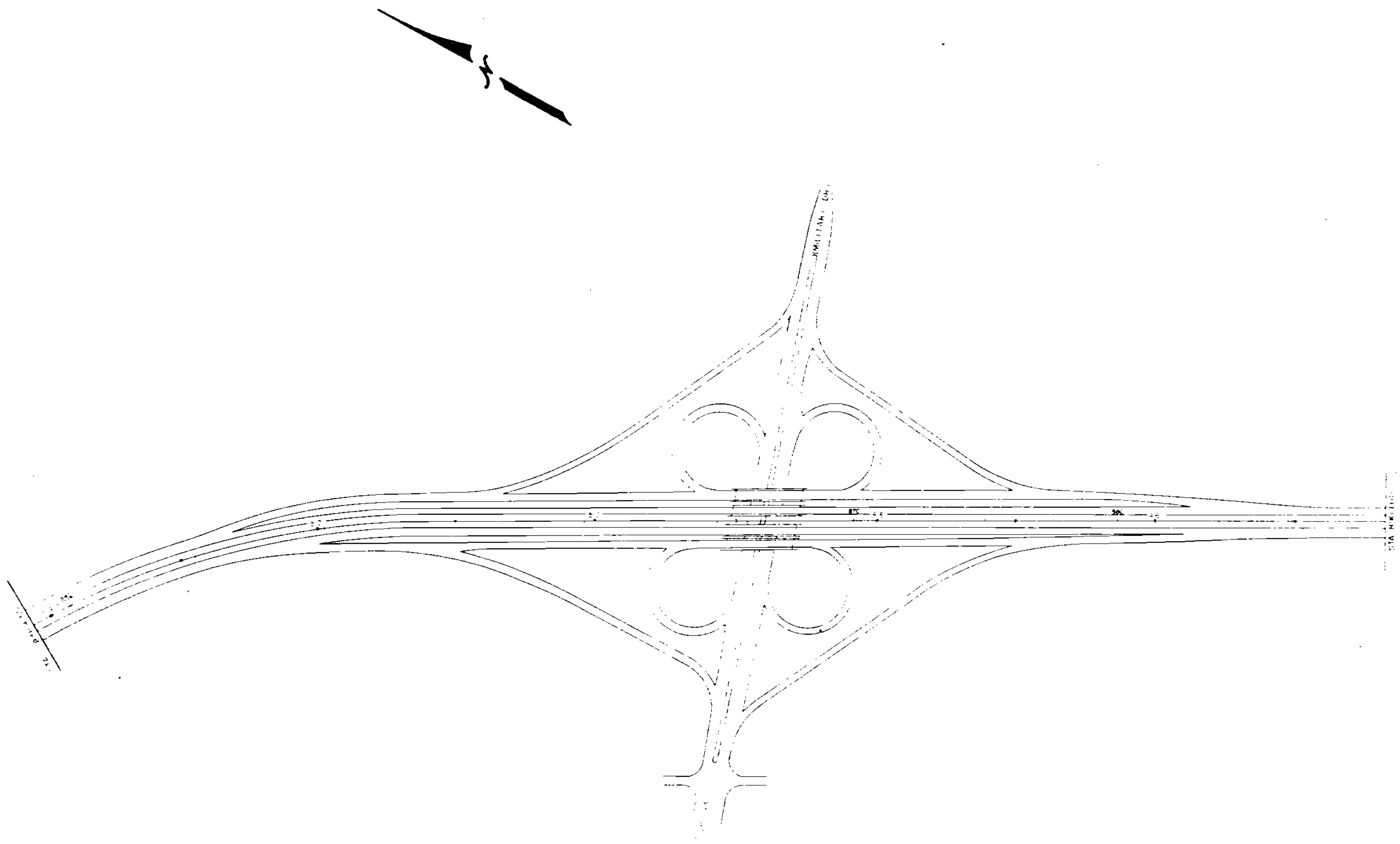


FIGURE 18

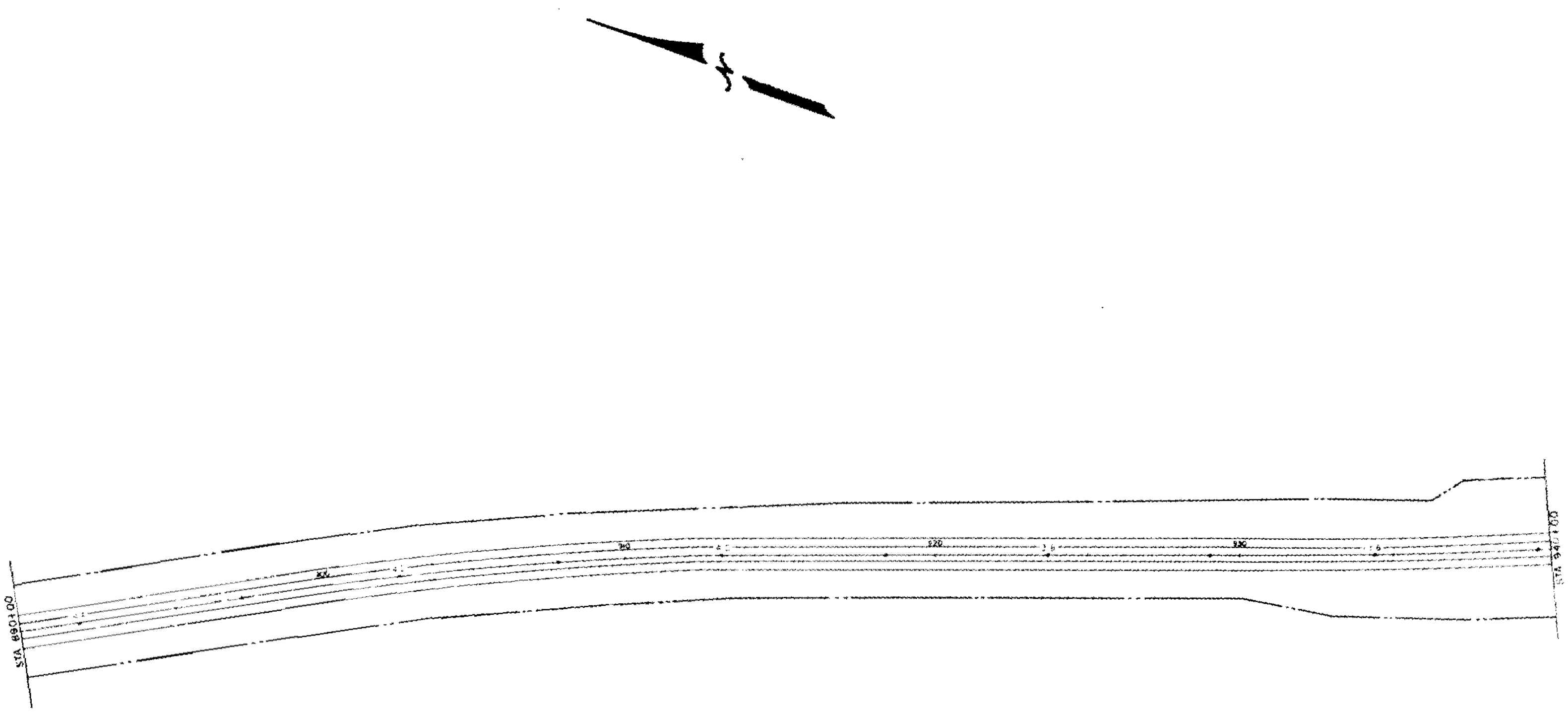


FIGURE 19

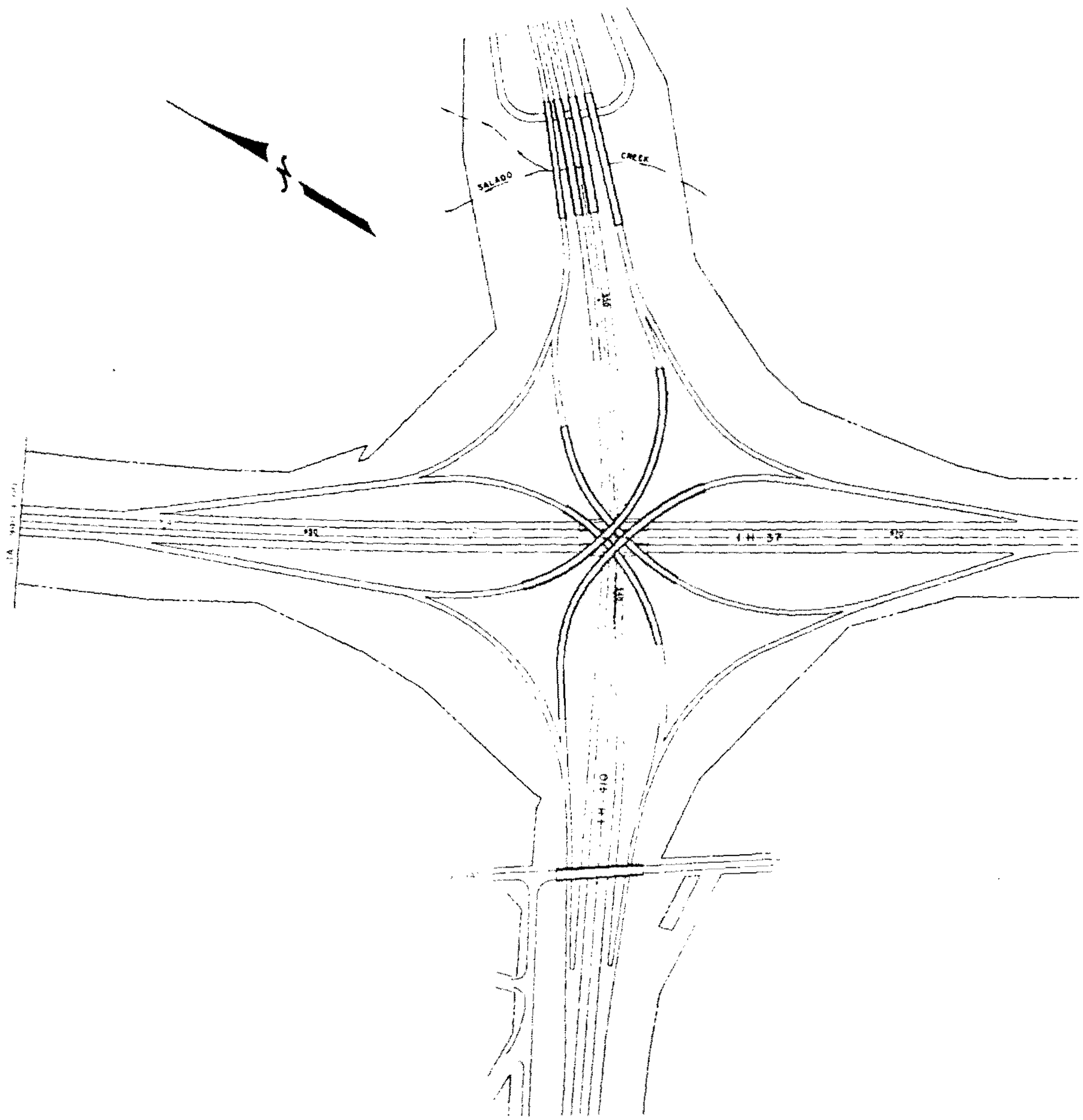
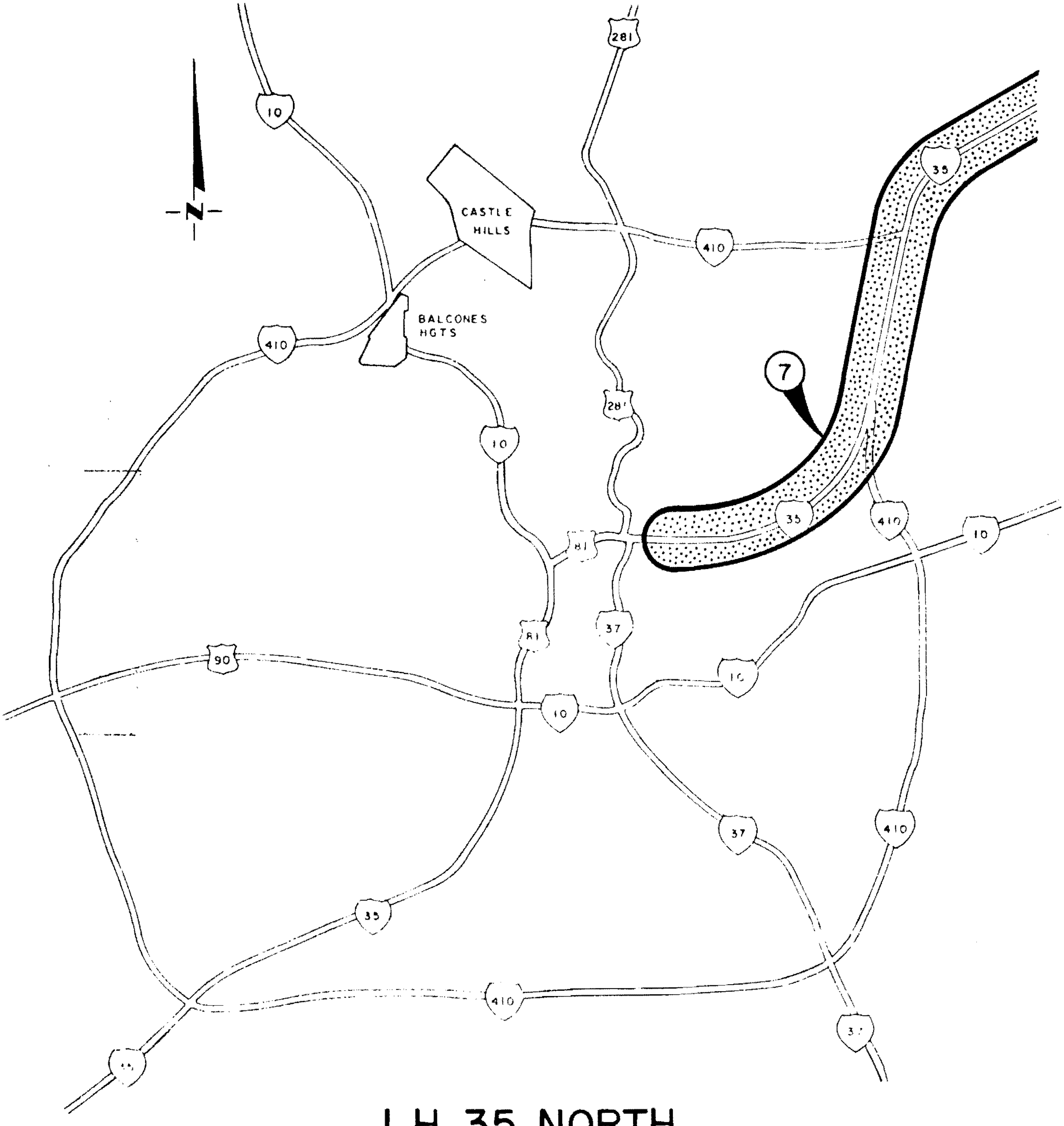


FIGURE 20



I. H. 35 NORTH

FREEWAY OPERATIONS STUDY

FROM: PINE STREET
TO: BEXAR-GUADALUPE COUNTY LINE

INTRODUCTION

This study will identify the areas that were capacity deficient in 1978 and expose the areas where access is not easily available. It will also identify the areas that were high accident locations.

Once these locations have been identified, this study will provide recommendations as to what measures should be taken to solve the problems.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10, the Department's Planning and Research Division in Austin. They provided traffic volumes for the mainlanes, ramps, frontage roads and turning movements at the interchanges and intersections. Level of service was calculated for all conditions to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing". The high accident locations could therefore be identified. A breakdown of these accidents can be found in Table A through L.

The areas where access is not easily available were identified by citizens and police participation and from observations made by this office and the San Antonio Public Works Department. This office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio Public Works Department notifies us of any problem areas they have noticed or have received complaints about.

After analysing the problem areas and proposing solutions, the anticipated impact of the solutions was determined by applying present traffic volumes.

GENERAL DISCUSSION

The limits of this study on I.H.35 north are from Pine Street to the Bexar-Guadalupe County Line. The existing roadway, from Pine Street to Judson Road, can be seen in FIGURE 1 through 12. The recommended solutions made by this study can be seen in FIGURE 1 through 7 and will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this study. Presently, there is a construction project underway within the limits of the study. The limits of construction are from just south of Walzem Road to just north of

Starlight Terrace. The project includes adding additional mainlanes, improving the connectors in the Fratt Interchange, providing additional access and converting the two-way frontage roads to one-way. FIGURE 1A and 1B show the project as completed. Planned for construction, to go to contract by late 1981, is the reconstruction of I.H.35 from just north of Starlight Terrace to just north of Toepperwein Road. This project includes adding additional mainlanes, providing an interchange at Toepperwein Road and converting the two-way frontage roads to one-way. These improvements can be seen in FIGURE 2A which shows the project as completed. Also being planned for improvements is I.H.35 from Toepperwein Road to Selma. This project will add additional mainlanes, provide a cloverleaf interchange at F.M.1604, improve the traffic circulation near S.H.218, provide an interchange north of F.M.1604 and convert the two-way frontage roads to one-way.

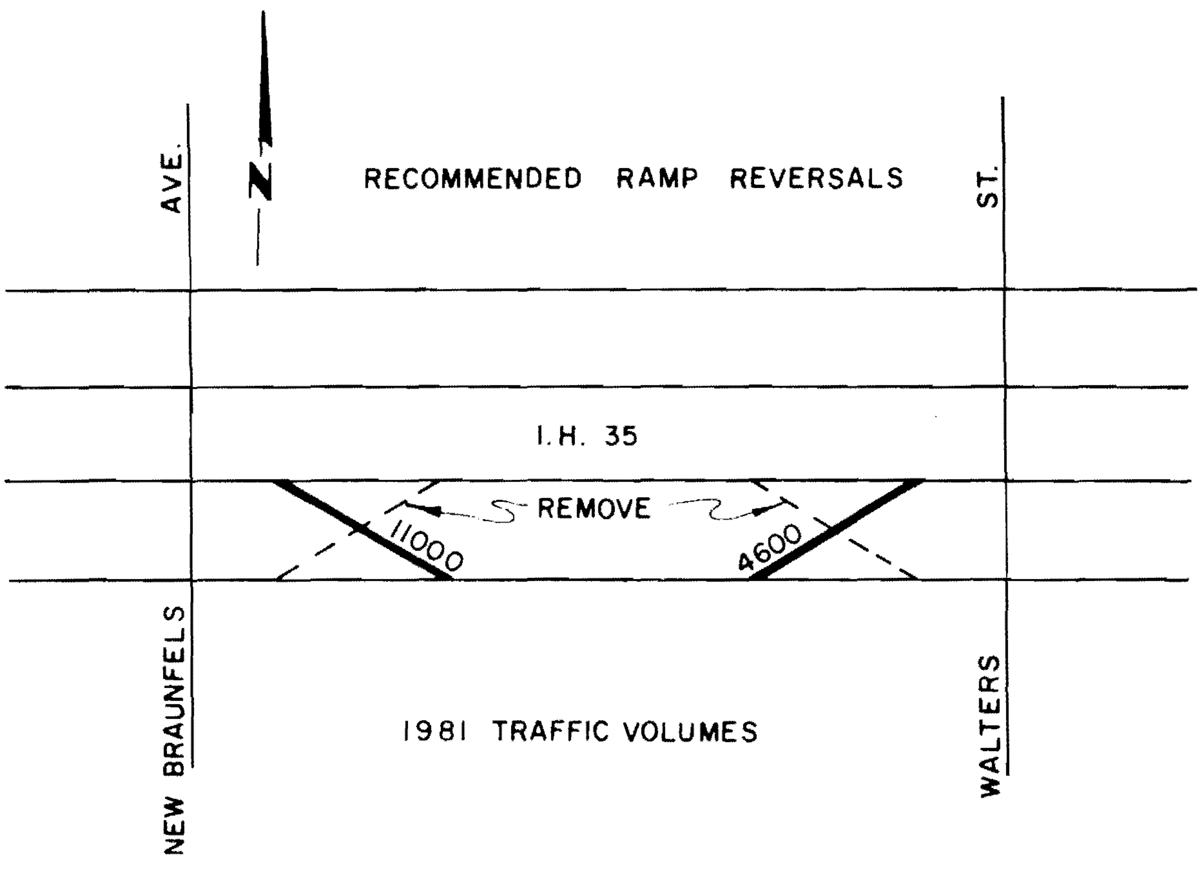
PROBLEMS AND RECOMMENDED SOLUTIONS

PROBLEM: Eastbound mainlane weaving problem near Pine Street

The I.H.37 - U.S.281 entrance to I.H.35 eastbound mainlanes is a high volume two lane entrance and I.H.35 has two mainlanes. The high volume entrance has created a weaving problem between this entrance and the exit to New Braunfels. I.H.35 is being planned for widening to three mainlanes through the I.H.37 - U.S.281 interchange. It is recommended that the additional mainlane continue through the interchange to the exit to New Braunfels. An additional mainlane should be added from the New Braunfels Street exit to the Walters Street exit to accommodate the high volume.

PROBLEM: Mainlane backups on eastbound exit to Walters Street

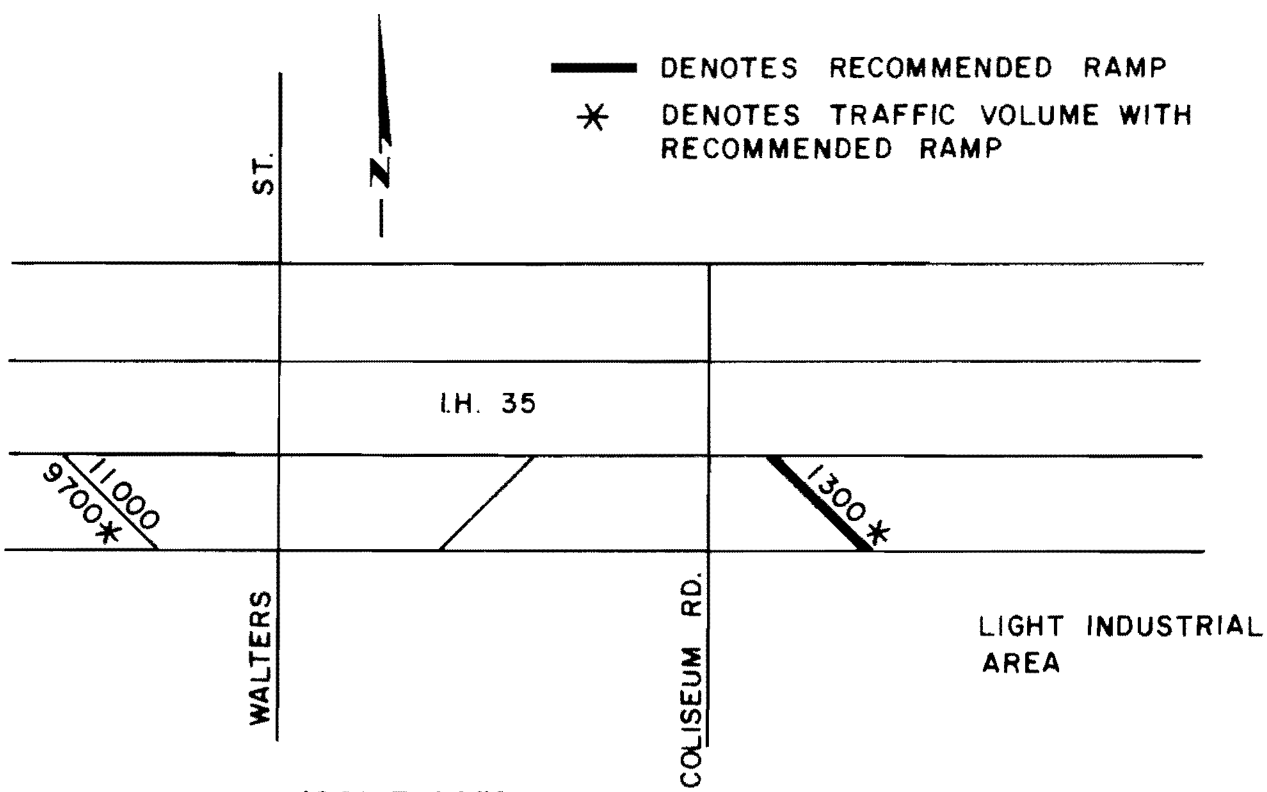
The eastbound exit to Walters Street is a high volume exit and mainlane backups are being experienced in the peak hours. These backups are creating unnecessary congestion on the mainlanes. If the eastbound ramps were reversed between New Braunfels Ave. and Walters



Street the high volume exiting traffic can be accommodated on the frontage road and the mainlane backups will be eliminated.

PROBLEM: Better access needed to the land adjacent to I.H.35 east of Coliseum Road

The land adjacent to I.H.35 east of Coliseum Road has developed into a light industrial area. This development has generated high truck traffic volumes which presently have to exit at Walters Street and have to travel through the Walters Street and Coliseum Road interchange to gain access to the area. By providing an eastbound exit just east of Coliseum Road the volume at these two inter-

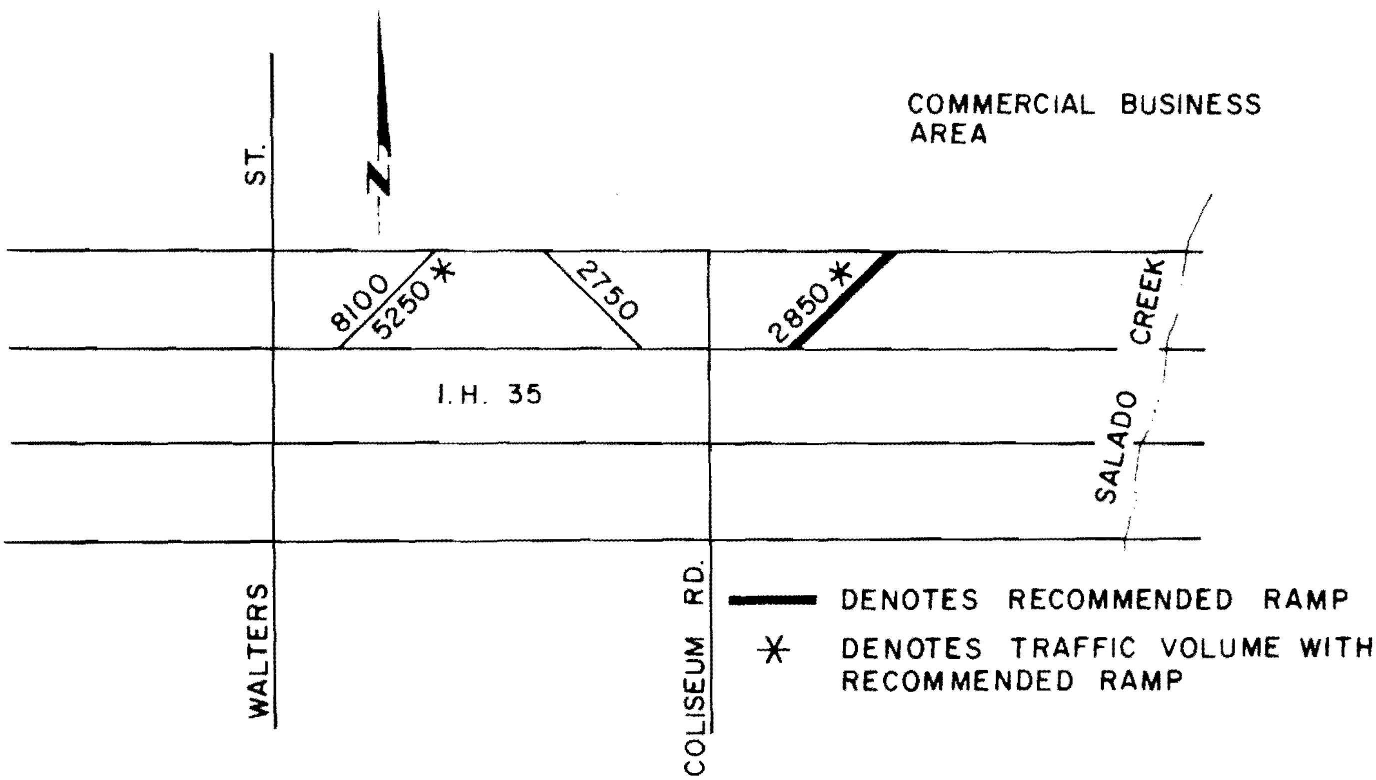


1981 TRAFFIC VOLUMES

changes will be reduced and a more direct access to the light industrial area will be provided.

PROBLEM: Better westbound mainlane access needed from the land adjacent to I.H.35 east of Coliseum Road

The land north of I.H.35 between Coliseum Road and Salado Creek has developed into a commercial business area. The high traffic volume generated by this area does not have easy access to the I.H.35 westbound mainlanes. They presently have to travel through the Coliseum interchange and through the short frontage road weaving section between Coliseum Road and Walters Street to gain access to the mainlanes.



1981 TRAFFIC VOLUMES

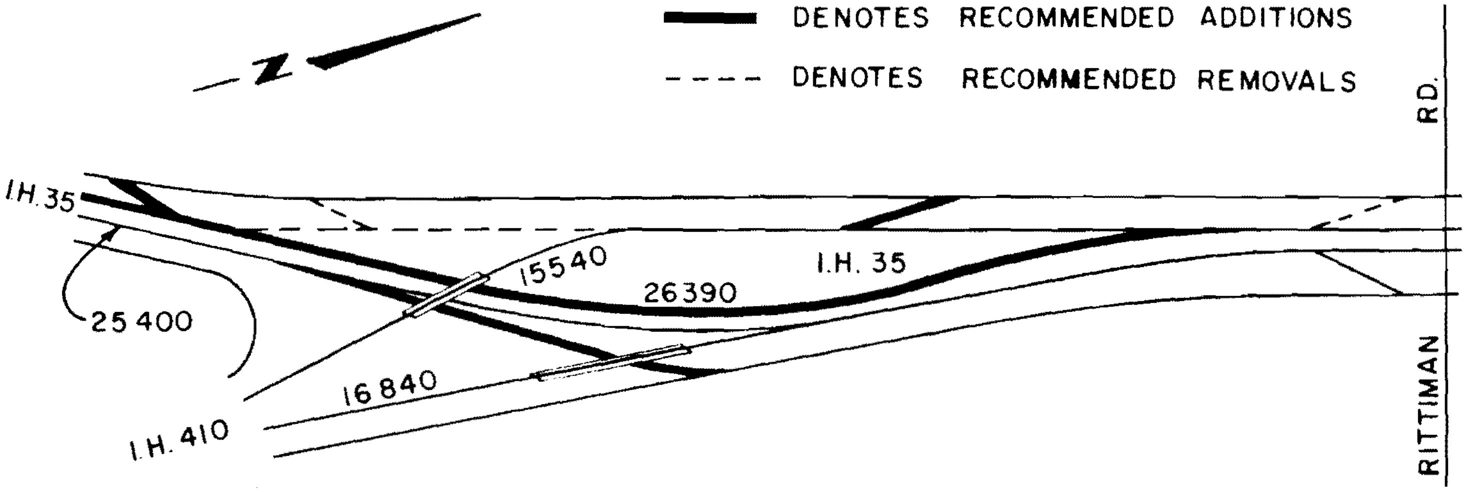
By providing a westbound entrance ramp just east of Coliseum Road a more direct access will be provided. The existing high volume westbound entrance ramp and short weaving section volume will also be reduced.

PROBLEM: Congestion in Binz-Engleman Road interchange

The increasing traffic volumes in the Binz-Engleman Road interchange has created congestion and excessive delay. The installation of traffic signals on the I.H.410-I.H.35 connector, north frontage road intersections with F.M.78 and with the I.H.35 south frontage road will reduce the delay and improve the flow of traffic through the interchange.

PROBLEM: Mainlane congestion on I.H.35 mainlanes between I.H.410 and Rittiman Road.

The increasing traffic volume in the weaving sections on both northbound and southbound I.H.35 mainlanes between I.H.410 and Rittiman Road have created an unacceptable mainlane level of service and a high accident rate. The left side I.H.410 exit from I.H.35 southbound has also become a problem with the increasing traffic volume. In order to improve the level of service, reduce the accident rate and eliminate the left side exit, the weaving sections and left



1981 TRAFFIC VOLUMES

side exit will have to be eliminated. This can be achieved by the following recommendations:

A. Realign the southbound mainlanes to run parallel with the northbound mainlanes and use the existing southbound mainlanes as a connector to I.H.410 southbound.

B. Provide an entrance ramp from the I.H.35 southbound frontage road to the recommended I.H.410 southbound connector. The frontage road traffic desiring to gain access to the I.H.35 southbound mainlanes may do so at the existing entrance ramp further south.

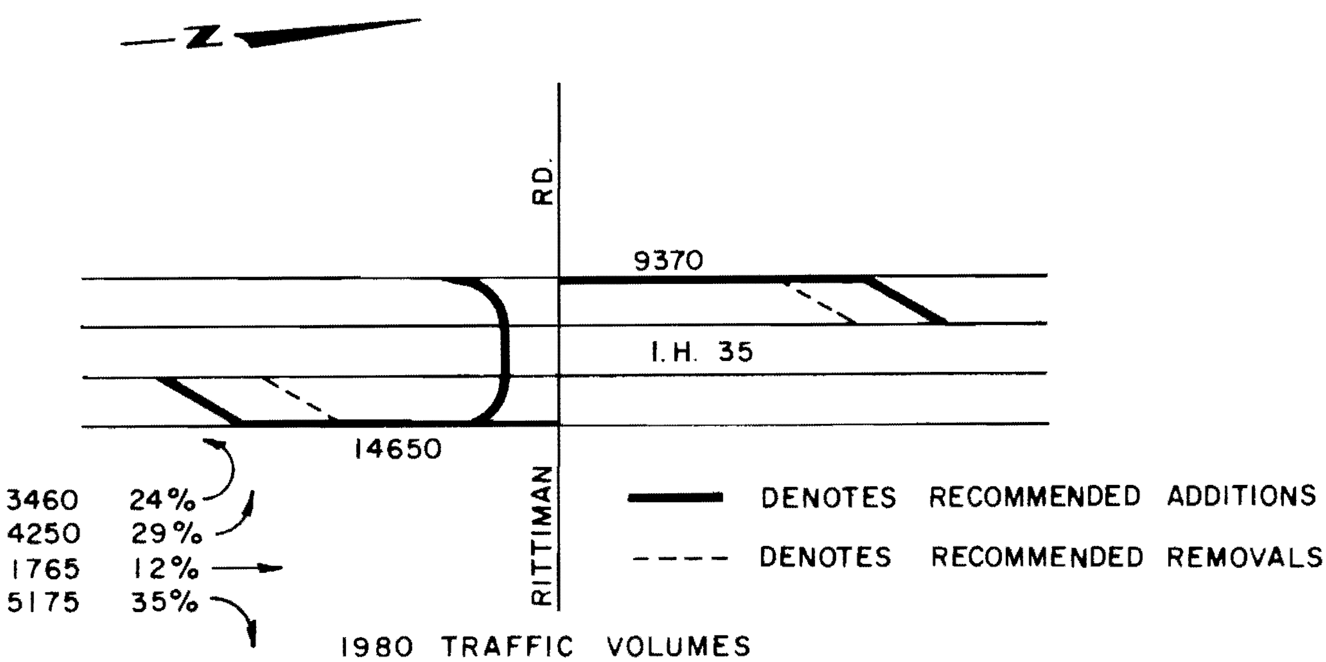
C. Relocate the I.H.35 southbound exit to Holbrook Road further south.

D. Provide an I.H.35 northbound exit to Rittiman Road south of the I.H.410 northbound entrance. This exit ramp should be grade-separated with the I.H.410 northbound entrance ramp.

As an interim method, to reduce the southbound mainlane volume, ramp metering signals should be installed on the southbound entrance from Rittiman Road.

PROBLEM: Congestion and mainlane backups at Rittiman Road interchange

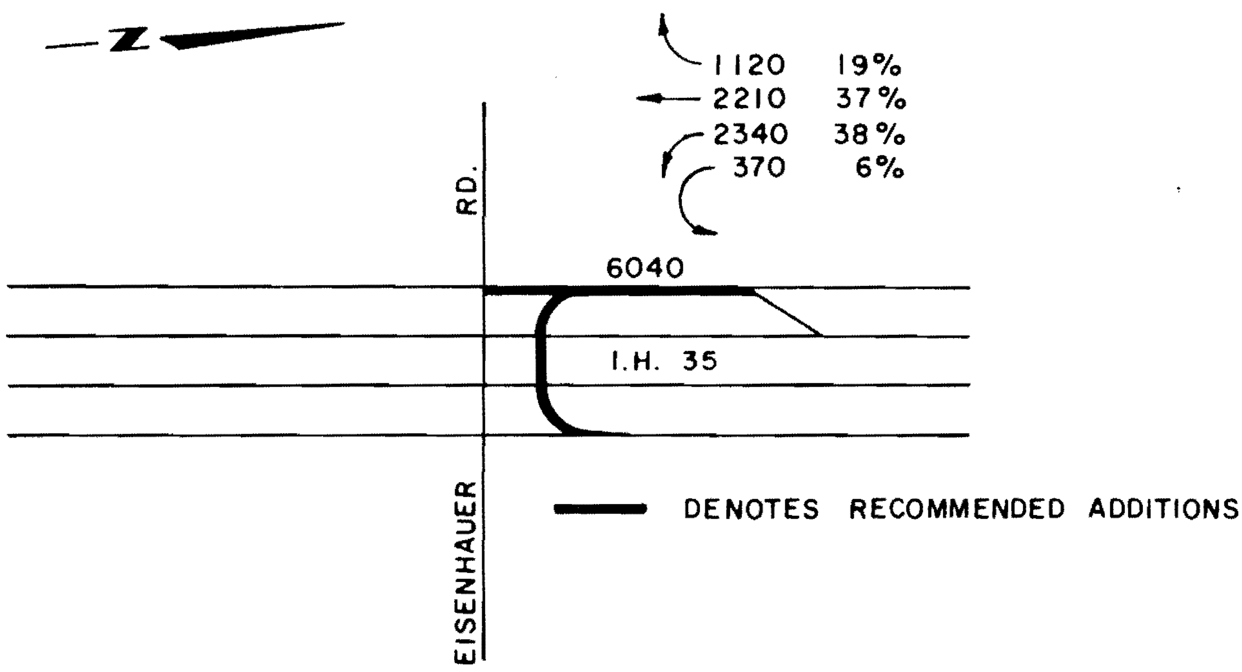
The Rittiman Road interchange is at capacity during the peak hours and 44 accidents have occurred on the frontage road approaches. The congestion in the interchange has also created mainlane backups. Both northbound and southbound exit ramps should be moved further back from Rittiman Road to provide additional storage on the frontage roads.



An additional lane should be installed on both frontage roads from the relocated exit ramps to the intersection and a turn-around should be installed on the south side of Rittiman Road.

PROBLEM: Congestion at Eisenhauer Road Interchange

The Eisenhauer Road interchange is experiencing congestion in the peak hours. The land east of I.H.35 between Eisenhauer Road and Walzem Road is a developing industrial area and as the traffic volumes increase it will be necessary to install an additional lane on the southbound frontage road approach to Eisenhauer Road.



1980 TRAFFIC VOLUMES

It will also be necessary to install a turnaround on the north side of Eisenhauer Road.

STUDY NO. 7

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H. 35 NORTH

1. Construct an additional eastbound mainlane from the I.H.37-U.S.281 interchange to the Walters Street exit.

2. Reverse the eastbound ramps between New Braunfels Street and Walters Street.

3. Construct an eastbound exit ramp just east of Coliseum Road.

4. Construct a westbound entrance ramp just east of Coliseum Road.

5. Install traffic signals on the I.H.410-I.H.35 connector, north frontage road intersections with F.M.78 and with the I.H.35 south frontage road.

6. Construct new I.H.35 southbound mainlanes between Rittiman Road and I.H.410 to run parallel with the northbound mainlanes. Convert the existing southbound mainlanes to be used as a connector to I.H.410 southbound. Construct an entrance ramp from the I.H.35 southbound frontage road to the new I.H.410 southbound connector. Remove the existing I.H.35 southbound entrance ramp from Rittiman Road. Relocate the existing I.H.35 southbound exit to Holbrook Road further south. Construct an I.H.35 northbound exit to Rittiman Road south of the I.H.410 northbound entrance.

7. Install ramp metering signals on the I.H.35 southbound entrance ramp from Rittiman Road prior to implementing recommendation number 6.

8. Remove both northbound and southbound exit ramps to Rittiman Road and relocate them at a location further back from Rittiman Road. Construct an additional frontage road approach lane on both sides of Rittiman Road. Construct a frontage road turnaround on the south side of Rittiman Road.

9. Construct an additional I.H.35 southbound frontage road approach lane to Eisenhauer Road and construct a frontage road turnaround on the north side of Eisenhauer Road.

AIR QUALITY ANALYSIS

The freeway operation study of IH 35 N. from Pine St. to Bexar-Guadalupe Co.Line was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for IH 35 North from Pine Street to Bexar-Guadalupe County Line.

IH 35 NORTH FROM PINE ST. TO BEXAR-GUADALUPE COUNTY LINE

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	147,415	87,862	-40.4
Tons/year	59.31	35.35	
Carbon Monoxide (CO)			
Grams/day	1,107,832	774,393	-30.1
Tons/year	445.73	311.57	
Nitrogen Oxides (NO_x)			
Grams/day	103,032	112,441	+9.1
Tons/year	41.45	45.24	

1978 ACCIDENT HISTORY

I.H.35

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	24.9	3^2		1^1	1							1	1^1	7^4
NB	ML	25.0											1		1
NB	ML	25.3	1^1		1										2^1
NB	ML	25.4		1					1						2
NB	ML	25.5			2^2	1							1		4^2
NB	ML	25.6	2	1											3
NB	ML	25.7	2^2								1^1				3^3
NB	ML	25.9	2^1			2^1									4^2
NB	ML	26.0	1	1					1^1						3^1
NB	ML	26.1	1^1								1^1				2^2
NB	ML	26.2					1								1
NB	ML	26.4	1		1										2
NB	ML	26.5												1	1
NB	ML	26.6		1^1				1^1							2^2
NB	ML	26.9	1					1	1					1^1	4^1
NB	ML	27.0			1^1										1^1
NB	ML	27.2									1^1				1^1
NB	ML	27.3							1						1

LEGEND

DIR. DIRECTION
LOC. LOCATION
M.P. MILEPOINT
R.E. REAR-END ACCIDENT
S.S. SIDESWIPE ACCIDENT
O. OTHER

E.B. EASTBOUND
S.B. SOUTHBOUND
W.B. WESTBOUND
N.B. NORTHBOUND
WET WET SURFACE
DRY DRY SURFACE

M.L. MAINLANE
C. CONNECTOR
F.R. FRONTAGE ROAD
1 FATALITY ACCIDENT
2 INJURY ACCIDENT

* Milepoints are shown on Figures 1-12 to identify accident locations.

TABLE A

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	27.4	1												1
NB	ML	27.5									1'				1'
NB	ML	27.7				1									1
NB	ML	27.9	3								1'				4'
NB	ML	28.1	1							1'					2'
NB	ML	28.2			1										1
NB	ML	28.3	1								1				2
NB	ML	28.6	1		1'										2'
NB	ML	28.8								1'	1				2'
NB	ML	28.9	1'			1									2'
NB	ML	29.2			1'						1				2'
NB	ML	29.6									1				1
NB	ML	29.9	1						1	1					3
NB	ML	30.1	2'		1										3'
NB	ML	30.2	1												1
NB	ML	30.5							1'			1			2'
NB	ML	30.6	1	1	1				1'						4'
NB	ML	30.7	1'	1	1										3'
NB	ML	30.9			1				2'						3'
NB	ML	31.0										1'			1'
NB	ML	31.3	1								1				2
NB	ML	31.5							1'						1'
NB	ML	31.6	3^3	1	1				1		1				7^3

TABLE B

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	32.2	1									1'			2'
NB	ML	32.3							1'						1'
NB	ML	32.5	4'		1			1							6'
NB	ML	32.6	3'		1				1		1			1	7'
NB	ML	32.7	2'		1					1'					4'
NB	ML	32.8	1'			1								1	3'
NB	ML	33.0	1												1
NB	ML	33.1	2	1					1'						4'
NB	ML	33.4							1'						1'
NB	ML	33.5			1'				1	1					3'
NB	ML	33.6									1				1
NB	ML	33.7	2'												2'
NB	ML	33.8		1											1
NB	ML	33.9							1		1				2
NB	ML	34.0	1						1						2
NB	ML	34.2	1												1
NB	ML	34.5		1											1
NB	ML	34.7	1												1
NB	ML	34.8	1												1
NB	ML	34.7			1'										1'
NB	ML	35.0	1							1					2
NB	ML	35.1	2^2		1										3^2
NB	ML	35.5												1'	1'

TABLE C

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	35.6	1												1
NB	ML	35.7							1						1
NB	ML	36.6			1^{1}										1^{1}
NB	ML	36.7									1				1
TOTAL			56^{20}	10^{1}	21^{9}	7^{1}	1	3^{1}	19^{8}	6^{2}	15^{40}	3^{2}	3	6^{3}	150^{51}

TABLE D

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	36.7												1	1
SB	ML	36.0	1												1
SB	ML	35.9			1										1
SB	ML	35.8						1			1'				2'
SB	ML	35.7		1							1		1		3
SB	ML	35.6			1										1
SB	ML	35.5			1'										1'
SB	ML	35.4	1												1
SB	ML	35.2									1'				1'
SB	ML	35.1						1							1
SB	ML	35.0	4		1'		1	2'		1	1	1	1		12^2
SB	ML	34.9				1					1'				2'
SB	ML	34.8	3		2										5
SB	ML	34.5									1'				1'
SB	ML	34.3	2								1'				3'
SB	ML	34.2	2	1						2			1'		6'
SB	ML	33.8	1								1'				2'
SB	ML	33.7	1'												1'
SB	ML	33.6			1					1					2
SB	ML	33.5	1												1
SB	ML	33.4								1'					1'
SB	ML	33.3	1										1		2
SB	ML	32.9							1						1

TABLE E

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	32.8	1								1				2
SB	ML	32.7	1												1
SB	ML	32.6									2^{1}				2^{1}
SB	ML	32.5	2	1					1						4
SB	ML	32.4	1						1	1					3
SB	ML	32.2				2^{1}					1				3^{1}
SB	ML	32.1		1	1				1^{1}						3^{1}
SB	ML	32.0	1		1^{1}										2^{1}
SB	ML	31.9	2						1^{1}						3^{1}
SB	ML	31.7	1^{1}			1									2^{1}
SB	ML	31.6								1					1
SB	ML	31.3	2									1			3
SB	ML	31.1	1												1
SB	ML	31.0	2^{2}												2^{2}
SB	ML	30.8	2						1^{1}						3^{1}
SB	ML	30.7	6^{1}		1^{1}						1^{1}				8^{3}
SB	ML	30.6	2^{1}												2^{1}
SB	ML	30.5	1					1							2
SB	ML	30.4	1												1
SB	ML	30.0	4^{2}	2^{2}	1^{1}	1			1						9^{5}
SB	ML	29.7		1^{1}											1^{1}
SB	ML	29.6												1	1
SB	ML	29.4			1										1

TABLE F

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	29.1							1'						1'
SB	ML	28.5			1										1
SB	ML	28.4									1'				1'
SB	ML	28.2	1												1
SB	ML	28.1	1	1'	1						2				5'
SB	ML	28.0							1						1
SB	ML	27.9		1					1						2
SB	ML	27.8							1'						1'
SB	ML	27.6										1'			1'
SB	ML	27.4									1				1
SB	ML	27.3	1												1
SB	ML	27.2				1									1
SB	ML	27.1												1	1
SB	ML	27.0								1					1
SB	ML	26.7	1'												1'
SB	ML	26.5				1									1
SB	ML	26.3	1			1									2
SB	ML	26.2									1'				1'
SB	ML	26.1	1			1'									2'
SB	ML	26.0	2'	1'											3^{2}
SB	ML	25.8	1												1
SB	ML	25.6	1'												1'
SB	ML	25.5				1'					1	1'			3^{2}

TABLE G

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	25.3					1								1
SB	ML	25.1	2^{1}												2^{1}
SB	ML	25.0		1	1	1^{1}									3^{1}
SB	ML	24.9			1^{1}										1^{1}
TOTAL			59^{12}	11^{5}	16^{6}	11^{4}	2	5^{1}	11^{5}	8^{1}	19^{10}	4^{2}	4^{1}	3	153^{47}

TABLE H

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	24.9			1										1
NB	FR	25.0									1				1
NB	FR	25.2	1^1												1^1
NB	FR	25.3				1^1									1^1
NB	FR	25.4			1^1										1^1
NB	FR	25.5			2	1		2^2			4^1				9^3
NB	FR	25.7									1				1
NB	FR	25.9	1^1												1^1
NB	FR	26.1			1										1
NB	FR	26.3			1^1										1^1
NB	FR	26.6			1^1										1^1
NB	FR	26.9	1		8^2			1							10^2
NB	FR	28.0						1							1
NB	FR	28.2	1												1
NB	FR	28.5			1										1
NB	FR	28.7						1^1							1^1
NB	FR	28.8			1										1
NB	FR	30.1			1										1
NB	FR	30.2						1							1
NB	FR	30.5			1										1
NB	FR	30.6	3^1		1	4^1									8^2
NB	FR	30.7	7	1	4	1		2^1	2^1			1		1	19^2
NB	FR	31.3				1									1

TABLE I

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	31.6	6^{1}						2		3^{1}				11^{2}
NB	FR	32.0		1^{1}											1^{1}
NB	FR	32.4	2						2						4
NB	FR	32.5	7^{1}		3	3^{1}		1	2		3^{1}			1	20^{3}
NB	FR	32.6		1											1
NB	FR	33.2												1^{1}	1^{1}
NB	FR	33.4	1		1^{1}										2^{1}
NB	FR	33.7	1											1	2
NB	FR	34.0							1						1
NB	FR	34.1	2^{1}											1^{1}	3^{2}
NB	FR	34.2	1^{1}		4									1	6^{1}
NB	FR	34.9									2^{1}				2^{1}
NB	FR	35.0			2										2
NB	FR	35.1			1^{1}										1^{1}
NB	FR	35.6			1^{1}										1^{1}
NB	FR	35.7	1		3				1		1^{1}				6^{1}
NB	FR	36.6	1^{1}												1^{1}
NB	FR	36.7			1^{1}										1^{1}
TOTAL			36^{8}	3^{1}	40^{9}	11^{3}	0	9^{4}	10^{1}	0	15^{5}	1	0	6^{2}	131^{33}

TABLE J

1978 ACCIDENT HISTORY

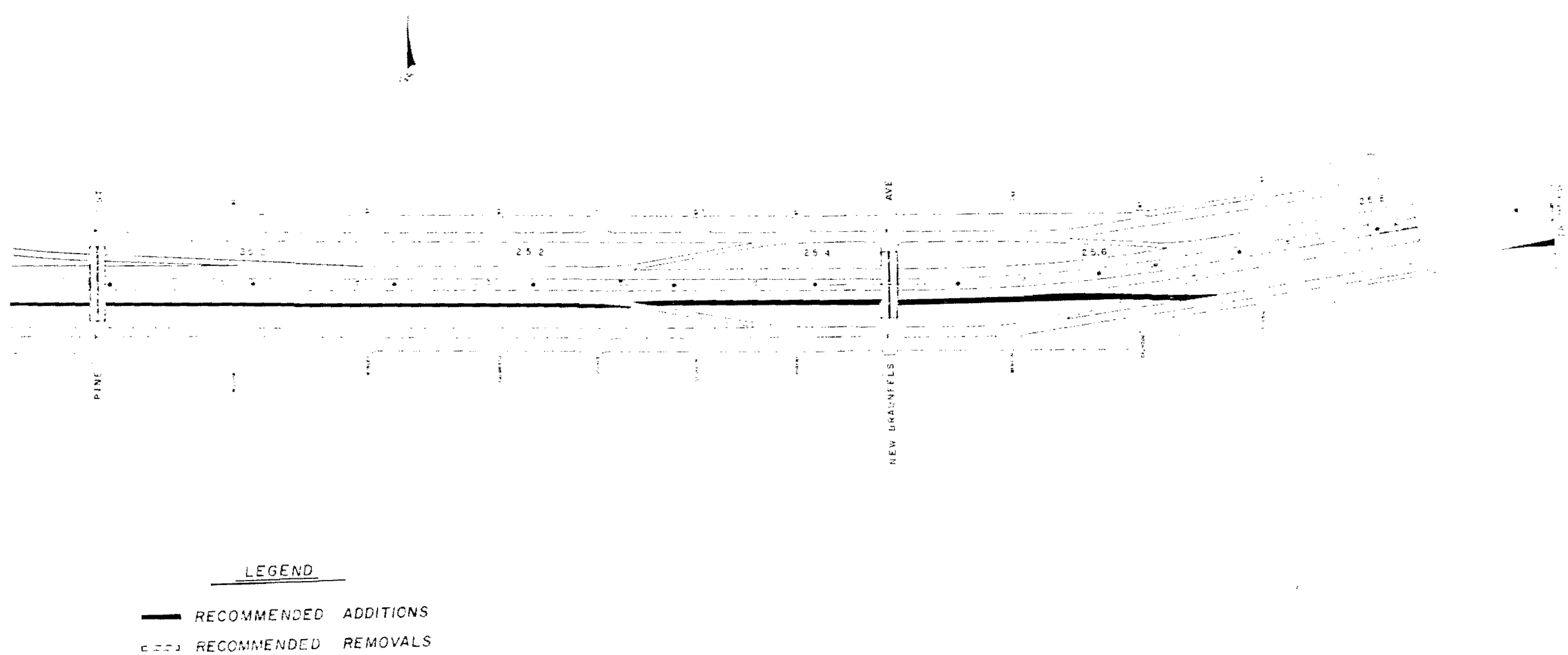
DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	36.7										1			1
SB	FR	36.5										1			1
SB	FR	35.8												1^1	1^1
SB	FR	35.7			1			1			3^1				5^1
SB	FR	35.4			1^1										1^1
SB	FR	35.0			6^1			3							9^1
SB	FR	34.3									1				1
SB	FR	34.1									1				1
SB	FR	33.7									1				1
SB	FR	33.6						1			1				2
SB	FR	33.5	1		3										4
SB	FR	33.4						1	1		1				3
SB	FR	33.2	1												1
SB	FR	32.6		1											1
SB	FR	32.5	23^2	1	3	1	1	1	4		1				35^2
SB	FR	32.0			1										1
SB	FR	31.6	5		3^1				1^1		1	1		2^2	13^4
SB	FR	31.5									1^1				1^1
SB	FR	31.4	1^1												1^1
SB	FR	30.7	5		6^3	1					3	1		1	17^3
SB	FR	30.3			1										1
SB	FR	29.4						1^1							1^1
SB	FR	29.0									1^1				1^1

TABLE K

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	28.7			1^{1}			1^{1}							2^{2}
SB	FR	28.6			1										1
SB	FR	27.6				2		1							3
SB	FR	27.4	1												1
SB	FR	27.3	1												1
SB	FR	27.0	2^{1}												2^{1}
SB	FR	26.9	3		3^{2}										6^{2}
SB	FR	26.3	2^{1}		1^{1}										3^{2}
SB	FR	26.1			1										1
SB	FR	26.0	2		4^{1}				2^{1}		1			1	10^{2}
SB	FR	25.5				2^{1}					4^{2}				6^{3}
SB	FR	25.4	1			1					1^{1}				3^{1}
SB	FR	25.3									1^{1}				1^{1}
SB	FR	24.9	1		1										2
TOTAL			49^{5}	2	37^{11}	7^{1}	1	10^{2}	8^{2}	0	22^{7}	4	0	5^{3}	145^{31}

TABLE L



PINE
25.2
25.4
25.6
AVE
NEW BRAUNFELS
LEGEND
RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS

FIGURE 1

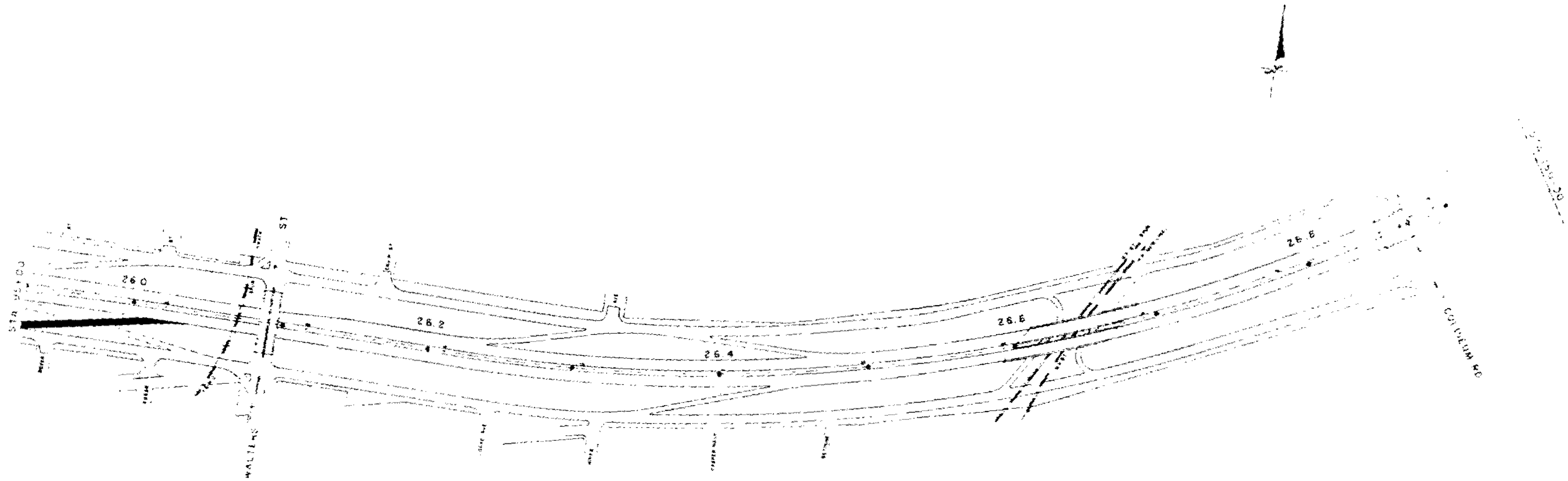


FIGURE 2

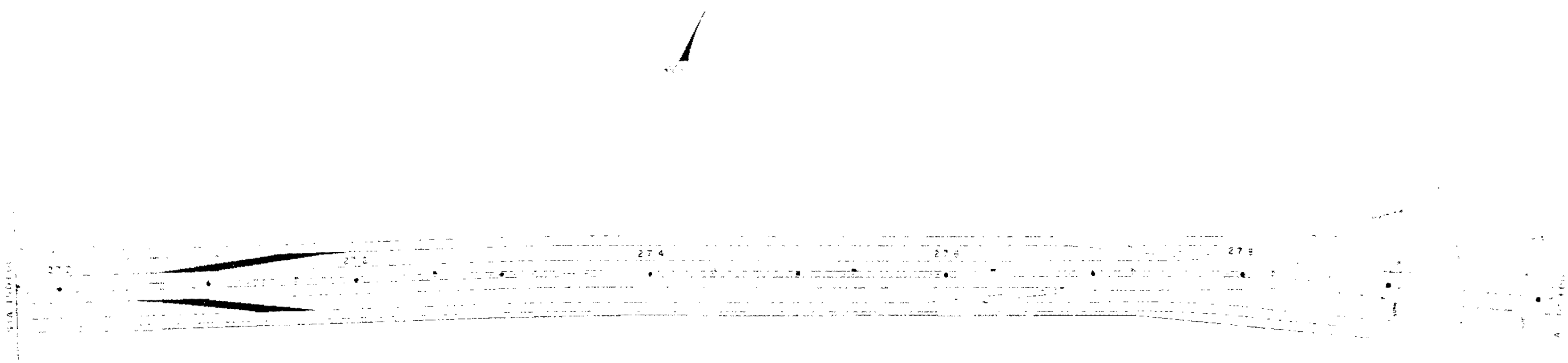


FIGURE 3

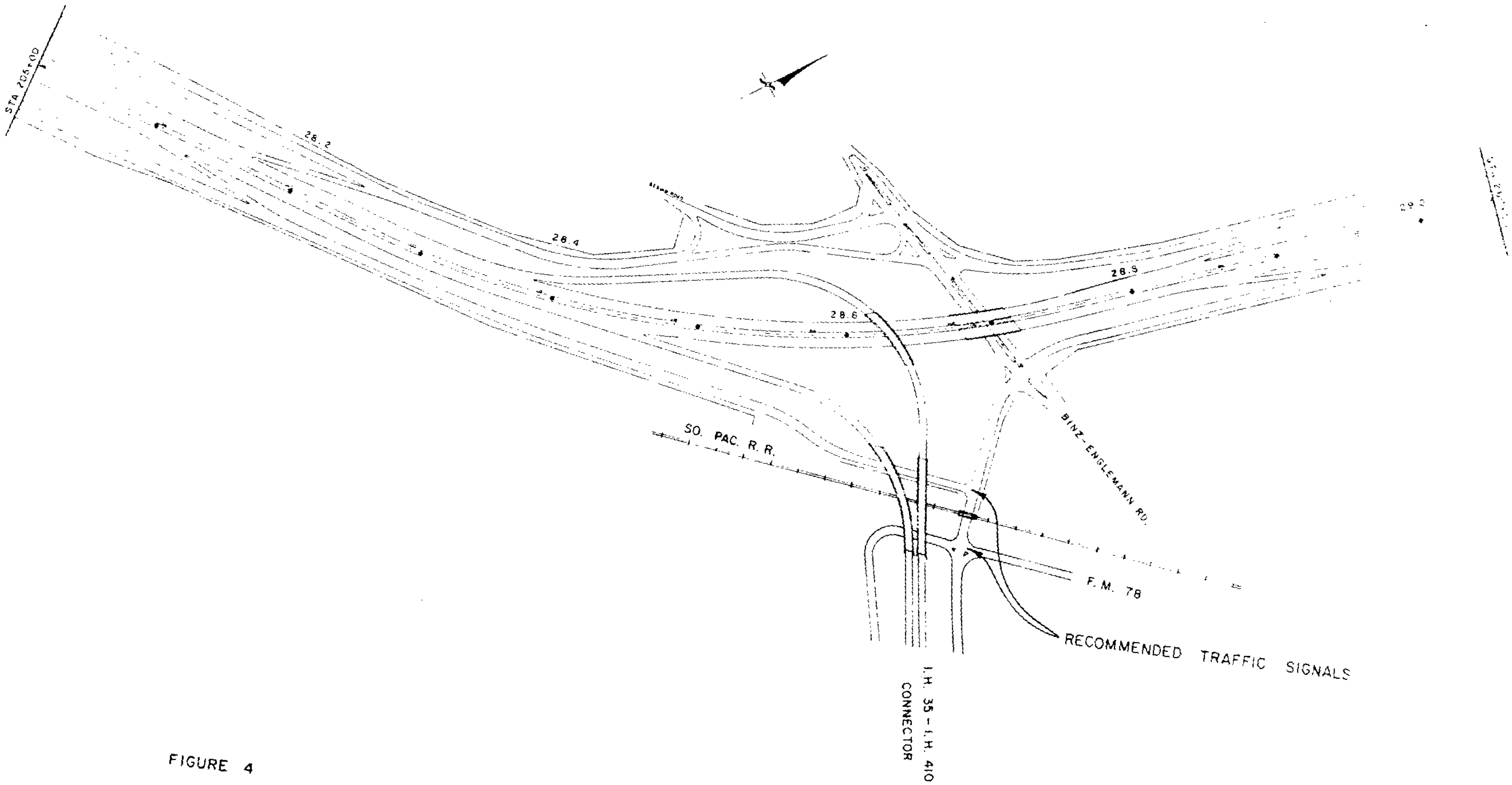

STA 205+00
28.2
28.4
28.6
28.9
BINZ-ENGLEMANN RD.
SO. PAC. R. R.
F. M. 78
RECOMMENDED TRAFFIC SIGNALS
I.H. 35 - I.H. 410
CONNECTOR

FIGURE 4

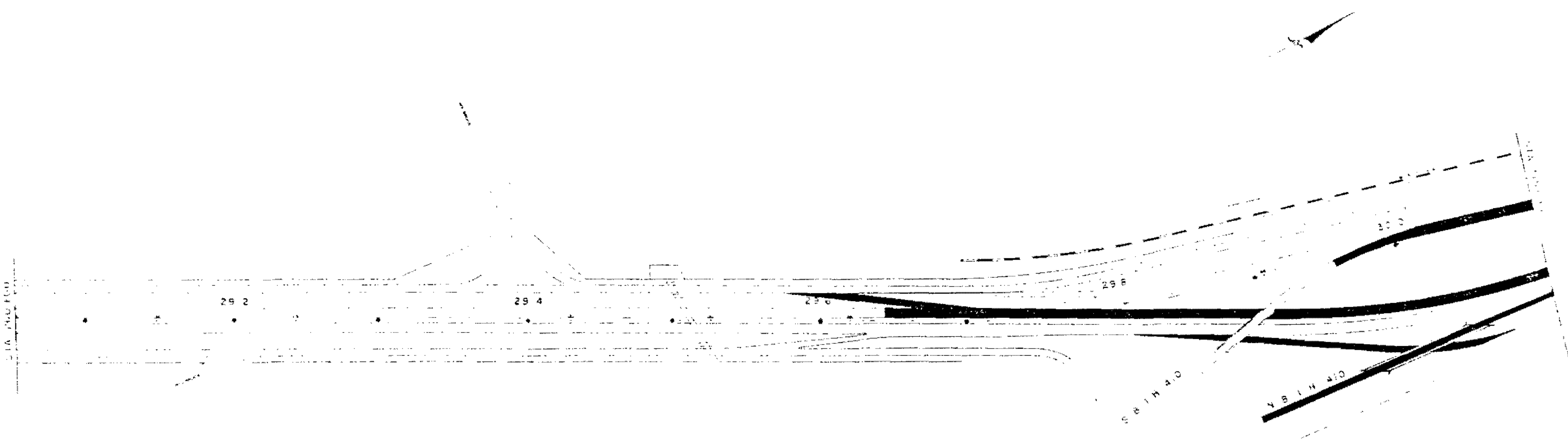


FIGURE 5

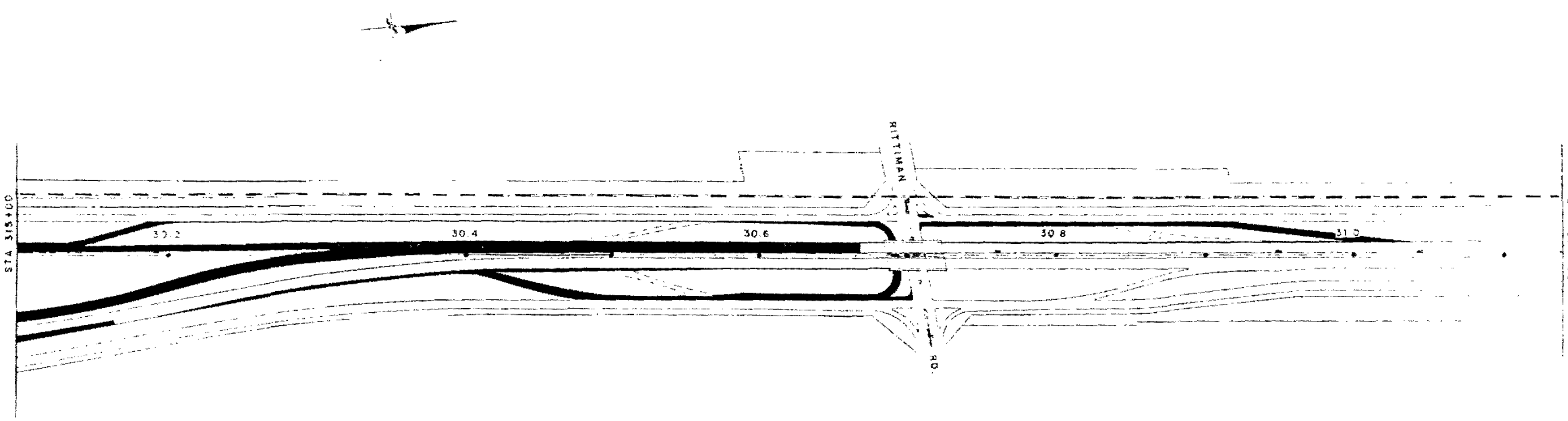


FIGURE 6

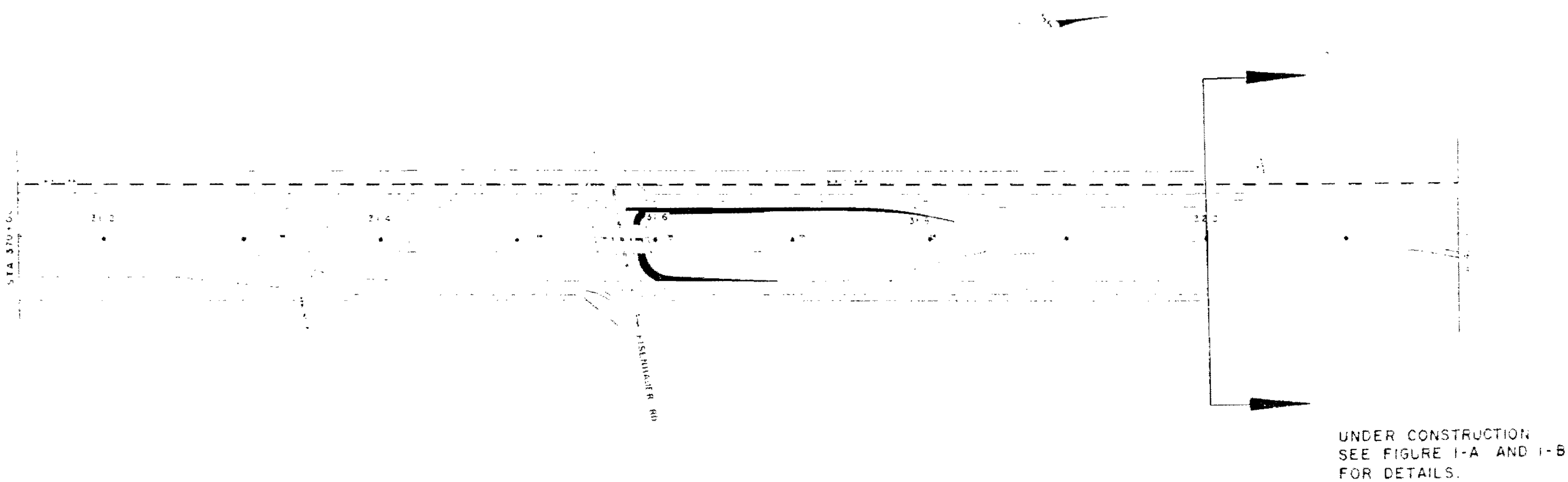
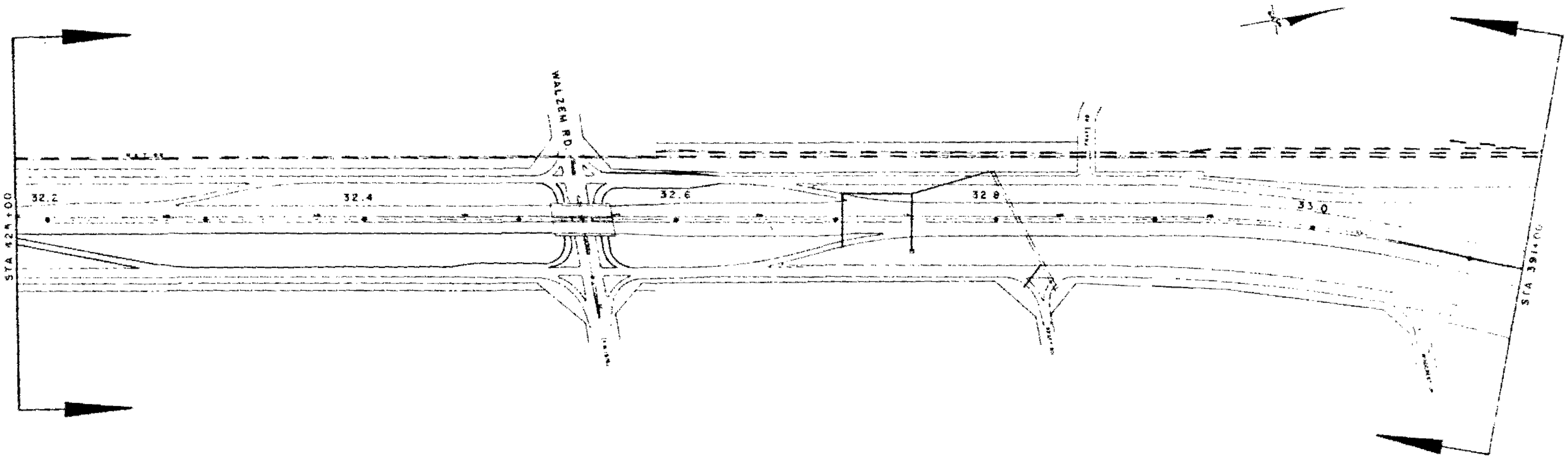


FIGURE 7



UNDER CONSTRUCTION
SEE FIGURE I-A AND I-B
FOR DETAILS.

FIGURE 8

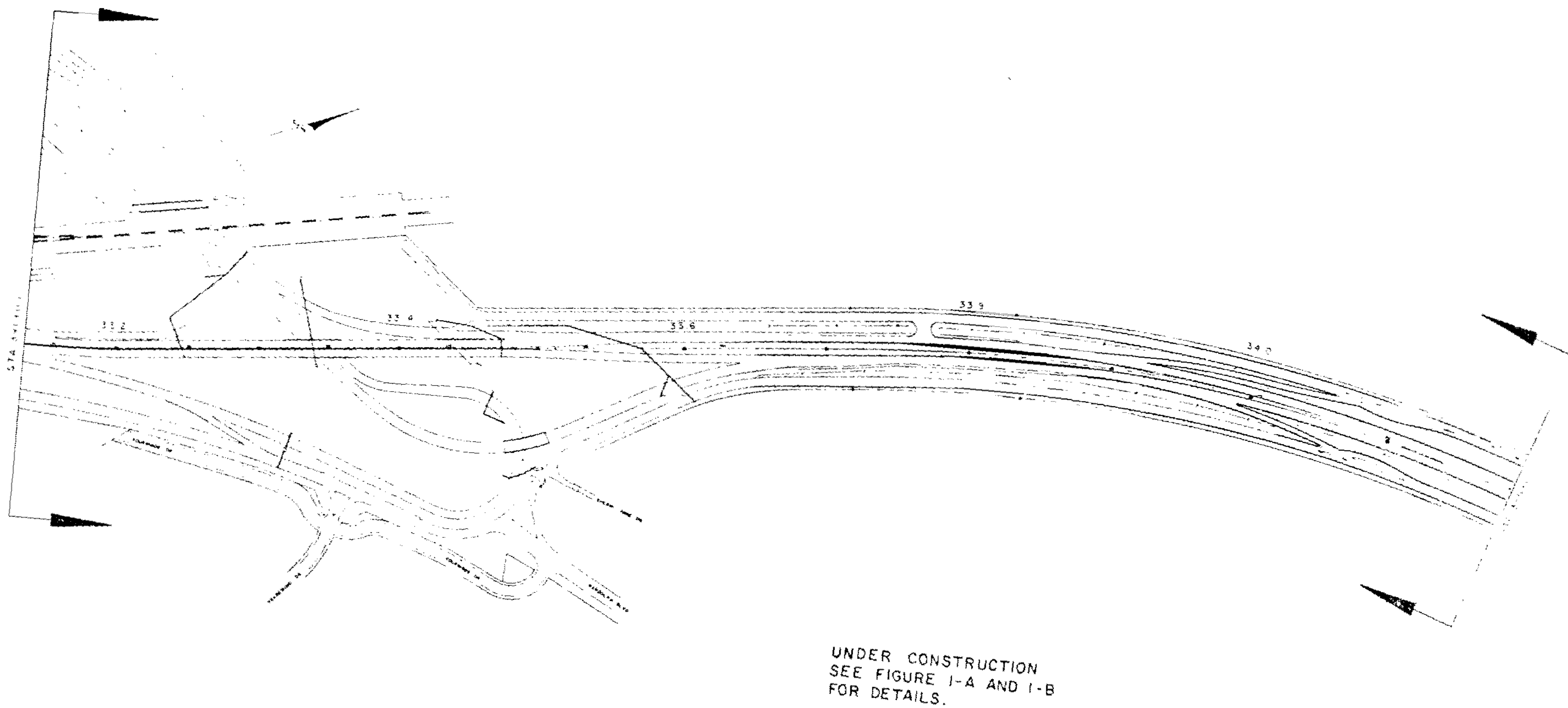

33.2
33.4
33.6
33.9
34.0
UNDER CONSTRUCTION
SEE FIGURE I-A AND I-B
FOR DETAILS.

FIGURE 9

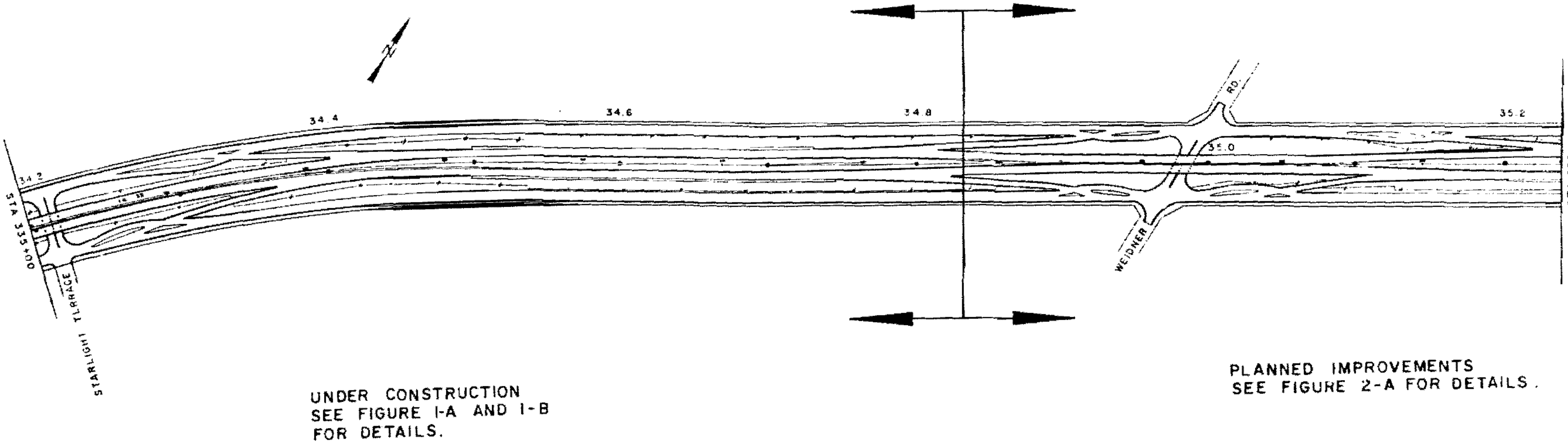
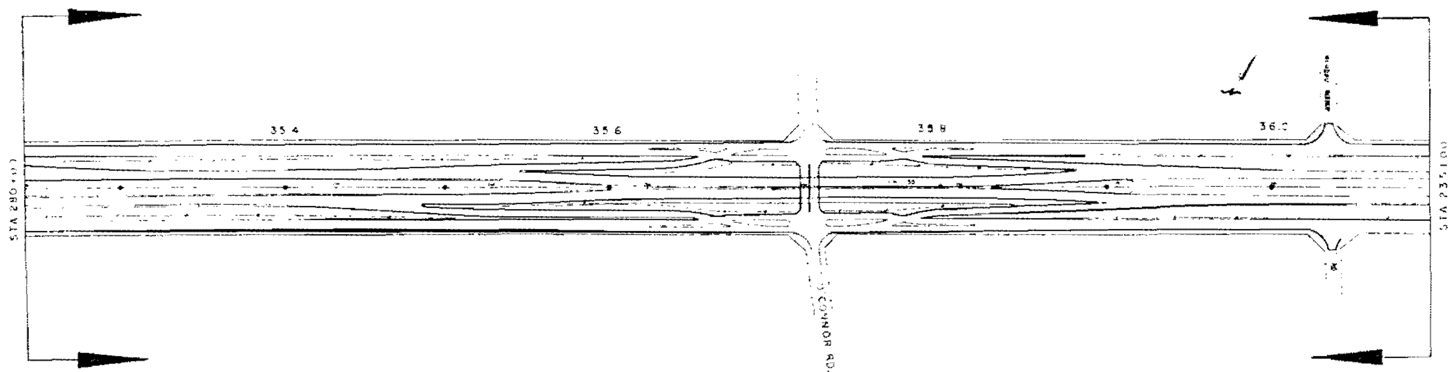
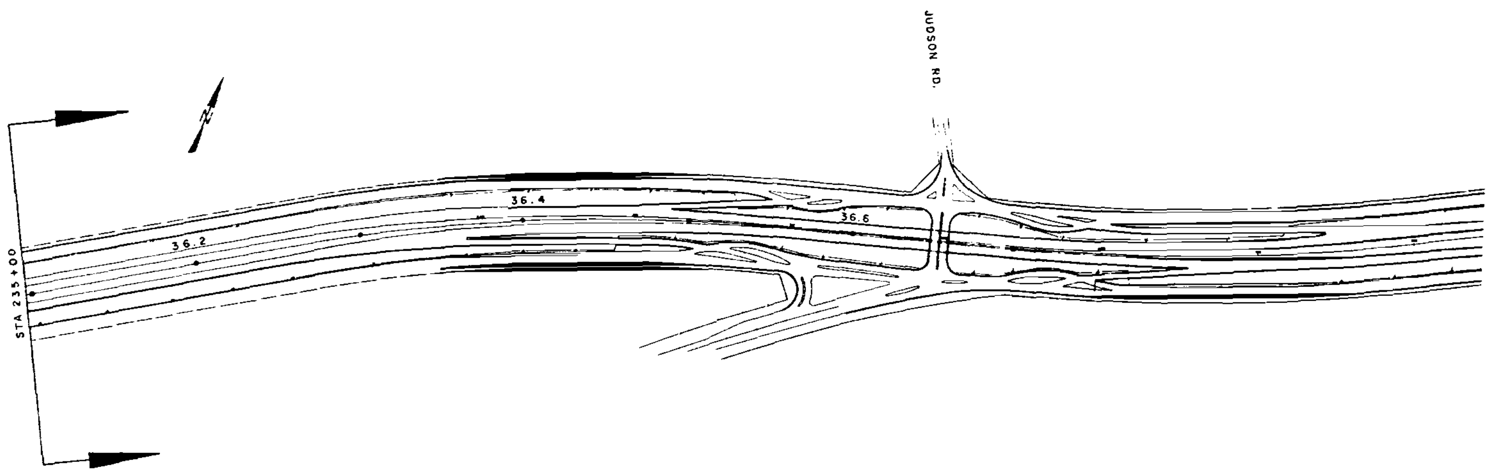

N
34.2
34.4
34.6
34.8
35.0
35.2
STA 335+00
STA 280+00
STARLIGHT TERRACE
WEIDNER RD.
UNDER CONSTRUCTION
SEE FIGURE I-A AND I-B
FOR DETAILS.
PLANNED IMPROVEMENTS
SEE FIGURE 2-A FOR DETAILS.

FIGURE 10



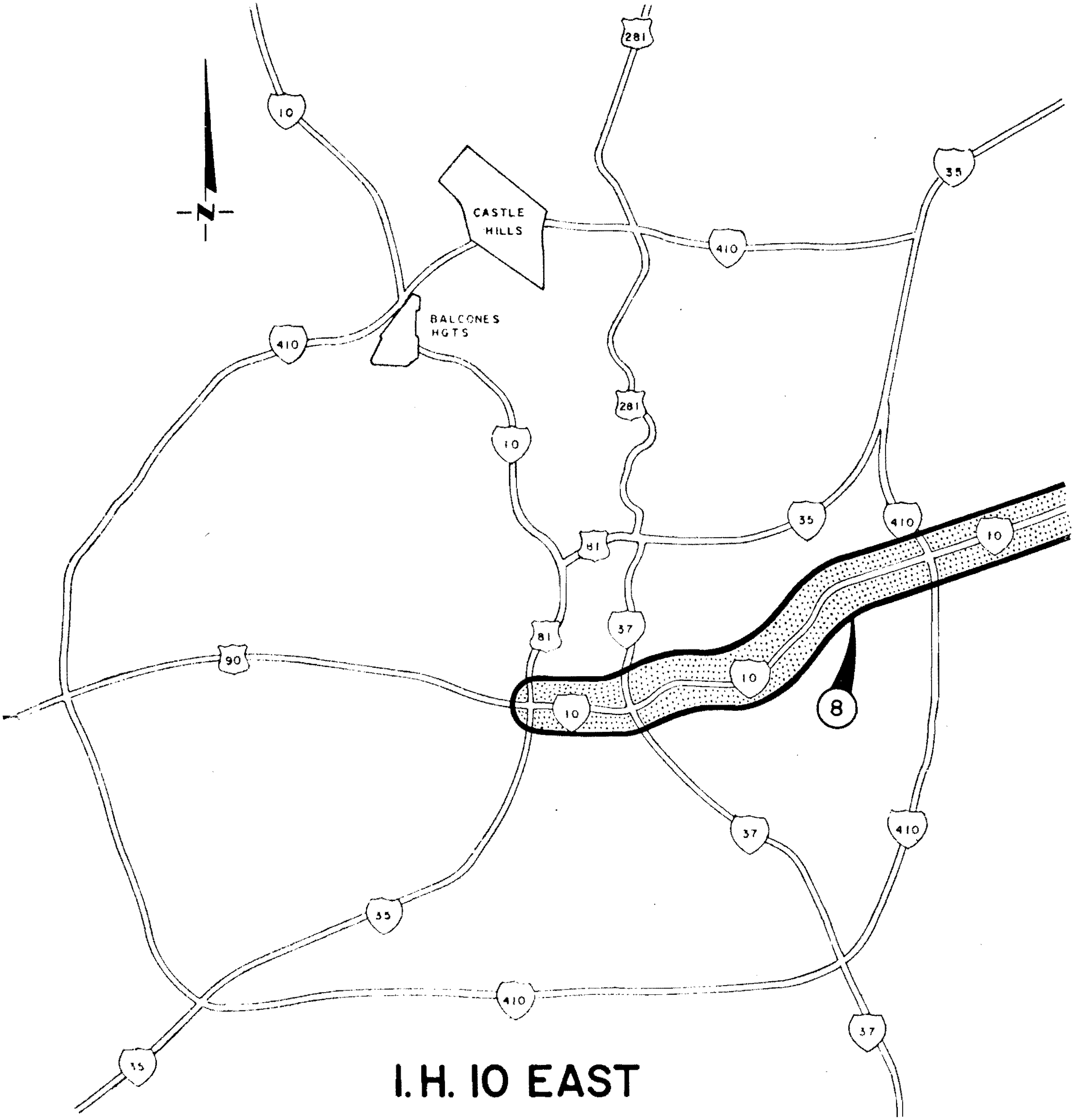
PLANNED IMPROVEMENTS
SEE FIGURE 2-A
FOR DETAILS.

FIGURE 11



PLANNED IMPROVEMENTS
SEE FIGURE 2-A
FOR DETAILS.

FIGURE 12



I.H. 10 EAST

FREEWAY OPERATIONS STUDY

FROM: NOGALITOS ST.

TO: BEXAR COUNTY LINE

INTRODUCTION

This study will identify the areas that were capacity deficient in 1978 and expose the areas where access is not easily available. It will also identify the areas that have become high accident locations.

STUDY PROCEDURE

The 1978 traffic volumes were obtained from File D-10, the Department's Planning and Research Division in Austin. They provided volumes for the mainlanes, ramps, frontage roads, and turning movements at the interchanges and intersections. Level of Service was calculated for all conditions to identify the capacity deficient areas.

The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing." The high accident locations could therefore be identified. The accident breakdown can be found in Table A through I.

The areas where access is not easily available were identified by citizens and police participation and from observations made by this office and the San Antonio Public Works Department. This office continually receives complaints and suggestions concerning specific locations from the public. It also receives Police Assignment Reports from the San Antonio Police Department of problem areas noticed by the Officers in the field. In addition, the San Antonio

Public Works Department notifies us of any problem areas that they have noticed or have received complaints about.

GENERAL DISCUSSION

The limits of this study on I.H.10 are from the Nogalitos Street Intersection to the Bexar County Line. The mainlanes, frontage roads, and intersections are operating at a good or acceptable level of service throughout the limits of this study. There were also very few accidents occurring in this area. For the most part, the land adjacent to I.H.10 is either undeveloped or is comprised of low traffic generating residential areas. Other traffic generators do exist, but they do not produce a significant traffic volume in which congestion is created. Access problems do exist and will be discussed in the PROBLEMS AND RECOMMENDED SOLUTIONS portion of this study. Figures 1 through 14 show the existing roadway.

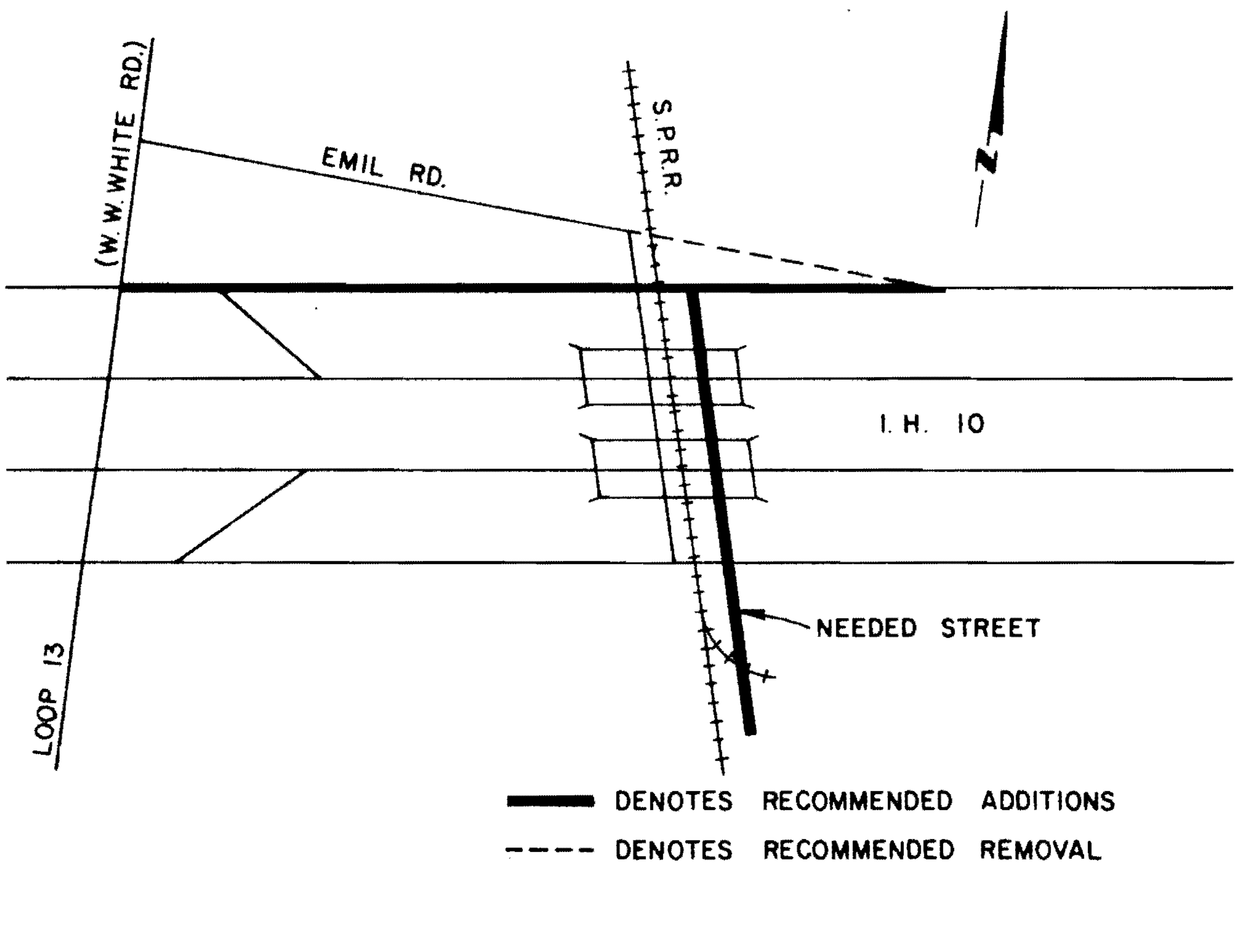
PROBLEMS AND RECOMMENDED SOLUTIONS

PROBLEM: Two-way frontage road at the Northwest quadrant of the I.H.410 Interchange.

As more development occurs and traffic volumes increase, it may be desirable to convert the two-way frontage road between Dietrich Road and the Southern Pacific Railroad at the Northwest quadrant of the I.H.410 Interchange, to a one-way frontage road. The conversion will provide continuity with the rest of the urban interstate system as well as provide a safer traffic operation. In conjunction with the conversion of the frontage road to one-way, it will be necessary for the City of San Antonio to provide interior circulation in this area in order to provide access for the traffic.

PROBLEM: Better access to westbound I.H.10 from the Southwest quadrant of the I.H. 410 Interchange.

Presently, traffic from the Southwest quadrant of the I.H.410 Interchange desiring to gain access to the I.H.10 westbound mainlanes must travel in a circuitous route. This route carries truck traffic from



an industrial area through a school zone. The circuitous route can be eliminated if access is provided from Pop Gunn Road to the bridge underpass of I.H.10 at the Southern Pacific Railroad. A road can then be constructed at the bridge underpass to accommodate the traffic in this area. The westbound frontage road should also be extended to run parallel to the mainlanes from Emil Road to Loop 13 (W. W. White Road). Access to the bridge underpass must be provided by the City prior to the construction of the recommendations.

STUDY NO. 8

SUMMARY OF RECOMMENDED IMPROVEMENTS ON I.H. 10 EAST

1. Convert the two-way frontage road in the northwest quadrant of the I.H.10 - I.H.410 interchange to one-way.

2. Construct an I.H.10 westbound frontage road between Loop 13 and just east of the Southern Pacific Railroad. Construct an underpass just east of the Southern Pacific Railroad tracks connecting the eastbound frontage road with the recommended westbound frontage road. Construct a city street to connect Pop Gunn Rd. with the recommended bridge underpass.

AIR QUALITY ANALYSIS

The freeway operation study of IH 10 E. from Nogalitos St. to Bexar County Line was analyzed to determine the air quality impact of the recommended freeway improvements. Emission factors for Bexar County were generated from MOBILE I, EPA's emission analysis program, for the base year - 1977 and the forecast year - 1982. MOBILE I produces composite emission factors for three significant pollutants - hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NO_x). These factors were utilized to quantify pollutant concentrations generated by motor vehicles within the freeway corridor and the resulting changes in emissions effected by the proposed freeway improvement recommendations.

The MOBILE I emission factors provide the total grams of pollutants emitted per day when multiplied by the daily vehicle miles traveled (VMT) for specific driving speeds. The traffic volumes directly impacted by the recommendations were determined from 1978 File D-10 traffic volumes. In addition, turning movement counts and small origin-destination studies were performed. The distances traveled in the base year and the forecast year were measured to determine the limits of the impact of the recommendations. For each recommendation an existing average driving speed (ADS) in 1977 and a forecast ADS utilizing the recommended improvement in 1982 were determined.

The MOBILE I input variables of VMT and ADS generated emission totals for 1977 and 1982 which were compared. The following table summarizes the air quality impact of the recommended improvements for IH 10 E. from Nogalitos St. to Bexar County Line.

IH 10 EAST FROM NOGALITOS STREET TO BEXAR COUNTY LINE

	1977 Emissions	1982 Emissions	Percent Change
Hydrocarbons (HC)			
Grams/day	8,052	4,529	-43.8
Tons/year	3.24	1.82	
Carbon Monoxide (CO)			
Grams/day	65,185	43,054	-33.9
Tons/year	26.23	17.32	
Nitrogen Oxides (NO_x)			
Grams/day	4,399	3,900	-11.3
Tons/year	1.77	1.57	

1978 ACCIDENT HISTORY

I. H. 10 East

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	0.3			2^{1}										2^{1}
EB	ML	0.5									1				1
EB	ML	0.8		1^{1}											1^{1}
EB	ML	1.0			1^{1}										1^{1}
EB	ML	1.1	2^{1}				1		1^{1}	1	1				6^{2}
EB	ML	1.3	2												2
EB	ML	1.5			1	2									3
EB	ML	1.6									1^{1}				1^{1}
EB	ML	1.8	1								1^{1}				2^{1}
EB	ML	2.0			1									1	2
EB	ML	2.3									1^{1}				1^{1}
EB	ML	2.6			1									1	2
EB	ML	2.7							1^{1}						1^{1}
EB	ML	2.9			1										1
EB	ML	3.2		1^{1}	1^{1}			1			2^{1}				5^{3}
EB	ML	3.4							1^{1}						1^{1}
EB	ML	3.7	1	1^{1}					1						3^{1}
EB	ML	4.8						1^{1}							1^{1}

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	(1)	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures 1-14 to identify accident locations.

TABLE A

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	5.0	1												1
EB	ML	5.6									1'	1'			2^2
EB	ML	5.9									1'				1'
EB	ML	6.0		1										1	2
EB	ML	6.2		1							2'(1)				3'(1)
EB	ML	6.3								1'					1'
EB	ML	6.6		1											1
EB	ML	24.5									1'				1'
EB	ML	24.6												1'	1'
EB	ML	25.0							1'						1'
EB	ML	25.1							1						1
EB	ML	25.2						1							1
EB	ML	25.3						1'						1'	2^2
EB	ML	25.4							1					1'	2'
EB	ML	25.6						1'							1'
EB	ML	25.7						1							1
EB	ML	26.1	1'												1'
EB	ML	26.3						1'							1'
EB	ML	31.3									2				2
EB	ML	32.0			1										1
EB	ML	32.3									1'				1'
EB	ML	32.5						1							1
EB	ML	34.0									1'				1'

TABLE B

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	ML	34.2									1				1
EB	ML	34.9								1^1					1^1
TOTAL			8^2	6^3	9^3	2	1	8^4	7^4	3^2	$17^{10(1)}$	1^1	0	6^3	$68^{32(1)}$

TABLE C

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	35.2						1							1
WB	ML	35.1	1												1
WB	ML	35.0						2^1						1	3^1
WB	ML	34.8									1'				1'
WB	ML	34.2									1				1
WB	ML	34.1			1'						1'				2^2
WB	ML	33.3								1'					1'
WB	ML	32.5									1'			1'	2^2
WB	ML	31.1									1'				1'
WB	ML	30.8									1'				1'
WB	ML	30.5	1												1
WB	ML	29.7	1												1
WB	ML	29.3									1				1
WB	ML	29.2									1				1
WB	ML	27.5										1'			1'
WB	ML	27.3			1										1
WB	ML	27.0									1				1
WB	ML	26.9									$2^{(1)}$				$2^{(1)}$
WB	ML	26.7	2^1												2^1
WB	ML	26.3	1					1	1						3
WB	ML	25.5						1							1
WB	ML	25.3									1				1
WB	ML	24.7		1											1

TABLE D

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	24.6	1												1
WB	ML	6.7									1				1
WB	ML	6.6						1							1
WB	ML	6.5												1	1
WB	ML	6.2			1										1
WB	ML	5.6			1										1
WB	ML	5.5							1^1						1^1
WB	ML	4.3	1												1
WB	ML	4.0		1^1											1^1
WB	ML	3.1							1^1						1^1
WB	ML	2.9							1^1						1^1
WB	ML	2.7	1								1^1				2^1
WB	ML	2.6				1^1									1^1
WB	ML	2.5								1					1
WB	ML	2.2		1											1
WB	ML	2.1			1^1			1							2^1
WB	ML	2.0			1				2^1						3^1
WB	ML	1.3	1^1						1^1						2^2
WB	ML	1.1			1^1				1	1					3^1
WB	ML	1.0	2^1								1				3^1
WB	ML	0.8								1^1					1^1
WB	ML	0.7	1												1
WB	ML	0.5	1^1	1^1	1						2^1				5^3

TABLE E

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	ML	0.4	1												1
WB	ML	0.3			1										1
TOTAL			9^{3}	3^{2}	7^{2}	1^{1}	0	2	7^{5}	3^{1}	5^{2}	0	0	1	38^{16}

TABLE F

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
EB	FR	0.3			1										1
EB	FR	1.1							1^1						1^1
EB	FR	1.5							1^1						1^1
EB	FR	2.1			2^1										2^1
EB	FR	2.2		1	1^1										2^1
EB	FR	2.3	1								2				3
EB	FR	2.4	1												1
EB	FR	2.7	1												1
EB	FR	3.3									1				1
EB	FR	3.4	2		2^1	1^1			2^1		2^1				9^4
EB	FR	3.7			1^1						1^1	1			3^2
EB	FR	4.4			1										1
EB	FR	4.5	2^1		1						1^1			2^1	6^3
EB	FR	5.4			1			1							2
EB	FR	5.6										1^1			1^1
EB	FR	6.2									1^1				1^1
EB	FR	6.5	1		1	1^1		1^1							4^2
EB	FR	6.6	1								1^1			2	4^1
EB	FR	25.3						2^1	1						3^1
EB	FR	26.8				1									1
EB	FR	26.9	1		2										3
EB	FR	32.5										1			1

TABLE G

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
TOTAL			10^{1}	1	13^{4}	3^{2}	0	4^{2}	5^{3}	0	9^{5}	3^{1}	0	4^{1}	52^{19}

TABLE II

1978 ACCIDENT HISTORY

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
WB	FR	32.5				1^1									1^1
WB	FR	32.4			1						1^1				2^1
WB	FR	27.0			1^1										1^1
WB	FR	26.9									1				1
WB	FR	26.3							1						1
WB	FR	26.1			1										1
WB	FR	25.3	2^1		1^1			1							4^2
WB	FR	6.6				1^1		1^1							2^2
WB	FR	6.5			2	2^1		1			2^2			1	8^3
WB	FR	5.5						1							1
WB	FR	3.9			1										1
WB	FR	3.7			2^1										2^1
WB	FR	3.4			1										1
WB	FR	2.3	1		1										2
WB	FR	2.2			1^1						2				3^1
WB	FR	2.1	2^1	1^1					1		1^1				5^3
WB	FR	1.9									1				1
WB	FR	1.1						1	1^1						2^1
WB	FR	0.5									1				1
WB	FR	0.4										1			1
WB	FR	0.3						1	1						2
TOTAL			5^2	1^1	12^4	4^3	0	6^1	4^1	0	9^4	1	0	1	43^{16}

TABLE I

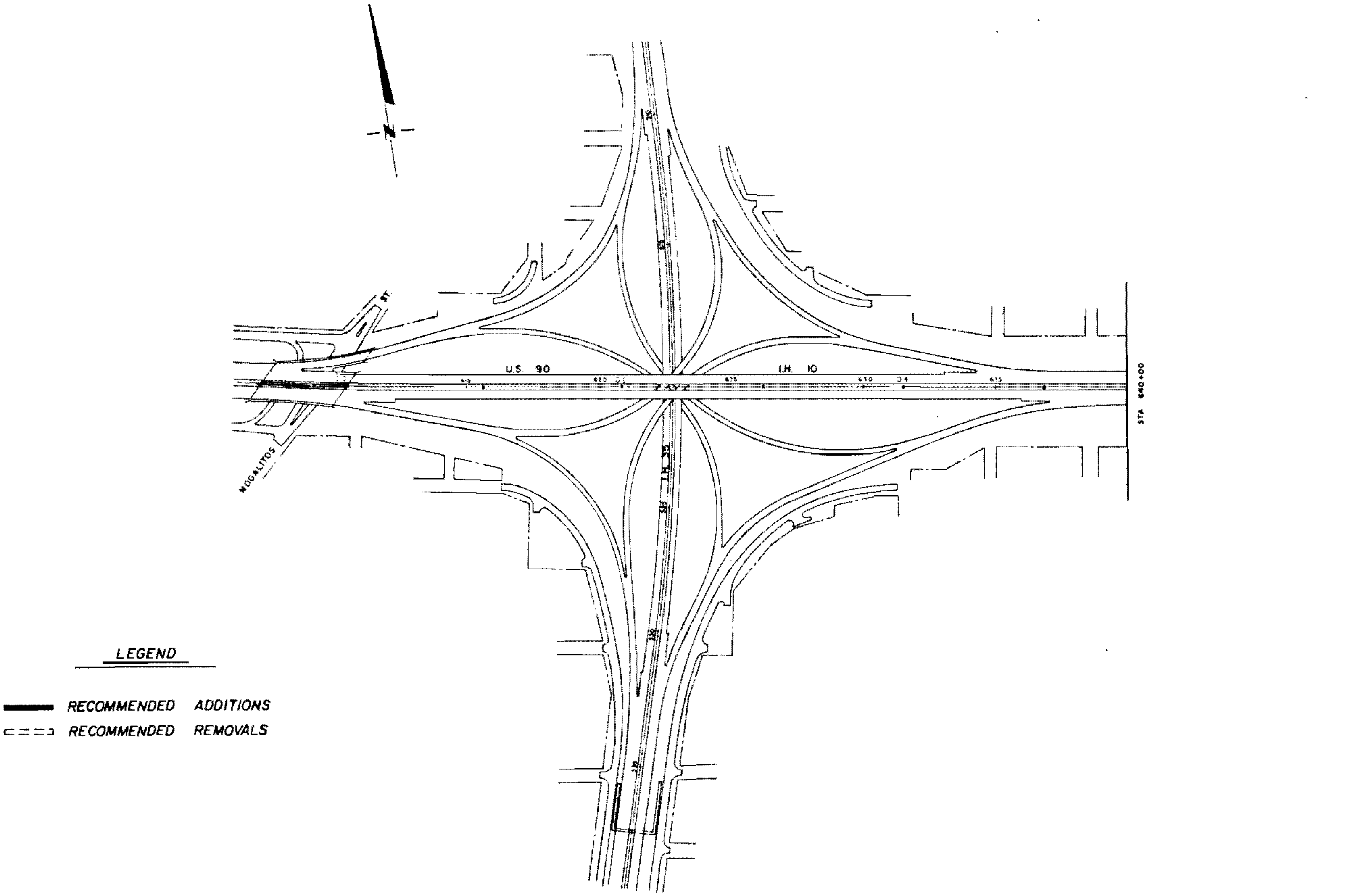

N
U.S. 90
I.H. 10
I.H. 35
STA 640+00
NOGALITOS
ST.
LEGEND
RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS

FIGURE I

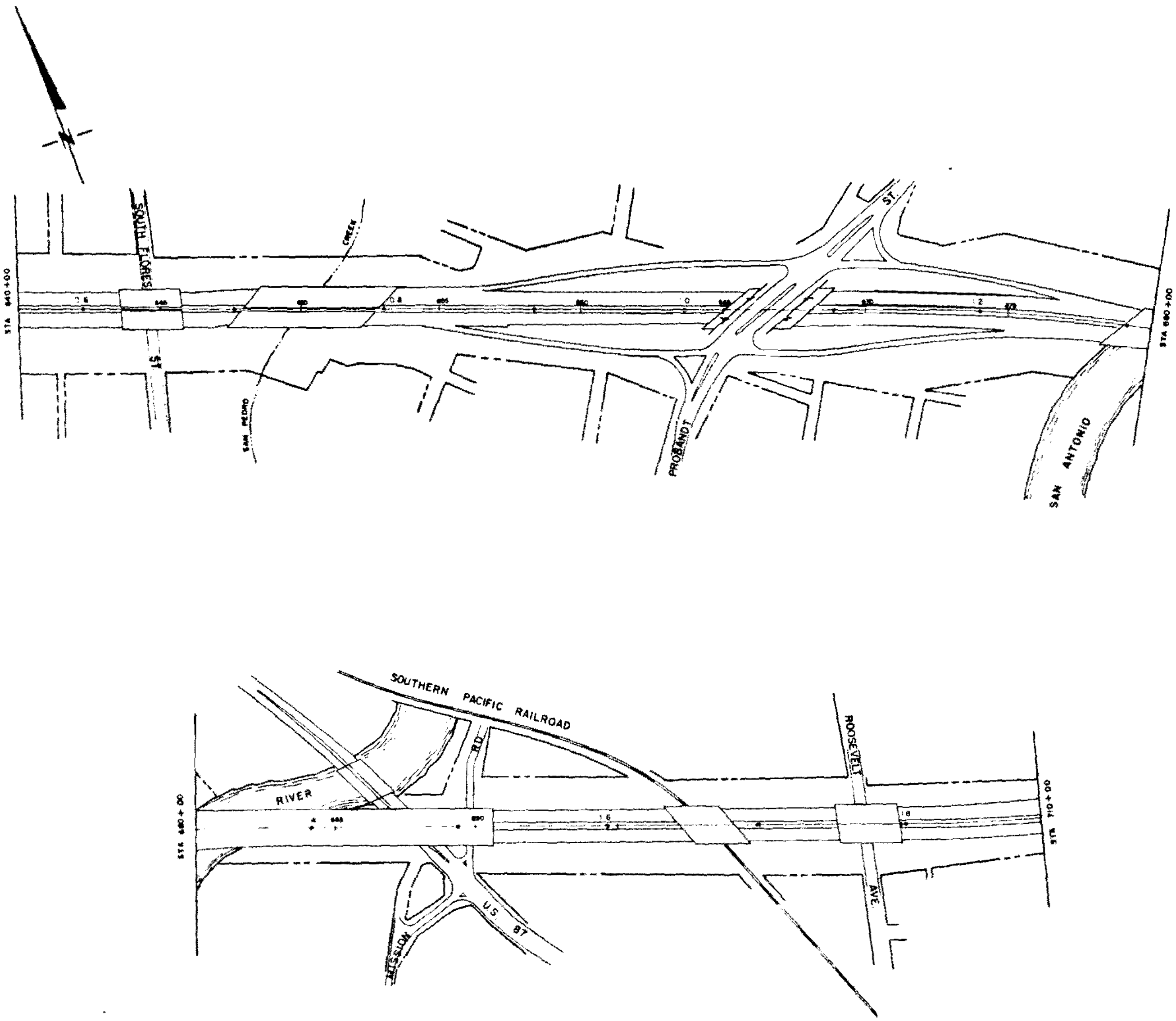

STA 640+00
SOUTH FLORES
ST
CREEK
SAN PEDRO
PROBANDT
ST
SAN ANTONIO
STA 680+00
SOUTHERN PACIFIC RAILROAD
RIVER
RD
MISSION
U.S. 87
ROOSEVELT
AVE.
STA 710+00

FIGURE 2

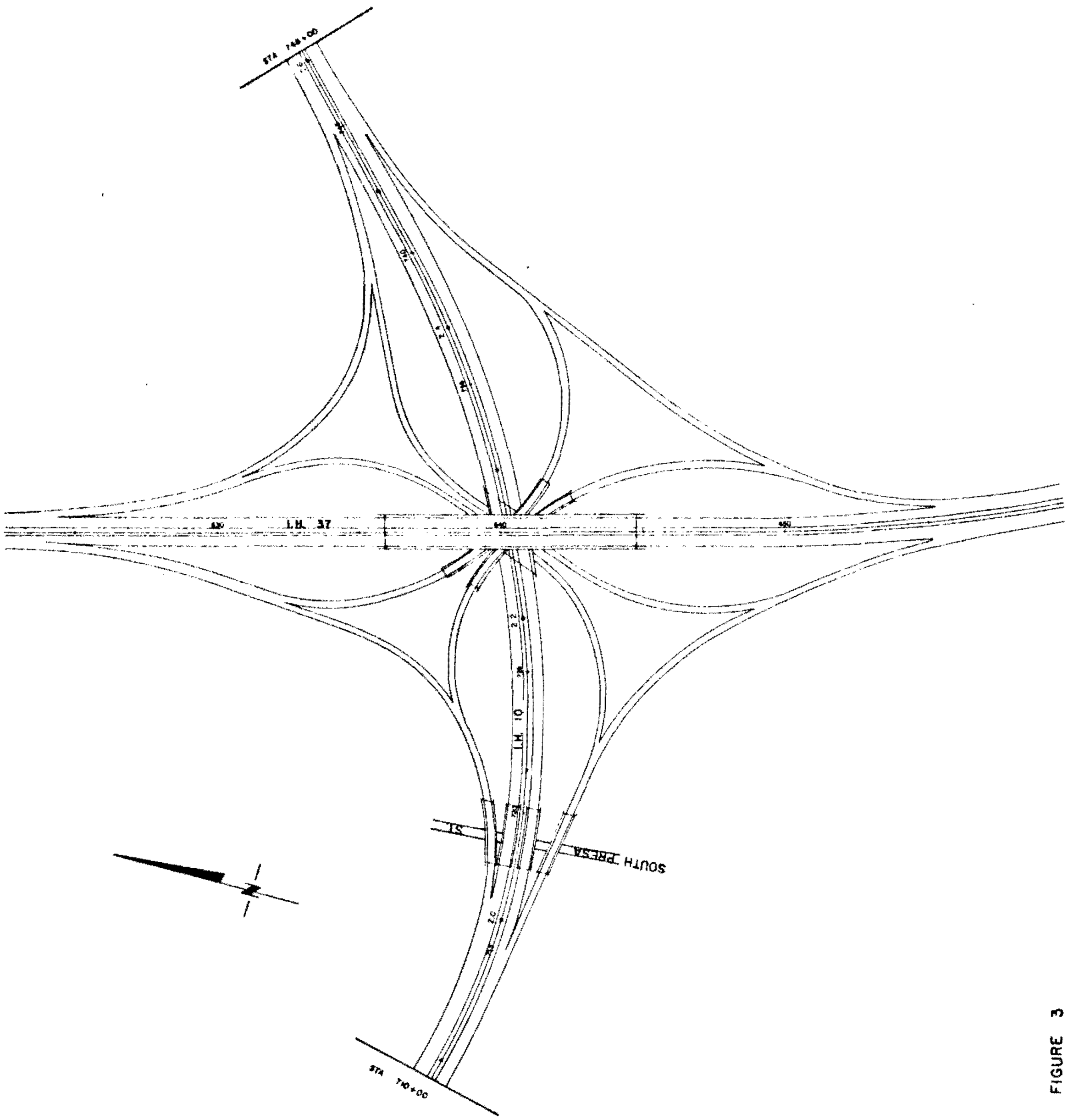


FIGURE 3

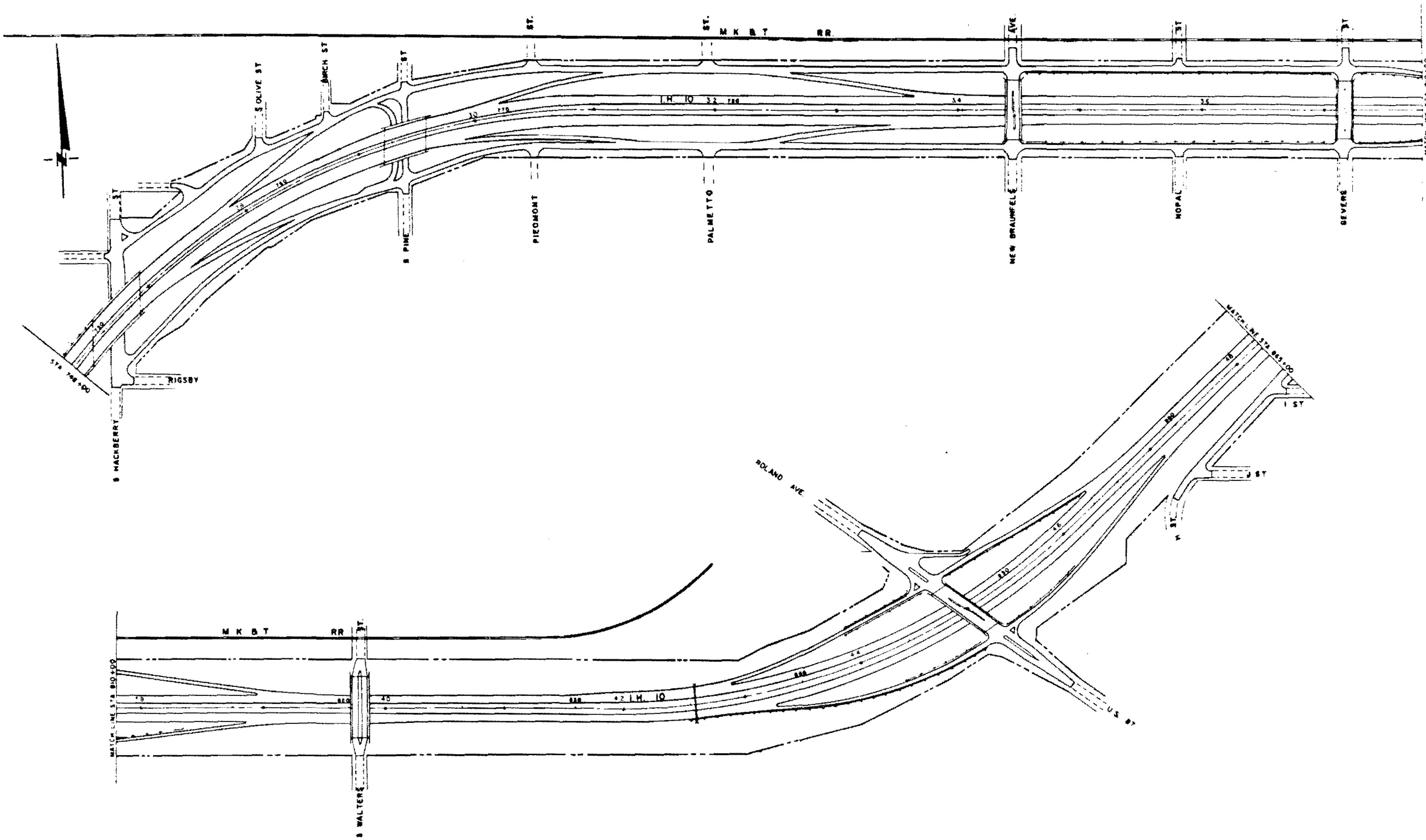

M K & T RR
I.H. 10
S OLIVE ST
BIRCH ST
S PINE ST
PIEDMONT ST.
PALMETTO ST.
NEW BRAUNFELS AVE.
NOPAL ST
GEVERS ST
S HACKBERRY ST
RIGSBY
STA 748+00
MATCH LINE STA 810+00
S WALTERS ST.
ROLAND AVE.
U.S. 87
H ST.
J ST
I ST
MATCH LINE STA 865+00

FIGURE 4

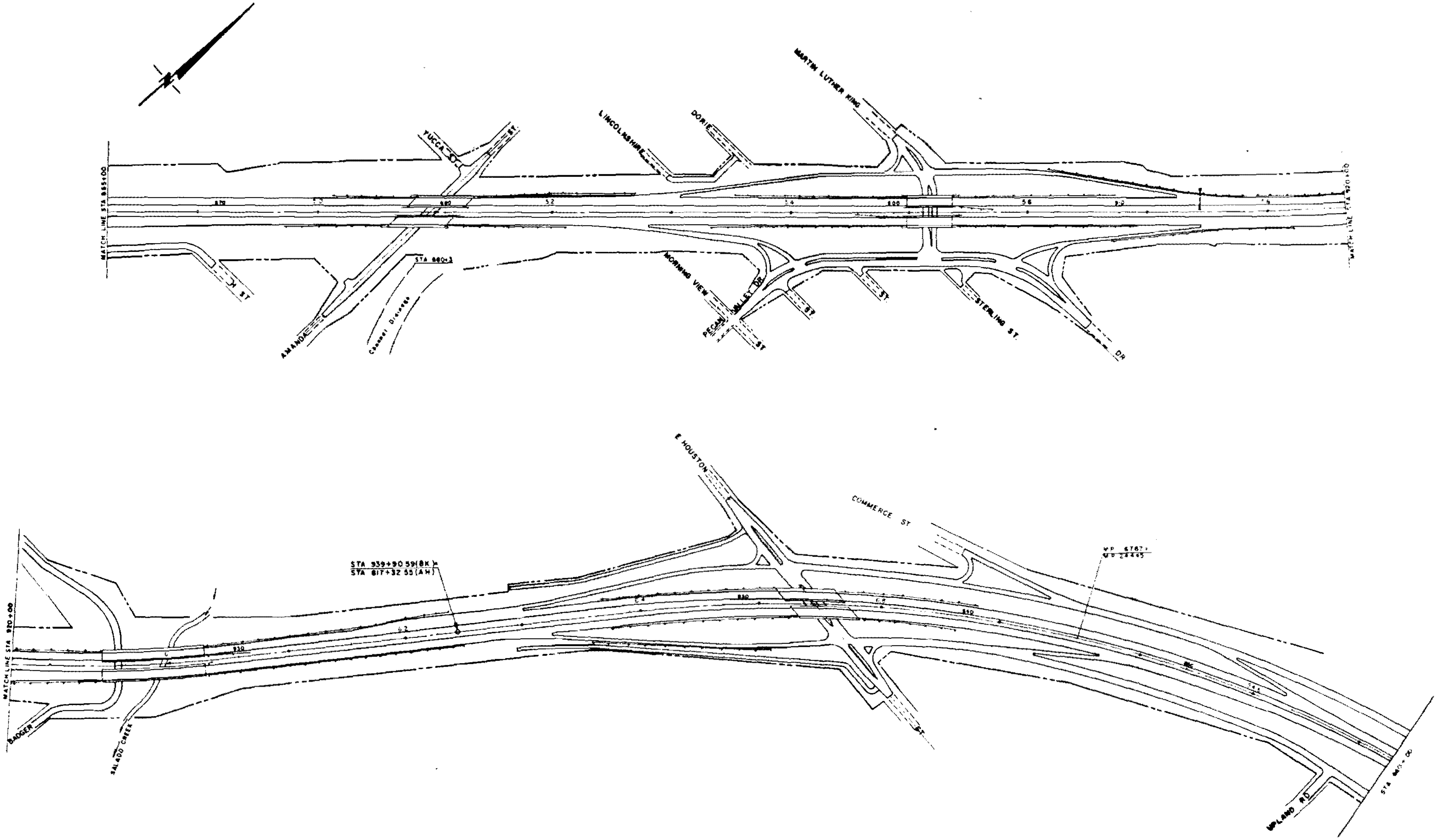

MATCH LINE STA 885+00
MATCH LINE STA 920+00
YUCCA
ST
LINCOLNSHIRE
DORIE
MARTIN LUTHER KING
K ST
AMANDA
Channel Drainage
STA 880+3
MORNING VIEW
PECAN
ST
STERLING ST
DR
E HOUSTON
COMMERCE ST
STA 939+90.59(BK)
STA 617+32.55(AH)
BADGER
SALADO CREEK
UPLAND RD
STA 940+00

FIGURE 5

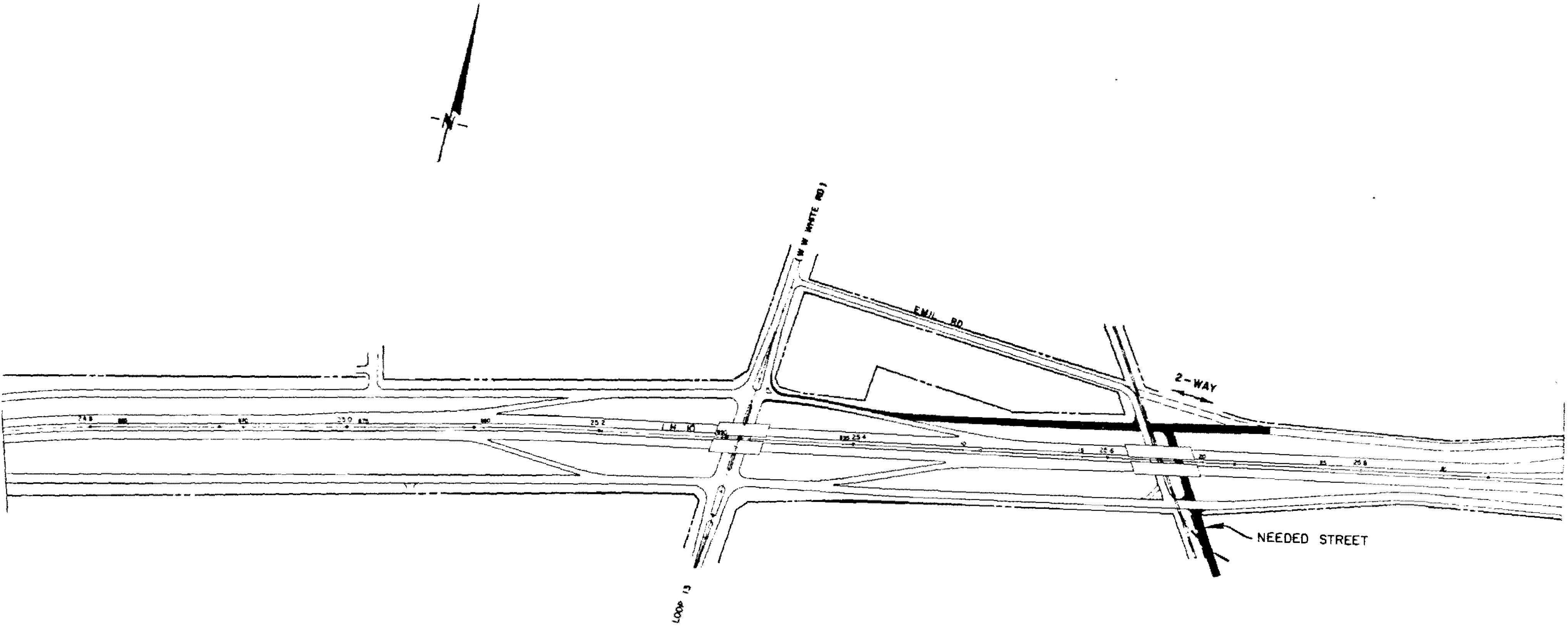


FIGURE 6

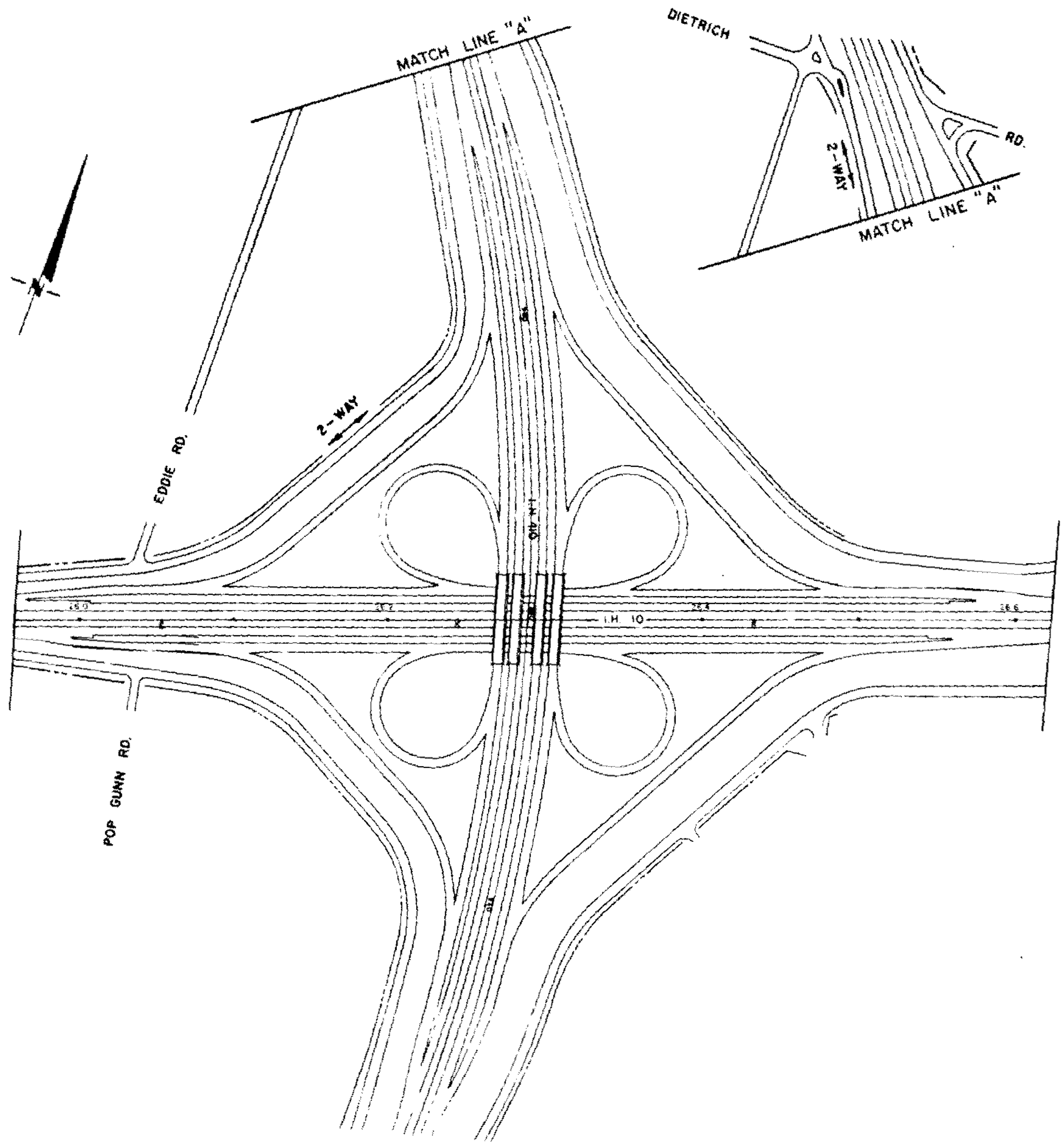

MATCH LINE "A"
DIETRICH
RD.
2-WAY
MATCH LINE "A"
EDDIE RD.
2-WAY
I.H. 410
I.H. 10
POP GUNN RD.

FIGURE 7

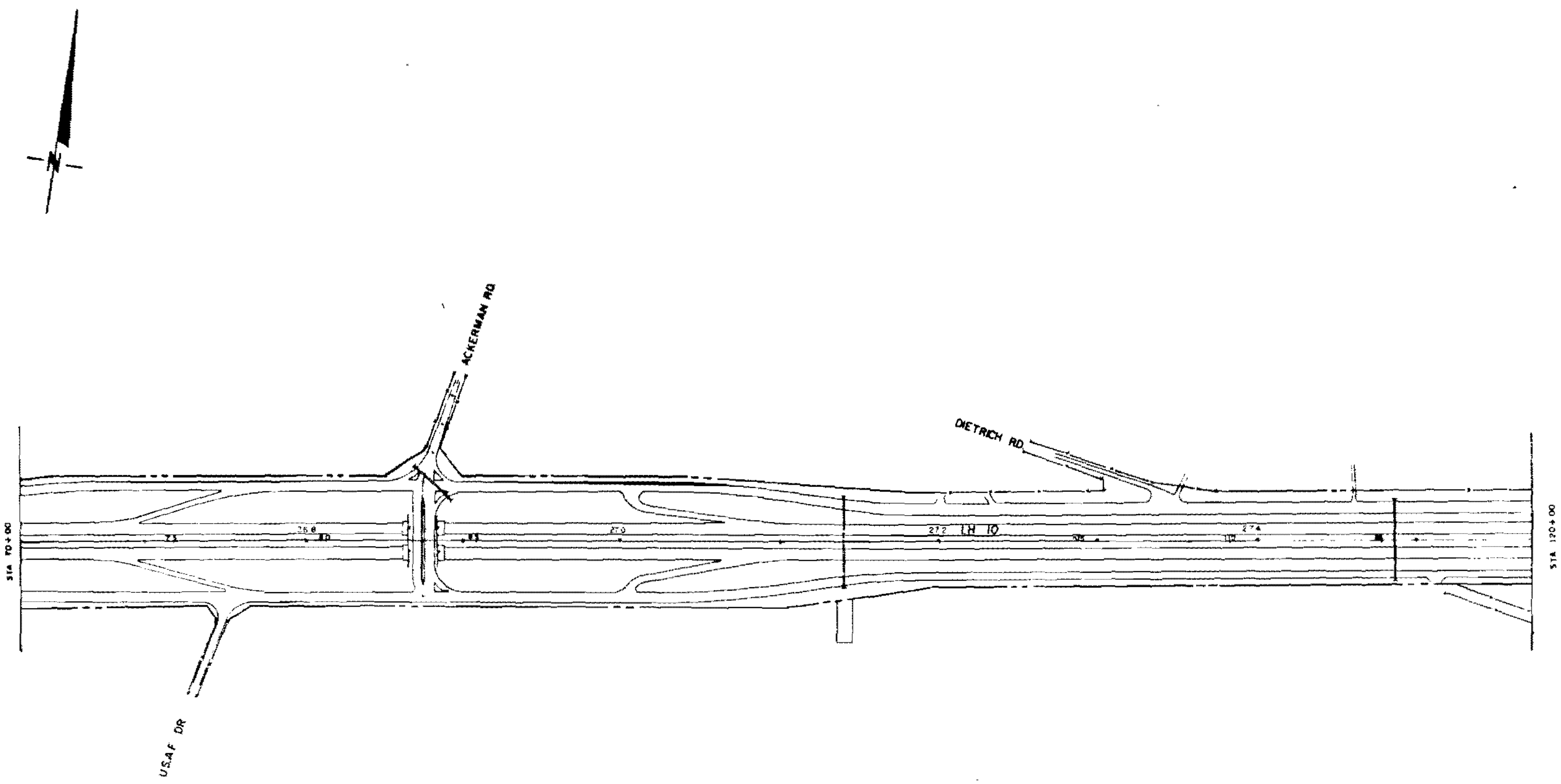


FIGURE 8

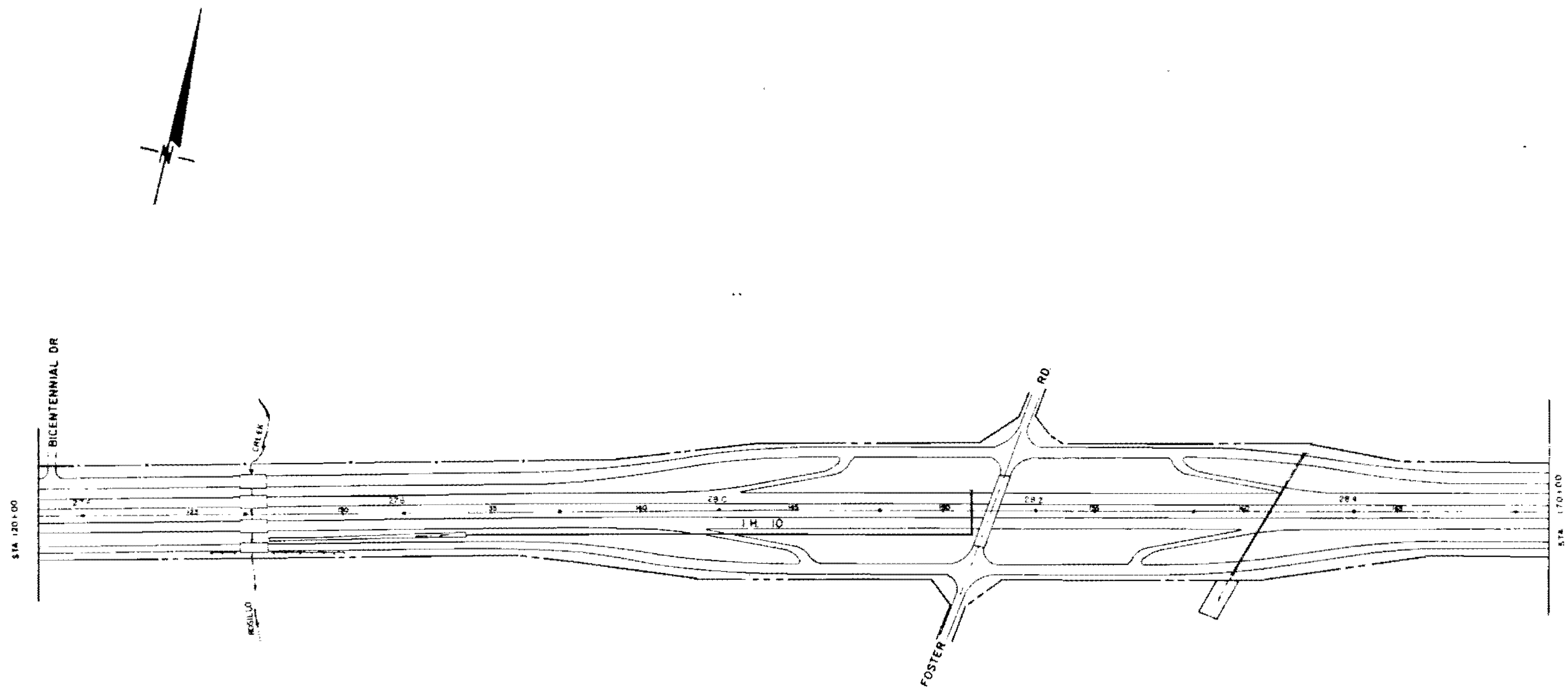

BICENTENNIAL DR
STA 120+00
CREEK
ROSILLO
I.H. 10
FOSTER RD
STA 170+00

FIGURE 9

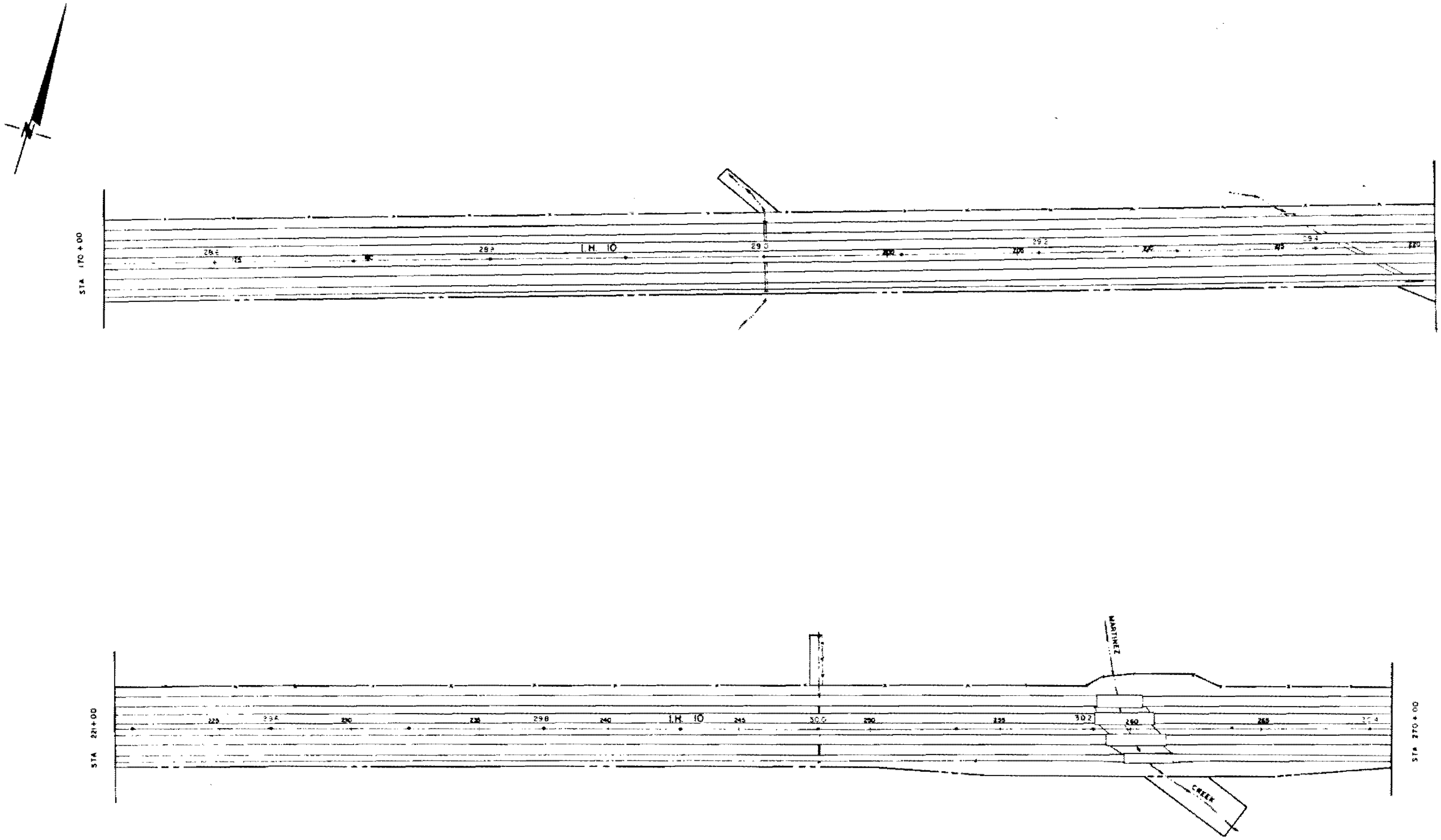

STA 170+00
I.H. 10
STA 221+00
STA 221+00
I.H. 10
MARTINEZ
CREEK
STA 270+00

FIGURE 10

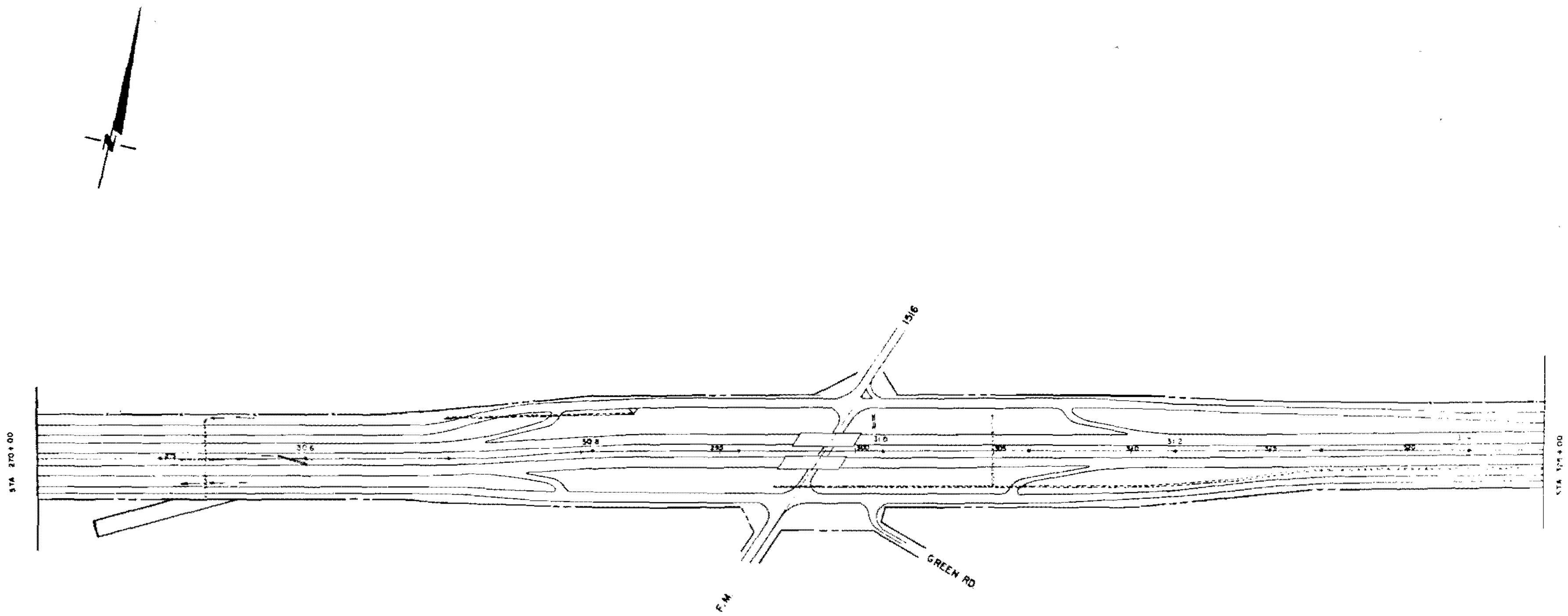


FIGURE 11

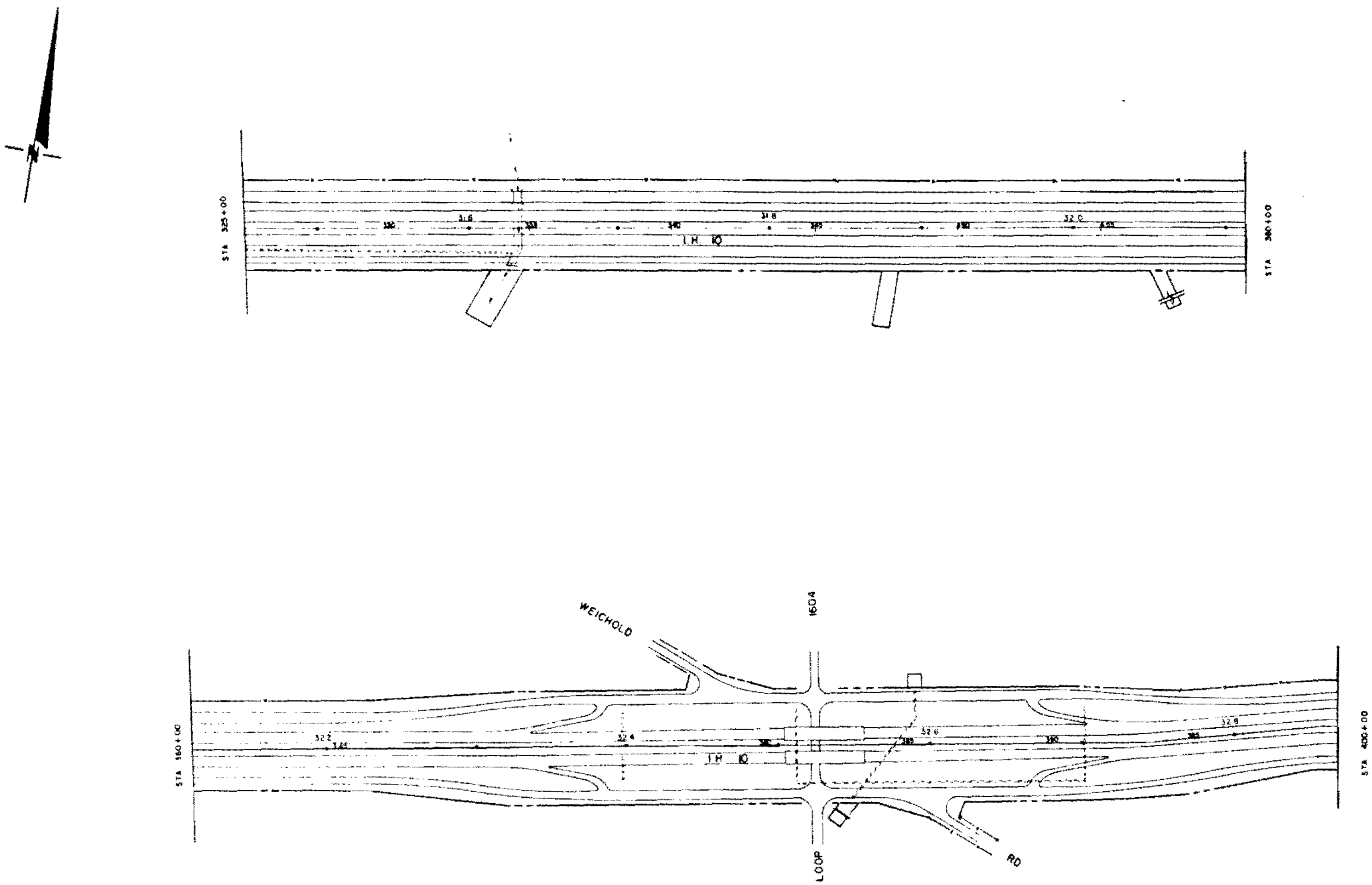
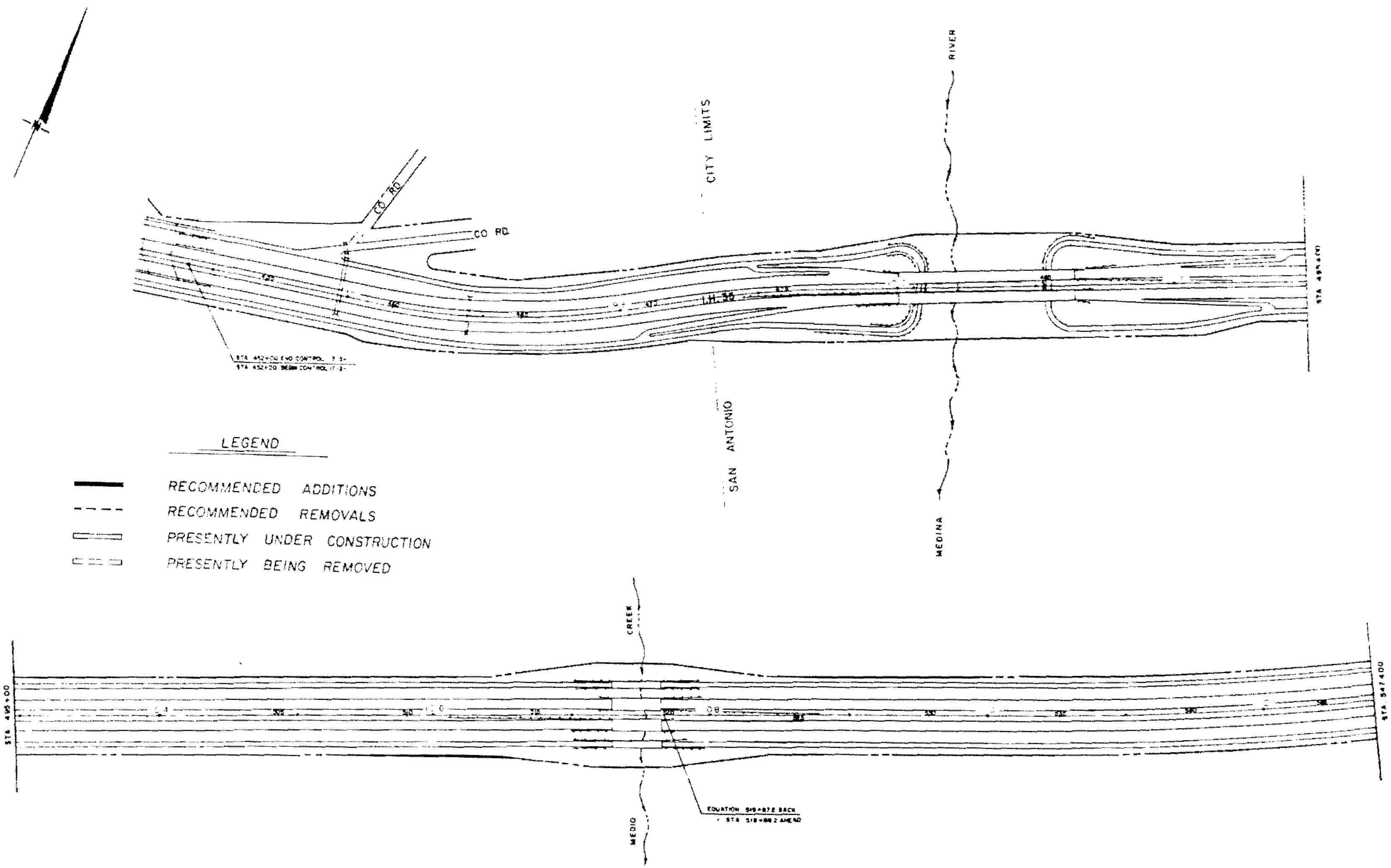

STA 325+00
STA 360+00
I.H. 10
STA 360+00
STA 400+00
WEICHOLD
1604
LOOP
RD

FIGURE 12



CITY LIMITS
SAN ANTONIO
RIVER
MEDINA
CO RD
CO RD.
I.H. 35
CREEK
MEDIO
STA 495+00
STA 547+00
LEGEND
RECOMMENDED ADDITIONS
RECOMMENDED REMOVALS
PRESENTLY UNDER CONSTRUCTION
PRESENTLY BEING REMOVED

FIGURE 1

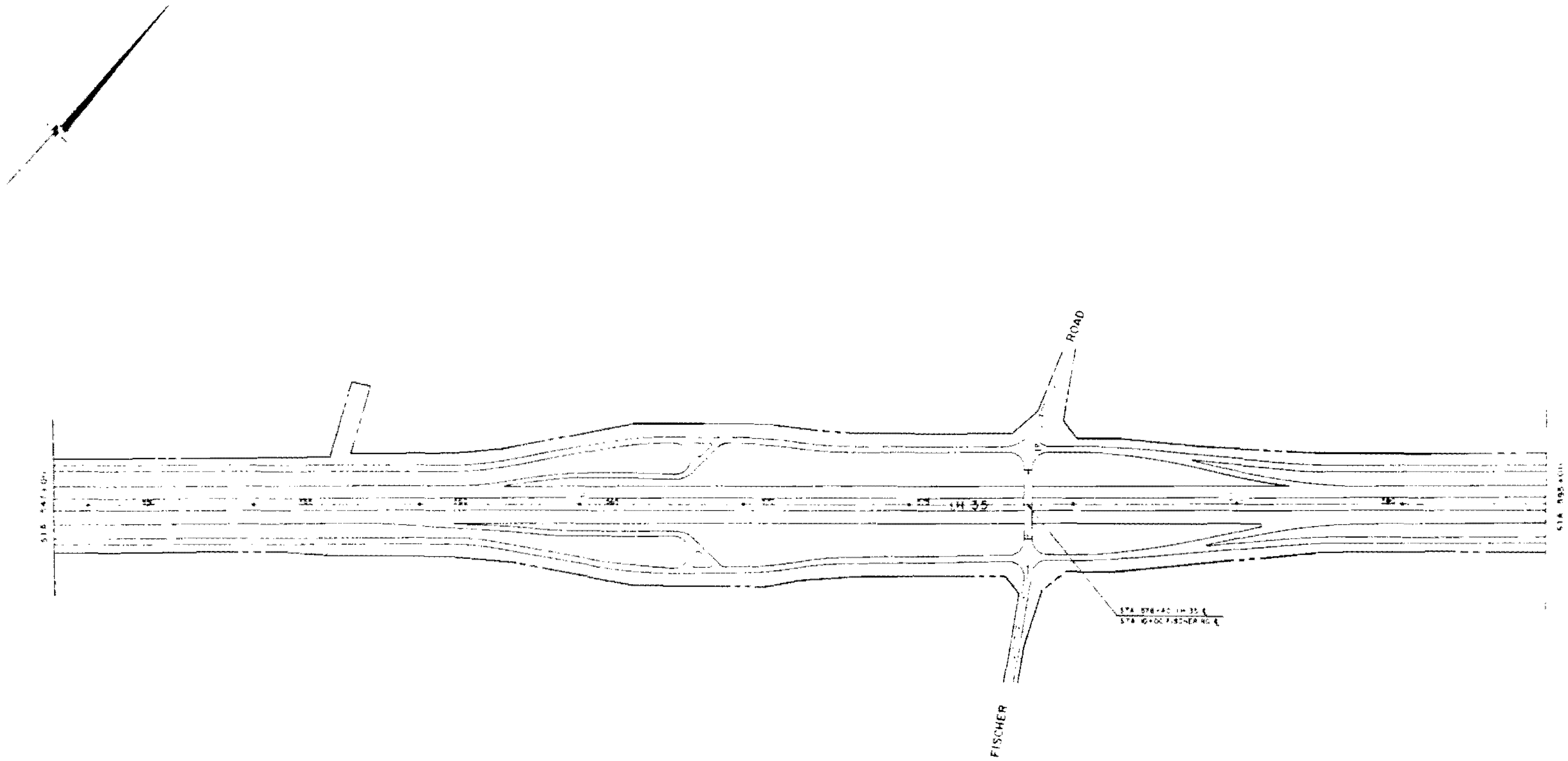


FIGURE 2

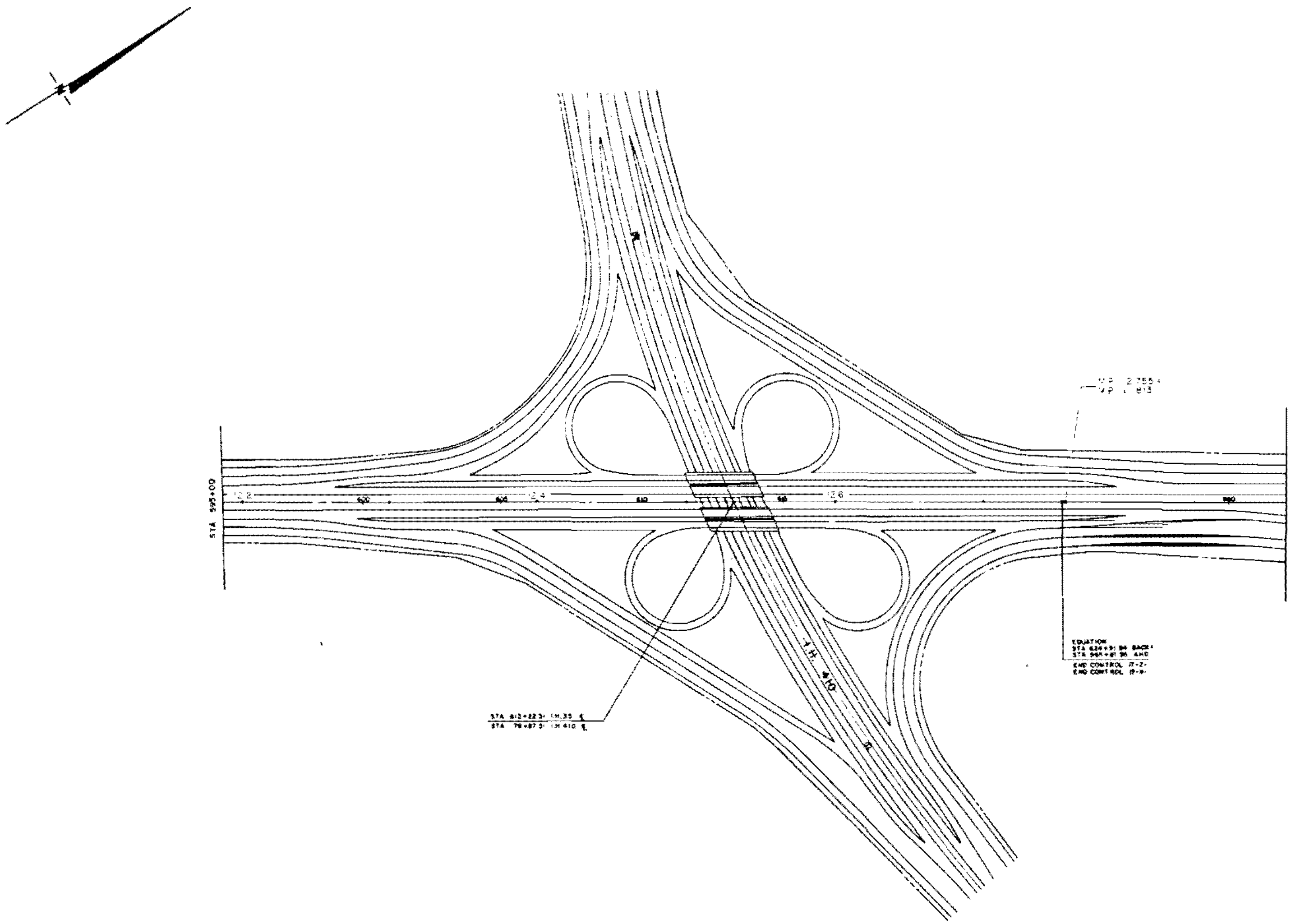


FIGURE 3

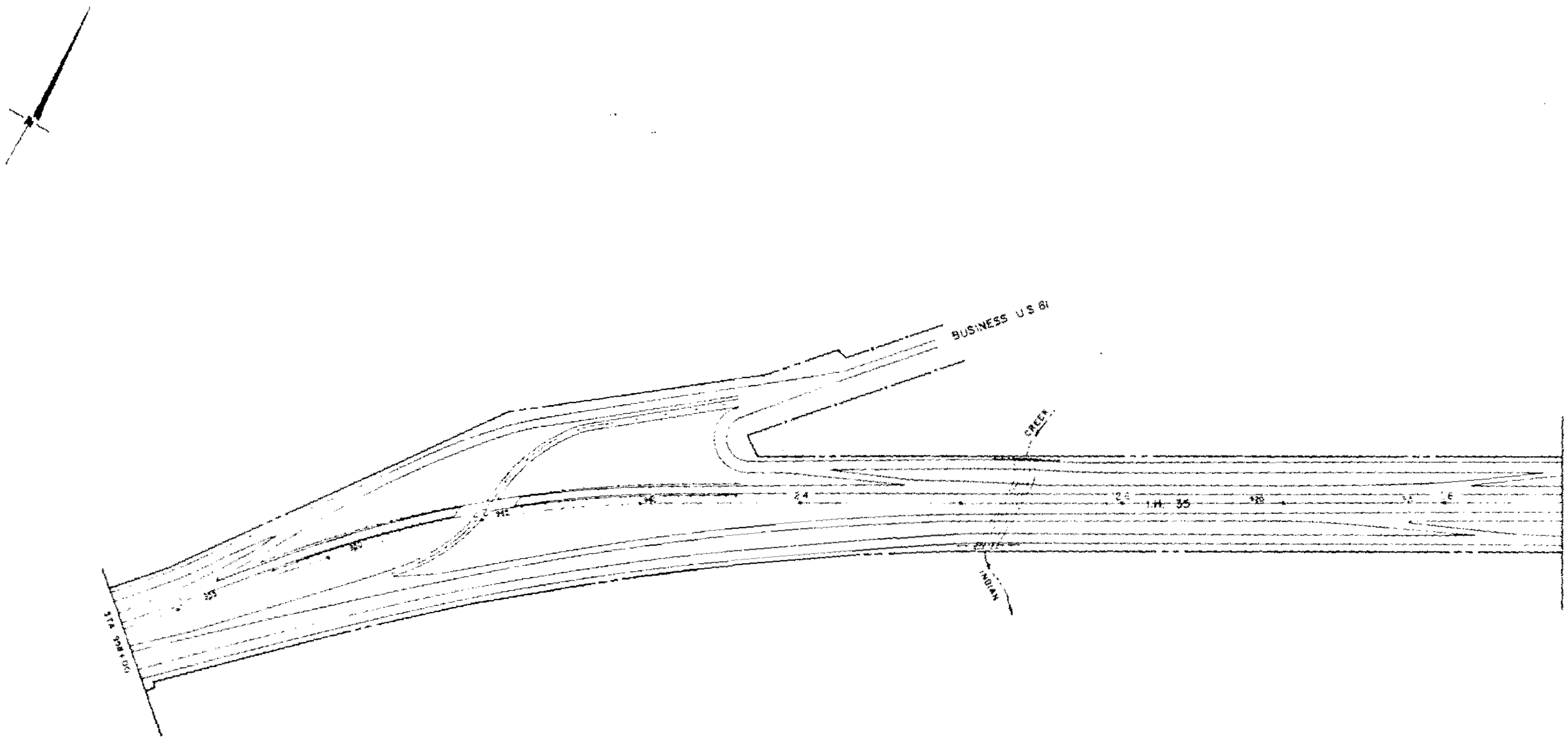
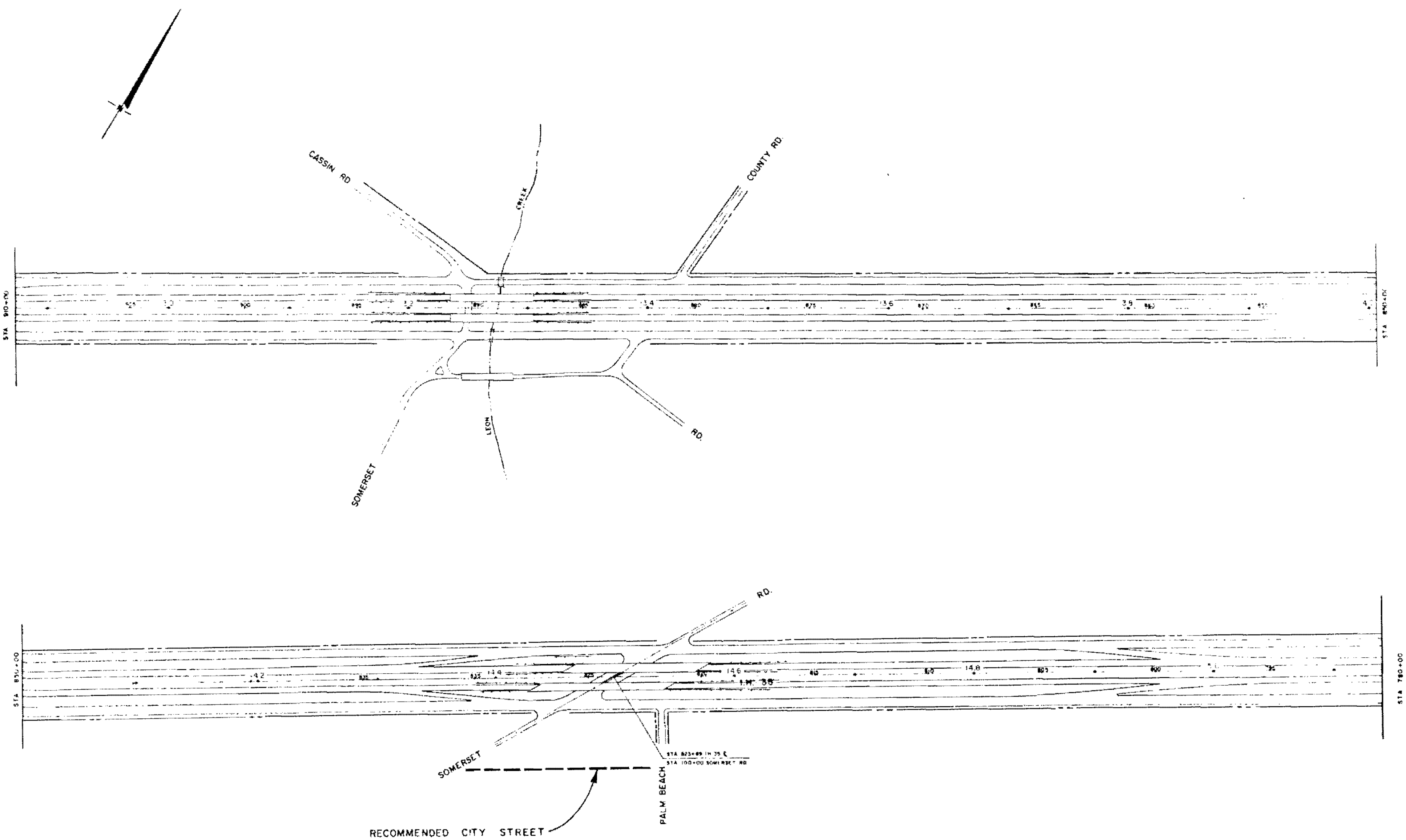


FIGURE 4



CASSIN RD
COUNTY RD
CREEK
LEON
SOMERSET
RD.
SOMERSET
RD.
PALM BEACH
I.H. 35
RECOMMENDED CITY STREET

FIGURE 5

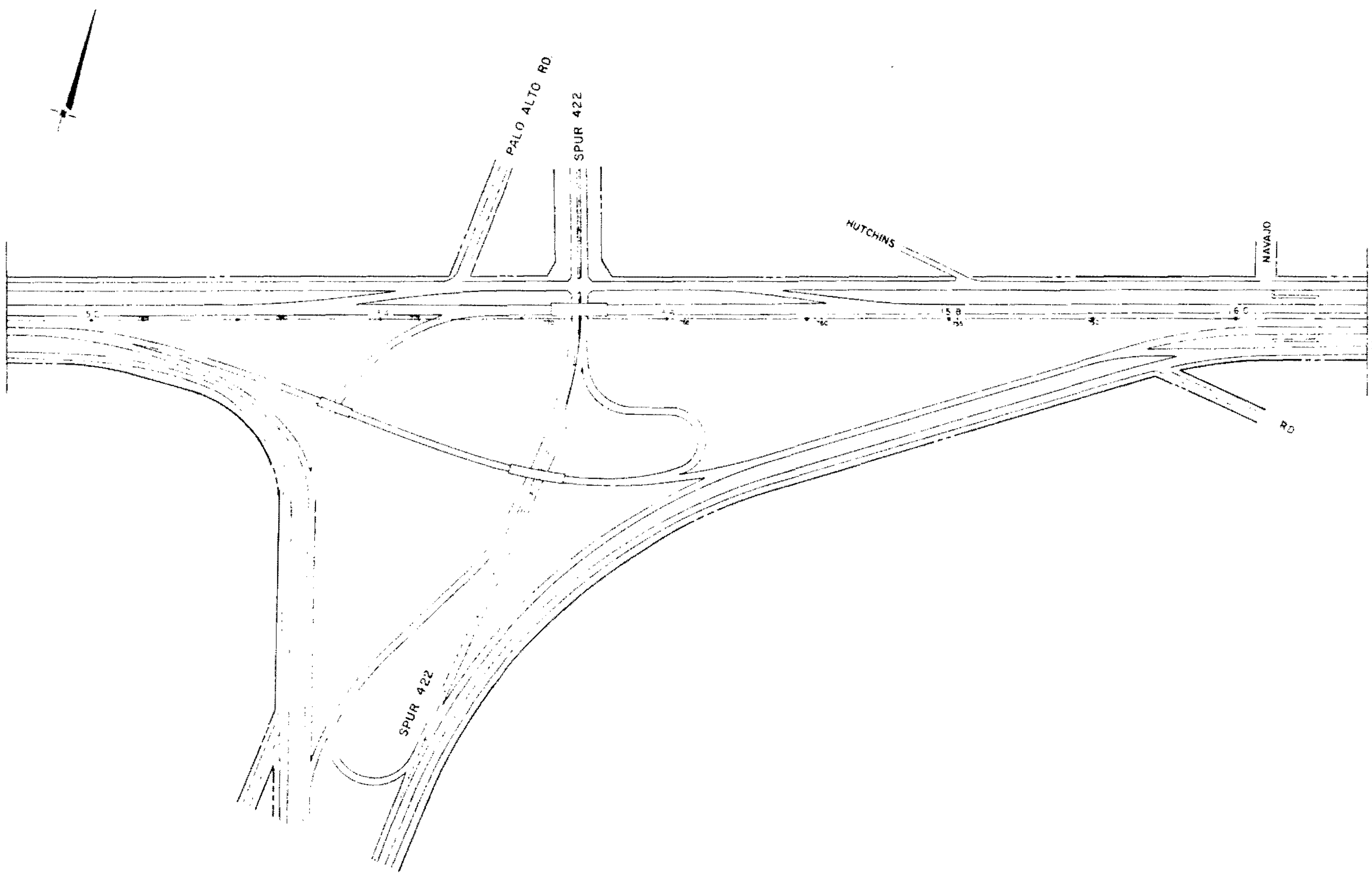


FIGURE 6

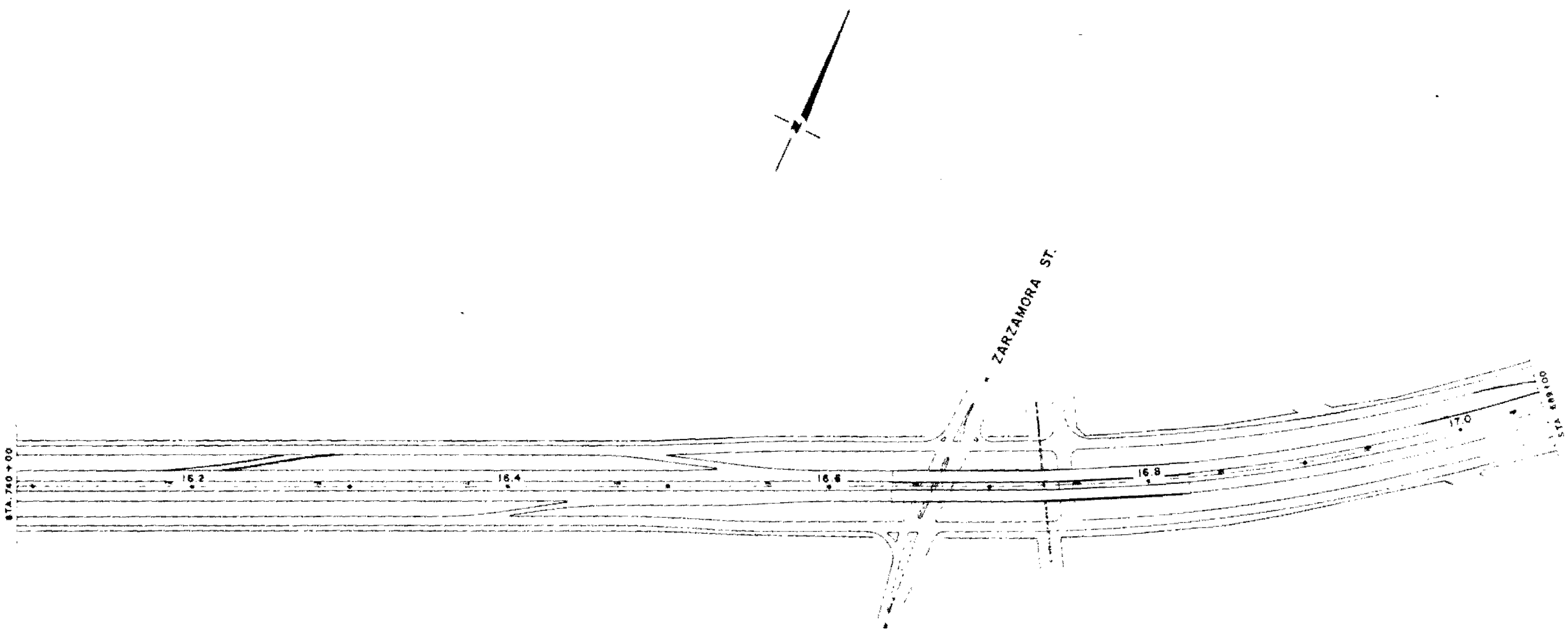


FIGURE 7

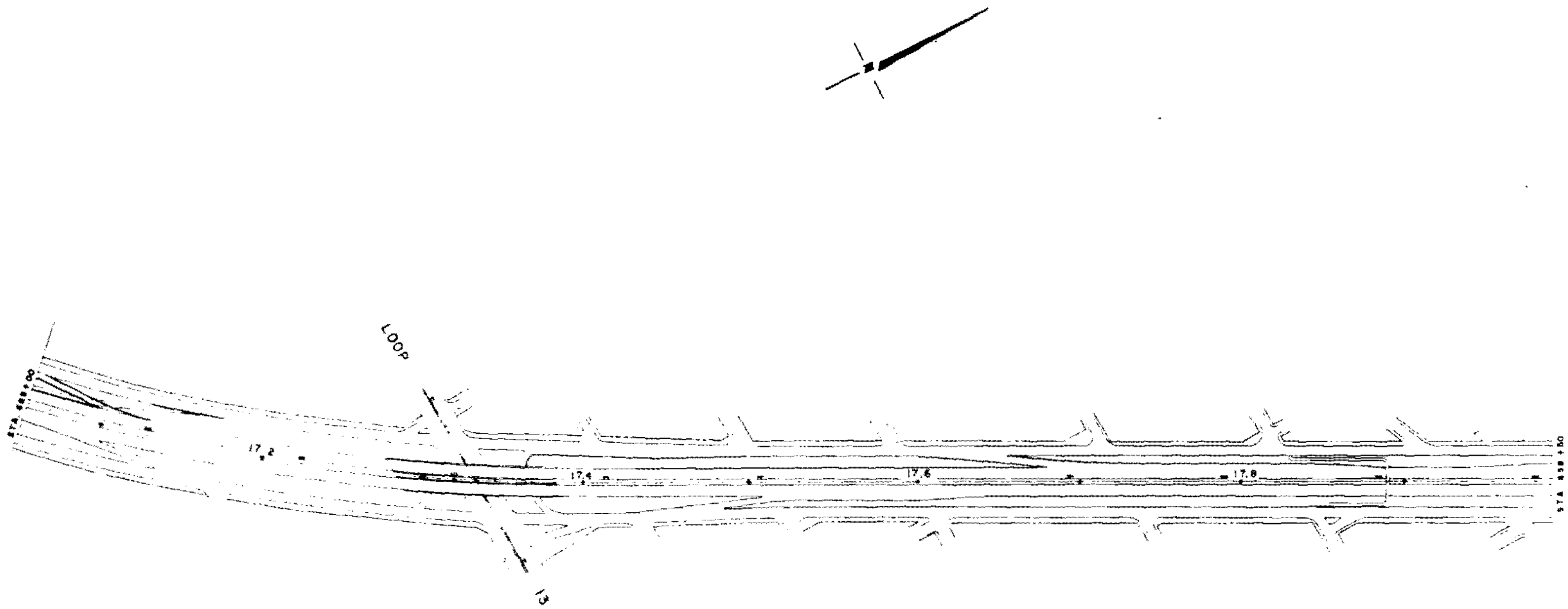


FIGURE 8

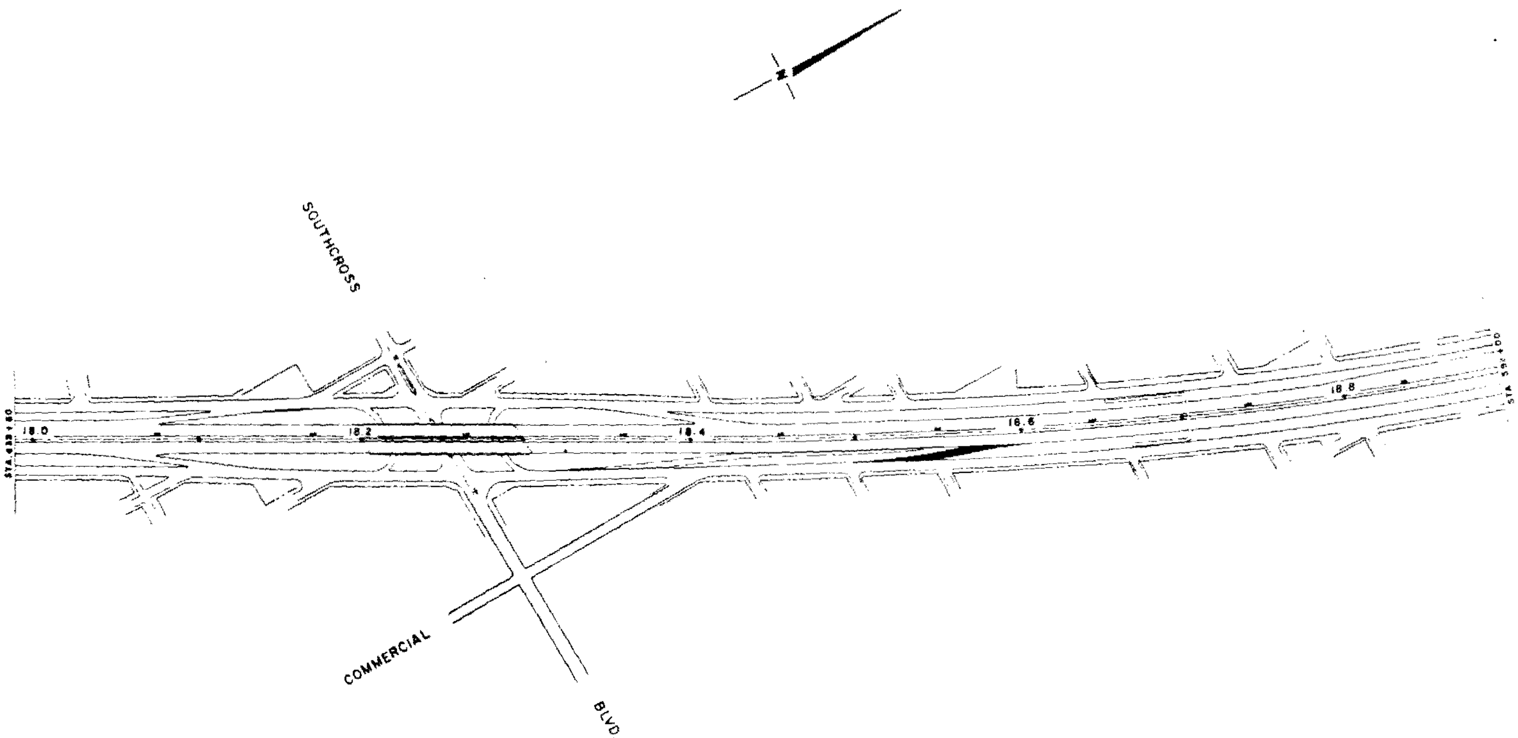


FIGURE 9

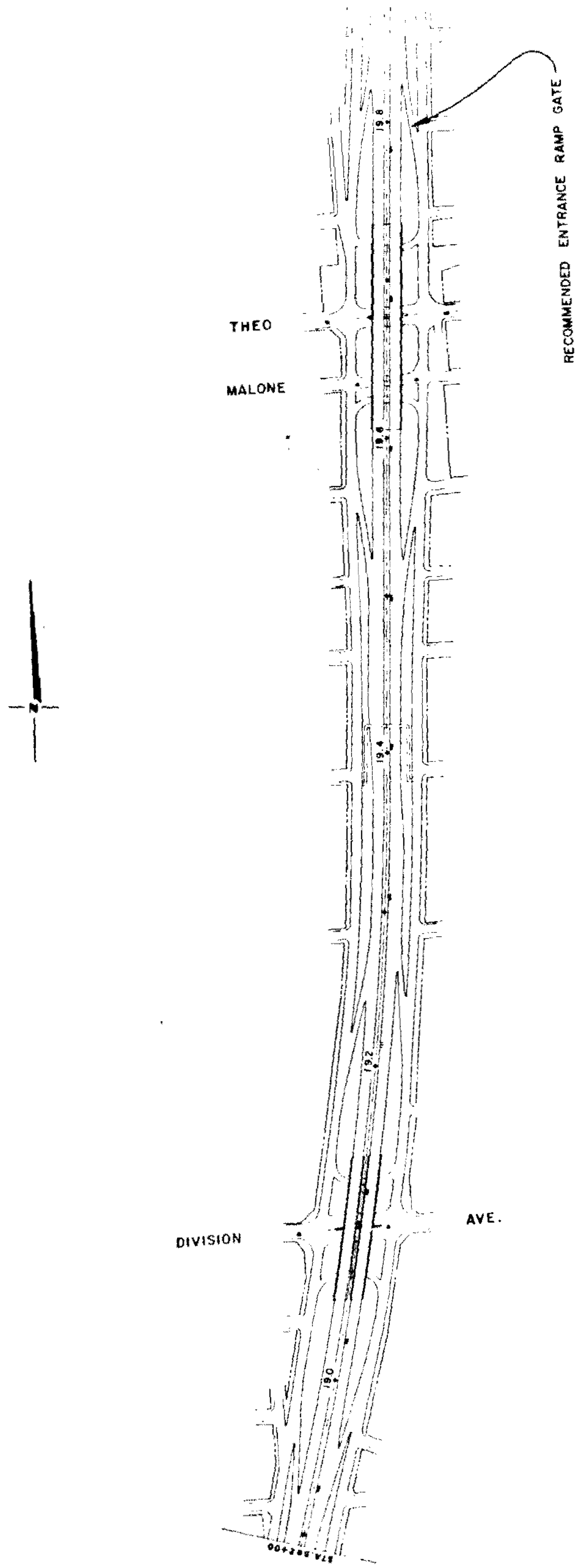
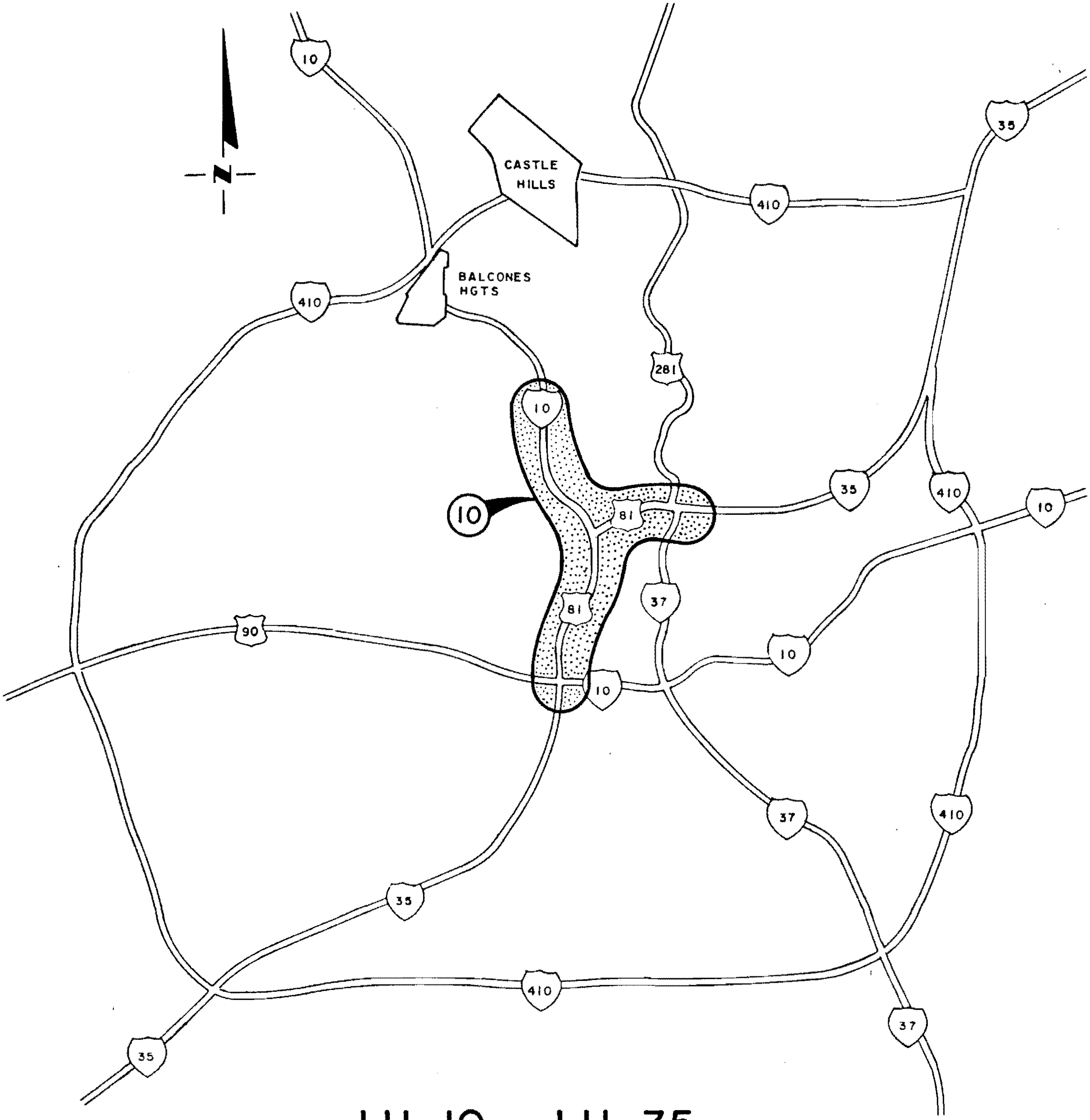

RECOMMENDED ENTRANCE RAMP GATE
THEO
MALONE
19.6
19.4
19.2
19.0
N
DIVISION
AVE.
STA. 882+00

FIGURE 10



I.H. 10 - I.H. 35

FREEWAY OPERATIONS STUDY

I.H. 10 - FROM: FRESNO DR. TO: I.H. 35

I.H. 35 - FROM: THEO AVE. TO: PINE ST.

INTRODUCTION

This study will identify the areas that are capacity deficient and expose the areas where access is not easily available. It will also identify the areas that were high accident locations.

GENERAL DISCUSSION

The limits of this study on I.H.10 are from Fresno Drive to I.H.35 and on I.H.35 from Theo Ave. to Pine Street. This section of downtown freeway is one of San Antonio's oldest sections of freeway. It is generally two lanes each direction with some areas having three lanes in each direction. The existing roadway within the limits of this study can be seen in FIGURE 1 through 9. The freeway within the limits of this study is extremely overloaded and the demand exceeds the capacity, especially during the peak hours. Consequently, it has been known to have some of the highest accident rates in the City. The 1978 accidents were obtained from the "Highway Traffic Accident Analysis Detail Listing". A breakdown of these accidents can be found in Table A through P.

Improvements to this downtown section of freeway have been in the planning stage in excess of ten years. The planned improvements can be seen in copies of photographs taken of a scaled model that show the improvements as built. The existing problems and planned improvements will be discussed in the PROBLEMS AND PLANNED SOLUTIONS portion of this study.

PROBLEMS:

1. The mainlanes of I.H.35 and I.H.10 are at capacity during the peak hours and the accident rates are extremely high throughout the limits of this study.

2. The lack of continuous frontage roads and improved ramp locations has created circuitous routes through residential areas and has caused unnecessary additional mainlane volume. The short mainlane weaving sections between ramps carry high volumes of traffic which has created unacceptable levels of service.

3. The I.H.10 southbound entrance ramps from Fredericksburg Road, Woodlawn Avenue, Cincinnati Avenue and Culebra Road are high volume entrance ramps. Entrance ramp metering signals have been installed to control the traffic volumes that have to enter the already congested mainlanes. These ramp metering signals have caused entrance ramp backups that sometimes result in congestion on the arterial streets. The Fredericksburg Road and Woodlawn Avenue entrance ramps are also too close together which overloads the outside mainlane.

4. The I.H.10 frontage roads north of Culebra Road are two-way traffic that result in driver confusion and intersection congestion.

5. An entrance ramp gate has been installed on the I.H.10 southbound entrance ramp from Colorado to control traffic during the A.M. peak period. This entrance ramp gate restricts vehicles from entering the already congested mainlanes and eliminates the unacceptable weaving level of service between this entrance ramp and the exit to Poplar Street during the A.M. peak period.

6. The I.H.10 northbound entrance ramps from Martin and Marshall are high P.M. peak hour traffic volumes. Entrance ramp metering has been installed to control the entering traffic volume and improve the mainlane level of service. The ramp metering has created excessive delay to the vehicles leaving the downtown area.

7. The connectors in the I.H.10-I.H.35 interchange do not provide adequate capacity to accommodate the demand in the peak hours.

8. Southbound I.H.35 access to the C.B.D. and the new Vista Verde South development is needed near Durango Blvd. The

present southbound routes to downtown are congested during the peak hours.

9. South Laredo Street, which is the I.H.35 east frontage road, between Guadalupe and Cevallos is two-way traffic which creates confusion, congestion and reduces the capacity.

10. Access to I.H.35 northbound is needed near the Union Stock Yards.

11. The mainlanes and weaving sections of I.H.35 between Pine Street and the I.H.10 interchange near Finesilver Manufacturing Company are at capacity during the peak hours. Because of the close proximity of the exit ramps and the intersections, mainlane backups have resulted and the high volume arterial streets have caused driver confusion and excessive delays. Better access is also needed to and from the C.B.D.

STUDY NO. 10

SUMMARY OF PLANNED SOLUTIONS ON I.H.10 AND I.H.35 - DOWNTOWN "Y"

1. Expand the existing facility to a total of 10 mainlanes. Five mainlanes in each direction, part of which would be in elevated sections above the existing roadway and other parts as widening the existing roadway.
2. Relocate the I.H.10 southbound exit ramp to Fredericksburg Road further north to provide access to the area streets.
3. Relocate the I.H.10 southbound entrance ramp to Fredericksburg Road to the upper level to prevent merging problems with the entrance ramp from Woodlawn Avenue.
4. Provide a continuous frontage road on the west side of I.H.10 between Woodlawn Avenue and Culebra Road. This will provide a continuous frontage road from I.H.410 to Culebra Road.
5. Construct a bridge on McAllister Street over Martinez Creek to provide access to the area streets from Culebra Road and convert the two-way traffic on the I.H.10 west frontage road north of Culebra Avenue to one-way.
6. Construct a right turn lane on the eastbound Culebra Road approach to the I.H.10 southbound frontage road.
7. Provide a continuous frontage road on the east side of I.H.10 between Cincinnati Avenue and Culebra Road. Convert the existing two-way traffic to one-way.
8. Remove the existing I.H.10 southbound entrance ramp from Colorado. The removal of this ramp will eliminate the mainlane weaving problem between this entrance ramp and the Poplar Street exit ramp.

9. Relocate the existing I.H.10 northbound entrance ramp from Marshall St. further north.

10. Provide an I.H.10 southbound exit ramp to the frontage road just south of N. Frio. This frontage road will provide access to the C.B.D. via N. Laredo or Pecos Street.

11. Remove the existing I.H.10 southbound one lane loop connection to I.H.35 northbound and provide an elevated two lane direct connection.

12. Provide an elevated three lane connection from I.H.10 southbound to I.H.35 southbound over Martin St.

13. Provide an I.H.35 southbound two lane connection to I.H.10 northbound.

14. Provide an I.H.35 northbound two lane connection to I.H.10 northbound.

15. Provide a grade separated interchange on I.H.35 at Durango Blvd.

16. Provide an I.H.35 southbound two lane loop connection to Durango Blvd. which will also provide access to Vista Verde South.

17. Grade-separate the I.H.35 southbound exit to Alamo Street with an entrance from Guadalupe Street.

18. Convert S. Laredo from two-way traffic to one-way traffic from Guadalupe to Cevallos. S. Laredo will become the northbound frontage road.

19. Remove the existing I.H.35 ramps from Alamo Street and relocate them from the frontage roads.

20. Provide an I.H.35 northbound entrance ramp from Powell Street.

21. Provide continuous frontage roads on the west side of I.H.35 between San Marcos and Nogalitos and from El Paso to S. Laredo.

22. Grade-separate the I.H.35 southbound entrance from San Marcos and the exit to Nogalitos.

23. Remove the I.H.35 northbound entrance ramp from Main Avenue and provide an entrance from Quincy.

24. Widen the Main Avenue Bridge over I.H.35 to provide a northbound left turn lane.

25. Convert the two-way traffic on Brooklyn Avenue and McCullough

Avenue to one-way, making Brooklyn Avenue one-way away from downtown and McCullough Avenue one-way toward downtown.

26. Provide an I.H.35 northbound exit ramp to McCullough Avenue from the upper level mainlanes.

27. Provide an I.H.35 southbound entrance ramp from McCullough Avenue to the upper level mainlanes. This entrance ramp will be grade-separated with the lower level exit ramp to Lexington.

28. Provide an I.H.35 northbound entrance ramp from Brooklyn Avenue to the upper level.

29. Provide an I.H.35 southbound exit ramp to Brooklyn Avenue from the upper level.

30. Remove the I.H.35 southbound exit ramp to Atlanta Avenue.

31. Remove the I.H.35 southbound entrance ramp from N. St. Mary's.

32. Remove the I.H.35 northbound entrance from N. St. Mary's.

33. Provide an exit to Broadway via Newell Street from the I.H.35 northbound connection to U.S.281 northbound.

34. Improve Newell Street to become a four lane divided street from Quincy to Broadway.

35. Extend Quincy northbound under I.H.35 to intersect with Newell Street to provide a continuous frontage road.

36. Extend Newell Street to Elmira Street to provide a continuous southbound frontage road.

CONCLUSION

The planned solutions will solve the existing problems by improving the level of service, providing better access, improving the overall circulation and eliminating the weaving sections. These improvements will eliminate the congestion which will reduce the high accident rates. Therefore, this study will recommend no additional improvements to the already planned solutions.

1978 ACCIDENT HISTORY

I.H. 10

DIR.	LOC.	M.P. *	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	22.8	1^{1}		1^{1}						1^{1}				3^{3}
SB	ML	22.9							1			3	1		5
SB	ML	23.0							1			2^{1}			3^{1}
SB	ML	23.1							1						1
SB	ML	23.2	3	1	2^{1}										6^{1}
SB	ML	23.3										1			1
SB	ML	23.5		1					1			1			3
SB	ML	23.6									1^{1}				1^{1}
SB	ML	23.7									1^{1}			1^{1}	2^{2}
SB	ML	23.8	4^{1}			1		1						1	7^{1}
SB	ML	23.9	1		1										2
SB	ML	24.0	1^{1}					1		1					3^{1}
SB	ML	0.2			1	1			1^{1}						3^{1}
SB	ML	0.3	1		1	2					1				5
SB	ML	0.4	1		1^{1}										2^{1}
SB	ML	0.5	3	1^{1}		1^{1}		1							6^{2}
SB	ML	0.6	1		1				1^{1}						3^{1}
SB	ML	0.7	5^{1}	1^{1}	2^{2}	1			2^{1}					1^{1}	12^{6}

LEGEND

DIR.	DIRECTION	E.B.	EASTBOUND	M.L.	MAINLANE
LOC.	LOCATION	S.B.	SOUTHBOUND	C.	CONNECTOR
M.P.	MILEPOINT	W.B.	WESTBOUND	F.R.	FRONTAGE ROAD
R.E.	REAR-END ACCIDENT	N.B.	NORTHBOUND	1	FATALITY ACCIDENT
S.S.	SIDESWIPE ACCIDENT	WET	WET SURFACE	2	INJURY ACCIDENT
O.	OTHER	DRY	DRY SURFACE		

* Milepoints are shown on Figures 1-9 to identify accident locations.

TABLE A

1978 ACCIDENT HISTORY

I.H. 10

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	0.8	4	1			2	1	1						9
SB	ML	0.9	4	1	2							1			8
SB	ML	1.0			1^{1}				1^{1}	1	1				4^{2}
SB	ML	1.1		1					1			1		1	4
SB	ML	1.2	3^{3}	1					1						5^{3}
SB	ML	1.3	8^{3}			1				1					10^{3}
SB	ML	1.4	8^{1}	1	3^{1}	2		1			1			1	17^{2}
SB	ML	1.5	1							1	1^{1}				3^{1}
SB	ML	1.6	2^{1}	1		1				1					5^{1}
SB	ML	1.9	1								1				2
TOTAL			52^{12}	10^{2}	16^{7}	10^{1}	2	5	12^{4}	5	8^{4}	9^{1}	1	5^{2}	135^{33}

TABLE B

1978 ACCIDENT HISTORY

I.H. 10

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	1.9	1	1						1	2^{2}				5^{2}
NB	ML	1.8	2	2						1					5
NB	ML	1.7	4^{2}												4^{2}
NB	ML	1.6												1	1
NB	ML	1.5	1									2^{1}	1	1	5^{1}
NB	ML	1.4	1	1					1	1	3^{2}		1		8^{2}
NB	ML	1.3							3^{1}						3^{1}
NB	ML	1.2	3^{1}								1				4^{1}
NB	ML	1.1										1^{1}			1^{1}
NB	ML	1.0	2^{2}	2^{1}		2					1^{1}				7^{4}
NB	ML	0.8	1	1						1	1	1^{1}			5^{1}
NB	ML	0.7	4^{3}	2	2	1			1				1		11^{3}
NB	ML	0.6			2						1				3
NB	ML	0.5	1			1									2
NB	ML	0.4	2^{1}		2			1		1					6^{1}
NB	ML	0.2	1		3^{1}	2		1	1		1				9^{1}
NB	ML	24.0						1	1						2
NB	ML	23.9					1							1	2
NB	ML	23.8	1^{1}												1^{1}
NB	ML	23.7	1												1
NB	ML	23.6	1												1
NB	ML	23.5					1	1	1^{1}						3^{1}
NB	ML	23.4	1		1^{1}	1									3^{1}

TABLE C

1978 ACCIDENT HISTORY

I.H. 10

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	23.2	1					1					1^{1}		3^{1}
NB	ML	23.0	1^{1}	1	1										3^{1}
NB	ML	22.8			1^{1}				1					2	4^{1}
TOTAL			29^{11}	10^{1}	12^{3}	7	2	5	9^{2}	5	10^{5}	4^{3}	4^{1}	5	102^{26}

TABLE D

1973 ACCIDENT HISTORY

I.H. 10

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	23.0									1^{1}				1^{1}
SB	FR	23.1			1										1
SB	FR	23.2	1		4^{3}						1				6^{3}
SB	FR	23.5			4^{2}						1^{1}			1^{1}	6^{4}
SB	FR	0.2	1^{1}		2^{1}	1^{1}		1	1						6^{3}
SB	FR	0.8	1									1		1	3
SB	FR	1.3	1												1
SB	FR	1.7			1										1
TOTAL			4^{1}		12^{6}	1^{1}		1	1		3^{2}	1		2^{1}	25^{11}

TABLE E

1978 ACCIDENT HISTORY

I.H. 10

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	1.3	1											1	2
NB	FR	0.8	3		1					1					5
NB	FR	0.2			7^{1}	1		2	1			1			12^{1}
NB	FR	23.5			1						1^{1}				2^{1}
NB	FR	23.2	1		3^{2}			1			1				6^{2}
NB	FR	23.0									1^{1}				1^{1}
TOTAL			5		12^{3}	1		3	1	1	3^{2}	1		1	28^{5}

TABLE F

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	19.9	8^{3}					1							9^{3}
NB	ML	20.0	1	1	1^{1}										3^{1}
NB	ML	20.1	13^{4}	5	4^{1}	3^{1}	1	1	2	3^{1}					32^{7}
NB	ML	20.2	4^{2}			1	1		1						7^{2}
NB	ML	20.3		1		2									3
NB	ML	20.4	2		1	2^{1}		3						1^{1}	9^{2}
NB	ML	20.5	3^{2}	2^{2}	2	2^{1}		3	1	1					14^{5}
NB	ML	20.6	2^{1}								2^{1}				4^{2}
NB	ML	20.7	1^{1}								1^{1}	1			3^{2}
NB	ML	20.9	1^{1}	1^{1}											2^{2}
NB	ML	21.0	2^{1}	2							1		1		6^{1}
NB	ML	21.1	1					1^{1}							2^{1}
NB	ML	21.2	1	1											2
NB	ML	21.3	1		1^{1}	1			1		1				5^{1}
NB	ML	21.4		1^{1}											1^{1}
NB	ML	21.5	4^{1}	1	2					1^{1}					8^{2}
NB	ML	21.6	3^{2}	1	1		1^{1}				1^{1}			1	8^{4}
NB	ML	21.7	5^{2}	1		1					1^{1}				8^{3}
NB	ML	21.8		1					1^{1}						2^{1}
NB	ML	21.9	4^{3}	1					2^{2}		1^{1}				$8^{5\ 1}$
NB	ML	22.0	1^{1}						2^{1}		1		1		5^{2}
NB	ML	22.1	3^{2}	3	1^{1}	1^{1}	1								9^{4}
NB	ML	22.2	3	2	1				1	2^{1}				1	10^{1}

TABLE C

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	22.3	14^{5}	1	1	1			1			1^{1}		1^{1}	20^{7}
NB	ML	22.4	4^{1}				1	1	1						7^{1}
NB	ML	22.5	18^{2}	5^{3}			1	1	3^{1}	2^{1}					30^{7}
NB	ML	22.6	4^{1}							1^{1}					5^{2}
NB	ML	22.7	2^{1}				1		1^{1}						4^{2}
NB	ML	22.8			1										1
NB	ML	22.9	2^{2}	1		1					1				5^{2}
NB	ML	23.1	3^{1}	2^{1}		2			1		2^{2}				10^{4}
NB	ML	23.3	1								3^{1}				4^{1}
NB	ML	23.4	3			1		2				1		1	8
NB	ML	23.5	2^{1}												2^{1}
NB	ML	23.6	2^{1}	4^{1}				1^{1}							7^{3}
NB	ML	23.7	4	2	2^{2}										8^{2}
NB	ML	23.8	5^{1}	3					1						9^{1}
NB	ML	23.9	2^{1}		$1^{(1)}$			1			1				$5^{1(1)}$
NB	ML	24.0	6	2	2^{1}	1^{1}					1	1		2	15^{2}
NB	ML	24.1	1	1											2
NB	ML	24.2	1^{1}												1^{1}
NB	ML	24.3	1		1	1		1	1	1^{1}	3				9^{1}
NB	ML	24.4	1			1			1^{1}						3^{1}
NB	ML	24.5				2^{1}		1							3^{1}
NB	ML	24.6									$1^{(1)}$				$1^{(1)}$
NB	ML	24.7						1				1			2

TABLE H

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	ML	24.8		1											1
TOTAL			139^{44}	46^{9}	$22^{7(1)}$	23^{6}	7^{1}	18^{2}	21^{7}	11^{6}	$21^{7(2)}$	5^{1}	2	7^{2}	$322^{92(3)}$

TABLE I

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	24.8	2^{1}	3		1^{1}					1				7^{2}
SB	ML	24.7												1	1
SB	ML	24.6	2							1	1				4
SB	ML	24.5		1^{1}		1^{1}								1	3^{2}
SB	ML	24.4	2		2^{1}				1^{1}					1	6^{2}
SB	ML	24.3	1^{1}			2	1^{1}	1			1^{1}			1	7^{3}
SB	ML	24.2	1												1
SB	ML	24.1	2^{1}	1^{1}		1		1							5^{2}
SB	ML	24.0	1	1^{1}			1				1	1^{1}			5^{2}
SB	ML	23.9	1		1	1									3
SB	ML	23.8	2		1										3
SB	ML	23.7	5^{2}	3		1			1						10^{2}
SB	ML	23.6	2								1				3
SB	ML	23.5	1	1											2
SB	ML	23.4	2	2	1	2		2^{1}							9^{1}
SB	ML	23.3	4	1		1					1^{1}				7^{1}
SB	ML	23.2	2^{1}												2^{1}
SB	ML	23.1	5^{2}			1			1		2^{1}				9^{3}
SB	ML	23.0	1									1			2
SB	ML	22.9	2			2^{1}				2	2^{2}	1		1^{1}	10^{4}
SB	ML	22.7	2		2^{1}	3			2		1				10^{1}
SB	ML	22.6	2^{2}					1			1				4^{2}
SB	ML	22.5	2^{1}	2	2				3^{3}						9^{4}

TABLE J

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	22.4	2^{2}						2						4^{2}
SB	ML	22.3	1^{1}		1	1			1						4^{1}
SB	ML	22.2	3^{3}		1^{1}	1			1^{1}			1		1	8^{5}
SB	ML	22.1	1	1	1										3
SB	ML	22.0	1	1					1^{1}		2^{1}			1	6^{2}
SB	ML	21.9	5^{1}	2^{1}	1			1^{1}	3^{1}		2^{1}			1	15^{5}
SB	ML	21.8	1^{1}		1^{1}				1^{1}		3^{2}			$2^{1(1)}$	$8^{6(1)}$
SB	ML	21.7	7^{6}	3^{1}	2			2^{2}	3^{1}		4	2		1	24^{10}
SB	ML	21.6	7^{3}		2^{2}	2^{1}	1	1^{1}	1^{1}	1^{1}	1	1^{1}		3	20^{10}
SB	ML	21.5	8^{4}	1^{1}	1				1					2^{2}	13^{7}
SB	ML	21.4												1	1
SB	ML	21.3	1^{1}						3^{2}		1^{1}	1^{1}			6^{5}
SB	ML	21.2	5	1	3	3^{1}		1	3^{2}	1	1	1			19^{3}
SB	ML	21.1	1												1
SB	ML	21.0	3						1						4
SB	ML	20.8	1^{1}	1	1^{1}	1		1^{1}	1			1^{1}			7^{4}
SB	ML	20.7		1^{1}		1		1	1^{1}	1	2^{1}	1^{1}			8^{4}
SB	ML	20.6		2^{1}						1					3^{1}
SB	ML	20.5	2					1	1	1	1^{1}			1^{1}	7^{2}
SB	ML	20.4	3^{1}								1			1	5^{1}
SB	ML	20.3												1^{1}	1^{1}
SB	ML	20.1							1^{1}						1^{1}
SB	ML	20.0			1										1

TABLE K

1978 ACCIDENT HISTORY

I. H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	ML	19.9			1			1^{1}	2^{1}						4^{2}
TOTAL			96^{35}	28^{8}	25^{7}	25^{5}	3^{1}	14^{7}	35^{17}	8^{1}	30^{12}	11^{5}		$20^{60\,1}$	$295^{104\,1}$

TABLE I.

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	19.9			1^{1}										1^{1}
NB	FR	20.1				1		1							2
NB	FR	20.2	1												1
NB	FR	20.3			1	1^{1}		3^{2}			2^{1}				7^{4}
NB	FR	20.4				1									1
NB	FR	21.0	1												1
NB	FR	21.4			2^{1}										2^{1}
NB	FR	21.5			1										1
NB	FR	21.6			1										1
NB	FR	22.2	2^{1}			1									3^{1}
NB	FR	22.3			1						1				2
NB	FR	22.4	2^{1}		1										3^{1}
NB	FR	22.5			1										1
NB	FR	22.6	1								1				2
NB	FR	22.7	2^{1}	1							1^{1}				4^{2}
NB	FR	22.9												1	1
NB	FR	23.1		1	1^{1}										2^{1}
NB	FR	23.2	1	2	1^{1}										4^{1}
NB	FR	23.3	10	3	7^{3}			2	1		7^{2}			3^{2}	33^{7}
NB	FR	23.4	1		7^{1}	2						1			11^{1}
NB	FR	23.5	1												1
NB	FR	23.6			5^{4}			2^{1}			2^{1}				9^{6}
NB	FR	23.7	3		1				1^{1}						5^{1}

TABLE M

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
NB	FR	23.9	1^{1}		1^{1}				1^{1}		2				5^{3}
NB	FR	24.0			2			1							3
NB	FR	24.4			1^{1}										1^{1}
NB	FR	24.5									1				1
NB	FR	24.6			1^{1}										1^{1}
NB	FR	24.7										1			1
TOTAL			26^{4}	7	36^{15}	6^{1}		9^{2}	3^{2}		17^{5}	2		4^{2}	110^{32}

TABLE N

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	24.8										1			1
SB	FR	24.6			1						1				2
SB	FR	24.5												1	1
SB	FR	24.4									1				1
SB	FR	24.3							1^{1}		1				2^{1}
SB	FR	24.0	1												1
SB	FR	23.9									1				1
SB	FR	23.8	1	1	1						1				4
SB	FR	23.7	2^{2}		3^{1}				1		1^{1}				7^{4}
SB	FR	23.6	9^{4}			2^{1}									11^{5}
SB	FR	23.5												1^{1}	1^{1}
SB	FR	23.4	1		5^{2}			2^{1}			1				9^{3}
SB	FR	23.3	3	1	14^{6}			3	1		4^{2}			2^{1}	28^{9}
SB	FR	23.2	2^{2}						1		1^{1}				4^{3}
SB	FR	23.1			5^{2}					1					6^{2}
SB	FR	23.0			3^{2}	1^{1}									4^{3}
SB	FR	22.9							1						1
SB	FR	22.8									1^{1}			1^{1}	2^{2}
SB	FR	22.7	5^{1}	1	14^{7}			2	2	1	1	1			27^{8}
SB	FR	22.5	6^{3}		6^{2}	2					2^{1}				16^{6}
SB	FR	22.4	1		2^{1}				1^{1}						4^{2}
SB	FR	22.3	3^{1}	1	22^{14}			1			4^{2}			2^{2}	34^{19}
SB	FR	22.2		1^{1}											1^{1}

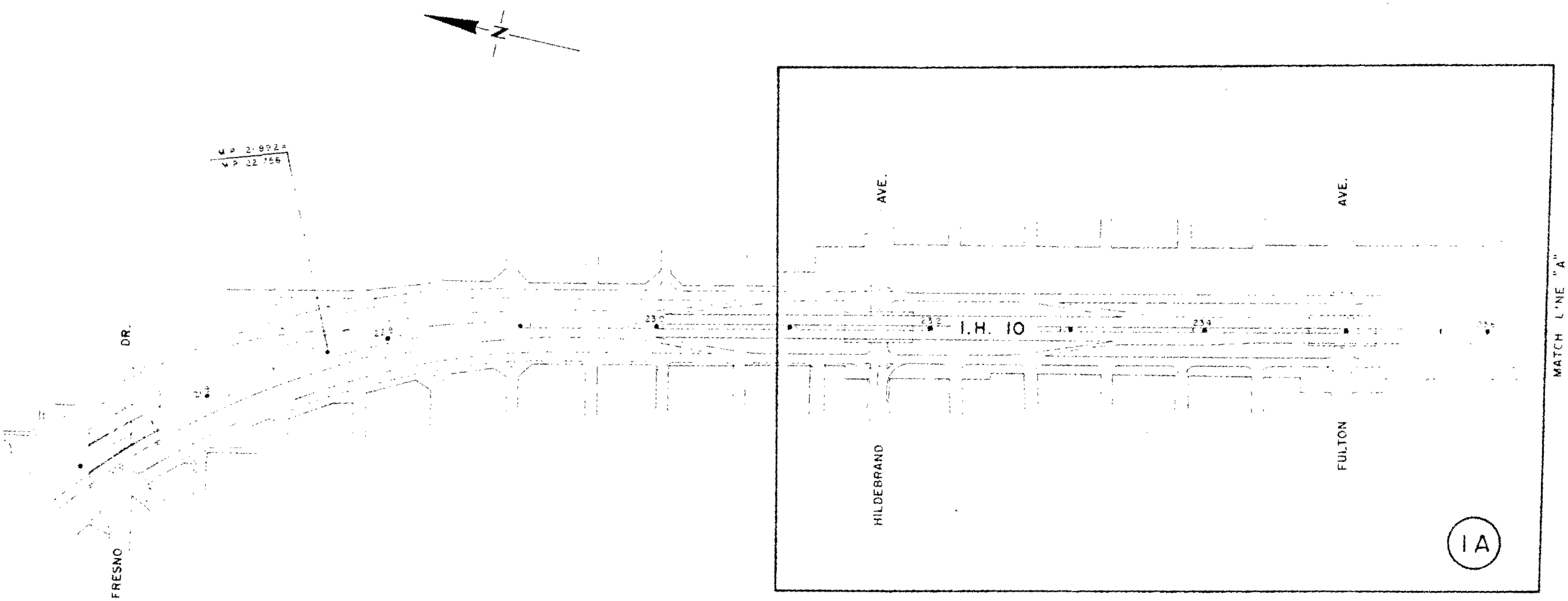
TABLE O

1978 ACCIDENT HISTORY

I.H. 35

DIR.	LOC.	M.P.	DAY						NIGHT						TOTAL
			DRY			WET			DRY			WET			
			R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	R.E.	S.S.	O.	
SB	FR	22.0									2				2
SB	FR	21.9	1		4^{3}						1^{1}				6^{4}
SB	FR	21.7								1					1
SB	FR	21.6			4^{1}			1							5^{1}
SB	FR	21.3	3^{1}								1^{1}	1			5^{2}
SB	FR	20.5			1										1
SB	FR	20.3		1					1					2	4
SB	FR	20.2			2	2^{1}		1^{1}							5^{2}
SB	FR	20.1												1	1
SB	FR	20.0									1				1
SB	FR	19.9												1	1
TOTAL			38^{14}	6^{1}	68^{41}	7^{3}		10^{2}	9^{2}	3	25^{10}	3		11^{5}	200^{78}

TABLE P



LEGEND

1A SEE PHOTOGRAPH THAT SHOWS THE PLANNED IMPROVEMENTS

FIGURE 1

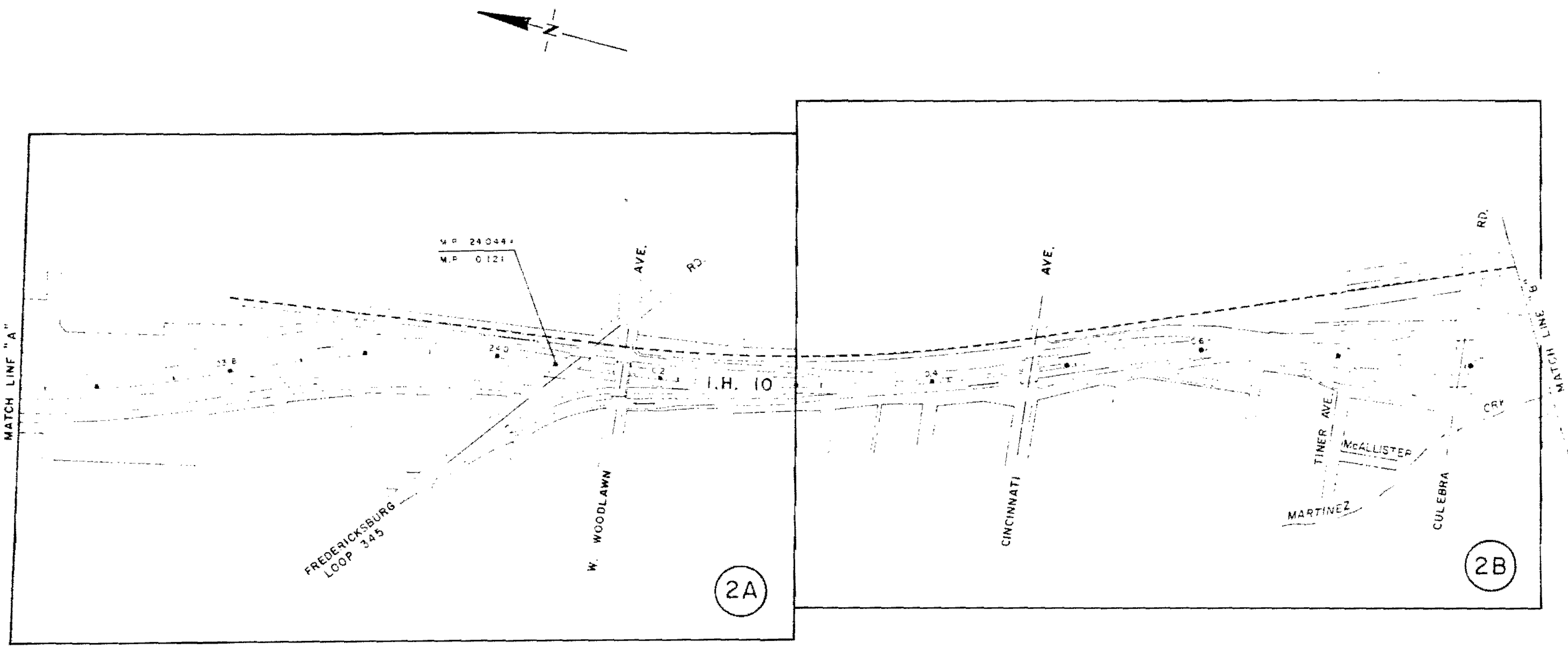

MATCH LINE "A"
M.P. 24.044+
M.P. 0.121
AVE.
RD.
W. WOODLAWN
FREDERICKSBURG
LOOP 345
I.H. 10
2A
AVE.
CINCINNATI
TINER AVE.
McALLISTER
MARTINEZ
CULEBRA
CRY
RD.
MATCH LINE "B"
2B
N

FIGURE 2

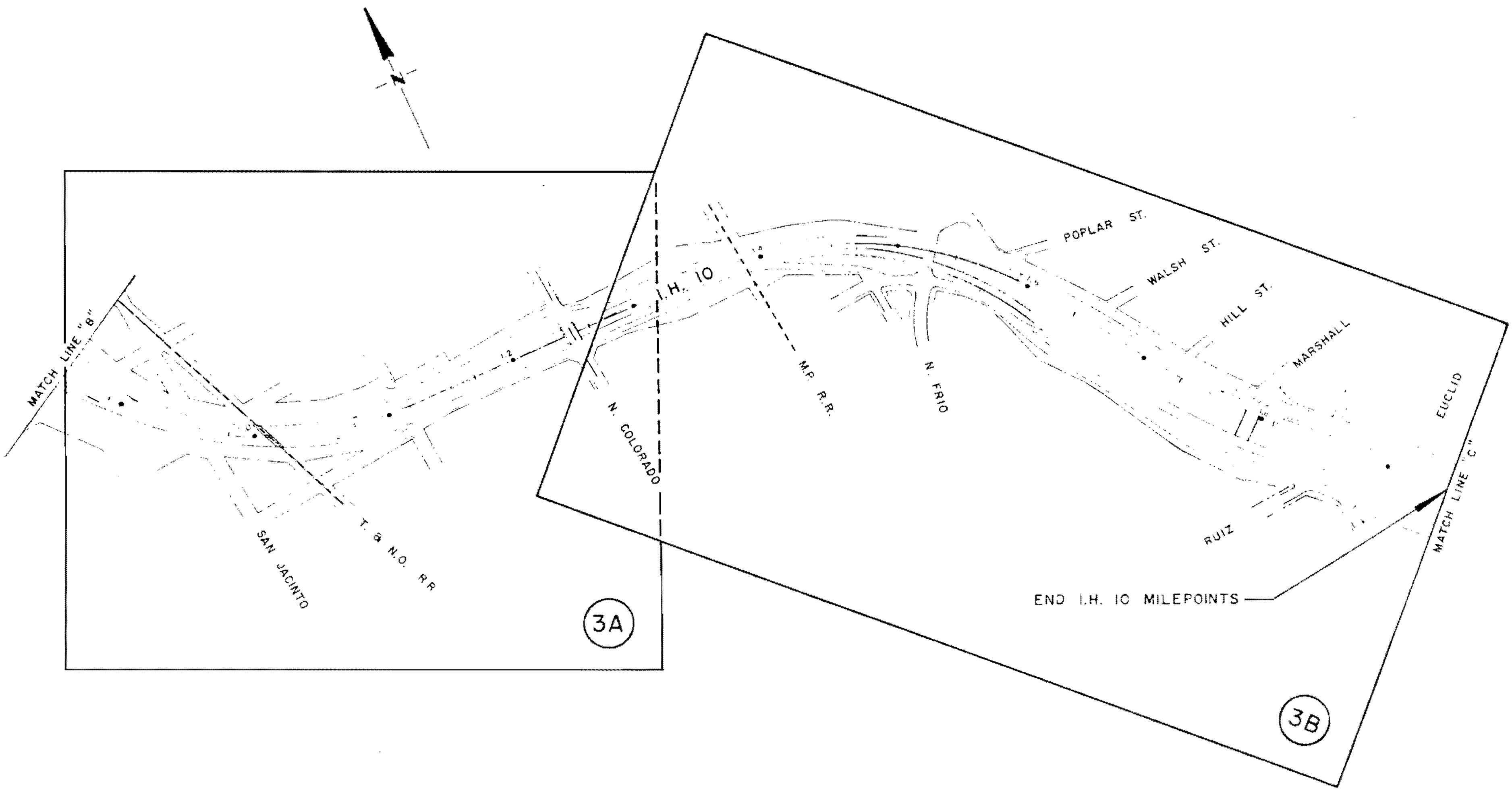

MATCH LINE "B"
SAN JACINTO
T. & N.O. RR
3A
N. COLORADO
I.H. 10
M.P. R.R.
N. FRIO
POPLAR ST.
WALSH ST.
HILL ST.
MARSHALL
EUCLID
RUIZ
MATCH LINE "C"
END I.H. 10 MILEPOINTS
3B

FIGURE 3

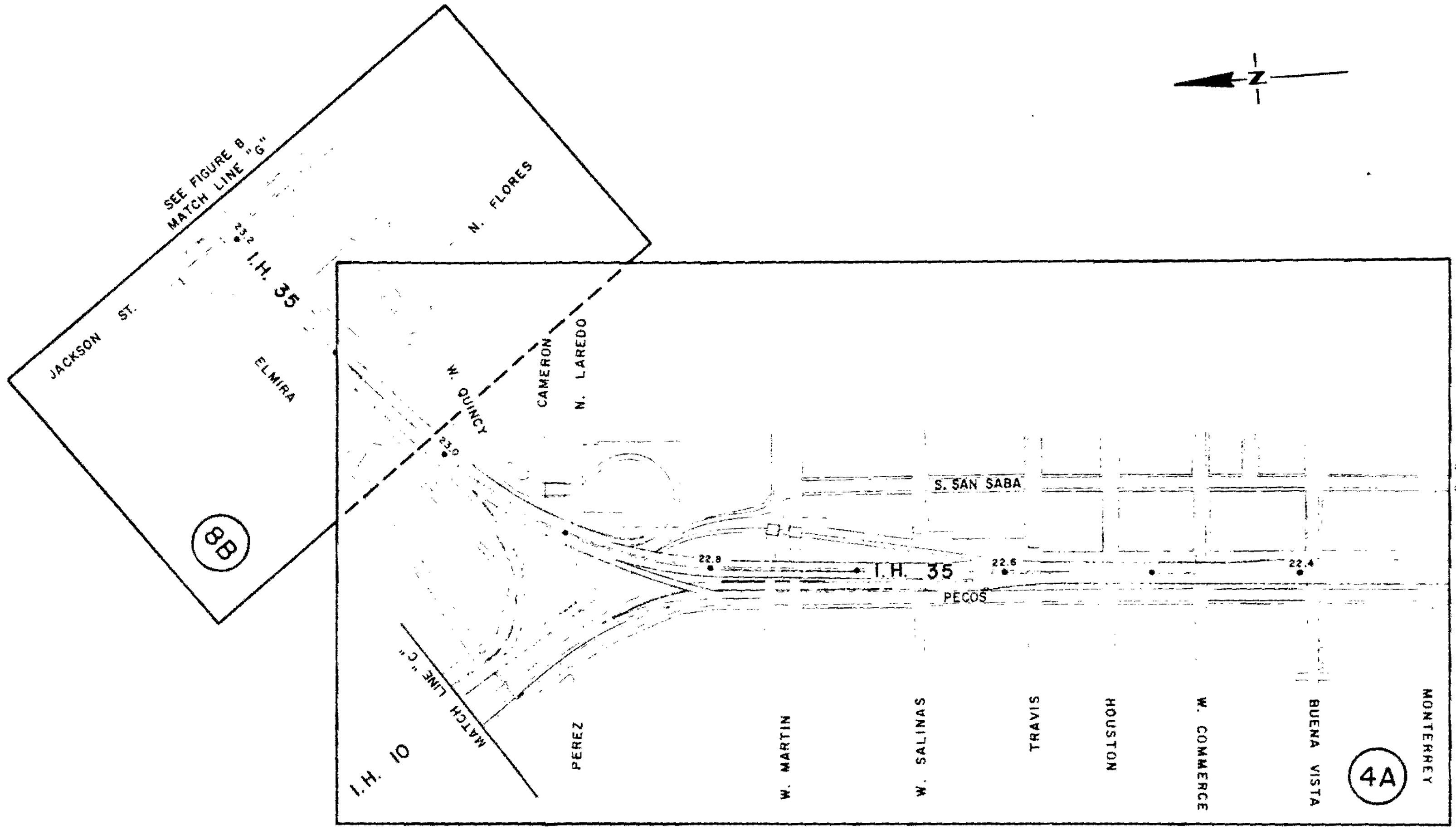

N
SEE FIGURE B
MATCH LINE "G"
N. FLORES
I.H. 35
JACKSON ST.
ELMIRA
8B
23.2
W. QUINCY
23.0
CAMERON
N. LAREDO
S. SAN SABA
22.8
22.6
22.4
PECOS
MATCH LINE "D"
MATCH LINE "C"
I.H. 10
PEREZ
W. MARTIN
W. SALINAS
TRAVIS
HOUSTON
W. COMMERCE
BUENA VISTA
MONTERREY
4A

FIGURE 4

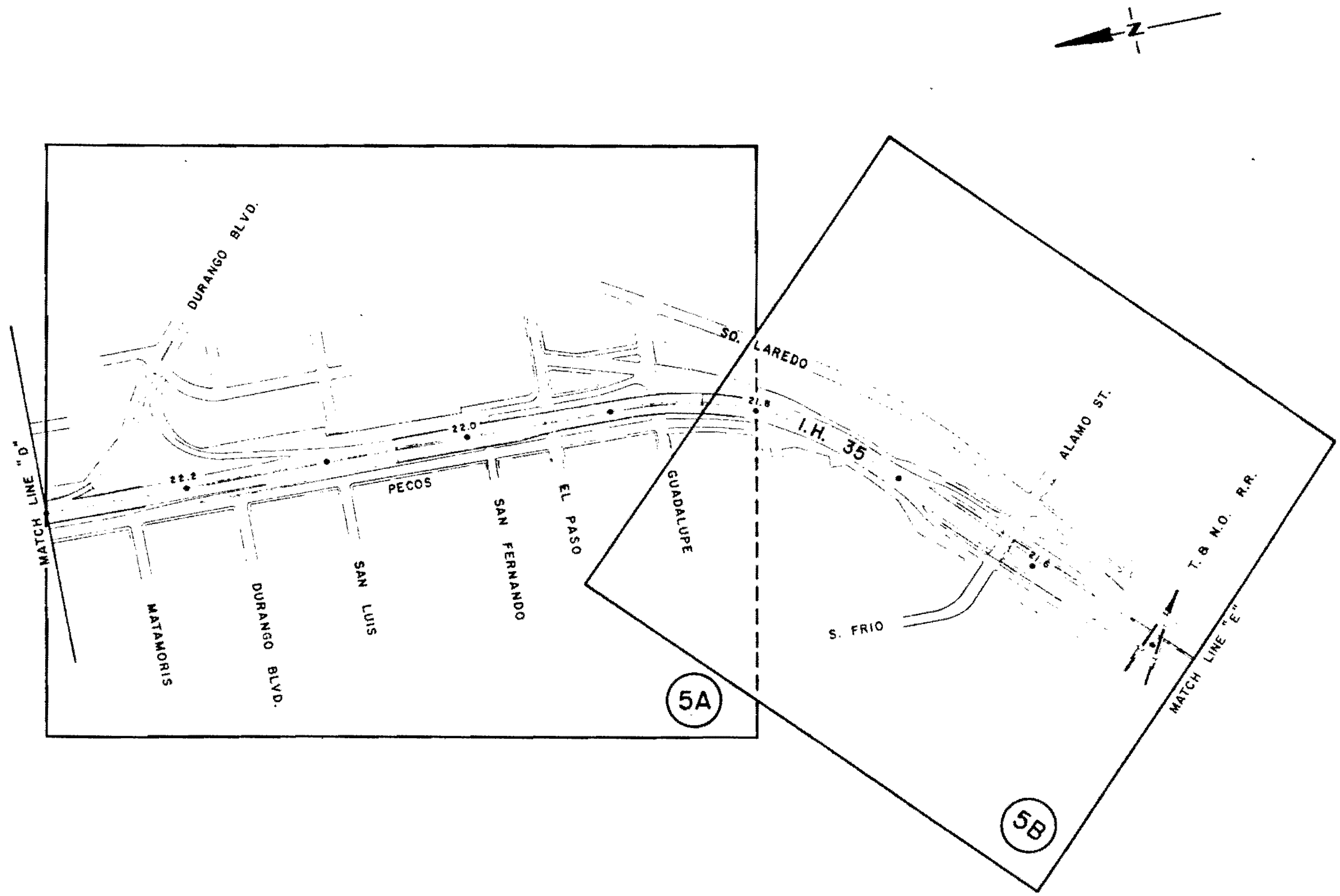

N
5A
5B
MATCH LINE "D"
MATCH LINE "E"
DURANGO BLVD.
SO. LAREDO
I.H. 35
21.6
21.8
22.0
22.2
PECOS
MATAMORIS
DURANGO BLVD.
SAN LUIS
SAN FERNANDO
EL PASO
GUADALUPE
ALAMO ST.
T. & N.O. R.R.
S. FRIO

FIGURE 5

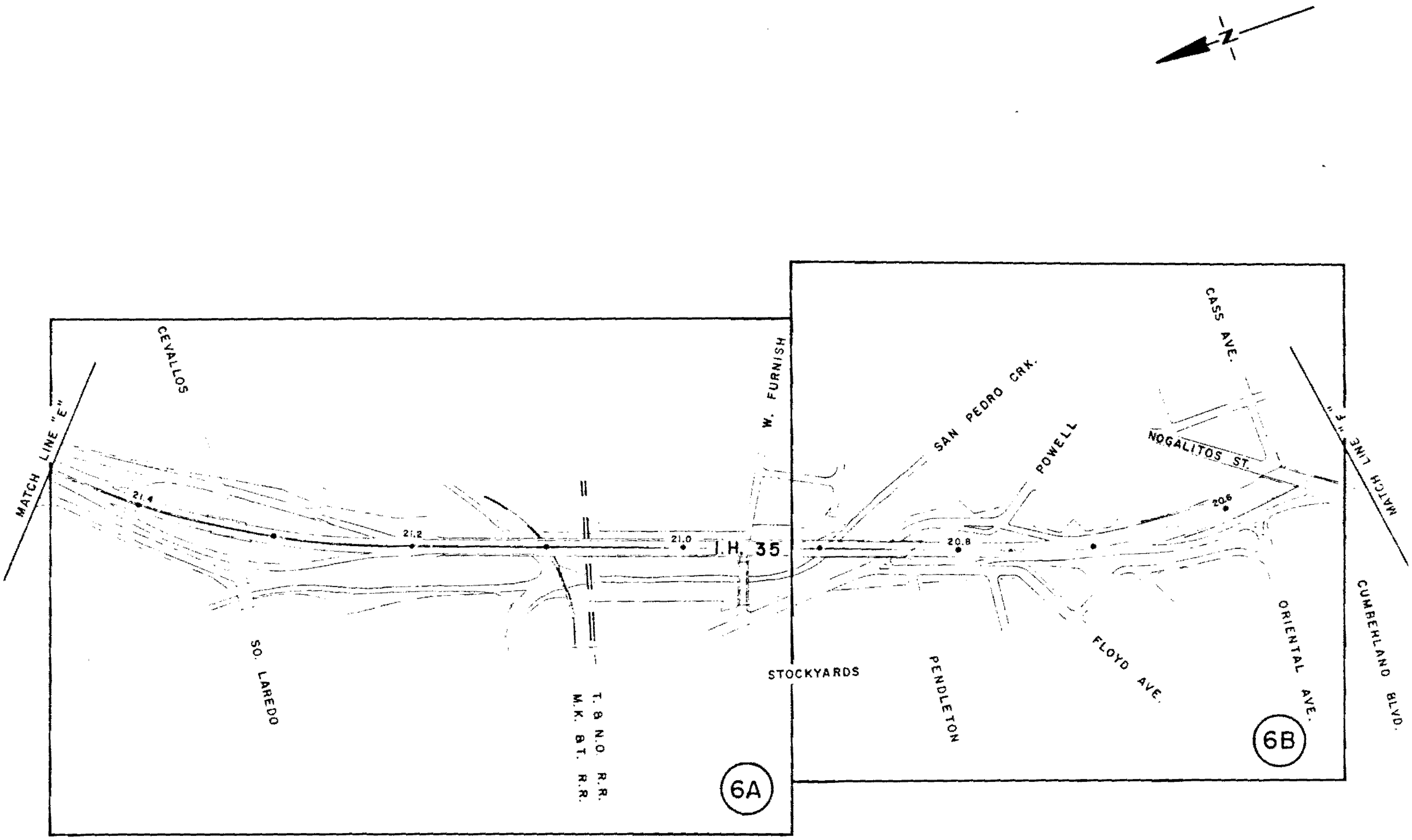

N
MATCH LINE "E"
CEVALLOS
21.4
21.2
21.0
I.H. 35
SO. LAREDO
T. & N.O. R.R.
M.K. &T. R.R.
W. FURNISH
STOCKYARDS
6A
SAN PEDRO CRK.
POWELL
20.8
PENDLETON
FLOYD AVE.
NOGALITOS ST.
20.6
CASS AVE.
ORIENTAL AVE.
MATCH LINE "F"
CUMBERLAND BLVD.
6B

FIGURE 6

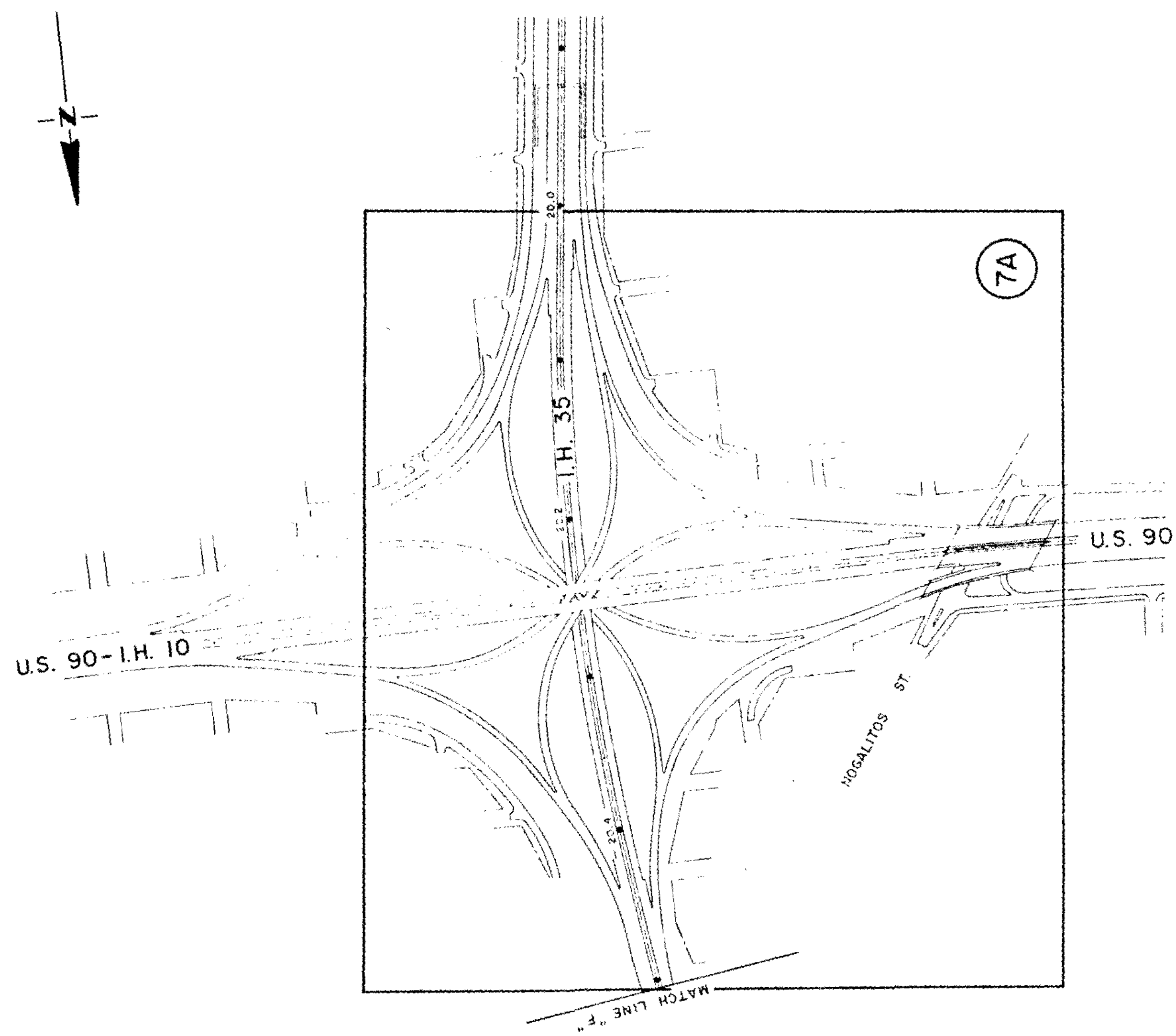
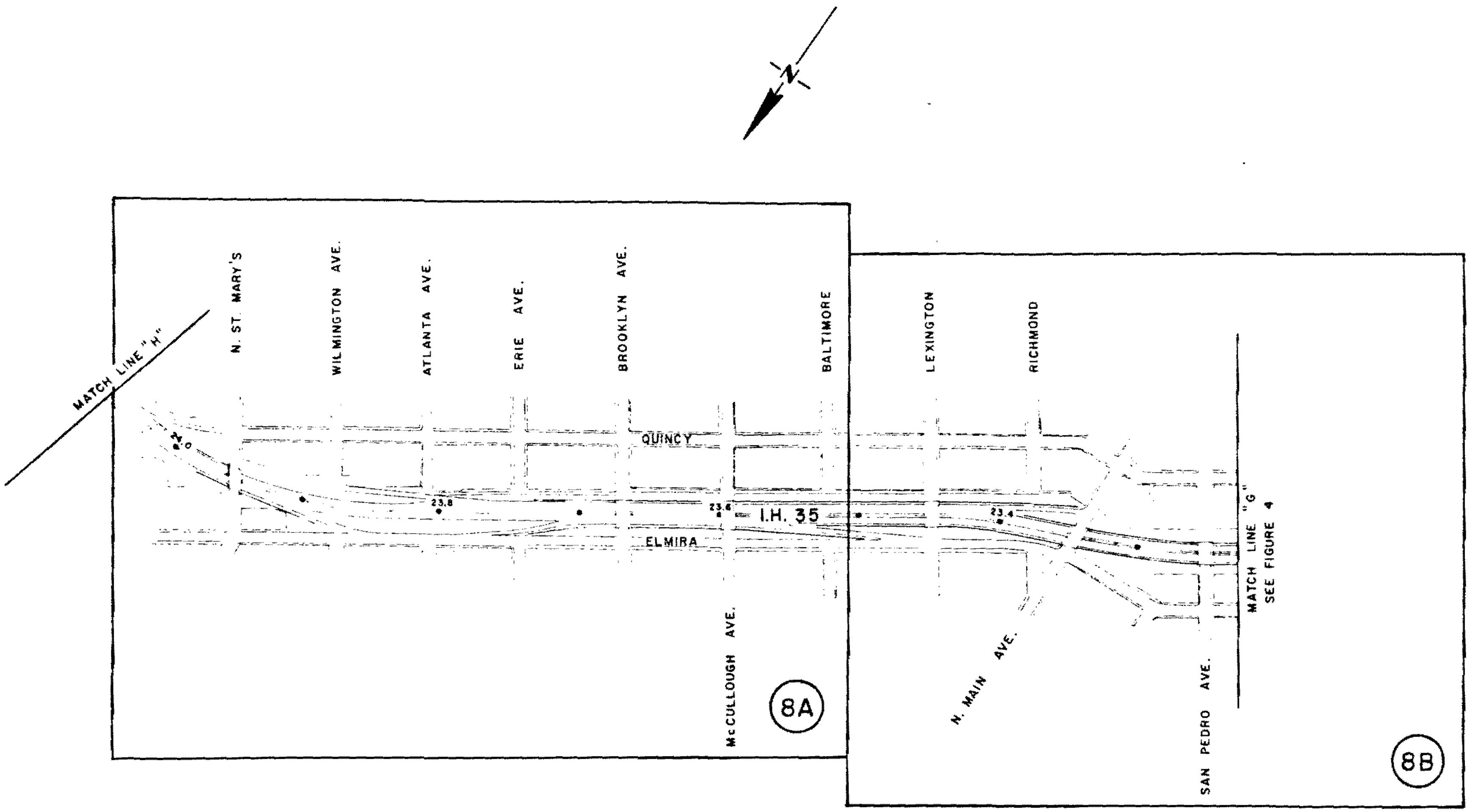


FIGURE 7



N
MATCH LINE "H"
N. ST. MARY'S
WILMINGTON AVE.
ATLANTA AVE.
ERIE AVE.
BROOKLYN AVE.
BALTIMORE
LEXINGTON
RICHMOND
QUINCY
ELMIRA
I.H. 35
23.8
23.6
23.4
McCULLOUGH AVE.
N. MAIN AVE.
SAN PEDRO AVE.
MATCH LINE "G"
SEE FIGURE 4
8A
8B

FIGURE 8

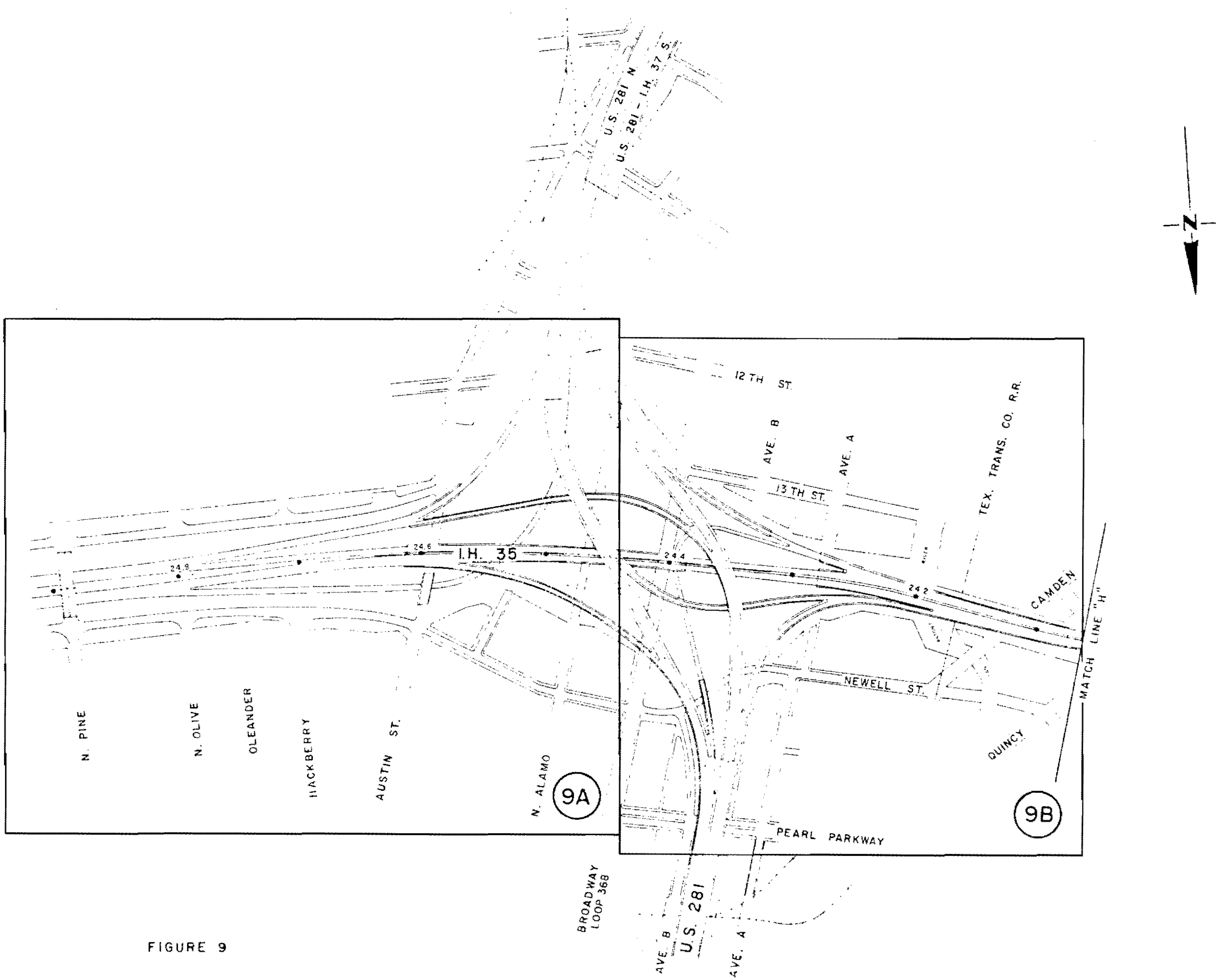
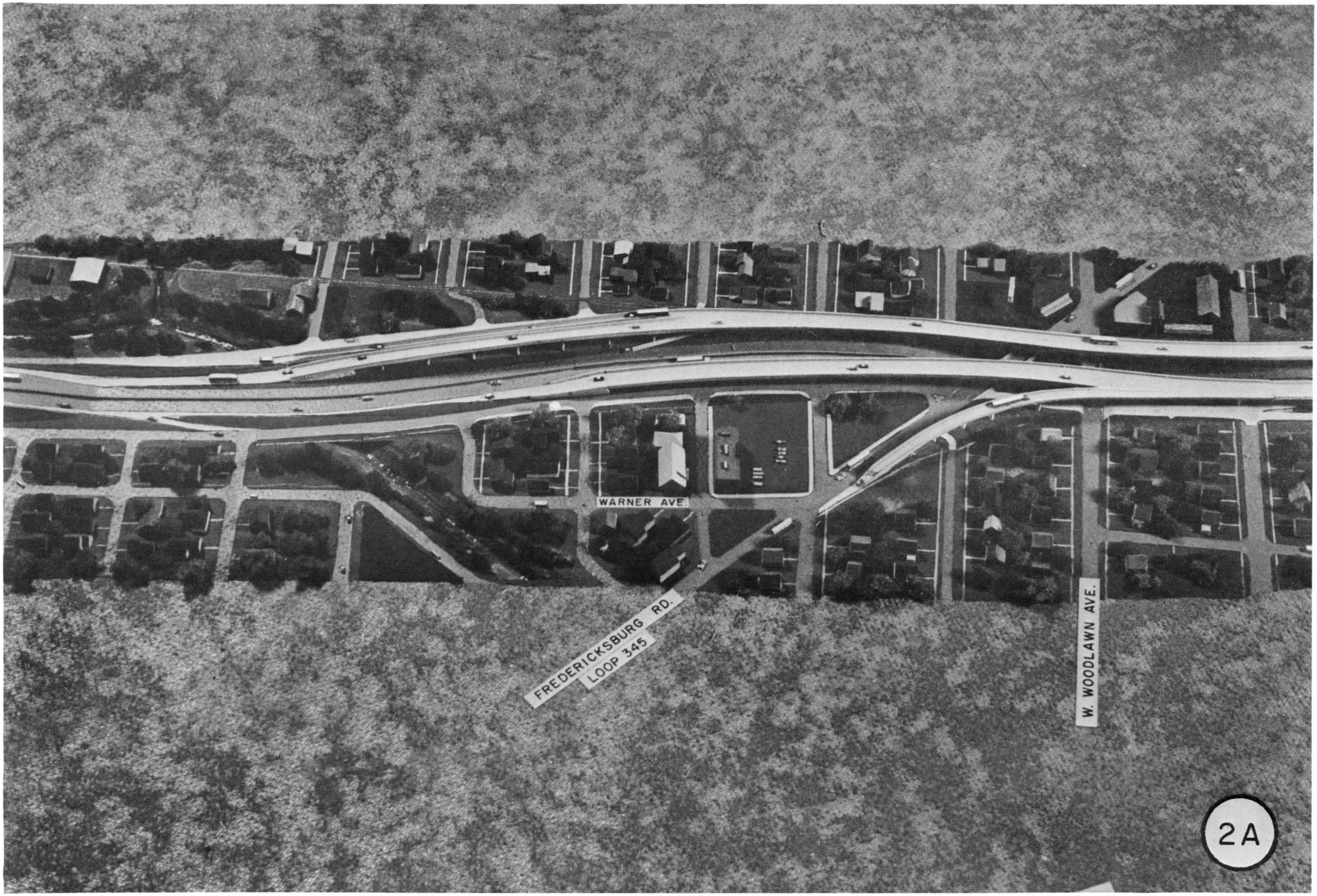
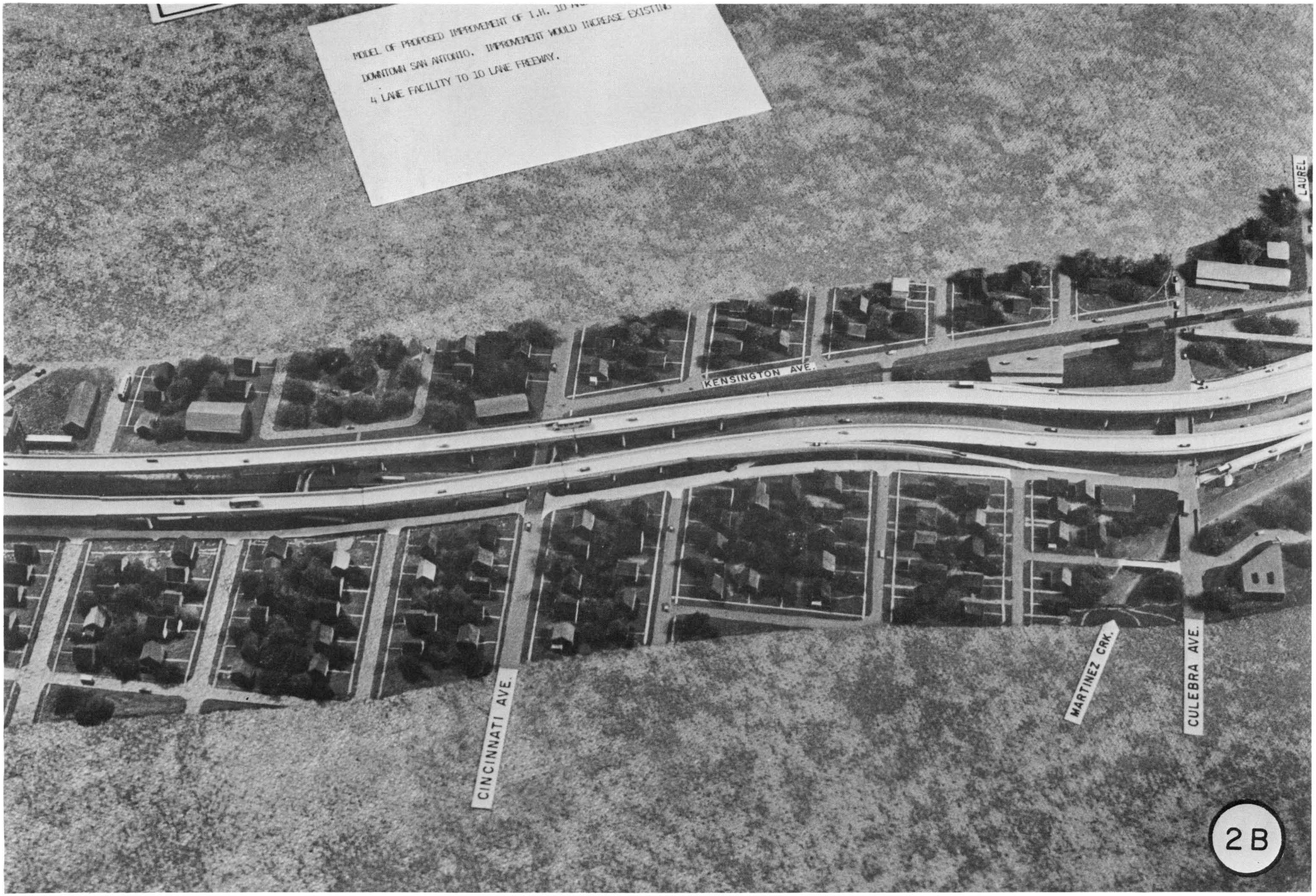
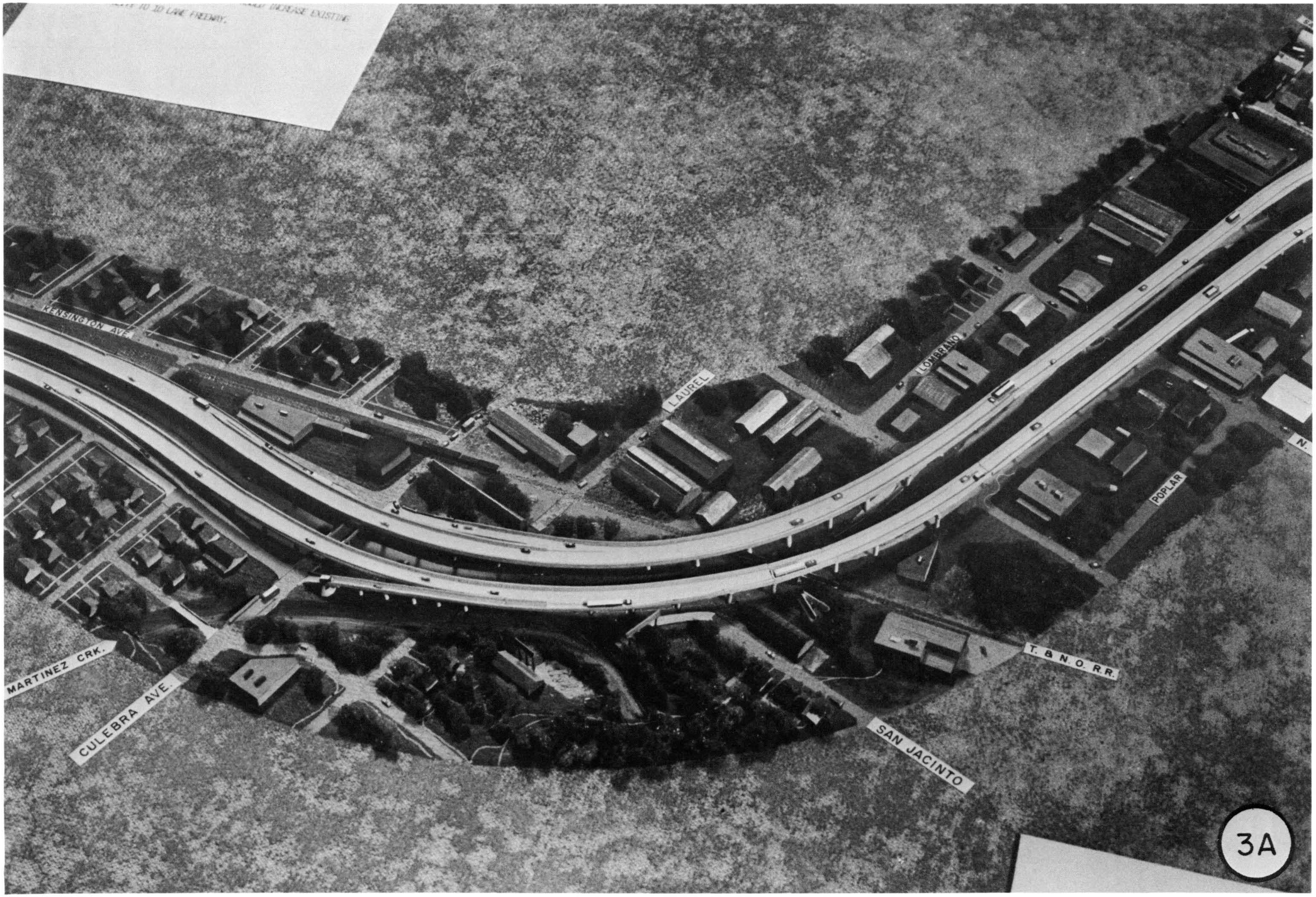

U.S. 281 N
U.S. 281 - I.H. 37 S.
12 TH ST.
AVE. B
AVE. A
TEX. TRANS. CO. R.R.
13 TH ST.
I.H. 35
24.9
24.6
24.4
24.2
CAMDEN
MATCH LINE "H"
NEWELL ST.
QUINCY
N. PINE
N. OLIVE
OLEANDER
HACKBERRY
AUSTIN ST.
N. ALAMO
9A
9B
PEARL PARKWAY
BROADWAY
LOOP 368
AVE. B
U.S. 281
AVE. A

FIGURE 9


T. & N.O. R.R.
MARTINEZ CRK.
WARNER AVE.
HILDEBRAND AVE.
FULTON AVE.
1 A

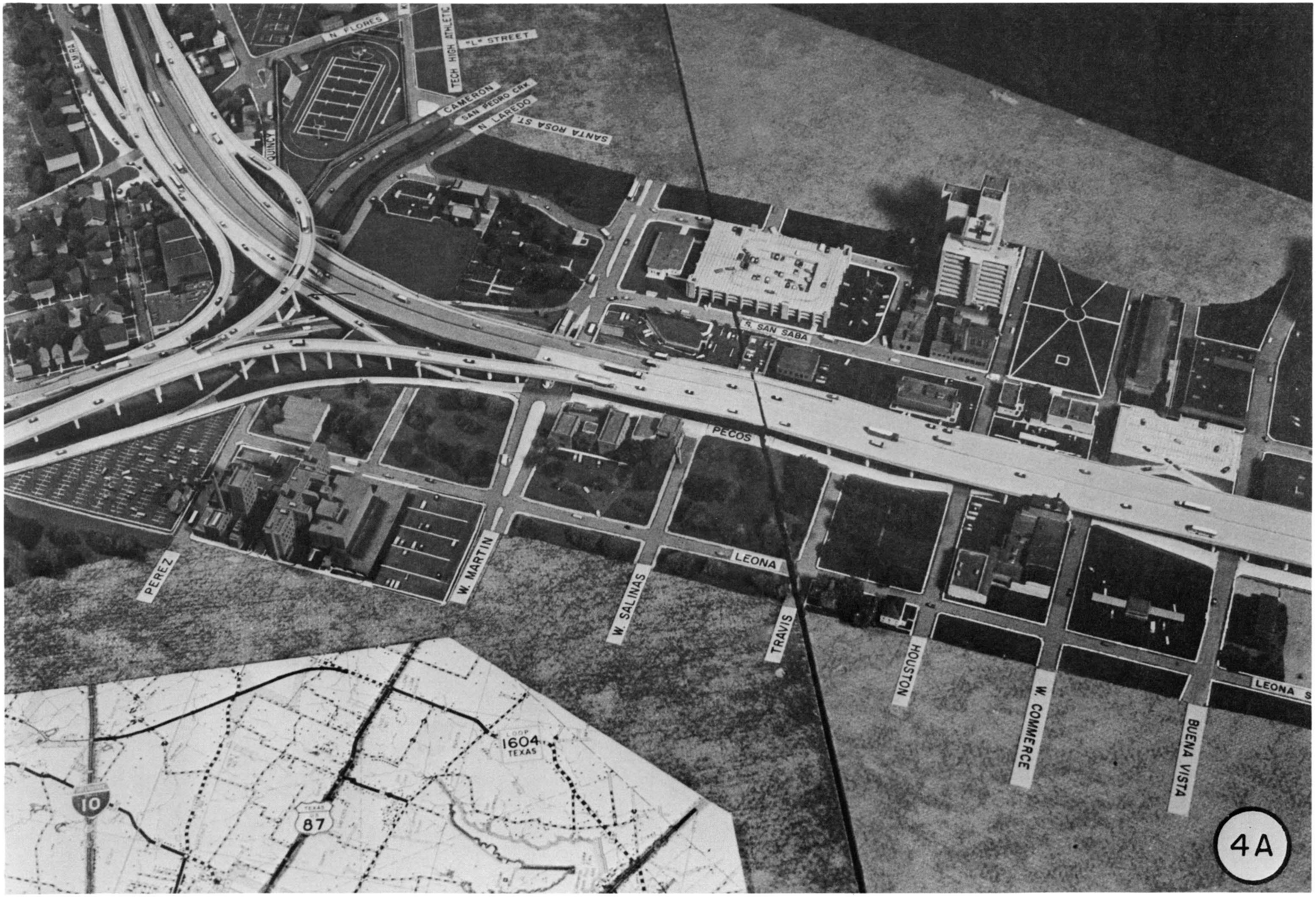

WARNER AVE.
FREDERICKSBURG RD.
LOOP 345
W. WOODLAWN AVE.
2A

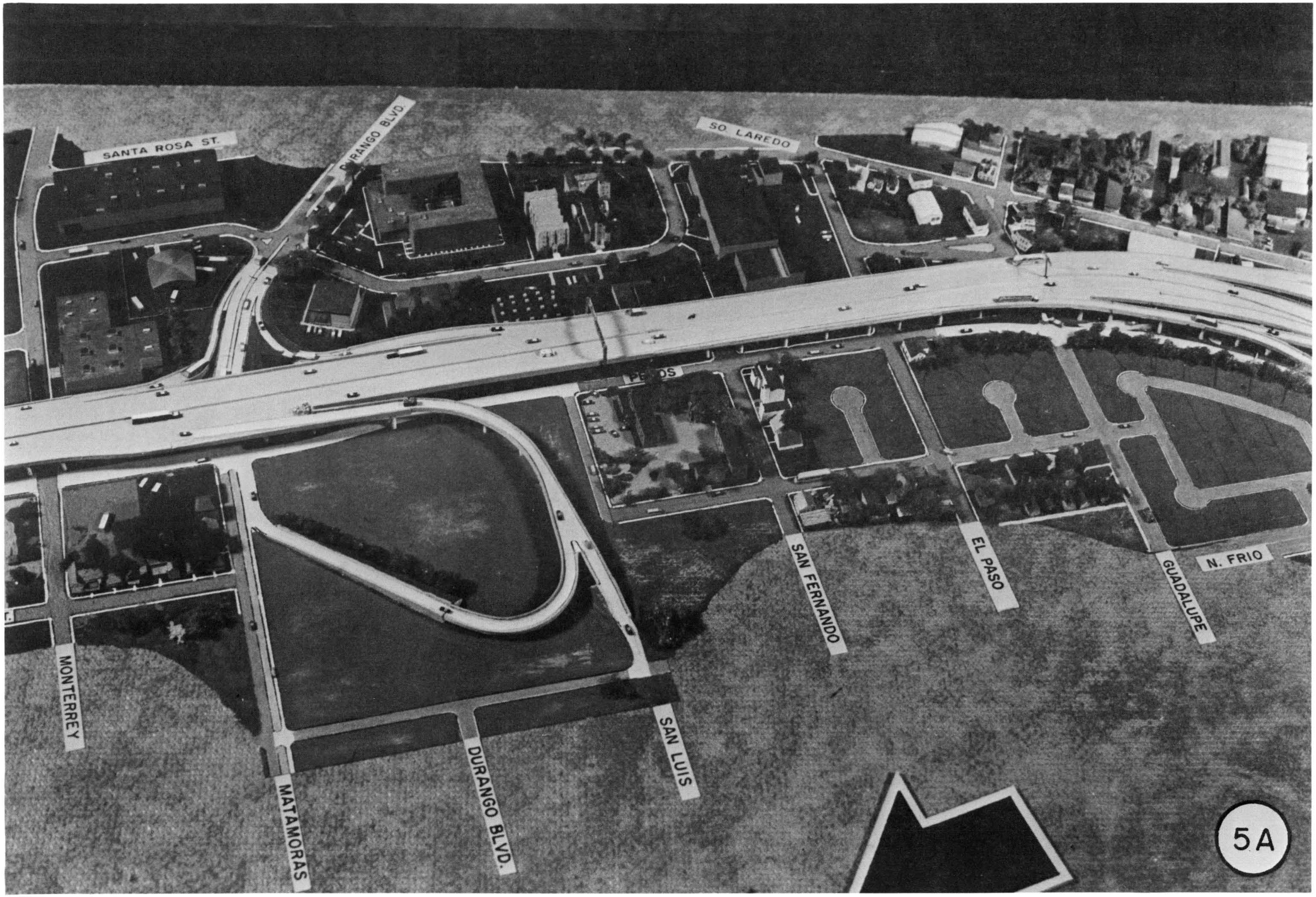

MODEL OF PROPOSED IMPROVEMENT OF I.H. 10
DOWNTOWN SAN ANTONIO. IMPROVEMENT WOULD INCREASE EXISTING
4 LANE FACILITY TO 10 LANE FREEWAY.
LAUREL
KENSINGTON AVE.
CINCINNATI AVE.
MARTINEZ CRK.
CULEBRA AVE.
2B

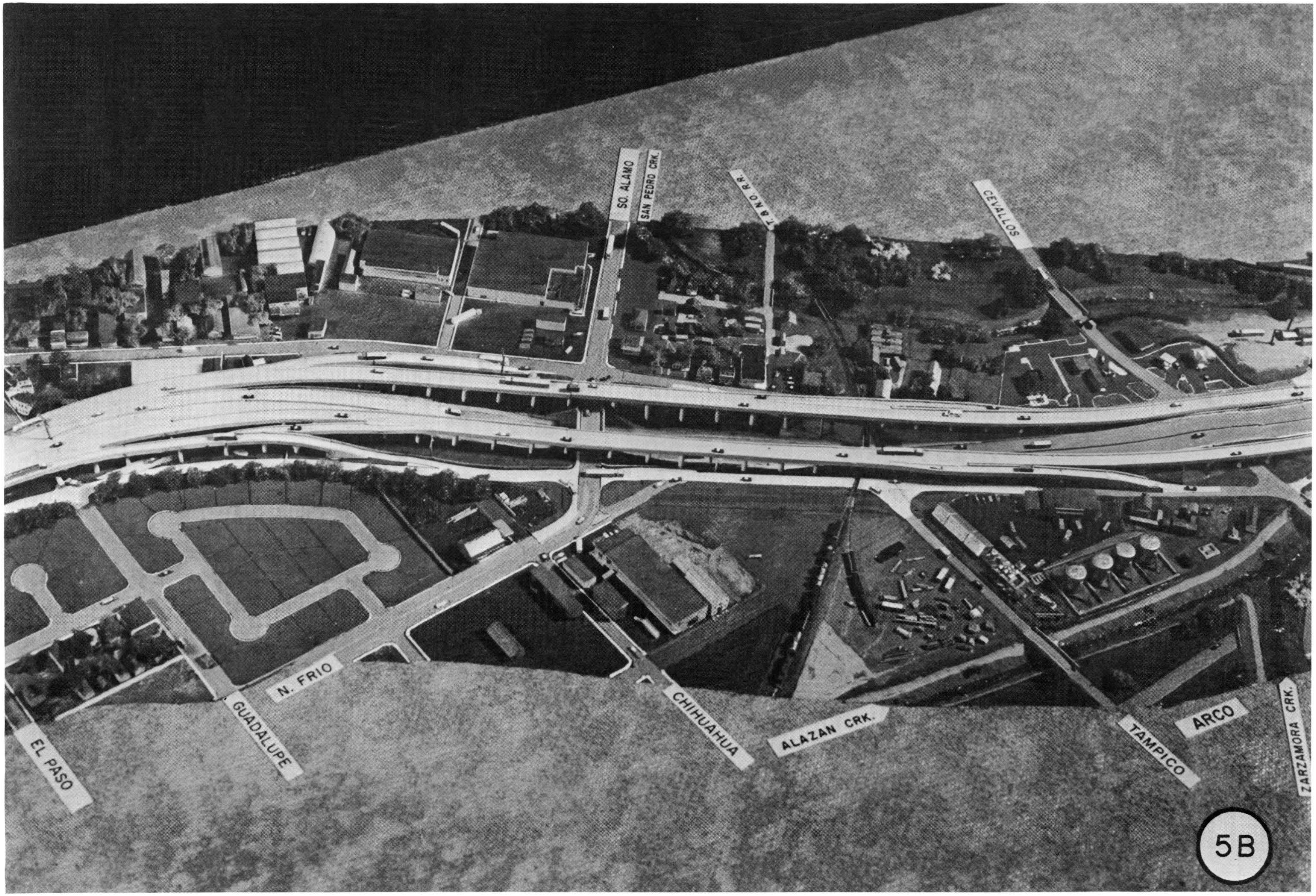


KENSINGTON AVE.
LAUREL
LOMBRANO
POPLAR
T. & N. O. R.R.
SAN JACINTO
CULEBRA AVE.
MARTINEZ CRK.
3A

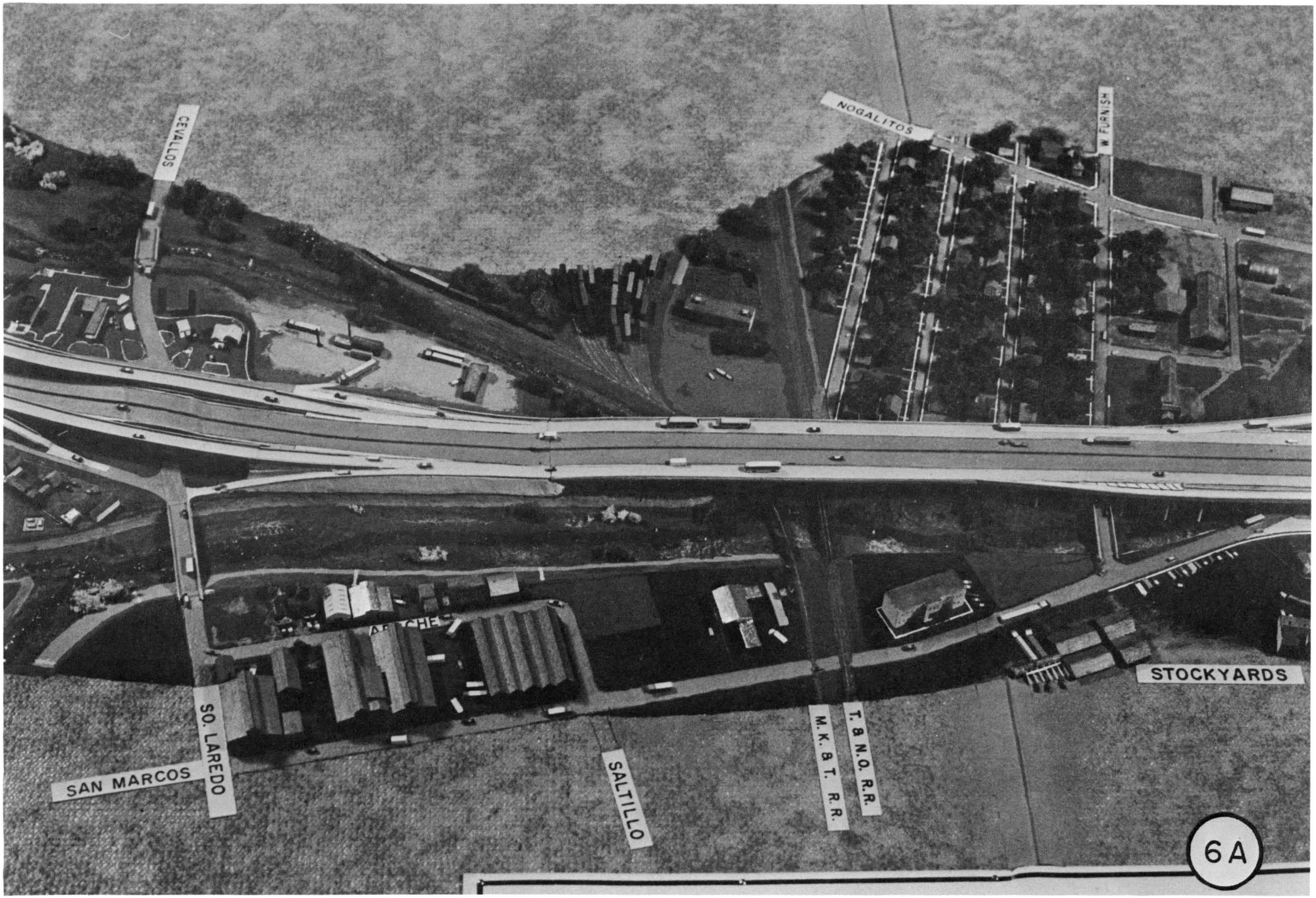

SAN PEDRO CRK.
W. CYPRESS ST.
POPLAR ST.
WALSH ST.
HILL ST.
MARSHALL
EUCLID
I.H. 10 N.
I.H. 10 S.
N. FRIO
M.P. R.R.
ARBOR
RUIZ
LOOP
1604
TEXAS
3B


N. FLORES
"L" STREET
TECH HIGH ATHLETIC
ELMIRA
QUINCY
CAMERON
SAN PEDRO CRK.
N. LAREDO
SANTA ROSA ST.
S. SAN SABA
PECOS
PEREZ
W. MARTIN
W. SALINAS
LEONA
TRAVIS
HOUSTON
W. COMMERCE
BUENA VISTA
LEONA ST
LOOP 1604 TEXAS
10
TEXAS 87
4A

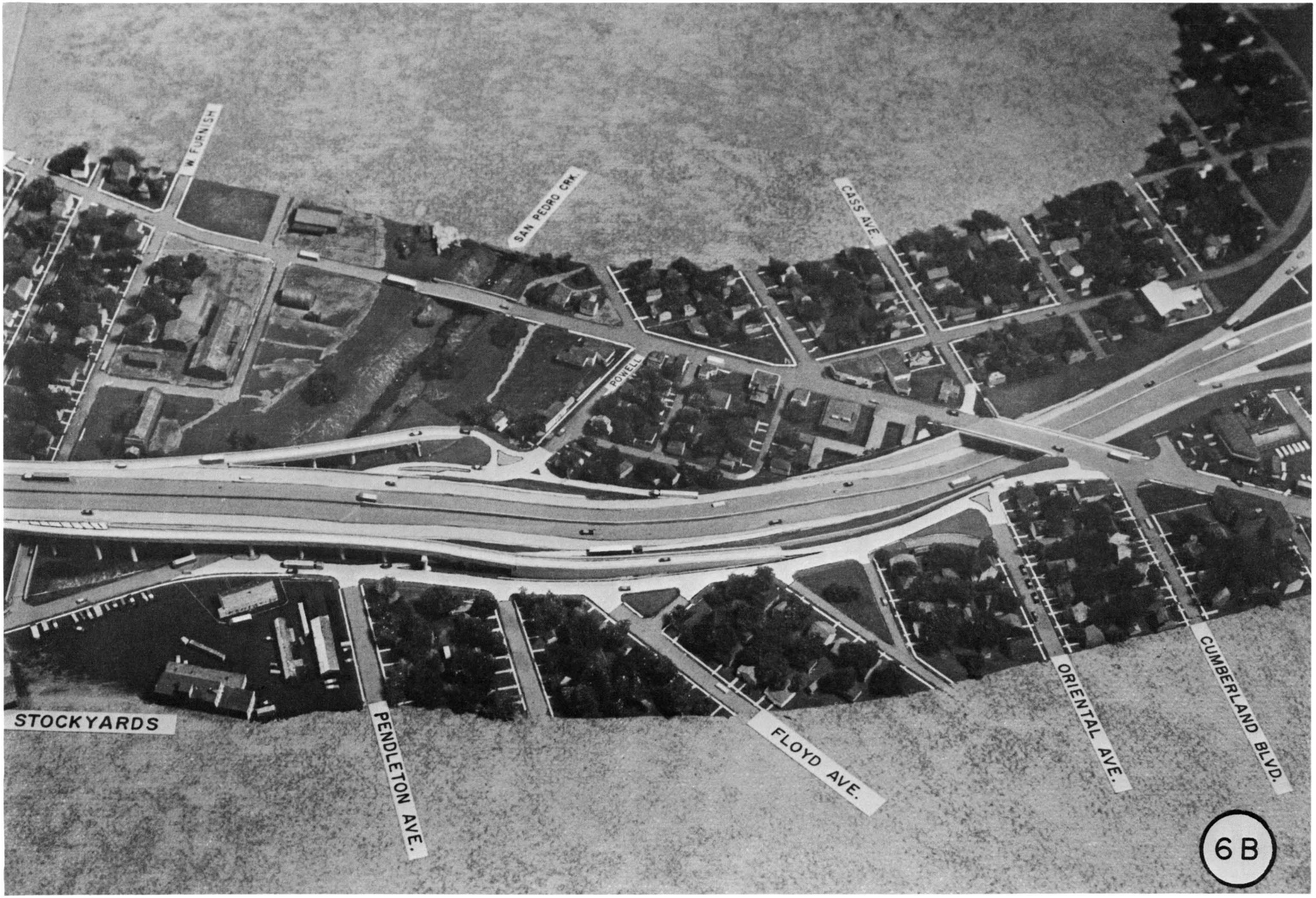

SANTA ROSA ST.
DURANGO BLVD.
SO. LAREDO
PECOS
MONTERREY
MATAMORAS
DURANGO BLVD.
SAN LUIS
SAN FERNANDO
EL PASO
GUADALUPE
N. FRIO
5A

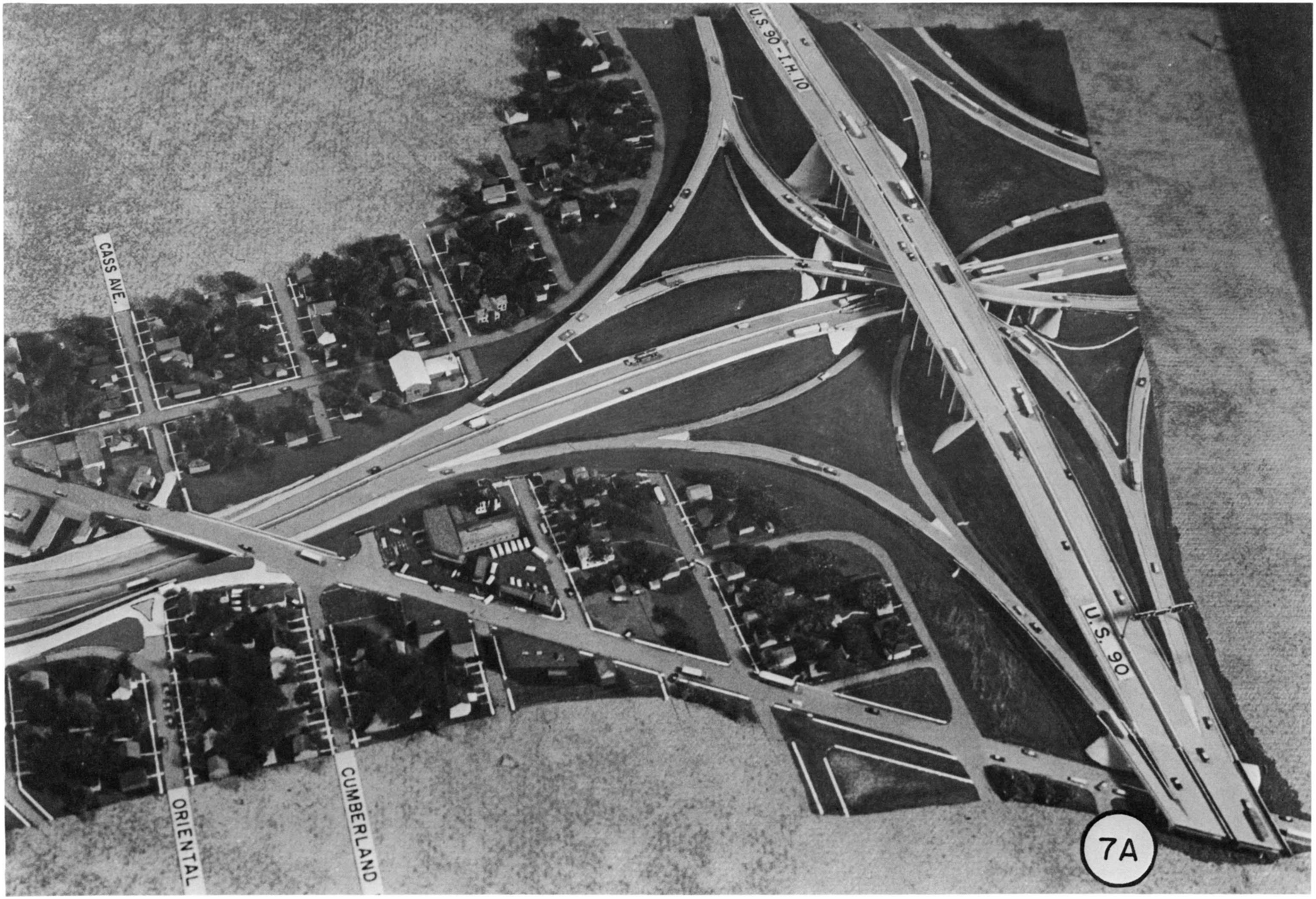

SO. ALAMO
SAN PEDRO CRK.
T. & N.O. R.R.
CEVALLOS
N. FRIO
GUADALUPE
EL PASO
CHIHUAHUA
ALAZAN CRK.
TAMPICO
ARCO
ZARZAMORA CRK.

5B

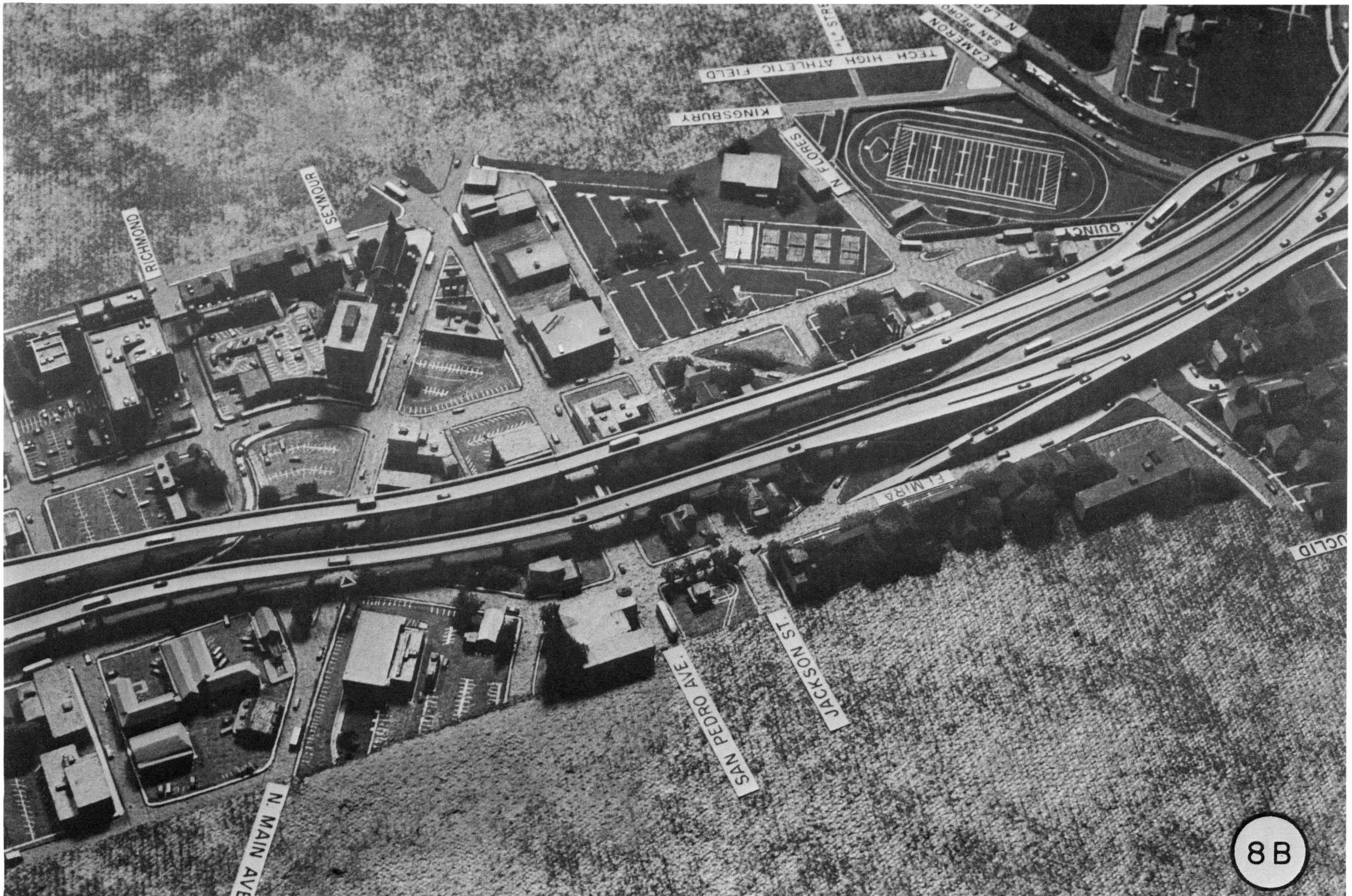


CEVALLOS
NOGALITOS
W. FURNISH
STOCKYARDS
SO. LAREDO
SAN MARCOS
SALTILLO
M.K. & T. R.R.
T. & N.O. R.R.
6A


W FURNISH
SAN PEDRO CRK.
CASS AVE.
POWELL
STOCKYARDS
PENDLETON AVE.
FLOYD AVE.
ORIENTAL AVE.
CUMBERLAND BLVD.
6 B


U.S. 90 - I.H. 10
CASS AVE.
U.S. 90
ORIENTAL
CUMBERLAND
7A


TEX. TRANS CO. R.R.
CPSB
N. ST. MARYS
CAMDEN
WILMINGTON AVE.
ATLANTA AVE.
ERIE AVENUE
BROOKLYN AVE.
CAMDEN
BALTIMORE
McLANE AVE.
EUCLID
McCULLOUGH AVE.
8A


RICHMOND
SEYMOUR
KINGSBURY
TECH HIGH ATHLETIC FIELD
CAMERON
SAN PEDRO
N. FLORES
QUINCY
ELMIRA
N. MAIN AVE.
SAN PEDRO AVE.
JACKSON ST.
8B


N. OLIVE
OLEANDER
HACKBERRY ST.
AUSTIN ST.
BLANCA
CASA
N. ALAMO
BROADWAY
LOOP 368
AVENUE "B"
U.S. 281 - I.H. 37
AVENUE "B"
NEWELL
SCALE: 1" = 200 Ft.
9A

U.S. 281 N.
AVENUE "B"
BROADWAY
N. ALAMO
NEWELL
SAN ANTONIO RIVER
AVENUE "A"
AVENUE "B"
TEX. TRANS CO. R.R.
N. ST MARYS
ELMIRA
9B