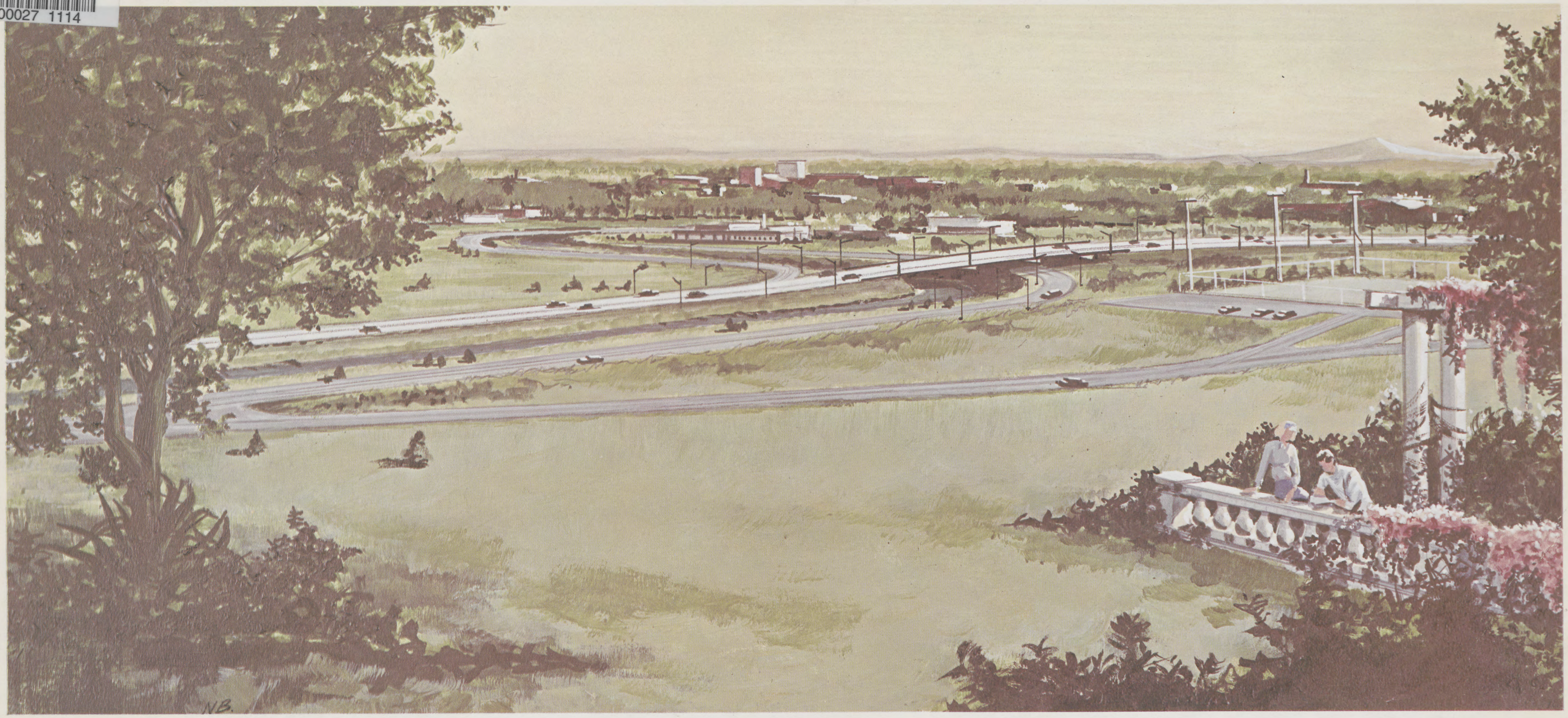


THE COLUMBINE FREEWAY

7

COLUMBINE FREEWAY ROUTE LOCATION & FEASIBILITY STUDY

I-25 TO STATE HIGHWAY 75
PREPARED FOR THE DIVISION OF HIGHWAYS, STATE OF COLORADO, IN COOPERATION WITH THE U.S. DEPARTMENT OF TRANSPORTATION; THE FEDERAL HIGHWAY ADMINISTRATION; THE BUREAU OF PUBLIC ROADS; BY MEURER, SERAFINI & MEURER, INC.

MEURER, SERAFINI AND MEURER, INC.
— *Consulting Engineers* —
2901 West 19th Avenue
Denver, Colorado 80204

C. S. Meurer
E. M. Serafini
M. R. Meurer

Civil Engineers
Structural Engineers
Land Surveyors

Phone: 433-7321

February 10, 1969

Charles E. Shumate, Chief Engineer
Division of Highways, State of Colorado
4201 East Arkansas Avenue
Denver, Colorado 80222

Subject: The Columbine Freeway Study F004-1(48)
Santa Fe Drive I-25 South to State Highway 75

Dear Mr. Shumate:

We are pleased to submit the Columbine Freeway Study for the Platte River Valley corridor between the Valley Highway (I-25) on the north and Chatfield Road (State Highway 75) near the Douglas–Arapahoe County line on the south. Our work was performed in accordance with the agreement dated February 2, 1968, between the Division of Highways, State of Colorado, and this firm. This study was made to determine a recommended freeway route through the Platte River Valley corridor and to set forth recommended designs and concepts for that freeway.

A design team consisting of engineers, planners and architects was utilized in accomplishing the work for this report. Our engineering staff was supplemented by planning and architectural support provided by the staff of Harman, O'Donnell & Henninger Associates, Inc., our planning consultants. Valuable support for such aspects of the Freeway as planning considerations for route selection, architectural and planning concepts for joint usage development, and concepts for landscaping, signing and lighting were provided by our planning consultants.

Preliminary planning was started for a freeway located on existing Santa Fe Drive for the length of the study corridor. As this design proceeded, it became obvious that an alternate location away from the existing business frontages along Santa Fe Drive should be investigated. An alternate route west of the South Platte River was selected between the Valley Highway and Belleview Avenue which would utilize as much open or undeveloped ground as possible and which would provide a compatible transition between existing and proposed land uses in the corridor.

During the study, members of our design team solicited information from public organizations and representatives of citizens' groups involved in the study corridor to make the Freeway compatible with community planning efforts and to develop appropriate joint usage concepts. Plans of various agencies for community facilities were considered in selecting the proposed freeway alignment. Plans of private interests along the route were also considered.

The Denver Metropolitan Area Transportation Study, 4B Surface Street System Analysis, 1966, was used as a base for projected street development of all east-west cross streets in the study corridor. An evaluation of this study with reference to the crossing streets is presented as a part of the

Mr. Charles E. Shumate
Page Two
February 10, 1969

Columbine Freeway study. The relationship of the Freeway to rubber-tired mass transit vehicles has been investigated, and the interchange types selected are compatible with the latest known and most acceptable methods of providing service for rubber-tired mass transit vehicles.

We wish to thank the members of the Division of Highways for their excellent cooperation in preparing separate traffic projections for the entire length of both the Santa Fe Route and the Western Route and in preparing right of way costs for necessary freeway acquisition on both alignments. We appreciate being given the opportunity to perform this important assignment, and we have particularly appreciated working with members of the Division of Highways; the Bureau of Public Roads; Arapahoe County; the cities of Denver, Englewood, Littleton and Sheridan; and many other citizens' groups that were involved. We believe that the freeway design recommendations as presented in this report could provide the basis for a major expansion and private redevelopment of the southwest Platte River Valley area; and that the influence of such a freeway would have a far-reaching and profound economic impact on the metropolitan area.

Respectfully submitted,

MEURER, SERAFINI AND MEURER, INC.

Malcolm R. Meurer, President

MRM:at

TABLE OF CONTENTS

TABLES/FIGURES/DRAWINGS

TABLES

FIGURES

DRAWINGS

SANTA FE ROUTE

WESTERN ROUTE

SUMMARY OF CONCLUSIONS

The two alignments studied are both satisfactory in terms of community development potential. The Santa Fe Route basically follows an existing barrier and division line in the urban development pattern and no additional disruptions, with the exception of added right of way requirements, are encountered. The Western Route, on the other hand, traverses an area in which the future development pattern will not be substantially disrupted or adversely affected by the construction of a freeway. Both alignments are very similar in terms of their relationship to the community facilities, overall urban development patterns, and the future joint usage and redevelopment possibilities. Both routes are compatible with the future development plans of the communities and counties affected. As alternates, however, the two routes have differences, some of which are substantial.

It is the recommendation of this study that the Freeway be located on the Western Route as opposed to locating the Freeway on the Santa Fe Route. The Western Route has distinct advantages in that it provides a better connection with the Valley Highway than the Santa Fe Route, and the turning movements in this interchange for the Western Route are much simpler and can be signed more easily. The severe restrictions along existing Santa Fe Dr. adjacent to the Gates Rubber Co. are completely avoided by utilizing the Western Route. A large amount of open, undeveloped land is available for Freeway construction along the Western Route as compared with the Santa Fe Route. This right of way must be reserved to insure that it will be available at the time of Freeway construction. In addition, the Western Route allows the existing businesses to be preserved along Santa Fe Dr.

The Western Route, with more land available, has the desired design feature that one way frontage roads are provided either side of the Freeway along most of the route to Belleview Ave. This will provide added traffic carrying capacity and a bypass in case of an accident on the Freeway. The alignment on the Western Route is superior to that of the Santa Fe Route in that it does not have the three distinct turning movements at each interchange which would be encountered along the Santa Fe Route. The Western Route has the advantage of causing a minimum disruption to existing traffic carried within the corridor by maintaining Santa Fe Dr. during construction of the Freeway. The Western Route will not isolate and restrict services that can be provided by the D & RGW Railroad. The advantage of providing grade separation crossings along Santa Fe Dr. is not included as a part of the Western Route; however, the three grade separation crossings that would be provided on the Santa Fe Route can be provided as an additional part of the Western Route for approximately $2.1 million. Even with this feature included, there would be a major cost differential favoring the Western alignment.

The cost of the Western alignment, including the spur connection from the Valley Highway to the Broadway—Lincoln one way pair, is estimated to be $47,760,000 for a 10.8 mile segment, which is $4.42 million per mile, including right of way. The estimated cost for the Santa Fe Route is $63,110,000 for the same length of segment, which is $5.84 million per mile. This gives a distinct cost advantage to the Western Route, attributable mainly to savings anticipated in right of way acquisition costs.

A traffic analysis for both routes indicated that the initial construction of the Freeway should include 6 lanes from the Valley Highway to Bowles Ave. and 4 lanes from Bowles Ave. south to County Line Rd. A freeway south of Bowles Ave. is not warranted at this time due to the low traffic volumes.

It is recommended that bridges be constructed to their ultimate width to provide 8 freeway lanes from the Valley Highway to Bowles Ave. and 6 lanes from Bowles Ave. to County Line Rd. This construction would eliminate the need for expensive widening of bridges at a later date as the traffic volume increases. Provisions have been made in the preliminary Freeway design to accommodate rubber-tired mass transit vehicles. Diamond interchanges have been planned at the major cross streets which will allow the incorporation of mass transit vehicles at the time they are required. It has been found this type of an interchange is most suitable for bus transit vehicles. Several features that are satisfactory for mass transit vehicles, such as acceleration lanes of approximately 1,070 feet, 450 foot deceleration lanes and 12 foot lane widths are provided. Recommendations are given for designation of a preferred lane on the Freeway for rubber-tired mass transit vehicles.

Recommended landscape design criteria is given for both freeway alignments studied. Because of the urban nature of the South Platte corridor, only enough right of way to serve the functional needs of the freeway should be acquired. Because of the Freeway speeds, it is recommended that large scale, visually simple landscape elements be provided. The Freeway should reflect the landscape characteristics of the area through which it passes. Plantings should be in large masses of one plant variety, rather than individual specimens. It has been recommended that an irrigated landscape be provided for this Freeway. Provision for continuous lighting between interchanges and complete lighting of the interchanges has been included in the design of this Freeway.

Some of the recreational area adjacent to the Overland Park Golf Course is required for Freeway construction. It is recommended that replacement land be provided south of the existing golf course between Jewell Ave. and Evans Ave. This location for an expanded Overland Park Golf Course is consistent with future plans of the City of Denver.

After a study of the possibility of utilizing railroad right of way for Freeway construction by moving the D & RGW railroad east onto the AT & SF right of way, it was concluded that this possibility was not practical. There was no cost savings in attempting to obtain right of way from either of the railroads. A preliminary investigation of possible split alignments was made. Both split alignments would utilize Santa Fe Dr. for southbound traffic, and either East Platte River Dr. or the Western Route for northbound traffic. Neither of these possibilities was found to be feasible.

Because the Columbine Freeway as it is now planned would qualify as a primary system on the State highway system, available financing would be 54% from Federal aid and 46% from State funds. This compares with interstate highway financing available of 90% from Federal aid and 10% from State funds.

ourse is
ent land
d Evans
nsistent

reeway
SF right
was no
he rail-
s made.
fic, and
traffic.

as a pri-
be 54%
terstate
m State

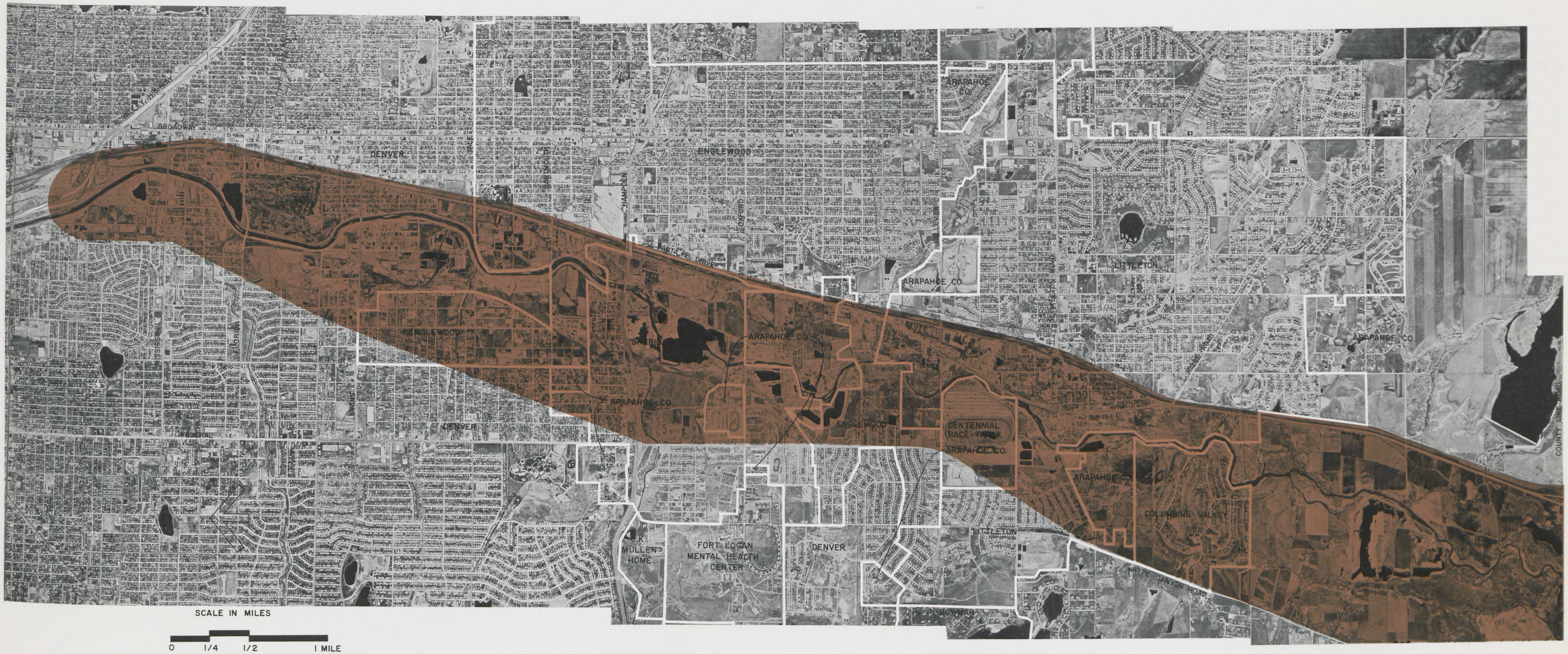


FIG. I / STUDY CORRIDOR

INTRODUCTION

PROJECT HISTORY

A southwest freeway in the South Platte Valley corridor was first proposed and recommended in a Comprehensive Plan adopted by the City and County of Denver in 1958. The corridor as shown on Figure 1 was the area of study in 1958 and covers the general area of study in this report. Beginning at the present interchange of the Valley Highway and South Sante Fe Dr., the proposed freeway route as recommended in 1958 crossed the South Platte River and paralleled South Lipan St. to Florida Ave., where it turned southwest along the west bank of the South Platte River. The route intersected West Evans in the vicinity of South Osage and then continued along the west side of the Colorado and Southern Railway spur to intersect Hampden Ave. near South Clay. South of Hampden, the route stayed west of the South Platte River with the exception of passing around the east side of Centennial Race Track. South of the Race Track, the route was located along Platte Canyon Rd. to serve the newly opened Martin Plant and the rapidly developing southwest metropolitan area. At that time, South Wadsworth Blvd. south of Hampden had not been developed as it is today to serve the developing southwest area.

The corridor was studied further in a Denver Planning Office report of August, 1961, entitled "Southwest Freeway—Feasibility Study." That report investigated, as possible freeway locations, South Santa Fe Dr., a roadway on either side of the South Platte River, and a route west of the River generally along the alignment suggested by the 1958 Comprehensive Plan. The 1961 Denver study recommended the westerly alignment, noting costs and acquisition problems along South Santa Fe Dr., major realignments required of the South Platte River for two roadways paralleling the River, and the fact that the westerly route was closer to the population to be served.

Recommendations of the 1961 Denver study were used by the Denver Metropolitan Area Transportation Study (DMATS) to formulate the study corridors for a proposed metropolitan transportation system. An assignment of the southwest freeway to the metropolitan transportation system was first made in the 1963, System 3, DMATS analysis.

Between 1961 and 1963, the development of Ruby Hill Park proceeded with Denver's acquisition of the high land of Ruby Hill Park and the development of plans for a park—golf course complex on either side of the River from West Florida to West Jewell. Because of this development of Ruby Hill Park, it was Denver's recommendation that the alignment of the proposed freeway in this area be moved to the west of Ruby Hill Park between Florida and Jewell to avoid taking the proposed freeway along the River between these two facilities. The alignment around the west side of Ruby Hill Park was the route used in the 1963, System 3, DMATS analysis.

In 1966, the Denver Planning Board made its recommendations for the Columbine Freeway location to the Executive Committee of DMATS. The Columbine Corridor was shown along the eastern edge of the College View residential area, along the western side of Ruby Hill Park and along Sanderson Gulch to Arizona Avenue. Two alternates were suggested for the corridor from Arizona north. One would go directly northeast to the Santa Fe—Valley Highway interchange area and the other alternate would proceed east paralleling Arizona to the vicinity of South Downing and the Valley Highway, where a new interchange was proposed. In the DMATS interim report of July, 1966, these recommendations were included with the route paralleling Arizona to Downing shown as the main route and the route to interchange with the Valley Highway shown as an alternate. Also in 1966, a report on the future of the Platte River Valley after the June, 1965, flood was published by a special task force working under the direction of the Mayor of Denver. In the southern part of the Platte Valley, the report recommended an expanded Ruby Hill—Overland Park recreation complex along the River and showed the lower part of the Columbine Freeway skirting this complex on the west. The Columbine Freeway was shown paralleling Arizona toward Downing Street and the Valley Highway.

Later in 1966, transportation planning groups in the metropolitan area were approached by private interests in the general Platte Valley area. These private interests indicated an interest in pursuing the possibility of a freeway along South Santa Fe Drive. After considerable discussion among the several governmental jurisdictions involved, it was agreed that the Santa Fe alignment for the freeway should be studied in more detail as well as the alignment west of the River. The Santa Fe alternate for the Columbine Freeway was then added to the proposed metropolitan area freeway system as envisioned by interested governmental jurisdictions.

Because of the foregoing plans for a southwest freeway and recent requests from Denver for high priority consideration of such a freeway, the Colorado Division of Highways has undertaken a route location study.

AUTHORIZATION FOR REPORT AND OBJECTIVES

Authorization of the route location study was given to the firm of Meurer, Serafini and Meurer, Inc., on February 2, 1968. An agreement was entered into with the Division of Highways, State of Colorado, to prepare a route location and feasibility study for the Columbine Freeway. The route location study was to include the general vicinity of South Santa Fe Drive between the locations of State Highway 75 (Chatfield Road) on the south and Interstate Highway 25 (Valley Highway) on the north for a total distance of approximately ten miles. It was intended that the route location study should encompass not less than two alternate plans, including but not limited to railroad and off-railroad alignments.

It was the Division of Highways' intent that the consultant would make a thorough examination along the entire route, including all feasible and economical locations, to study alternates of a freeway route with joint usage and facilities that would complement community development. The study was to include recommended preliminary roadway alignments, grades, access, structures, treatment of existing utilities, cost estimates and right of way requirements for each route studied. All of the information obtained and developed during the study was to be written and included in a report which would summarize the findings of each route studied, with conclusions and recommendations.

NEED FOR FREEWAY

In examining the DMATS System 5 transit corridors as shown on Figure 2, it can be seen that from the southeast quadrant of the city, which is served by the Valley Highway to Hampden Ave. on the west, the Columbine Freeway would provide a necessary transportation corridor. In an east-west direction, Sixth Ave. is in existence as a freeway west of the Valley Highway. Hampden Ave. from the foothills near Morrison to Santa Fe Dr. is being developed to a freeway status, and the New Chatfield Road is being planned as a freeway along the Douglas County—Arapahoe County line. Examining the north-south corridors from the Chatfield Dam to the Denver central business district, it can be seen that the only major arterials west of South Santa Fe Dr. are (1) Federal Blvd. which terminates at the Centennial Race Track; (2) Sheridan Blvd., which in essence has been terminated at Bow Mar; and (3) Wadsworth Blvd., which now serves the southwest area near Martin Company. At the time of latest traffic counts in 1965, Santa Fe Dr., a four lane major arterial with a center lane for left turns, was carrying approximately 33,000 vehicles per day in the vicinity of Mississippi Ave. Design capacity for such an arterial roadway is approximately 22,500 vehicles per day. Additionally, the intersection problem at Mississippi Ave. and Santa Fe Dr., based on accident statistics, is the third worst intersection in the city of Denver.

In examining the need for a freeway, one important fact which should be realized is that the greatest volume of daily urban travel is to and from points in the urban area other than the central business district. As much as 95% of this travel, including that in the large cities, is by auto or truck. Other forms of transportation, such as mass transit rail or mass transit buses, often do not conform to the travel pattern of people traveling to areas other than the central business district. Other methods as they presently exist cannot provide for this need in any reasonable, economic way. Currently the automobile and the highway are unmatched in providing much of the service demanded by a diversified, spread out, urban society. Nevertheless, the automobile cannot do the whole job. Until it is found from evidence that the future urban life will not include the automobile, we must continue to seek a city form compatible with the automobile and, at the same time, work with transit authorities, The Department of Transportation, the cities and counties and planning agencies, to provide a complementary mass transportation system which is vitally necessary for our urban areas. Further consideration of mass transit is given in Chapter II of this report.

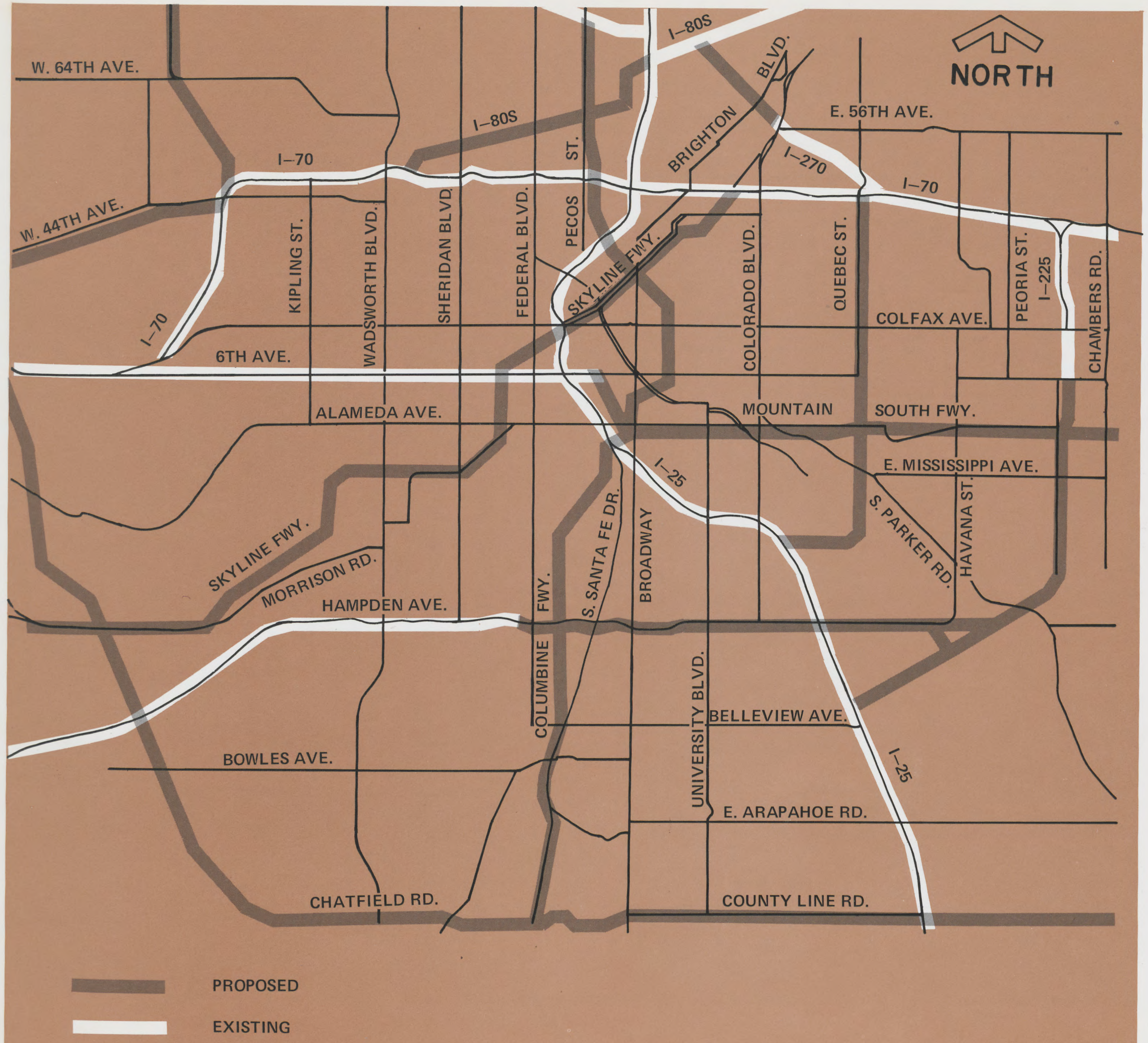


FIG. 2 / DMATS SYSTEM 5 EXISTING AND PROPOSED FREEWAY SYSTEM

SOURCE OF ROUTE STUDY DATA

Basic data for this project was gathered from many sources, including the following:

1. Division of Highways, State of Colorado
2. U. S. Bureau of Public Roads
3. City and County of Denver
4. City of Englewood
5. City of Littleton
6. City of Sheridan
7. Denver Regional Council of Governments
8. Arapahoe County
9. South Platte Area Redevelopment Council
10. South Suburban Metropolitan Parks and Recreation District
11. Colorado Water Conservation Board
12. U. S. Army Corps of Engineers
13. Denver Urban Renewal Authority
14. Model Cities Program in the College View area
15. Utility companies and districts
16. Railroad companies
17. Major private interests being affected by the freeway

The Colorado Division of Highways furnished soil boring information along the route; traffic information including present average daily traffic and projected average daily traffic for 1990; plans of existing highway projects; cost estimates of required right of way; uncontrolled aerial photography; and a copy of all related reports and studies for the subject area.

In the process of gathering basic information during the course of the study many meetings were held with interested city and county planning and engineering departments and interested private parties to gain the fullest understanding of present and proposed facilities in the study corridor. In addition, it was the intent of the Division of Highways that periodic progress reports of the Columbine Freeway study would be presented by the consultant to interested municipal and public agencies. Four such meetings were held during the contract period. Three of these meetings were held on May 9, 1968, September 3, 1968, and November 7, 1968, to present findings of the study and to solicit comments from the agencies in attendance. Many valuable comments were obtained during these meetings and consideration was given to the information received in making the route location study. A fourth and final meeting was held with all interested agencies to apprise them of the report findings and recommendations before its final publication. Additionally, progress reports of the study were presented to the regular meeting of the South Platte Area Redevelopment Council on October 9, 1968; to a joint meeting of the Denver and Englewood Planning Commissions on October 16, 1968; Sheridan City Council and Planning Commission on November 12, 1968; and to the Littleton City Council and Planning Commission on November 26, 1968.

TRAFFIC ANALYSIS

TRAFFIC PROJECTIONS

To study the need for a southwest freeway and to have a basis for number of lanes and interchange design, existing traffic counts were taken and future traffic projections were made and analyzed. Both existing traffic counts on South Santa Fe Drive and the 1990 traffic projections for a freeway located on Santa Fe Drive and for a freeway located west of the Platte River were made by the Colorado Division of Highways for this study. This information was supplied in Average Daily Traffic (ADT) volumes for the freeway as shown on Figure 3. In addition, ADT volumes were provided for each turning movement at each interchange and are shown on the preliminary plan drawings of each interchange.

To make the 1990 traffic projections, traffic assignments on the existing street network were made, based on projected urban development throughout the metropolitan area. The projected level of urban development for 1990 was based on the recommendations of city and county planning departments in the entire metropolitan area and indicated that more industry and major traffic generators are expected to be located near the study boundaries than at present. For example, it has been assumed that the Atchison, Topeka and Santa Fe Railroad and Gates Rubber Company industrial parks currently planned south of Ken Caryl Road and east of existing Santa Fe Drive will be developed. Figure 3 shows that traffic volumes are expected to increase substantially above present volumes along the entire route for both alternatives, the Santa Fe route (System 6A-1) and the Western route (System 6A-3), because of an outward shift of industrial and commercial land use. This shift resulted in a lower percentage of trips to the central city and smoothed out the directional distributions experienced at the present time.

At the time of the 1965 traffic counts on Santa Fe Dr., as shown on Figure 3, the segment of Santa Fe Dr. from the Valley Highway to Belleview Ave. had traffic counts ranging from 23,000 to 33,000 ADT. Santa Fe Dr., a four lane divided major arterial roadway, has a design capacity of 22,500 ADT. Santa Fe Dr. could feasibly be upgraded to a divided six lane major arterial with a design capacity of 35,000, but as can be seen by the existing and projected traffic volumes, a freeway was already required at some locations in 1965. With the increased traffic volumes and growth potential of the Platte River Valley, there should be no doubt as to the need for additional traffic carrying capacity in that corridor.

ROUTE COMPARISONS

In comparing the Santa Fe Route (System 6A-1) with the Western Route (System 6A-3), the volumes for each freeway location are nearly the same with the exception that total ADT volumes are slightly lower for the Western route. Although not portrayed on Figure 3, System 6A-3 shows a substantial use of Santa Fe Drive for short trips and for access to existing development. Since much of the existing development along Santa Fe Drive would be destroyed under System 6A-1, very little traffic volumes were assigned to the frontage roads for that facility.

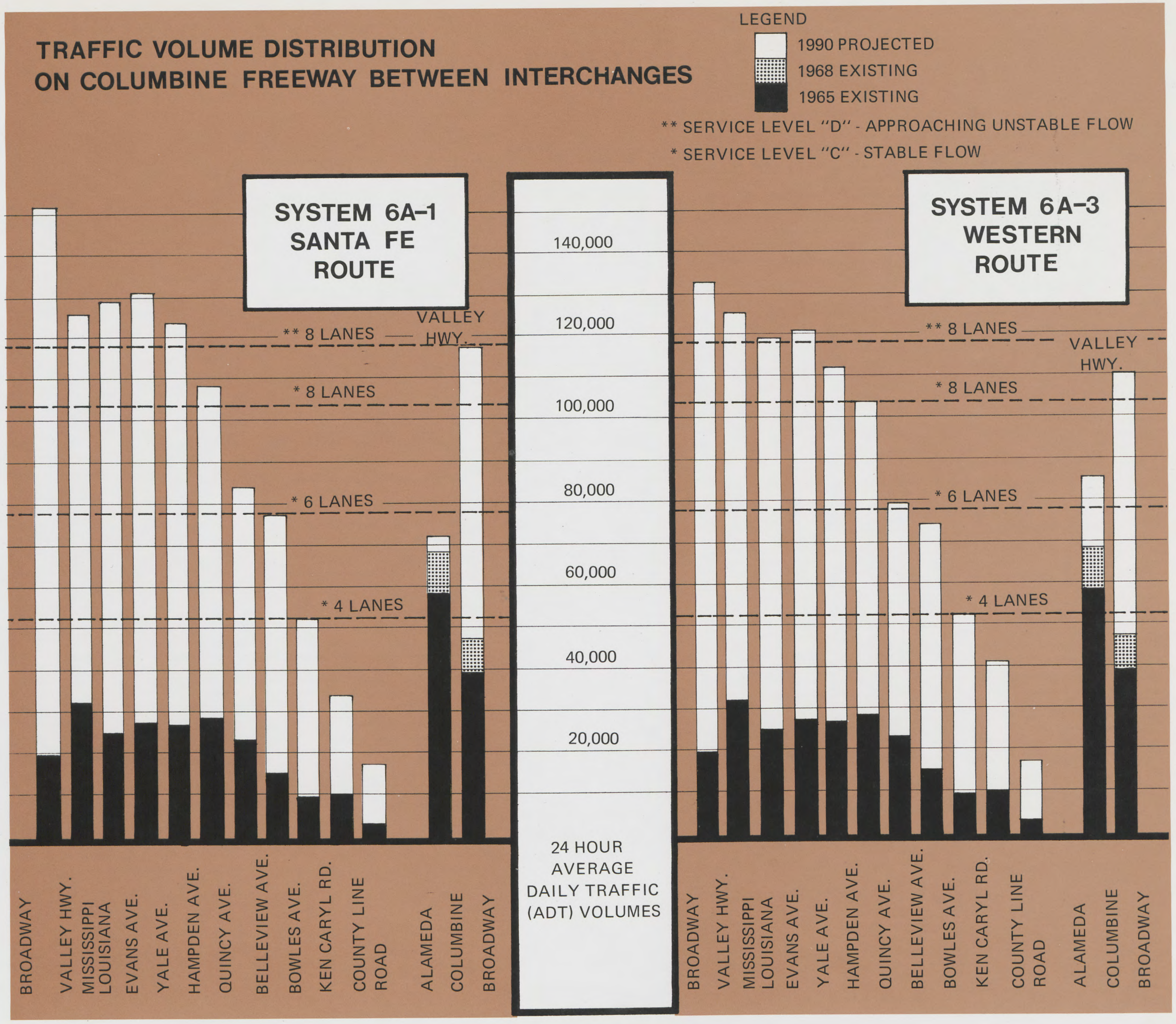


FIG. 3 / TRAFFIC VOLUME DISTRIBUTION

CHAPTER II

FIG. 4 / KEN CARYL ROAD CONNECTION

Because the Western route is located approximately two-thirds of a mile to the west of Santa Fe Drive, many more drivers east of South Santa Fe Drive would choose to use existing Broadway for north—south travel than if the freeway were located on existing Santa Fe Drive. Even with this heavier use of Broadway for System 6A-3, the capacity of Broadway would not be exceeded. The heavier use of Broadway should have the effect of injecting added importance to commercial interests along the entire length of Broadway. In addition, the Western Route, being located closer to Federal Blvd. and Sheridan Blvd., had an effect of reducing somewhat the projected traffic volumes on those two major arterials.

North of the Valley Highway for the Western Route, Figure 3 shows a lower total volume than for the comparable location on the Santa Fe Route. This is caused by the traffic projection assumption that a motorist would choose the shortest possible route on a time basis. With the Western Route located approximately two-thirds of a mile west of Santa Fe Dr., many motorists would choose either Santa Fe Dr. or Broadway in preference to the Freeway. On the above basis, it appears that if the Western Route were selected for a Freeway, Santa Fe Dr. and Broadway will both continue to serve an important function of carrying traffic. Because the traffic projections as presented herein do not take into account an overloaded situation on a Freeway or a street system and readjust accordingly, a traffic projection results as is shown for System 6A-3 on the Valley Highway north of the proposed Freeway. With a higher projected volume on the Valley Highway for this point than for a comparable location on the Columbine Freeway, it is obvious that the status of congestion on each route would dictate the drivers choice and both freeways would probably carry an equal load.

The entire planned Columbine Freeway and its subsequent development south of Bowles Avenue will depend on the proposed development of this area actually occurring. At the present time, a freeway is not required for this area. There are announced plans by the Gates Rubber Company to begin a joint development with the Atchison, Topeka and Santa Fe Railroad in the Santa Fe Industrial Park planned for the area east of Santa Fe Drive and south of Ken Caryl Road. As this development materializes, Arapahoe County has agreed to construct a new, relocated Ken Caryl Road east of Santa Fe Drive in the vicinity of the suggested roadway as shown on Figure 4. The development of this area south of Bowles Avenue will have a major effect on the need for a freeway in that area and for an interchange at Ken Caryl Road. Because of these proposed developments, a four lane freeway has been planned south of Bowles Avenue with a diamond interchange at Ken Caryl Road. It is recommended that this freeway development be constructed only when the traffic volumes justify such a development.

VALLEY HIGHWAY INTERCHANGE

In examining Figure 3, the volumes projected for the viaduct segment of the Columbine Freeway from the Valley Highway northeast to the Broadway—Lincoln one way pair are for both systems higher than the volume levels on the rest of the Columbine Freeway or the Valley Highway in this area. If this segment is not constructed, it can be expected that the 133,000 ADT volume of system 6A-3 or the 152,000 ADT volume of system 6A-1 would have to be carried by the Valley Highway and the Santa Fe—Kalamath one way pair north of the Valley Highway. The following summary outlines volumes that must be carried by these two systems if the connection to the Broadway—Lincoln one way pair is not made.

VALLEY HIGHWAY—SANTA FE—KALAMATH (ONE WAY PAIR)

	(ADT) Present Volumes	(ADT) Planned Capacities
Valley Highway North of Columbine Freeway	68,000	104,000
Santa Fe—Kalamath one way pair north of Valley Highway	19,800	34,200
TOTAL	87,800	138,200

The total to be carried by Santa Fe– Kalamath and the Valley Highway north of the Columbine Freeway interchange if the Columbine Freeway were not extended to the area of Broadway and Lincoln would be a minimum of 87,000 from Valley Highway (projected 1990 volumes system 6A-3) plus 133,000 from the Columbine Freeway, plus 27,000 projected for Santa Fe—Kalamath, making a total of 247,000 on a planned capacity of 138,200, leaving a deficit capacity of 108,800. It is recommended that early in the construction of the Columbine Freeway, six lanes be carried on a viaduct over to the Broadway—Lincoln one way pair north-south which could have ramps to and from the proposed Alameda—Dakota one way pair east-west. These four streets have a planned capacity of 79,000 ADT according to the 1966 DMATS 4B Surface Street System Analysis.

REQUIRED LANEAGE

Also included on Figure 3 are maximum design capacities for 4 lanes, 6 lanes, and 8 lanes for an urban freeway at the "C" level of service. These values were obtained from the Highway Capacity Manual of 1965, Special Report 87, Table 9.1, using a peak hour factor of 0.85 and a design hour volume factor of 11%. The "C" level of service which represents a stable flow condition with high vehicle speeds was used as a design standard. The higher capacity "D" level of service is a larger volume flow condition that is approaching unstable flow with little freedom to maneuver and represents a condition tolerable for short periods. An "E" level of service is unstable flow and lower operating speeds than level "D" with some momentary stoppages. Level "F" is forced flow with many stoppages in which the highway acts as a storage area. It should be noted as the levels of service decrease toward level "F", higher volumes are carried at lower speeds until at the "F" level of service, the entire system stops functioning.

From Figure 3 it was determined that initial freeway construction for both routes should provide 6 lanes from the Valley Highway to Bowles Avenue and 4 lanes from Bowles Avenue to New Chatfield Road. It is planned that the ultimate Freeway would have 8 lanes from the Valley Highway to Bowles Avenue and 6 lanes from Bowles Avenue to New Chatfield Road. When traffic volumes exceed the capacity of an 8 lane freeway, it is anticipated that other freeway locations will be obtained or other forms of transportation will be used.

It is felt that freeways with more than eight lanes of capacity do not function satisfactorily. Because of the extensive weaving required to reach the inside lanes, these lanes do not carry their share of the traffic load.

The traffic projections show that for the northern part of the route the design level exceeding the capacity of 6 lanes could be reached in the first 10 years of the freeway use, assuming a straight line ratio for volume increase. It is therefore planned that the embankment and bridges would be constructed to their ultimate width during initial construction so that the expense of widening bridges and construction of embankment near a full service freeway would not be required when the additional lanes are required. Volume projections to 1990 for both alternatives between Bowles Avenue and Ken Caryl Road show a requirement for a four-lane freeway. For both systems south of Ken Caryl Road, the 1990 projected volumes are only slightly higher than the highest volumes which were being carried by Santa Fe Drive in 1965 on a 4 lane major arterial street with a center turning lane. In addition, it can be seen that the projected volumes for system 6A-3 south of Ken Caryl Road are somewhat higher than for system 6A-1. This was caused by designating New Chatfield Road as a freeway for system 6A-3 when it was previously designated as a major arterial in system 6A-1.

INTERCHANGE DESIGN

Projected turning movement volume for interchange ramp designs as shown on each of the proposed interchange layout sheets are given in average daily traffic (ADT) volumes. The directional design hour volumes (DDHV) for ramps were determined by multiplying the total of the two directions of a certain turning move in ADT by the design hour volume factor, K, (ranges from 11% to 15%) and by a direction distribution factor (D=60%). The resulting value was then adjusted by a ratio of one direction ramp ADT divided by the average ADT of the two directions of the turning move. The design hour volume factor of 11% was used for the freeway and all ramps from the Valley Highway through Bowles Avenue. For the freeway from Bowles Avenue south, a K factor of 12% was used and for all interchange ramps from Bowles Avenue south, a K factor of 15% was used. An example of the above method is given for the turning move (system 6A-3) southbound Freeway to eastbound Hampden (8500 ADT) and westbound Hampden to northbound Freeway (9300 ADT).

Total ADT = 8500 + 9300 = 17,800 vehicles per day

$$DDHV_{(9300)} = 17{,}800 \times 11\% \times 0.60 \times \frac{9300}{8900} = 1225 \text{ vehicles per hour}$$

As a general guide for interchange design, the following traffic capacities in vehicles per hour were used:

Freeway lane	1500 VPH per lane
Diamond interchange with maximum of 2 lanes per ramp	800 VPH per lane
Loop interchange with 1 lane per loop	800 to 1200 VPH per lane
Directional interchange with maximum of 2 lanes per ramp	1200 VPH per lane
Signalized Street Intersections	500 to 800 VPH per lane

It was determined that the most suitable type of interchange for this route was a diamond interchange because of its simplicity, requirement for a relatively small amount of right of way, ability to carry projected volumes and compatibility with requirements for bus transit as discussed in Chapter III. Where high through volumes of traffic would hamper the turning movements of a diamond interchange, such as at Hampden Ave., a tri-level diamond interchange with the turning movements on a separate level has been planned. For a discussion and perspective views of two types of tri-level interchanges, see Chapter V and Chapter VI.

MASS TRANSIT STUDIES AND RECOMMENDATIONS

GENERAL CONSIDERATIONS

Because of existing public preferences and policy, the increasing demand for transportation in the Denver area is now directed primarily toward highway improvements. As these demands on the limited funds for highway improvements continue to increase and as the side effects and costs from reliance upon highways alone begin to mount in terms of parking needs, increased urban sprawl, erosion of the central business district and loss of urban land development to highway rights of way, it becomes imperative that the efficiency of the total transportation expenditure in terms of satisfying those demands be increased. These demands for transportation may be sorted into two general categories.

The first category of demand and apparently the greatest today is to move as many vehicles as possible. We measure our success in meeting this demand in terms of the efficiency of our highways in moving great numbers of vehicles. This demand originates in the public group for whom job requirements, pleasure and pride of a luxurious automobile, special convenience, recreational use, and certain other personal needs as well as industrial needs such as delivering goods are the outstanding values associated with the transportation system. Thus, this group's needs are best satisfied by a system which is suitable for operation of large numbers of private and individually operated vehicles and not necessarily a large number of passengers.

The second category of demand and the least satisfied in the Denver area is for mass transit, which amounts to the movement of great numbers of people and goods in as few vehicles as possible. This demand originates in those people who place value upon overall transportation costs, safety, speed, limited personal liability, use of travel time for multiple activities, and other needs which are best satisfied by mass transit facilities. Part of this group will use private vehicles when the transit facilities are unacceptable to them. However, for various reasons, such as age, poverty, or severe physical handicaps, another part of the group has no alternative to mass transit. Poor public transportation means poor transportation to them and no public transportation means no transportation.

In terms of satisfying the total transportation needs of the public, efficiency in moving large numbers of passenger vehicles is only one aspect of the transportation problem, just as mass transit is only one aspect. Each transportation system has its advantages and disadvantages in satisfying the public's needs. The best approach for meeting these needs is to be alert to the actual public requirements and preference and then place appropriate emphasis on satisfying each of the requirements most efficiently.

In addition to satisfying the total transportation needs of the public efficiently, it is equally important that transportation expenditures and construction be recognized as an extremely important element in the overall direction and development of an urban area. A total transportation system must be devised which compliments related urban goals such as reducing the impact of the car and its travel and parking needs on the city and avoiding costly and open-space-destroying urban sprawl. Mass transit must play an essential role in a future, balanced transportation system for Denver.

The question of what type of mass transit system should be developed for Denver is a difficult one. Because of the relatively low density urban sprawl in Denver compared with other large cities, the conclusion reached by study and evaluation of many reports published on the subject for the Denver area is that rubber tired mass transit vehicles (commercial buses and privately pooled vehicles) operating on existing and future Denver freeways and major arterial streets appears to be the most suitable system for the area from an economic and technological viewpoint for several years in the future. It should be noted that there is currently proposed for the Denver area an Integrated Transportation–Urban Design Study (ITUDS) which is planned to be part of the Council of Governments' comprehensive planning program and could take 3 to 5 years to complete. If this study materializes, it will be carried out by the Denver Regional Council of Governments and will involve several phases of development.

By making the freeways readily adaptable to use by transit buses, the highway can be made to contribute significantly to an improved public transit service and, at the same time, increase the service provided for the individual vehicle operators. This transit system offers one of the most flexible systems for adapting to changing concentration points of economic and housing activity as little or no additional expense is involved in changing routes or levels of service.

Other systems such as surface rails, elevated rails and subways, which are not flexible, generally involve large initial capital outlays and would probably require enormous subsidizing to remain in operation in this relatively low population density area. However, should the continuous evaluation of Denver's transportation system reveal a fixed rail system as publicly preferred and feasible, a rail route is now in existence through the Platte River corridor.

Past experience with fixed inflexible rail systems indicates that dense and stable population concentrations of about 12,000 to 15,000 people per square mile are required for an efficient feeder system to operate. For example, New York has a density of about 25,000 and Chicago about 17,000, while Denver has only about 7,000 and the Denver Four County Metro area has only about 3,000 persons per square mile. Further, with adequate land available for development in all directions, there is reason to expect metropolitan Denver to continue sprawling in this low population density pattern. It is expected that for many years the majority of the people of this region will continue to be satisfactorily served with highway and street transit, if these facilities are used efficiently. The existing and planned freeway and street facilities for the metropolitan area should be capable of providing an acceptably high level of individual auto and bus transit service for many years.

An investigation of efficiency in the use of our street and freeway system, based on number of people moved, can be illustrated by the following facts. Even when a freeway lane is operating at close to vehicular capacity with about 1,500 cars an hour, it is operating at only a fraction of its passenger capacity because the average car occupancy in Denver is approximately 1.8 persons per car, or 2,700 persons per lane per hour. If these cars carried 4 persons per car, which is within the capacity of practically all passenger vehicles, the highway lane would more than double in terms of efficiency in moving passengers. If buses were operating in this same lane with a headway of 30 seconds, these buses could move 6,000 passengers per hour (120 buses x 50 seated passengers). This 30 second headway leaves room for at least 5 automobiles between buses which, if restricted to cars carrying at least 4 persons could move 2,400 additional passengers (600 x 4) for a total of 8,400 in a bus and pooled car restricted lane versus only some 2,700 in a passenger car only lane. If, on an eight lane freeway, one lane each direction were designated as a preferred lane for pool cars and buses, the people-carrying capacity of the freeway could be increased from 21,600 persons per hour to 33,000 persons per hour, or a 53% increase. These figures represent the reasonable upper and lower limits of what can be expected.

People can justly be expected to demand a choice in their mode of travel; and for a great many individuals, and certainly many businessmen, the use of buses or pooled cars involves hardship and sacrifices or outright impossibilities that make their use impractical. Nevertheless, the fact remains that many more passengers could be moved on available and planned lanes than is currently accepted if the more efficient alternatives were made attractive enough to earn the choice of the riders.

Some considerations which are important in the decision of individuals as to which mode of transportation they use are:

1. Convenience, comfort and ease of use
2. Time involved and directness
3. Prestige, pride in personal vehicle and other emotional factors
4. Costs
5. Safety
6. Vehicle reliability
7. Weather protection while waiting
8. Independence from others
9. Ability to relax while riding
10. Ability to avoid heavy traffic
11. Opportunity to choose riding companions.

With the preceding facts and characteristics in mind, the following criteria were decided upon for insuring that the freeway would be readily adaptable to use by rubber tired mass transit.

RECOMMENDED CRITERIA

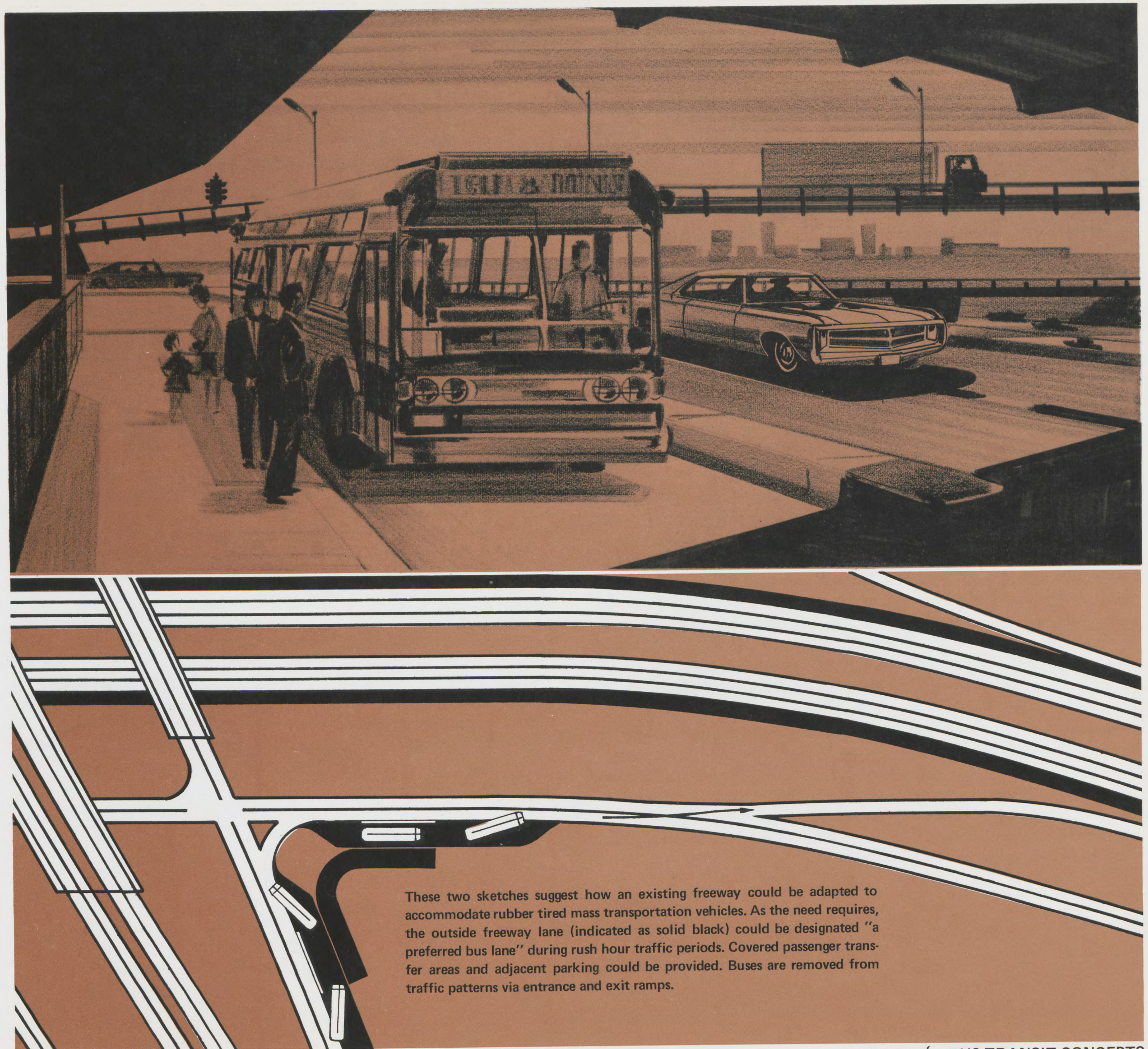
1. Interchange layouts and available right of way must be such that future bus stops may be economically constructed in positions most convenient to passengers. Generally the most convenient level for passengers is at street level. The buses should have direct access to these stops such as through diamond interchange ramps versus cloverleaf interchange loops or other indirect ramps which add to travel time. An illustration of what can be done to accommodate future bus stops at diamond interchanges is shown in Figure 5.

2. Provisions for bus ingress and egress for loading along freeway for moving to and from more distant major parking lots and for connecting with local buses should be provided at all interchanges except directional interchanges. This can be done easily with the use of diamond interchanges.

3. Loading platforms should be placed within the first 100 feet of a diamond on-ramp, if possible. See Figure 5 for typical proposed loading platforms.

4. Right of way provisions should be made for future bus bypass lanes on ramps around waiting traffic if on-ramp metering or monitoring is utilized to regulate lightly loaded vehicles entering onto an overloaded freeway.

5. Provision should be made for a 10 foot wide (minimum) passenger loading platform.



These two sketches suggest how an existing freeway could be adapted to accommodate rubber tired mass transportation vehicles. As the need requires, the outside freeway lane (indicated as solid black) could be designated "a preferred bus lane" during rush hour traffic periods. Covered passenger transfer areas and adjacent parking could be provided. Buses are removed from traffic patterns via entrance and exit ramps.

FIG. 5 / BUS TRANSIT CONCEPTS

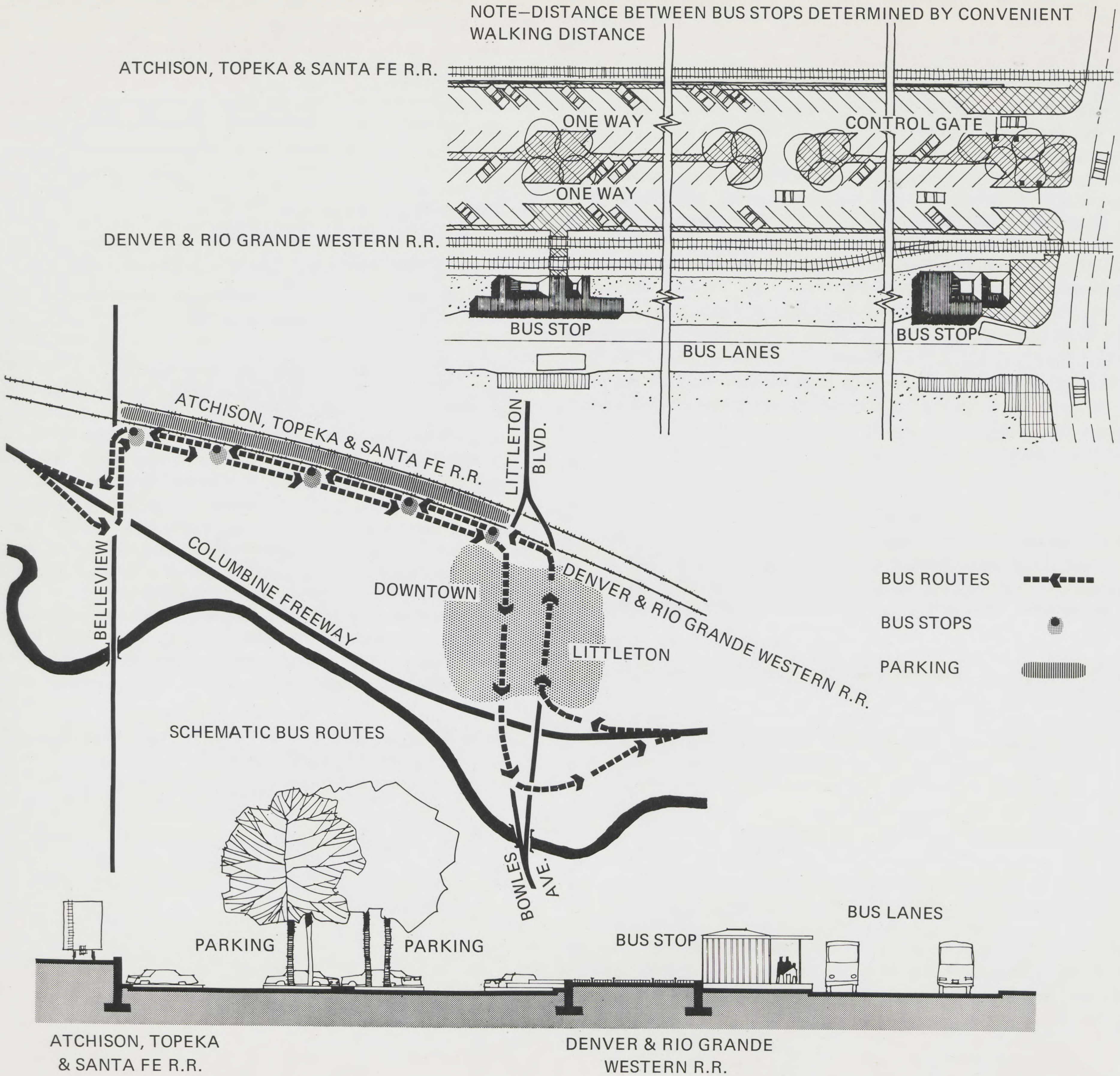


FIG. 6 / SUGGESTED TRANSIT PARKING

FIG. 7 / PREFERRED BUS LANE

6. Provisions should be made for commuter parking and the wide right of way between the AT & SF and D & RGW railroad tracks appears to offer a unique opportunity for joint highway department, railroad and transit authority cooperation. Throughout the major portion of the South Platte corridor route, the main line tracks are sufficiently separated to allow parking to occur between the tracks. A system of parking is suggested utilizing commuter buses which would exit the freeway, parallel the railroad tracks and re-enter the freeway at a convenient interchange. Drivers with destinations convenient to the freeway bus system; i.e., the Denver central business district, could park between the tracks and board the bus at a convenient bus stop adjacent to the tracks. Local and semi-local bus systems could be routed and scheduled to connect with the freeway bus system.

The utilization of railroad right of way is especially desirable in light of the flexibility inherent in the system. First, with varying complications, largely determined by railroad requirements, parking could occur at any of a number of locations along the freeway route. Secondly, parking location is not dependent on a particular freeway alignment and the total system will function, given any freeway alignment in the South Platte corridor. Figure 6 (suggested transit parking) indicates how such a system might relate to the downtown Littleton area.

Implementation of parking between the railroad tracks would require cooperation between the railroads and parking authorities. The operational requirements of the railroads must be considered and it is suggested that railroad right of way used for parking purposes be leased from the railroads.

7. Provisions should be made for acceleration and deceleration lanes suitable for buses:

a. 1,070 feet acceleration lane with taper included
b. 450 feet deceleration lane with taper included
c. 12 feet minimum lane width.

8. In locating passenger loading platforms, consideration should be given to causing passengers to climb as little as possible. Passenger ramps should be designed with a maximum 10% slope.

9. Shelters should be provided for waiting passengers.

10. The outside lane of the freeway should be considered for preferential lane designation when rubber tired mass transit needs develop. Preferential designation means that during certain periods of heavy demand, vehicles other than buses and pooled cars can use this lane only for entering or exiting the freeway. See Figure 7 for concept of preferred lanes and possible signing.

11. Preferred lanes should be used only where 3 or more lanes occur one way.

12. Policies to reserve a freeway lane must be within authority of local and state agencies.

13. Walkways should be provided under or over freeways at all platform locations. This is accomplished in a diamond interchange with no additional structure required.

14. Storage space should be provided for several buses where high demand is likely at platforms.

SUGGESTED GUIDELINES FOR OPERATION

Recommended guidelines for the successful use of the freeway by buses are presented as follows:

The effort for transit bus use of the freeway must be a joint effort by the transit authorities and local and state authorities. The fact must be recognized and accepted by the general public as well as authorities that an economical mass transit system is slow in time to develop. When vehicular congestion on the freeway becomes such that buses can no longer move at a speed equal to that in light traffic, preferential lanes should be adopted for use by buses and pooled cars during the rush hours. The users of the remaining lanes must be educated to accept the rules even though the preferential lane is operating at below vehicular capacity while their lanes are loaded to or in excess of vehicular capacity. It must be remembered that the preferred lane is still carrying a greater passenger capacity than the other lanes.

The details of the traffic control devices for a preferred lane will require careful consideration. On a signal controlled by the level of traffic density, the lightly loaded cars and all trucks would be directed to the left lanes of the freeway, leaving the preferred lane to buses and pooled cars only. If the cars remained in the right lane against the signal, then they would be required to leave the freeway at the next exit. In essence, lightly loaded cars could use the preferred lane only for entering or leaving the freeway. If, after entering the freeway, the left lanes were found to be too crowded to allow merging left, then the lightly loaded vehicle would be required to exit the freeway at the next exit. Also, metering devices and observation could restrict lightly loaded vehicles from entering the freeway when unreserved lanes reach capacity by stopping these vehicles at the on-ramp. Obviously, this level of traffic control would require considerable education of the public as well as adequate observation and enforcement.

Assuming the bus and pooled car traffic continues to develop after preferred lanes have been designated, exclusive lanes on the freeway should be considered. Outside lanes will not function as exclusive lanes because the lightly loaded vehicular traffic must use these lanes for weaving to use the on and off ramps. Inside exclusive lanes eliminate the weaving problem but require construction of exclusive off and on ramps for use by the buses. Alternatives are (1) additional preferential lanes; (2) construction of a separate mass transit route elsewhere, such as between the existing rail lines along Santa Fe Drive; or (3) adoption of a rail system utilizing existing rail lines for the corridor movement. It is probable that adoption of a rail system will have gained an economical and technological advantage over the adoption of exclusive bus lanes at that future time. In addition, it is reasonable to expect changes in public policy toward transportation which will be in favor of alternatives to the exclusive bus lane for mass transit when Denver's traffic becomes so dense.

SUMMARY OF RECOMMENDATIONS

No special facilities for the use of mass transit vehicles will be initially constructed but provisions for the room required for such construction will be made.

Diamond interchanges, or a modification of that type of interchange, are being proposed along the entire route. In addition, full acceleration lanes of 1,070 feet are being proposed for all freeway entrances. The above two items of initial construction seem to be the two most important considerations of the freeway design to allow for future incorporation of a bus transit system into the freeway operation.

As demand for transit develops, the loading platforms, including turnout lanes, metering devices, etc., may be evaluated and installed.

As demand for additional transit facilities develops beyond the ability of preferential lanes on the freeway, a re-evaluation of the solutions available at that time should be conducted. The technological and economical situation 10 to 15 years from the date of this study are open only to a highly speculative type of prediction. A separate rail transit system is possible within the existing railway right of way corridor.

It is recommended that right of way for automobile parking lots be considered near the interchanges and bus loading platforms at such locations as Hampden, Bowles or at the New Chatfield Road interchanges. It has been observed that unless a driver has a long distance (15 miles or more) to drive, he probably will not leave his car to take a bus if adequate freeways are available. This can now be observed in the desire for parking facilities at the Broomfield interchange and at the proposed East Boulder Bypass interchange, both on the Denver—Boulder Turnpike. If the desire for automobile parking lots becomes apparent at interchanges closer to the central business district, right of way will have to be acquired in the future. It appears that this can be accomplished within the railroad right of way close in as well as at outlying sites as shown in Figure 6 for the Littleton area.

PLANNING CONSIDERATIONS FOR ROUTE SELECTIONS

TRANSPORTATION AND FREEWAY PLANNING

As previously discussed in Chapters II and III, freeway planning and construction must be kept within the context of the need for an eventual balanced transportation system, comprising various modes and methods of transportation. So, too, must freeway planning be viewed in the larger context of urban planning and urban design, as well as in the context of engineering, traffic analysis, and facility construction.

The freeway system, in any community, will be among the largest expenditure items and its direct and indirect effects upon the total development of the community will be equally as significant as the expenditure. These effects are as profound and permanent as any made within the city. The effect upon the social and institutional fabric of an urban area in terms of service patterns, community facility locations, and places of work and residence are a part of the freeway location.

Physical influences of a freeway cause the removal or clearance of areas for right of way and the creation of development barriers. The potential division of previously contiguous community units and service areas, the concentration of development potential and demands near interchanges, and the introduction of the influence of noise are a part of the decision for freeway location.

The first phase of freeway planning is the decision to build a freeway. This sets the phasing and scheduling of the freeway in terms of total metropolitan needs and determines the general location of the freeway in the metropolitan area with relation to the general corridor. The second phase of freeway planning takes place within the corridor itself. Once the decision has been made that a freeway is needed and a specific corridor is designated, this second phase proceeds to determine where within the corridor the freeway can best be constructed, how it can be specifically treated to solve total urban development criteria, and what the cost of construction will be. The third or final phase is actual construction of the freeway, which involves detailed engineering site planning.

As explained in Chapter I, the first of these planning steps was completed by establishing the freeway criteria and a freeway corridor. This study is the evaluation of the overall planning and engineering aspects of alternate freeway alignments within the designated corridor.

The Study Corridor

As indicated in Figures 1 and 8, the corridor is precisely defined on its eastern boundary by the existing railroad tracks and by the substantial industrial and residential development which lies immediately to the east. At the southern end of the corridor the development east of the railroad tracks becomes more sparse, but the corridor is still strongly defined by the steep hillside and bluff area which parallels the railroad tracks on the east.

On the western boundary, the corridor is strongly defined at its northern end by the hillside and bluff which runs southwesterly from Ruby Hill Park and College View to the vicinity of Federal Blvd. south of Oxford Ave. This western topographic boundary is further reinforced by the change in land use and the substantial residential development which occurs continuously west of this line. Between Quincy Ave. and Bowles Ave., the western corridor boundary is primarily determined by the existing residential and commercial development which lies west of South Federal Blvd. and the Centennial Race Track. South of Bowles Ave., the western corridor limits are generally determined by Platte Canyon Rd. and by the residential development to the west.

Planning Participation

There are six major civil jurisdictions in the study corridor. They are the City and County of Denver, Arapahoe County, and the municipalities of Englewood, Littleton, Sheridan and Columbine Valley. The extremely inter-related nature of the jurisdictions of these government bodies is indicated in Figure 1. As explained in Chapter I, these and other bodies have been closely involved with the development of this report and have been frequently consulted. Every effort has been made to consider freeway alternative alignments which maximize the opportunities available to the various public and private entities within the corridor.

Existing Corridor Conditions

Two factors which have left the strongest impression on the development conditions in the study corridor are the traditional transportation systems of both rail and highway and the serious flood danger in the lower elevations of the valley. The availability of railroad access and freight sidings have encouraged substantial industrial development in the corridor. The industrial activity extends south along the AT & SF tracks on the east side of the corridor as far south as Littleton. In the central portions of the corridor the industrial activity extends south to the vicinity of Hampden Ave. along the alignment of the Colorado & Southern railroad tracks.

Prior to the construction of the Valley Highway—Interstate 25 connection from Denver to Colorado Springs in 1950, Santa Fe Dr. was the primary southern highway connection to and from Denver. Virtually all of the development immediately flanking Santa Fe Dr. constructed prior to 1950 was highway and highway service oriented. Many of the land uses along Santa Fe Dr. are still related to its present function as a collector highway within the metropolitan area.

Within the corridor, there is a very limited amount of residential use, as can be seen on Figure 1. Recreation facilities which exist or are under construction in the corridor are: Vanderbilt Park north of Mississippi Ave.; Ruby Hill Park and Overland Golf Course; Pioneer Park along the east bank of the South Platte River north of Harvard Ave.; Englewood Centennial Park north of Union Ave.; South Suburban Park and the Columbine Country Club south of Bowles Ave.; and the Castlewood public golf course near Ken Caryl Rd.

The primary natural feature of the corridor is the South Platte River Valley. As graphically demonstrated in June, 1965, the valley has been extremely susceptible to flood damage from both the South Platte River and Bear Creek which joins the South Platte immediately south of Hampden Ave. While much of the lower topographic areas of the valley have remained undeveloped because of the flood danger, there are many instances where poor quality development has encroached into the flood plain. In the section of the river valley between Hampden Ave. and Belleview Ave. and in the section from Bowles Ave. south, the valley area is virtually undeveloped.

The valley corridor has been an important and extensive source of sand and gravel. The area between Hampden Ave. and Union Ave. has been extensively mined in the past and one large operation is still under way. The most active operations existing at this time, and the only ones foreseen to exist in the future, are in the vicinity of Ken Caryl Rd. and Chatfield Rd.

Corridor Development Potential

Two important aspects of the valley's development potential are elimination of the flood threat and provision for adequate highway circulation. The flood threat will be removed with the completion of the Chatfield Dam and its downstream improvements by 1972. Similarly, flood control in the Bear Creek Valley has proceeded to the point of project planning on the Mt. Carbon Dam immediately east of Morrison. The Columbine Freeway will dramatically improve the highway circulation situation. Both of these projects together will increase the desirability of the corridor as a location for development and will tend to cause removal and replacement of obsolete properties, development of vacant land, and the reorganization of obsolete land use patterns.

An important aspect of the corridor's potential is the unique opportunity for development afforded by the Platte River with substantial areas of vacant ground adjoining it south of Dartmouth Ave. With the removal of the current environmental problems and with the creation of the freeway, the opportunity will exist to create an environment in which the South Platte River, substantial lakes and other water elements, and open space are an integral part of the new community development.

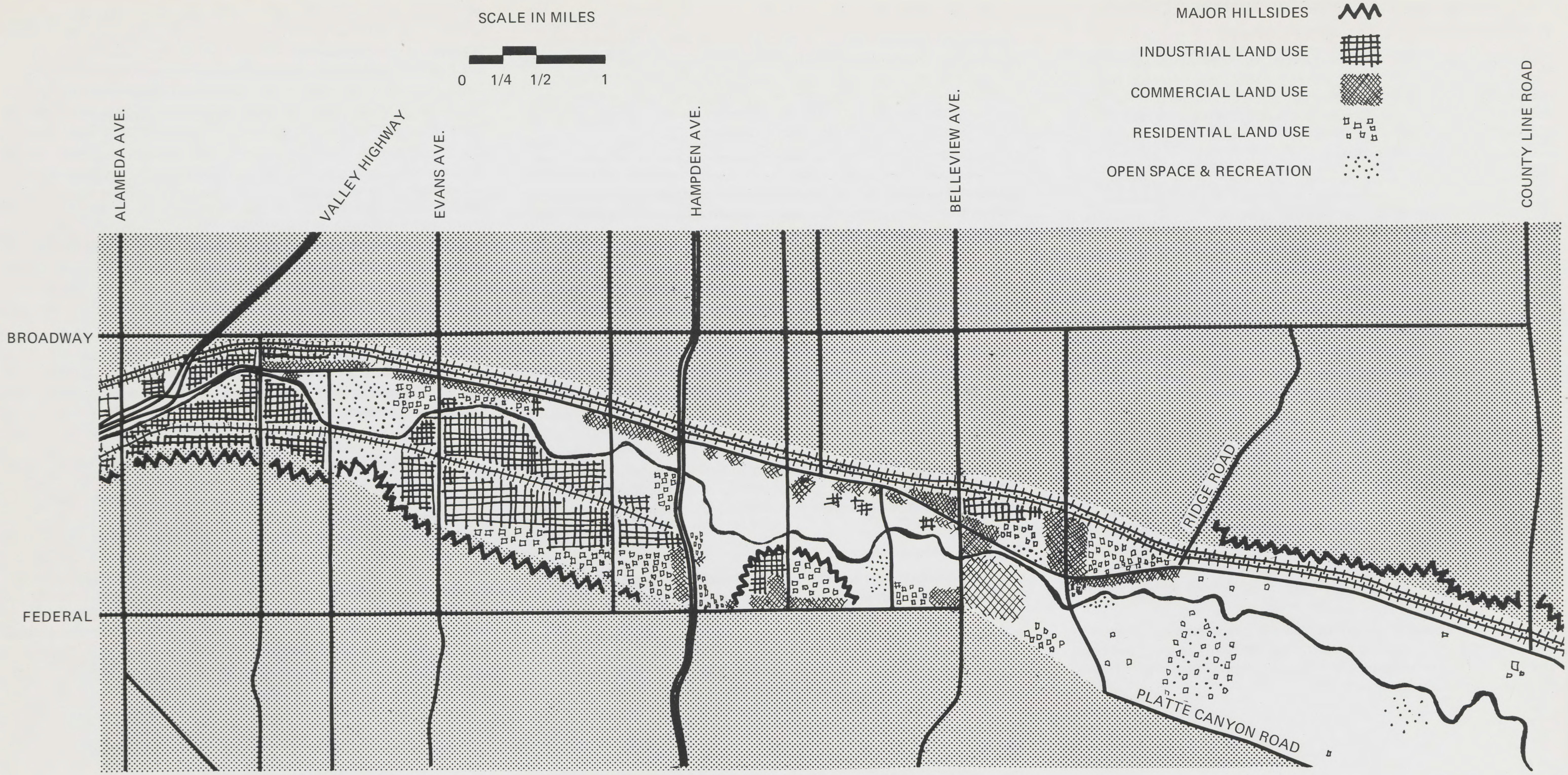


FIG. 8 / STUDY CORRIDOR SCHEMATIC

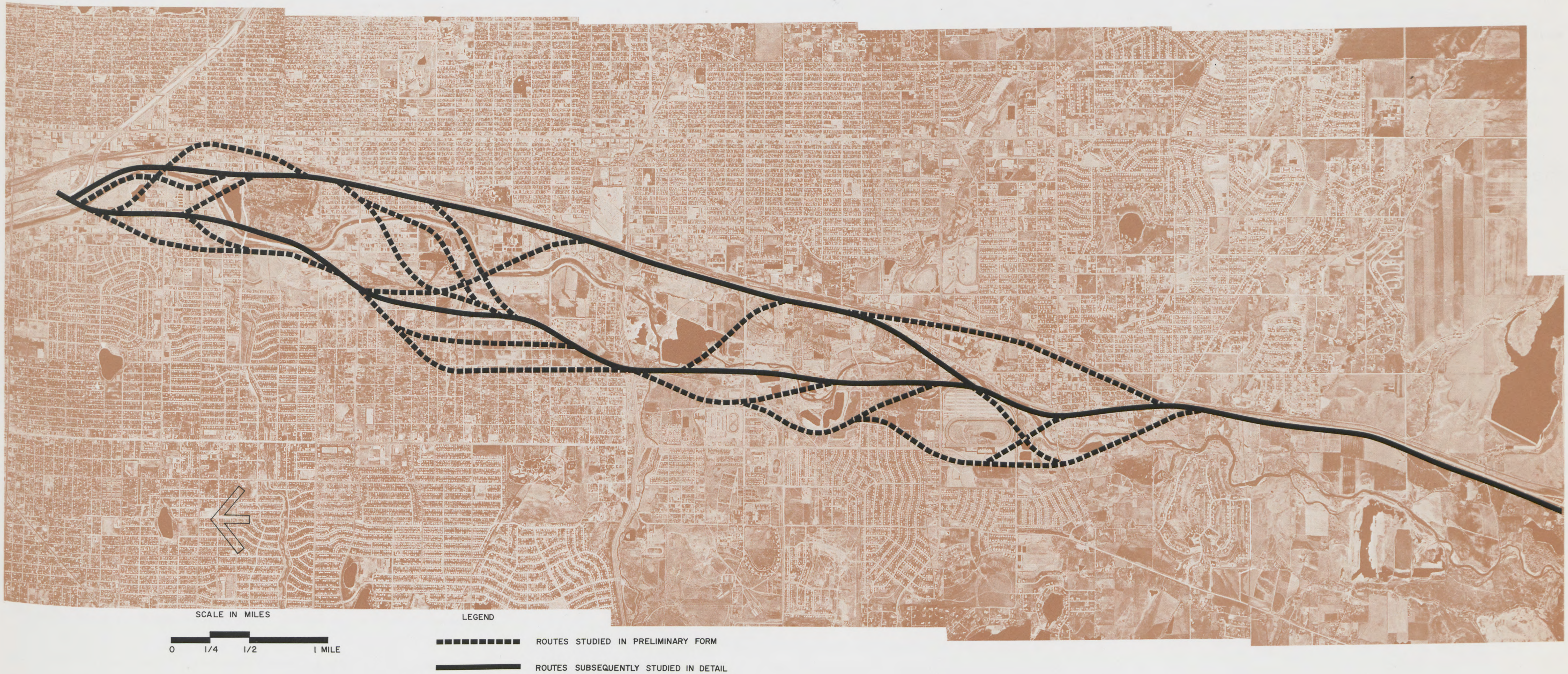


FIG. 9 / FREEWAY ALIGNMENTS STUDIED

ALTERNATE ROUTES STUDIED

Within the study corridor, a preliminary analysis was made of a variety of alternate routes. The general planning criteria for route analysis were as follows:

Compatibility with existing and projected community facilities and land use patterns, including compatibility with local governmental plans for development.

Ability to recognize natural and man-made development boundaries and to avoid separating cohesive development units.

Ability to retain future development parcels in logical, cohesive units and to maximize future development flexibility.

Ability to avoid disruption and displacement of significant economic activities.

Ability to minimize the quantity, expense, and disruption when acquiring freeway right of way.

Ability to achieve an improvement in north-south travel within the valley and achieve optimum interchanges with major east-west streets and highways.

Ability to avoid closely paralleling the South Platte River to create substantial new development opportunities with river orientation.

The routes studied are summarized in Figure 9, with the two routes selected for further study shown in solid lines.

Valley Highway to Evans Ave.

In this section of the corridor the primary planning concern is balancing a minimum disruption of the Overland Park Golf Course and Ruby Hill Park developments with reasonable right of way and freeway construction costs.

Because of topographic problems north of Ruby Hill Park and the separation of western residential areas from this Park, it is not feasible to locate the freeway west of Kalamath St. On the east side of the corridor, it is not economically feasible to cross to the eastern side of the D & RGW and AT & SF railroad tracks. Through this section, the only three feasible routes are along the east side of the Overland Park Golf Course, along the western edge of the Overland Park Golf Course adjoining the South Platte River, and along the eastern edge of Ruby Hill Park adjoining the South Platte River. The route through the eastern edge of Ruby Hill Park, adjoining the westerly side of the Platte River is not acceptable because it uses the only flat active recreation area of the Park.

The two best locations either traverse the golf course area immediately adjoining the Platte River or on its extreme eastern edge along Santa Fe Dr. Both of these locations will require redesigning and construction of a portion of nine holes of the golf course. To do this, additional land for golf course reconstruction will be required on the south side of the golf course between Jewell Ave. and Evans Ave. This residential area is now in sound condition with the exception of deteriorated and obsolete commercial properties along the eastern edge facing Santa Fe Dr. However, it is felt by the Denver Planning Department and Denver Urban Renewal Authority that this residential area will gradually decline in the quality of environmental conditions because of the lack of supporting community facilities and because of the inevitable competition for this land for commercial properties along Santa Fe Dr. and Evans Ave. Acquisition for golf course purposes would be consistent with Denver's plans for the area.

North of Mississippi Ave., only the western-most routes avoid conflict with Vanderbilt Park which is currently being constructed immediately west of the Platte River opposite the Gates plant.

Evans Ave. to Hampden Ave.

All alignments must intersect Hampden Ave. at either Santa Fe Dr. or at the mid-point between Santa Fe Dr. and South Federal Blvd. because of interchange spacing requirements. The three routes traversing southwestwardly from Santa Fe Dr. in the vicinity of Evans Ave. to the Colorado & Southern railroad tracks near Dartmouth Ave. were all found to be unfeasible because of the extreme difficulty of passing through or around the Public Service Co. plant and the Robinson Brick and Tile Co. plant. Both of these facilities have substantial plans for expansion on their now vacant ground, and expansions would be impossible with the freeway alignment shown. The eastern route shown along Santa Fe Dr. follows existing major circulation and land use barriers. Additional right of way land is required on the west side of Santa Fe Dr. which would displace commercial properties in that area.

The two routes west of the Colorado & Southern railroad tracks were eliminated because of their conflict with the proposed Model Cities neighborhood program and with recreation facilities proposed for the area. Moreover, both routes are longer and would involve considerable added expense to construct bridges for important north-south street circulation on Zuni and Tejon Sts. Both routes also have construction disadvantages because of the hillside topography encountered.

The route along the Colorado & Southern Railroad trackage is well suited for a freeway location in that it takes maximum advantage of vacant ground and follows an existing circulation and land development barrier.

Hampden Ave. to Belleview Ave.

The alignment along South Santa Fe Dr. is similar to the alignment north of this point in that it follows and reinforces an existing land development barrier.

The western-most alignment studied was an attempt to hold the freeway to the extreme western side of the corridor so that maximum development opportunities would be retained in the substantial vacant ground which surrounds both sides of the South Platte River. Both the City of Sheridan and the City of Englewood have recommended strongly against this alignment. Sheridan is opposed to the disruption that the alignment would create passing through developed areas near Oxford Ave. Englewood has strongly recommended against the southern section of this alignment because it traverses their proposed Centennial Park, which has received a Department of Housing and Urban Development grant for land acquisition.

The central alignment traverses generally vacant ground and in some areas parallels the future alignment of the South Platte River relocation as planned by the Corps of Engineers. This alignment is acceptable to Sheridan, Englewood, and Arapahoe County through whose jurisdictions it passes. However, this alignment has a disadvantage paralleling the river in that it precludes the future creation of land development on the west side of the river with orientation to the river, water, and open space possibilities.

An alignment was studied traversing from the western Hampden interchange southeastwardly to Santa Fe Dr. in the vicinity of Quincy Ave. The alignment is somewhat longer but it has two advantages. One, it provides an opportunity to use a western freeway alignment north of Hampden Ave. and a Santa Fe alignment south of Hampden Ave. should that be desirable. Secondly, by traversing the future river alignment at more nearly right angles, it does not preclude future land development and/or recreational facilities relating to the river.

Belleview Ave. to Ridge Rd.

The eastern-most alignment studied in this area was along the D & RGW and the AT & SF railroad tracks east of downtown Littleton. The Littleton Planning Department recommended against this route because of the separation which it would create between downtown Littleton and the balance of the community. The route had the further disadvantage of requiring relocation and reconstruction of the railroad tracks within their existing right of way.

The route west of Centennial Race Track was determined to be unfeasible because of the difficulty and expense of the interchange at Belleview Ave. in the vicinity of Federal Blvd., the elimination of parking at Centennial Race Track essential to its continued operation, and the difficulty of providing an adequate interchange in convenient proximity to downtown Littleton. Another problem encountered in the investigation was the serious conflict with park developments proposed by the South Suburban Metropolitan Park and Recreation District in the vicinity of the South Platte River south of Bowles Ave.

The central alignment along existing Santa Fe Dr. follows and reinforces the existing development barrier and land use pattern in that area. An effective interchange can be provided on this alignment with Bowles Ave. and the freeway can be located far enough west to avoid conflict with the proposed Arapahoe Junior College site.

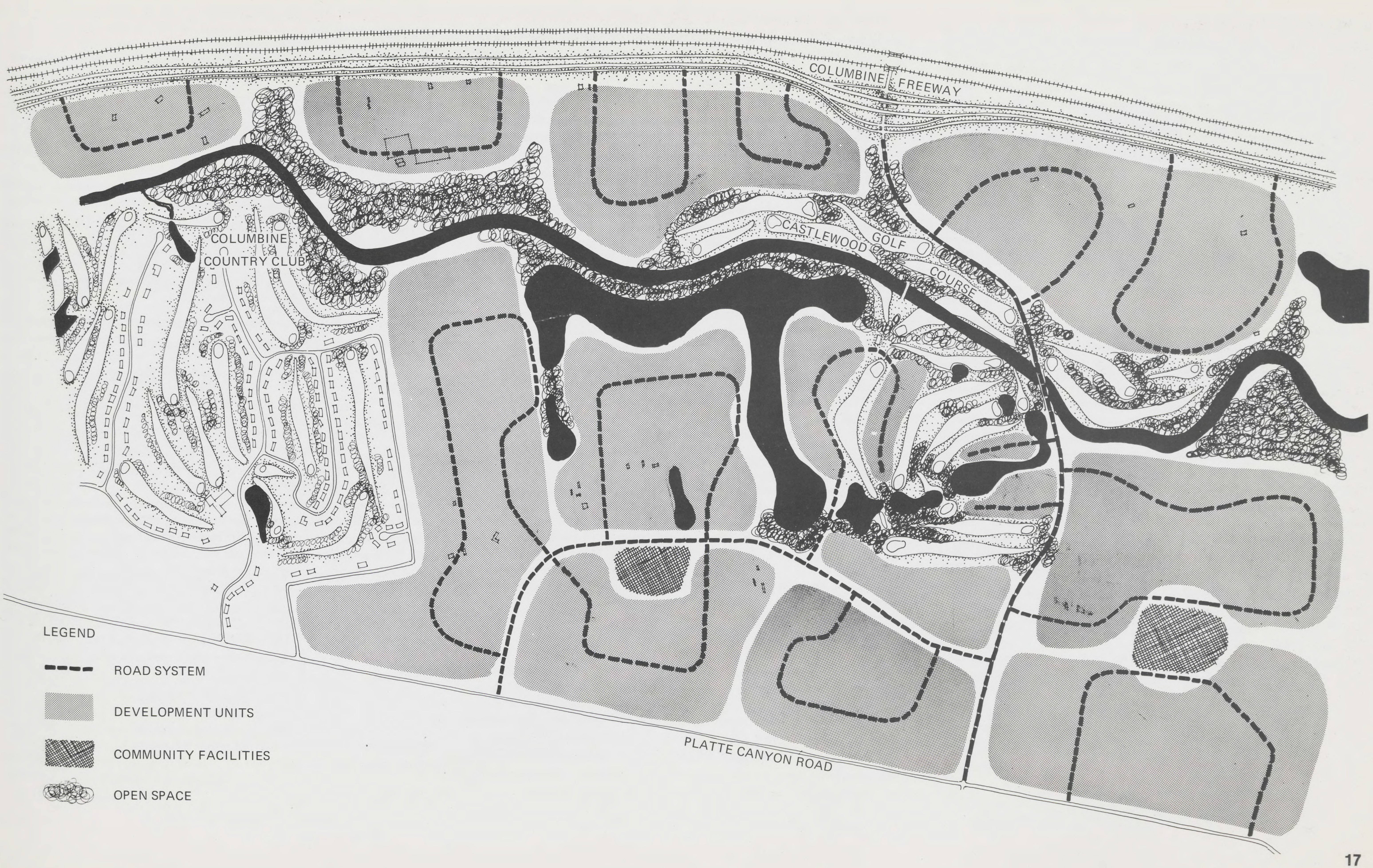


FIG. 10 / RECOMMENDED LAND USE RELATIONSHIPS

Ridge Rd. to Chatfield Rd.

The substantially undeveloped nature of the area south of Bowles Ave., with the excellent quality of the limited development in that area, offers the opportunity to take maximum advantage of the environmental features of the river area. The Columbine Country Club and Columbine Valley Community are examples, as is the new Castlewood Golf Course under construction near Ken Caryl Rd. This area should be planned with maximum development exposure to the river and with a circulation pattern consisting of loop roads feeding separately from Santa Fe Dr. and from Platte Canyon Rd. The only future river crossing foreseen in this area by the Arapahoe County Planning Department is Ken Caryl Rd. No major north-south streets are planned between Santa Fe Dr. and Platte Canyon Rd. These elements are indicated in Figure 10, which presents a schematic plan of the development potential.

The alignment along Santa Fe Dr. follows the line of an existing development barrier formed by the substantial topographic change immediately east of the railroad tracks, the railroad tracks, and the existing Santa Fe Dr. The other alignment possibility on Platte Canyon Rd. was not considered because it would not provide a direct tie to Highway 85 and Castle Rock.

Of the numerous routes considered through the corridor, two routes are felt to be the most feasible in terms of combined engineering and planning considerations. These two routes, an eastern route along Santa Fe Dr. and a western route as shown on Figure 9, are discussed in detail in subsequent chapters.

LANDSCAPE DESIGN CRITERIA

Two orientations to the landscape aspects of freeways include the points of view of motorists on the freeway and of people in areas abutting the freeway. The motorist is largely concerned with the fast, safe access that a freeway provides. Aesthetic considerations such as visual orientation to major urban elements and a visually pleasing roadside scene are factors which should be considered in total freeway design. The abutting land user is typically interested in either physical separation from the freeway as in residential uses, or conversely, in direct visual orientation to the freeway as in commercial and industrial uses.

Consideration of the various landscape elements of freeways and the special characteristics of the South Platte corridor determined the following landscape design criteria which are the basis for the detailed landscape recommendations found later in this chapter:

Because of the urban nature of the South Platte corridor, only enough right of way to serve the functional needs of the freeway should be acquired. Functional needs include aesthetic considerations relating to the freeway, but the freeway right of way cannot and should not be expected to provide major open spaces for non-freeway uses.

Freeway speeds and the driver's resultant narrow angle of vision are a major factor in freeway landscape design. Details tend to be insignificant at freeway speeds. Large scale, visually simple landscape elements are appropriate.

The freeway should reflect the landscape character of the areas through which it passes. The utilization of maximum buffer plantings in areas where the freeway is potentially harmful and minimum plantings in areas where the freeway is least disruptive tends to reinforce adjacent landscape characteristics.

Freeway Landscape Elements

The freeway as a landscape element includes all the physical components of a freeway alignment, such as cross sections, plant materials, structures, lighting and signing. Most of these elements are flexible and, within the limits of safety requirements, can be modified to adapt the freeway to various landscape conditions.

Alignment is a major concern when considering the freeway in terms of the aesthetics of the travel experience; i.e., smooth, continuous alignment and orientation to views. In a predominately urban environment such as the South Platte corridor, the restraints imposed by existing and proposed developments, the existing street grid, the river and topography effectively preclude an alignment based largely on the aesthetics of a visually graceful alignment.

The freeway cross sections can be either at-grade, terraced, elevated on fill or structures, depressed or bermed. Functional and aesthetic requirements often dictate a particular cross section type. Adjacent to especially fragile areas, an earth berm is recommended. Because of minimum right of way widths, medians are generally not wide enough to allow for tree plantings. Minimum median widths with guard rail can be utilized in areas where the freeway right of way must be an absolute minimum. Right of way outside of the freeway or frontage roads is varied to incorporate unusable parcel remnants into the freeway landscape and provide space for plantings to insure a foreground for views.

Plant materials possess aesthetic qualities which are desirable as elements in the freeway landscape. In addition, functional requirements play a major role in planting design. Plant materials can aid in the channelization of traffic, indicate changes in alignment, reduce headlight glare, reduce the nuisance of noise, dust and fumes, screen unpleasant views and screen the freeway from abutting land uses. The existing plant material characteristics of the South Platte Valley, maintenance costs, and functional and aesthetic considerations determined basic plant materials as follows:

Major plantings should be provided in freeway segments adjacent to especially fragile areas.

Minimum plantings (enough for interest only) are recommended in areas that benefit from direct freeway orientation.

The majority of plantings should occur in the area between freeway lanes and frontage roads. Frontage roads relate to adjacent areas and are of a scale and speed to be compatible with all land uses.

For maximum screening effect, small trees and large shrubs are recommended because they provide eye level foliage.

A relatively small variety of native plant types and grasses is recommended.

Plantings should be in large masses of one plant variety rather than individual specimens.

The question, in a semi-arid area such as Denver, of whether to irrigate or not poses numerous problems. Recently completed portions of I-70, which are irrigated, have been well received by the public. It is recommended that an irrigated landscape be provided for this Freeway. Additional research by the Division of Highways, state universities, and other agencies, public and private, is needed before a dry highway landscape truly representative of Colorado conditions can be utilized.

Lighting and signing standards are largely determined by State and Federal standards. Total illumination of the freeway with overhead standards has obvious advantages to the Freeway traveler, but the nuisance to adjacent residential areas is very real. Provision for continuous lighting between interchanges and complete lighting for interchanges as defined by the Colorado Division of Highways Design Manual has been made in the cost estimates for this Freeway. Because the safety benefits to the Freeway traveler far outweigh the nuisance to adjacent residential areas, it is recommended that the above provision for lighting be adopted.

DESIGN CRITERIA

DESIGN BASIS

Preliminary design for this study was based on Freeway Standards. References serving as guidelines for the preliminary design included Division of Highway manuals and standards, U. S. Bureau of Public Roads memoranda, American Association of State Highway Officials policy manuals on roadway and bridge design and other selected references by architects, planners and engineers.

SAFETY FEATURES

Safety features which were incorporated into the Columbine Freeway design include carrying the right 10 foot shoulder across bridges with an additional two foot guardrail offset, giving a total of 12 feet from the edge of the right lane to the bridge safety curb. On the left, a 4 foot shoulder is carried across the bridge with an additional two foot guardrail offset, making a total of 6 feet from the edge of the left lane to the bridge safety curb.

For a freeway undercrossing structure, the desirable 30 foot offset from the edge of the right lane to the right pier or obstruction has been maintained. On the left, where possible, at least 12 feet of clearance from the driven lane has been provided to the face of the guardrail that surrounds the pier located in the median. With two feet of clearance allowed from the guardrail face to the edge of the pier and one foot from the face of the pier to the center of the pier, 15 feet is required from the edge of the left lane to the center of the pier. This results in a minimum 30 foot median. It has been proposed for ultimate design after provision for two 12 foot lanes, the desired minimum median be 36 feet; and in congested, high-density areas, the absolute minimum median be 12 feet. The 12 foot medians would require a fully continuous double-faced guardrail separating the directional lanes of traffic. Where possible, it is planned to depress one set of freeway lanes with reference to the other lanes, and by maintaining the 6:1 cross slope, provide additional horizontal clearance between the lanes in the median. A minimum of 40 feet has been provided from the edge of the right freeway lane to the edge of the adjacent frontage road lane to provide horizontal clearance for safety, landscaping and fencing.

For safety and for aesthetic considerations, the fill slopes are 6 to 1 for heights up to 10 feet; 4 to 1 for heights from 10 to 25 feet; and 3 to 1 for heights over 25 feet. All cut slopes have been planned as 3 to 1 slopes. Retaining walls have been planned in areas where very expensive land and building or manufacturing facilities can be saved with their use, but in general, retaining walls have not been used in preference to slopes.

As a guide for landscaping, trees of 4 inch caliper and larger are kept at least 30 feet clear from the edge of the freeway and ramp traveled lanes. Bushes and small trees up to 4 inch caliper may be placed within 20 feet of the traveled lane. All Freeway sections have open slopes outside of the shoulders which require no curb and gutter sections on either side of the lanes. For fill sections, a valley gutter has been planned at the edge of the shoulder in preference to a mountable curb or an asphaltic concrete curb.

BRIDGE CONCEPTS

Freeway bridges as a major element of the urban freeway should be kept within an overall design continuity. A sense of lightness and openness is desirable. Railing should be inconspicuous and so designed as to not block views from the bridge. Concrete, in various smooth and textured finishes, is beautiful in itself and should not be cluttered with decorative panels or masonry veneer. When retaining walls and slope paving are used, the detailing and finish should be compatible with bridge structures.

In developing the types of bridges that are realistic and feasible, two major factors that must be considered are safety and aesthetics. For safety reasons, both left and right approach shoulders are carried across the bridges and approach guard railing is joined to bridge guard railing to provide continuity between approaching roadway shoulders and guard railing. By providing this continuity, the tendency of narrowing the roadway to cross a structure is eliminated, and the obstacle of the end of bridge railing and parapet section is eliminated.

Bridge railing parapets of a median barrier design that can deflect vehicles with little or no damage are recommended. The bridge railings including the parapets and structural tube sections will be approximately 2'–9" high overall (See Figure 12). This height will allow visibility over and through the railing. The American Association of Highway Officials' manual entitled "Highway Design and Operational Practices Related to Highway Safety" encourages the use of covered medians between parallel structures which are less than 30 feet apart. Parallel bridges on this freeway with a covered median would have a total width of approximately 160 feet, and a tunnel effect would result under the bridges. Because the bridge railings incorporate a vehicle deflecting parapet which connects with approach guard railing of the same design, it is recommended that the median area be left open to allow more natural light and air space under the parallel structures.

To produce a pleasing concept for bridges over the entire project, utilizing factors such as uniformity, simplicity, and pleasing proportions, it is recommended that cast-in-place concrete box girder bridges be the basic bridge structure for this freeway. Concrete box girders provide a highly efficient structure with minimum depth to maximum span capabilities. For an illustration of a typical concrete box girder bridge, see Figure 11. Some advantages of using this type of structure include its ability to take any shape required to fit curved alignment and profile requirements, and its ability to span long distances efficiently.

Two basic structure types are proposed for the roadway bridges. One is a single span bridge as shown in Figure 12, and the other is a two span bridge as shown in Figure 13. Spans less than 100 feet can be conventionally reinforced and spans from 100 feet to 150 feet should be prestressed.

Due to construction difficulties of crossing the Platte River, it is recommended that precast prestressed AASHO girders be utilized to eliminate falsework problems in the construction and still approach the total structure theme. AASHO girders can be utilized economically in spans up to 100 feet.

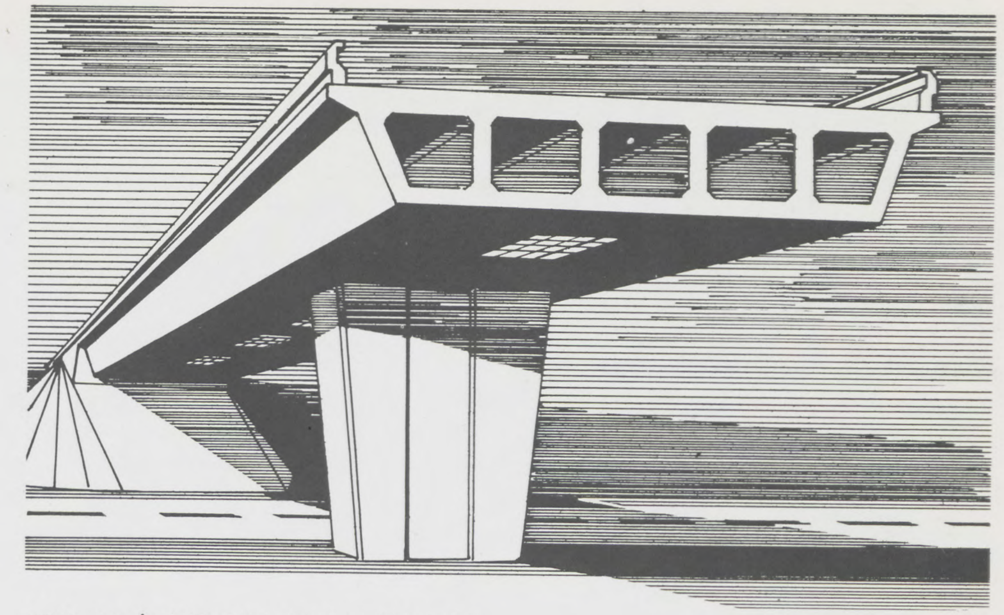


FIG. 11 / TYPICAL BOX GIRDER

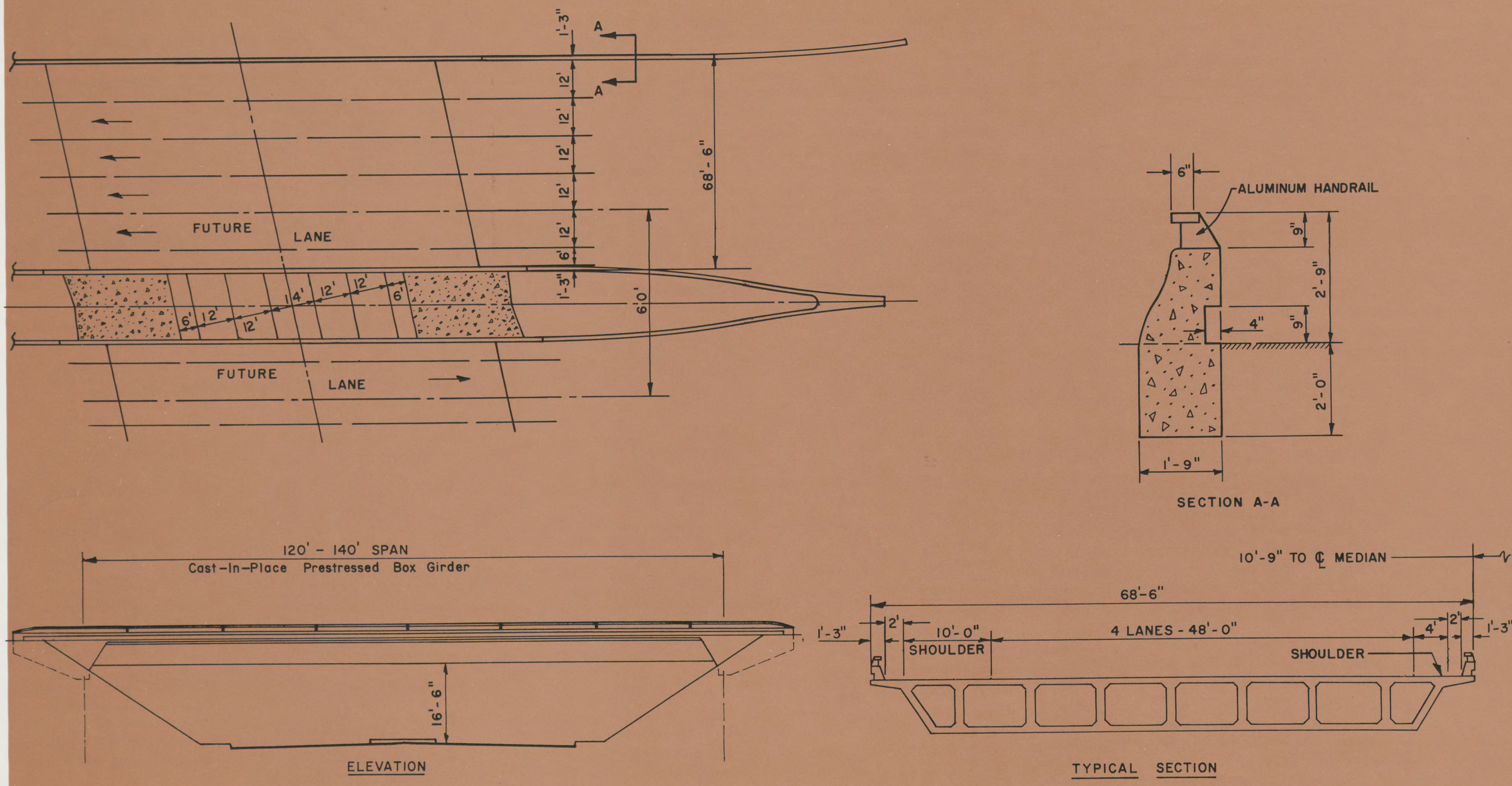
Viaduct structures, including ramps, would be continuous box girders of approximately 100 to 125 foot spans (See Figure 14).

The structure types proposed at the Hampden interchanges for either alignment are basically the types previously mentioned. For the Santa Fe Route, a tri-level diamond interchange is proposed as illustrated in Figure 15. This interchange will require 8 separate structures, all in the prestressed–post tensioned span length range as shown in Figure 16. The tri-level interchange proposed for the Western Route, as illustrated in Figure 17, results in Hampden Ave. crossing the Freeway on an elevated four span structure. The structures required for the turning level and for Hampden Ave. are shown in Figure 18. The tri-level diamond interchange for the Western Route will require only three structures compared with the eight structures required at the Hampden Ave. interchange on the Santa Fe Route, but because of the massive 500 foot structure for the Western Route, the cost of structures for both interchanges is practically the same.

A third type of bridge to be considered is the railroad structure. Because of the ballast requirements for railroad support and the large loads produced by a train, the railroad bridge should be constructed of steel plate girders, as shown in Figure 19.

In recommending a concrete cast-in-place box girder bridge as the structural concept for this study, the problems of formwork spanning existing streets or traffic patterns must be considered. In several crossings for either alignment, the traffic would present no problem because it would be detoured around construction. At other crossings, it will be more convenient to construct the bridge over an existing street.

FIG. 12 / SINGLE SPAN BRIDGE



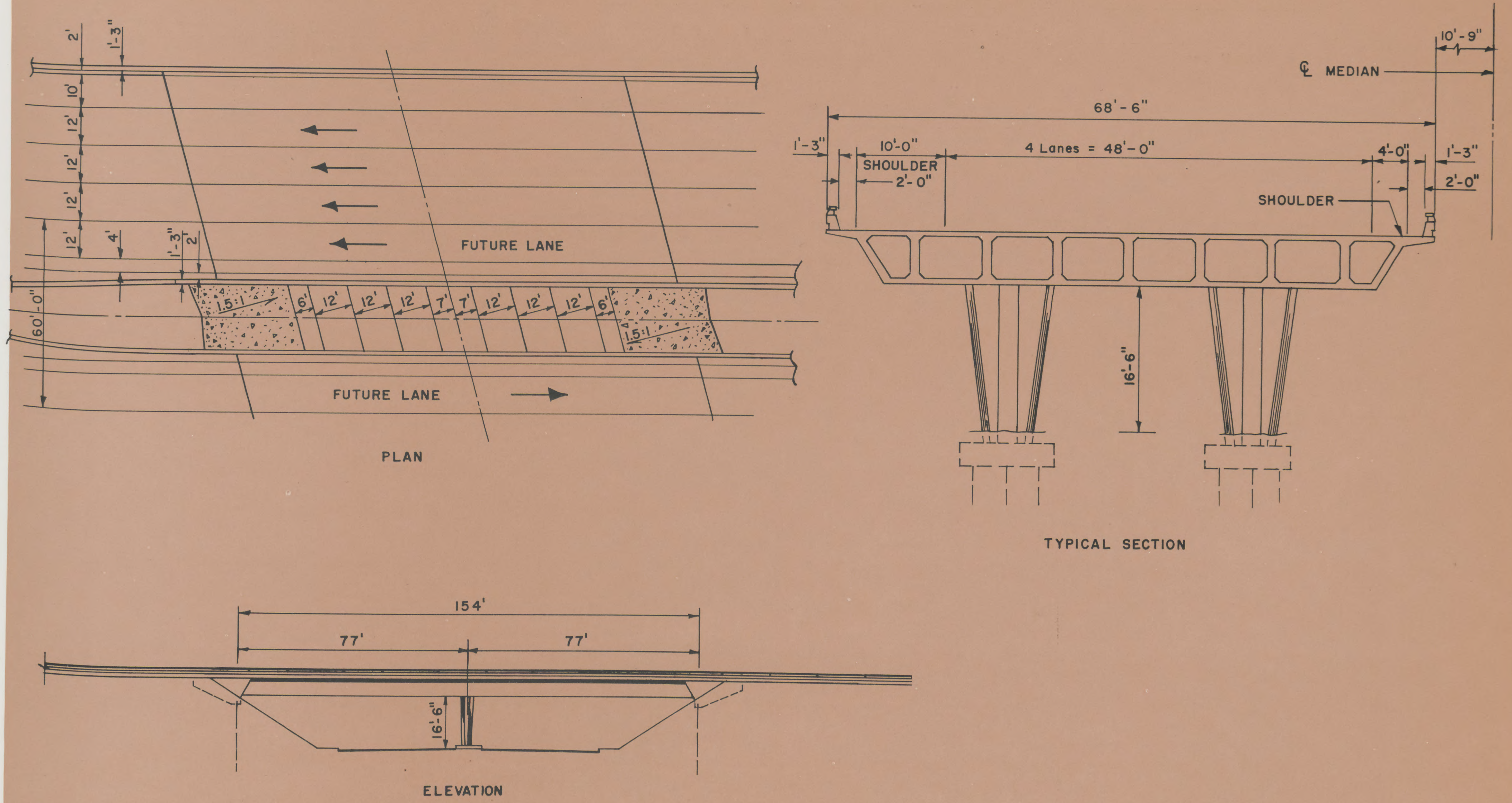
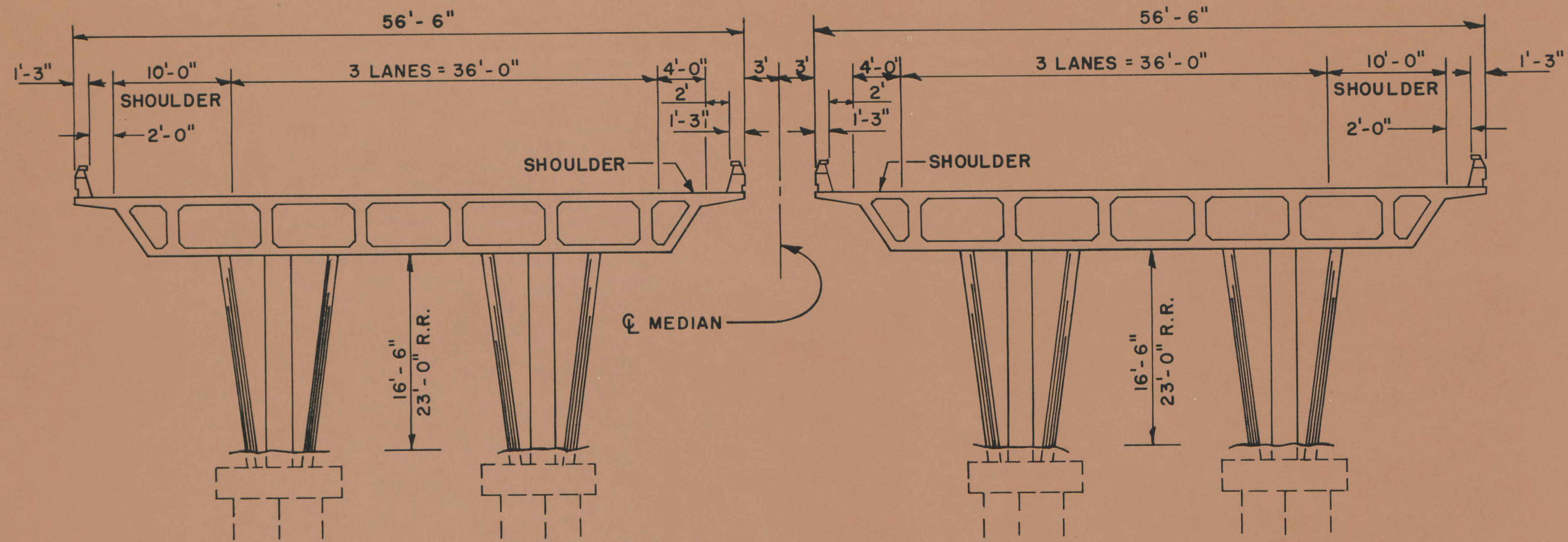
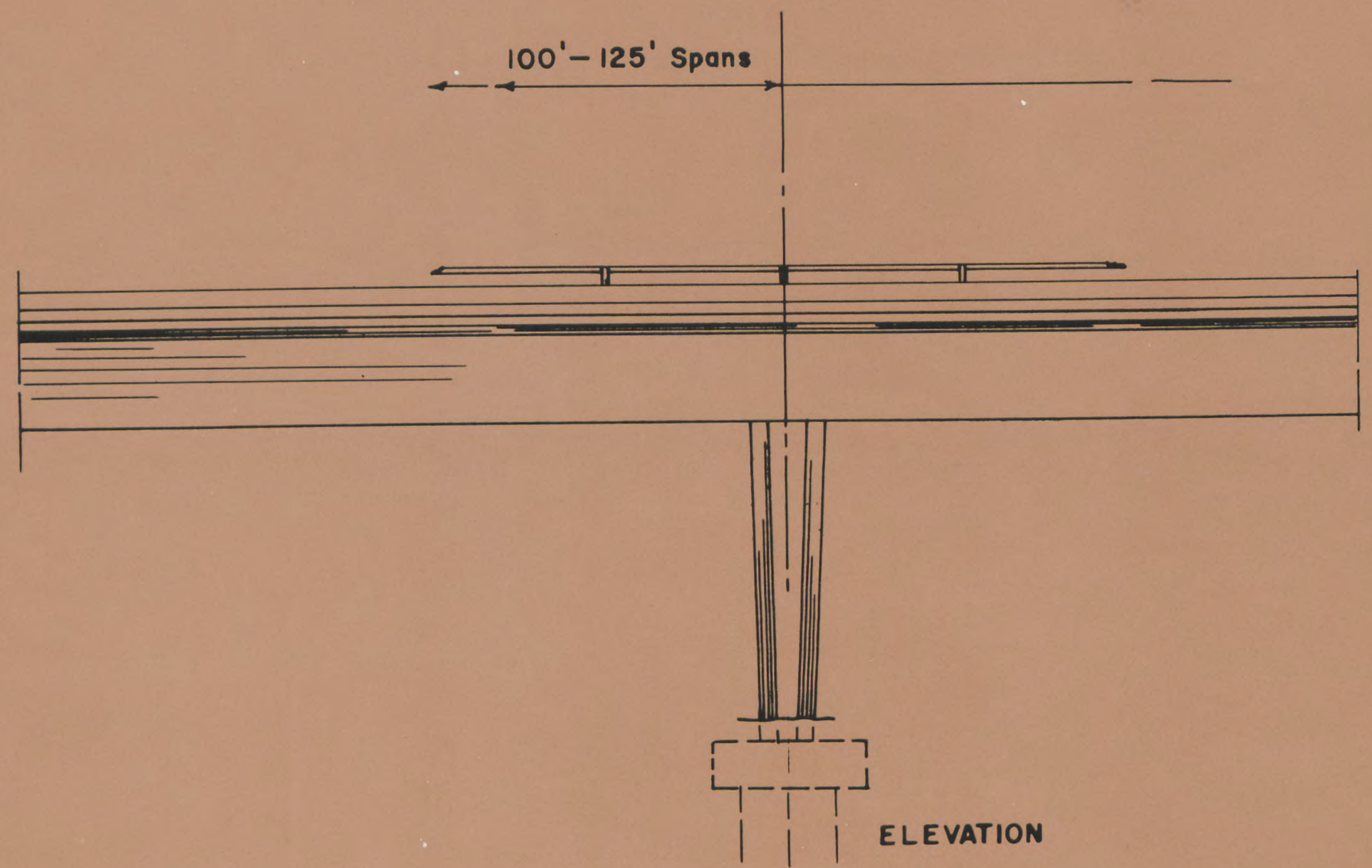


FIG. 13 / TWO SPAN BRIDGE

FIG. 14 / VIADUCT STRUCTURE



TYPICAL SECTION OF VIADUCT



ELEVATION

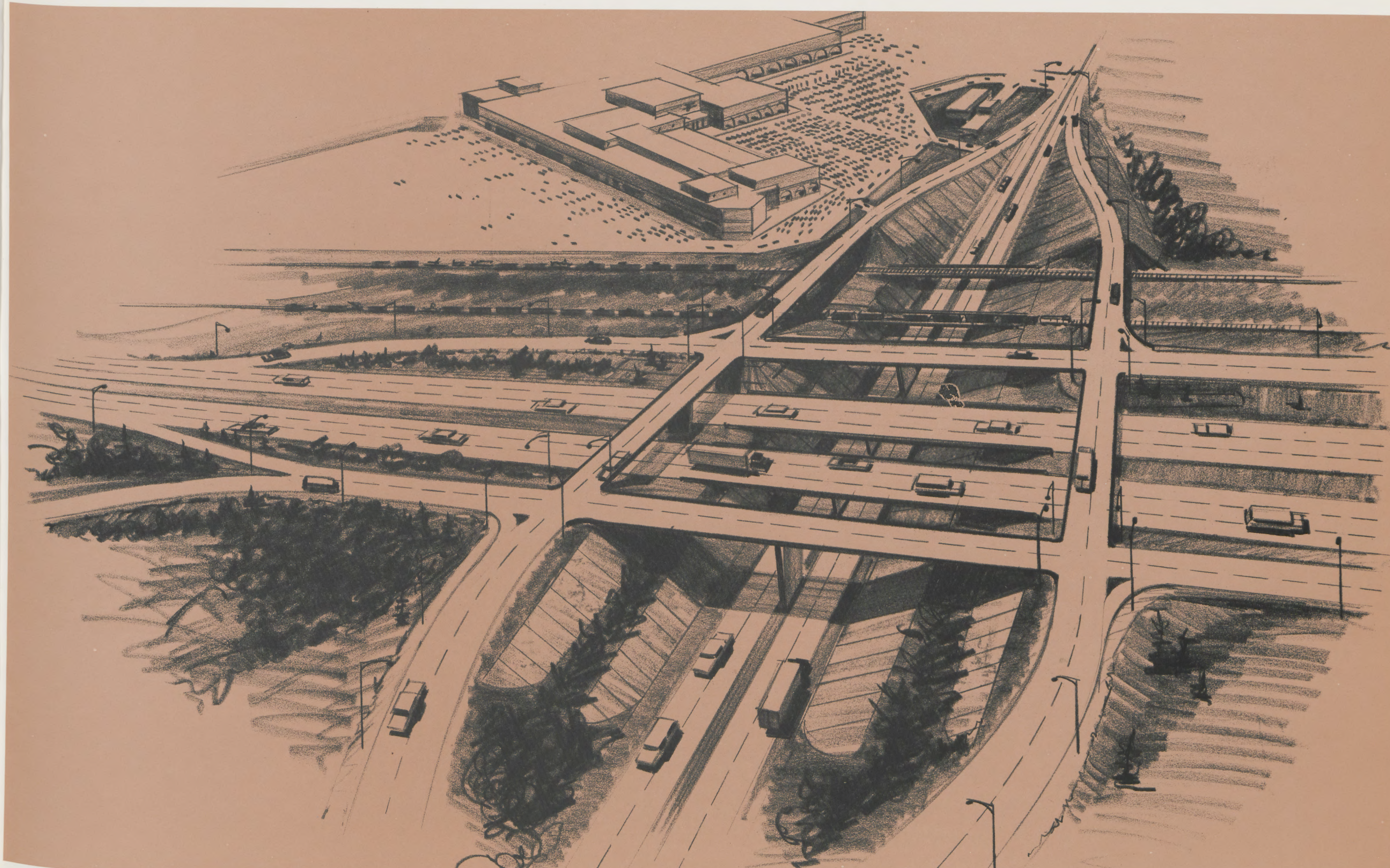


FIG. 15 / HAMPDEN INTERCHANGE—SANTA FE ROUTE

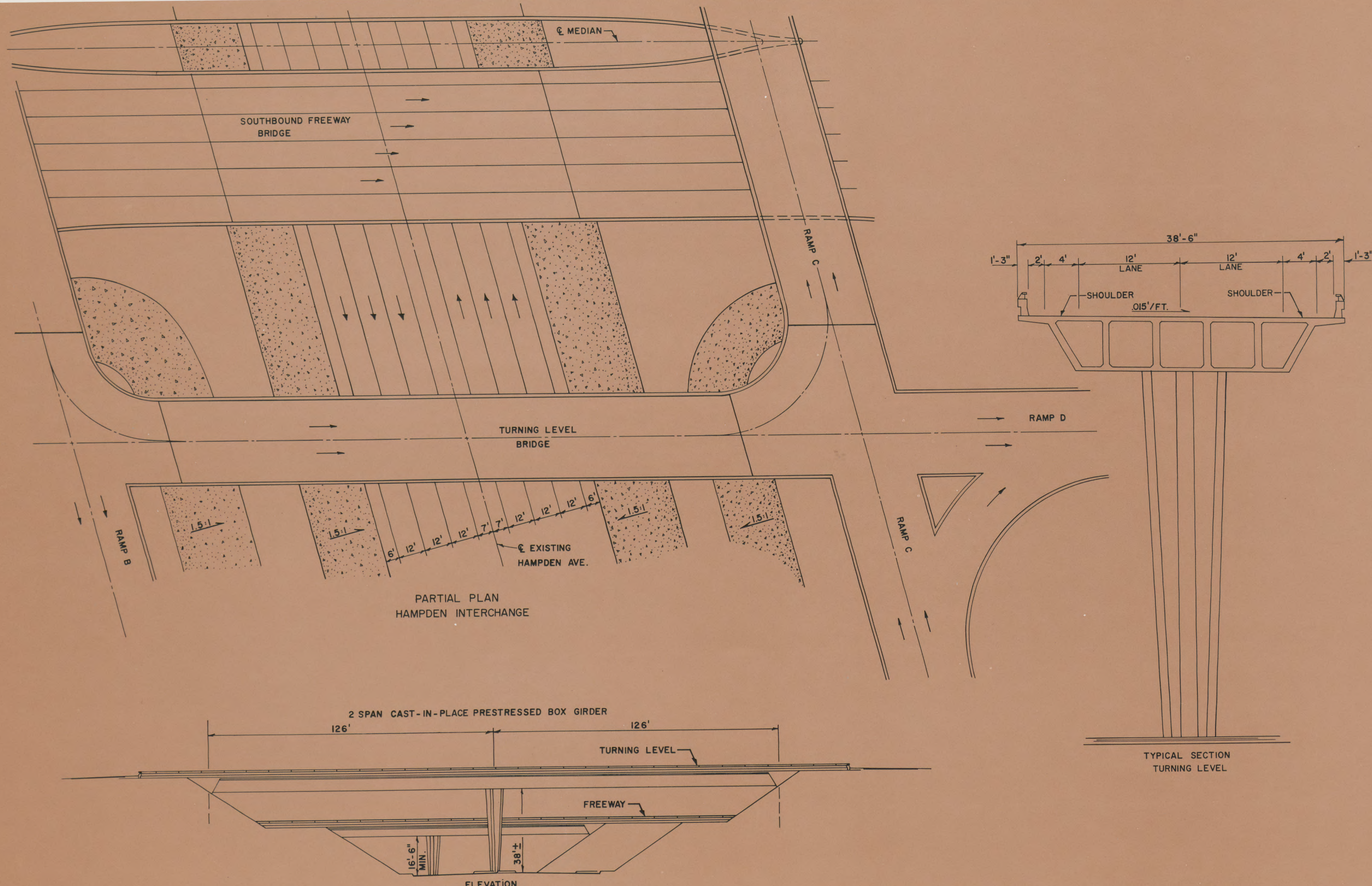
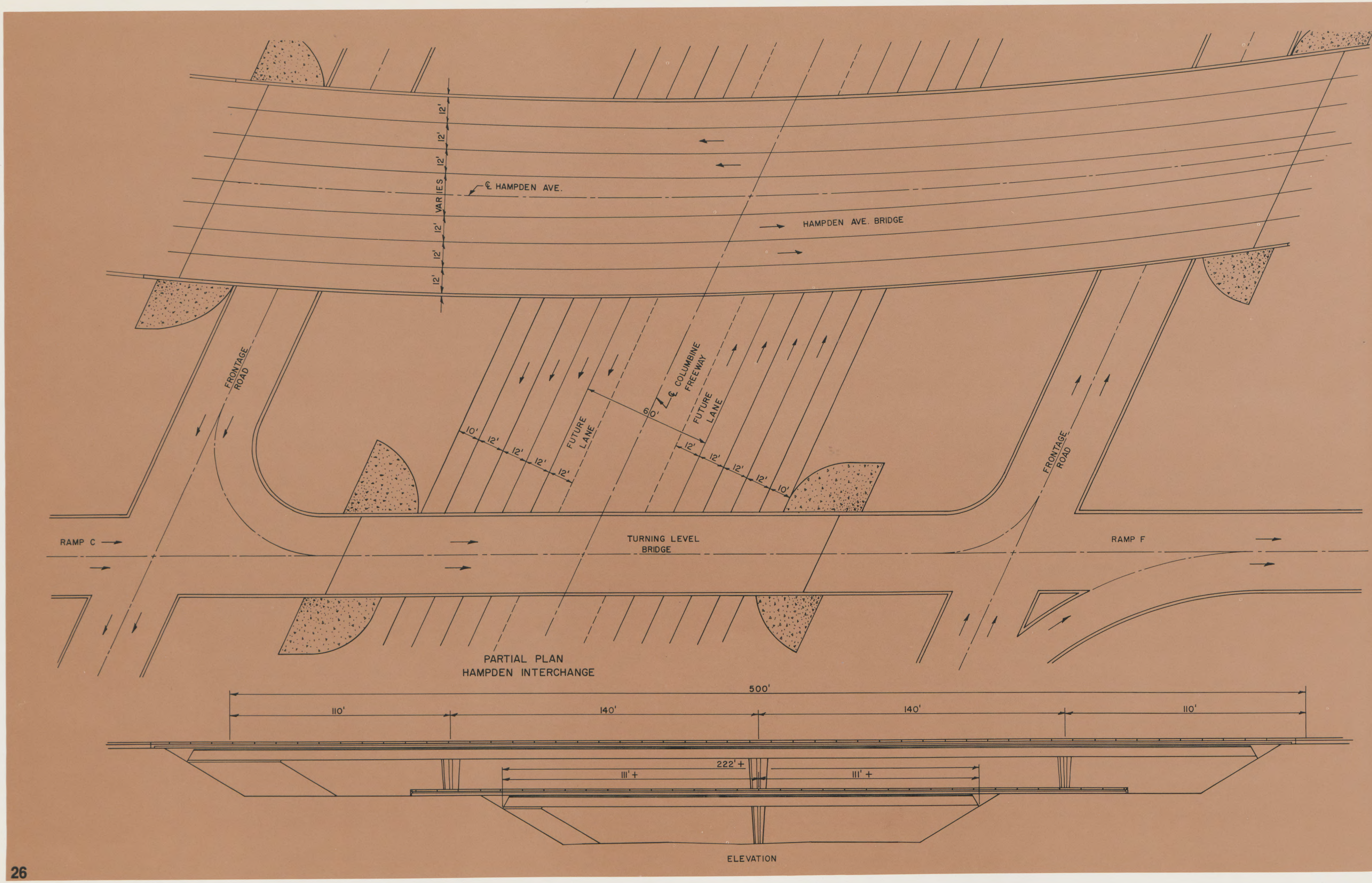


FIG. 16 / HAMPDEN BRIDGES—SANTA FE ROUTE

FIG. 17 / HAMPDEN INTERCHANGE—WESTERN ROUTE

FIG. 18/ HAMPDEN BRIDGES—WESTERN ROUTE



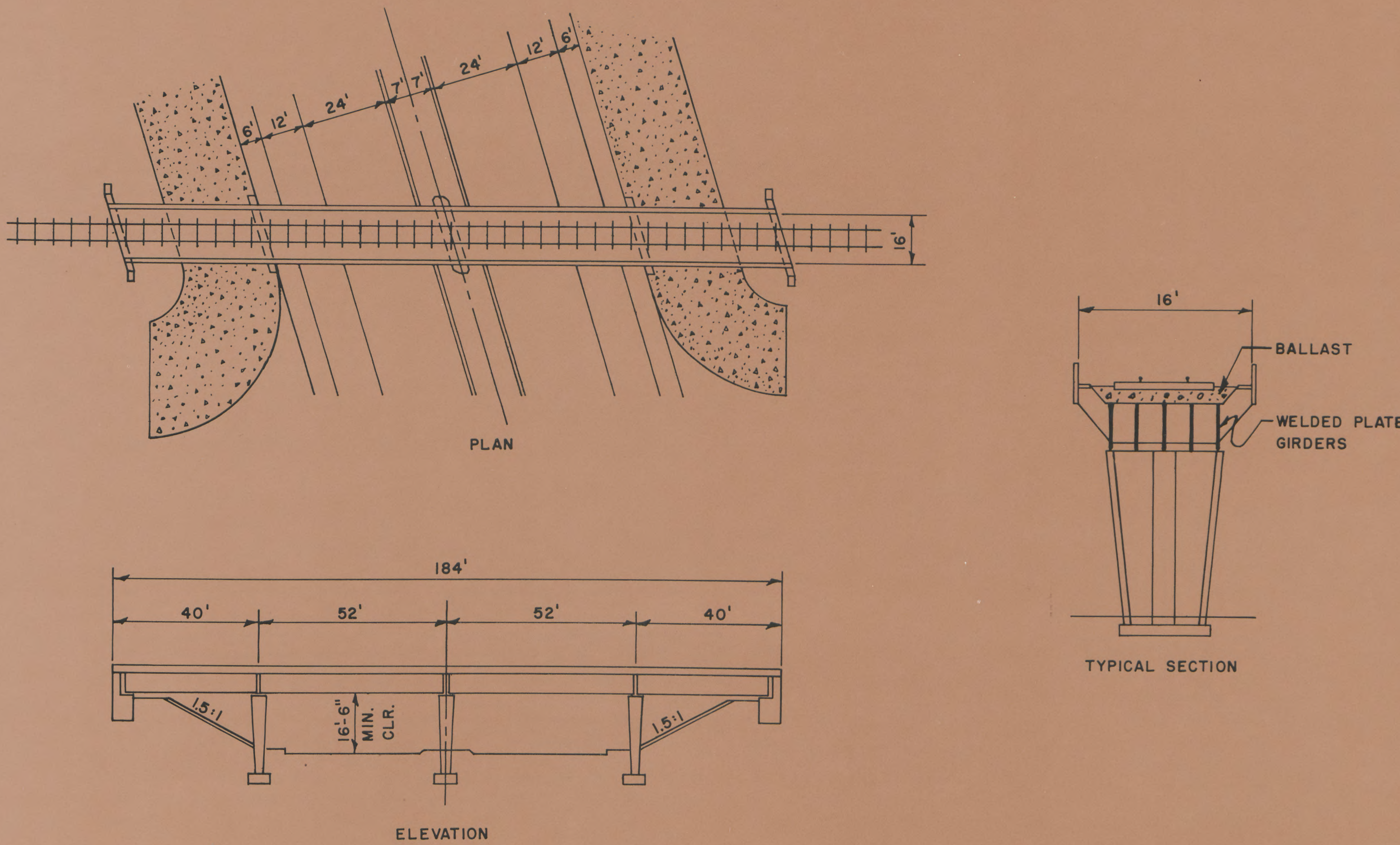


FIG. 19 / RAILROAD BRIDGE

TABLE 1 / DESIGN CRITERIA FOR COLUMBINE FREEWAY

DESIGN SPEED

Freeway	60 MPH
Ramps	30 MPH
Other Roads	Colorado Standards

HORIZONTAL ALIGNMENT

Minimum Radius	1150 Ft.
Minimum Length of Curve	500 Ft.
Minimum Tangent Distances	
Between Reverse Curves	500 Ft.
Between Curves in Same Direction	500 Ft.
Superelevation - Maximum	0.08 Ft./Ft.
Loop Minimum Radius	250 Ft.
Loop Entrance and Exit Minimum Radius	500 Ft.

VERTICAL ALIGNMENT

Maximum Allowable Grade (Freeway)	5.0%
Ramp and Local	6.0%
Maximum Desirable Grade	3.0%
Minimum Grade	0.20%
Minimum Desirable Grade	0.5%
Minimum Length of Vertical	
Curves (Freeway)	400 Ft.
Ramp and Local	200 Ft.
Minimum Stopping Sight Distance	600 Ft. for 60 MPH
	200 Ft. for 30 MPH

BRIDGE STANDARDS

Loading	
Freeway	H20-S16-44
Railroads	A.R.E.A. Standards
Minimum Vertical Clearance	
All Roadways	16'–6"
Railroads (Above Top of Rail)	23'–6"
Horizontal Clearance	
Underpasses	
Local Street Median (Minimum)	14 Ft.
Ramps and Local Outside (Minimum)	8'–0" From Lane To Pier or Obstacle
Freeway Outside (Minimum)	30'–0" From Lane To Obstacle
Railroad	
Tangent (Minimum)	12'–0"*
Provision for Maintenance Road	18'–0"*
* Measured From Centerline of Track	
Overpasses	
Local (Curb to Curb)	As Required

ROADWAY

Pavement Section	Concrete or Asphaltic Concrete
Pavement Width	
Freeway	12' Lanes with 4' Shoulder Inside and 10' Shoulder Outside
Ramps One Way	16'–0" Roadway
Ramps Two Way or 2 Lane 1 Way	28'–0" Roadway
Freeway Median Widths	
Provision for 2 Future Lanes (Minimum)	36'–0"
Desired Minimum With Provision for 2 Future Lanes	60'–0"

In the past it has generally been the policy of the Division of Highways to utilize welded steel plate girders for bridges crossing freeways or major traffic carriers to avoid the need for supporting formwork which would disrupt traffic. For this freeway, with the bridges crossing local street traffic, it is believed that cast-in-place concrete box girders with their appearance of clean, smooth lines, simplicity, and inherent low maintenance costs, can be used without undue disruption of local traffic. To provide for local traffic under bridge construction, an opening for each direction of traffic approximately 14'–6" high by 37 feet wide can be provided. This opening would allow for two 12 foot lanes with an 8 foot shoulder on the right and a 5 foot shoulder on the left, and would more than provide for the 13'-6" legal height allowed for semitrailer trucks.

Because of the proposed Arapahoe Junior College and proposed park development near the Platte River west of the College, a pedestrian overcrossing has been suggested in the vicinity of Bowles Ave. In maintaining the basic theme of simplicity, a concrete arch structure is recommended with a span length of approximately 225 feet and a height of about 30 to 35 feet (See Chapter VI).

ROADWAY SECTION

The roadway section for the planned freeway consists of 6 twelve foot lanes from the Valley Highway to Bowles Ave. and 4 twelve foot lanes from Bowles Ave. to the end of the project. Details of the freeway lanes, ramps and frontage road widths and cross sections are shown on Figures 20 and 21. Vertical clearance between crossing roadways has been set at approximately 22 feet to allow 5'–6" for bridge girders and slab plus the minimum required vertical clearance of 16'–6" for the traffic opening. A vertical separation of approximately 28 feet has been provided between top of rail elevation and the roadway surface passing over a railroad track to allow 4'–6" for bridge girders and slab plus the 23'–6" clearance required for the railroad.

DESIGN SPEED AND GRADES

A design speed of 60 miles per hour has been planned for the Columbine Freeway, with a design speed of 30 miles per hour for ramps. The horizontal alignment of the Freeway was designed with a minimum radius of 1,150 feet to accommodate the 60 miles per hour design speed. The minimum length of a horizontal curve is 500 feet, and the minimum tangent distance between curves in the same direction or between reversed curves is 500 feet. A minimum ramp radius of 250 feet with a 500 foot radius at the entrance or exit which will allow for a design speed of 30 miles per hour is planned for all interchanges.

The maximum allowable grade for the freeway is 5%, with a desirable maximum grade of 3%. The stopping sight distance for any vertical curve on the Freeway is never less than 600 feet. The maximum allowable grade for ramps and local streets is 6%. For a summary of design criteria used in the design of the Freeway, see Table 1.

RIGHT OF WAY

For right of way acquisition, a minimum of 20 feet has been provided from the edge of the frontage road lane to the right of way line to allow for frontage road shoulder, curb and gutter, and slope. At least 10 feet of right of way has been provided from the toe of slope to the right of way line for maintenance of the highway right of way. When the frontage road has to be constructed as part of the Freeway, it is included inside of the Freeway right of way. When the existing surface streets are utilized as frontage roads, that street right of way is excluded from the Freeway right of way. For areas where the Freeway is located adjacent to the railroad right of way, a minimum distance of 20 feet has been provided from the edge of the Freeway lane to the railroad right of way.

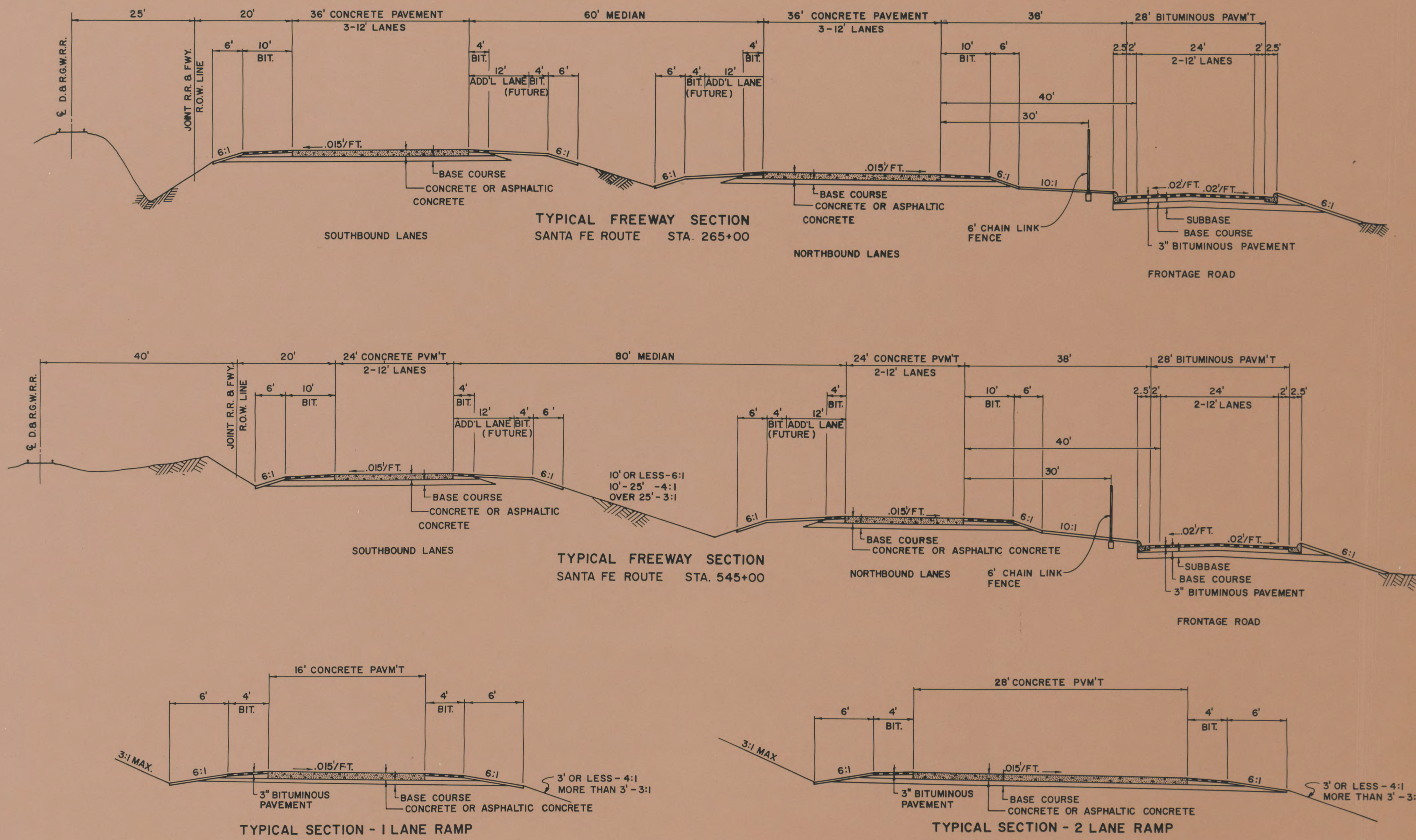


FIG. 20/ ROADWAY SECTIONS—SANTA FE ROUTE

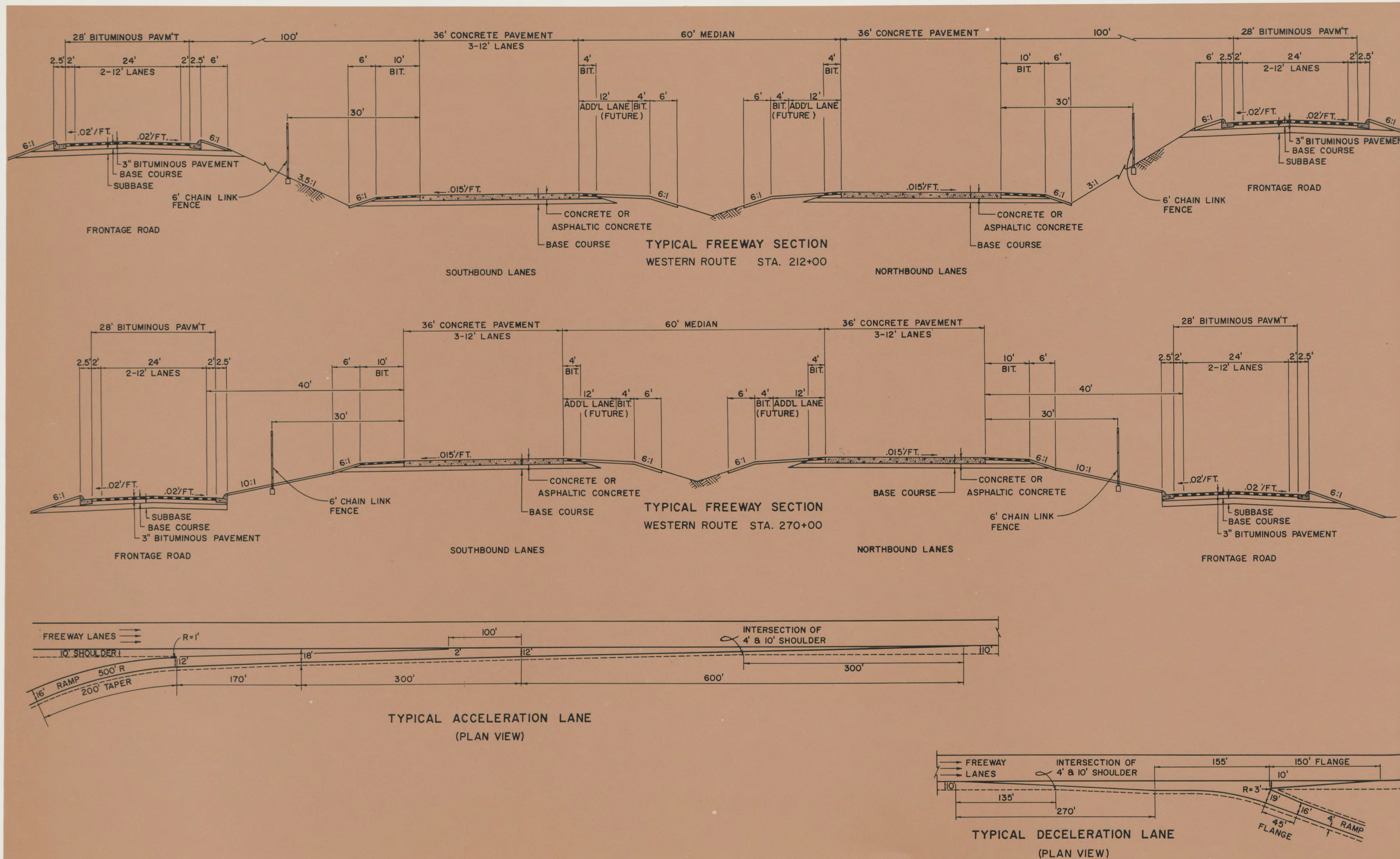


FIG. 21 / ROADWAY SECTIONS—WESTERN ROUTE

SANTA FE ROUTE

INTRODUCTION

This chapter of the report discusses the Santa Fe Route from the vicinity of the Valley Highway interchange with Santa Fe Dr. to the Arapahoe—Douglas County line near Chatfield Rd. In land use and planning terms, the Freeway alignment is well situated because it follows a long-established division line between land uses along Santa Fe Dr. and the railroads. It causes a minimum disruption to urban development in the South Platte River Valley corridor, with exception of the properties adjacent to Santa Fe Dr. As indicated in later right of way reports, the cost of this acquisition will be substantial, but this alignment represents an opportunity to substantially reorganize land use and development patterns in the under-utilized land between Santa Fe Dr. and the South Platte River from Evans Ave. south to Hampden Ave. Figure 22 summarizes the resulting long range development potential for the corridor and indicates street circulation patterns. The existing railroads, utilities and major arterial highway connections present significant engineering and construction problems.

PLANNING, PRELIMINARY DESIGN, AND LANDSCAPE CONSIDERATIONS

Preliminary design drawings for this Route are included at the end of this chapter. These are Drawings 1 through 21, plan and profiles, and Drawings 22 through 41, interchange layouts including ramp and cross street grades. Frontage road grades are proposed to be at or near the existing ground line and therefore are not shown in these plans. In isolated cases where the frontage road grade is critical, a segment of it is shown on the interchange grade sheets, such as at Dartmouth Ave. near Little Dry Creek.

Discussion and recommendations are included for planning and landscape considerations as they affect the freeway and adjacent lands. Items which typically affect adjacent lands are community improvement and development opportunities created by the freeway construction. Landscape design cross sections and plans are presented to indicate the typical freeway landscape possibilities.

Valley Highway to Jewell Ave.

As shown on Drawing 1, the initial construction for the viaduct north of the Valley Highway would include a two lane ramp connection with Lincoln St. northbound and a two lane ramp connection with Broadway southbound. One lane ramps northbound to Dakota Ave. and southbound from Alameda Ave. are proposed. This initial construction will allow for future construction of the Columbine Freeway in a northerly direction somewhere in the area east of Broadway. For initial construction, only those turning movements that are required, considering the Columbine Freeway ends at the Valley Highway, are shown. Should the Columbine Freeway be extended north of the Broadway—Alameda intersection at some later date, five additional turning movements could be added to the interchange at the Valley Highway to provide all turning movements between the two freeways. In the Valley Highway interchange, full access from the Kalamath—Santa Fe existing one way pair and the Valley Highway is provided to the Columbine Freeway except for the movement from northbound on the Valley Highway to southbound on the Columbine Freeway. This movement would be carried off of the Valley Highway to a proposed bridge at Mississippi Ave. which would cross the Valley Highway. This low volume movement could then reach the Columbine Freeway via Mississippi Ave. westbound.

It is proposed that all of the Columbine Freeway from the Valley Highway to the area of its terminus in the vicinity of Broadway and Alameda would be an overhead viaduct structure because of heavy industry, railroad facilities, and existing local street patterns in that area. The alignment was chosen to provide the best interchange layout with the Valley Highway and to keep the cost of right of way as low as possible.

For the Freeway between the Valley Highway and the Mississippi—Louisiana planned one way pair, the horizontal alignment is very critical, as shown on Drawing 5. The northbound lanes of the Columbine Freeway will require retaining walls on both sides and, depending upon the future plans of the Gates Rubber Company, may require that the River be relocated somewhat to the west in this area. At the Mississippi—Louisiana one way pair, the Freeway will be carried over these streets because of existing utilities and the existing bridge across the South Platte River. Mississippi Ave. at this time is a two way street, and Louisiana Ave. does not exist between Santa Fe Dr. on the east and South Huron St. on the west. In meetings held with members of the Denver Traffic Engineering Department, and in subsequent meetings held between Denver Traffic and Denver Planning, it was determined that Mississippi could be made one way westbound and Louisiana one way eastbound. This proposed change of street designation would greatly simplify the interchange layout for both Mississippi and Louisiana Avenues. The work that would be required outside of the project area to accomplish the change in street designation for Mississippi and Louisiana is listed as follows:

1. Construction of Louisiana Ave. from Santa Fe Dr. through the Navajo Trucking facility to Huron St. on the existing 60 foot right of way. This includes construction of a bridge for Louisiana Ave. across the Platte River.

2. Construction of a bridge to carry Mississippi Ave. across the Valley Highway. The existing northbound ramp to the Valley Highway under the proposed Mississippi Ave. bridge would have to be revised slightly to provide vertical clearance for the proposed bridge.

3. Acquisition and relocation of the Dumb Friends League facility, including land to provide right of way for the construction of Louisiana Ave.

To accommodate the Mississippi—Louisiana one way pair interchange, it is planned that one way frontage roads would be provided east of the freeway northbound and west of the freeway southbound between the Valley Highway on the north and existing Florida Ave. on the south. South of Florida Ave., a two way frontage road is proposed east of the Freeway only to serve the existing businesses between the Overland Golf Course and the railroad tracks.

Florida Ave. has been cut off between Santa Fe Dr. and east Platte River Dr. as it carries no traffic now that could not be easily carried by either of the river drives to and from the Mississippi—Louisiana one way pair. To minimize the amount of right of way required through the golf course, no frontage road is planned on the west side of the freeway adjacent to the golf course. The northbound freeway lanes east of the golf course are set at the elevation of existing Santa Fe Dr., and the southbound freeway lanes are depressed somewhat, providing a split elevation for the freeway lanes.

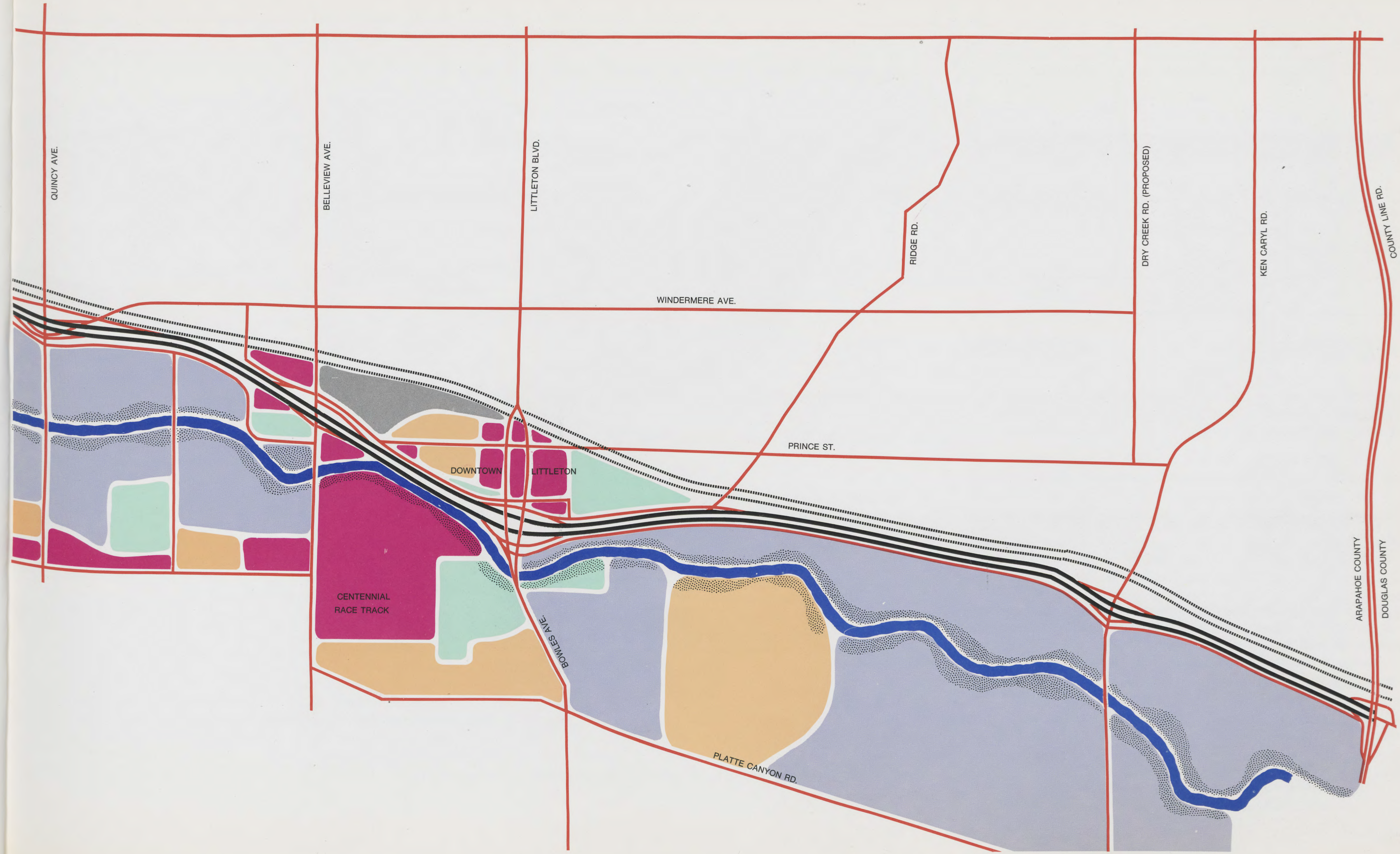
Because of the industrial character of the area immediately south of the Valley Highway, buffer plantings on the east side will not be required. However, the Vanderbilt Park, to be located west of the river north of Mississippi Ave., must be screened substantially with plant materials. This planting can occur on both the park land and the freeway right of way. Figure 23 is a plan view key showing the amount of planting required as indicated on all of the typical landscape treatment sections. The typical landscape treatment recommended for the area opposite Vanderbilt Park is shown on Figure 25.

With a strip along the eastern edge of existing Overland Park Golf Course to be acquired for freeway right of way, it is recommended that replacement lands be acquired immediately south of the existing golf course, between Jewell Ave. and Evans Ave. for necessary reconstruction of the golf course. This land should encompass the entire area between the freeway and the South Platte River between the existing golf course and Evans Ave. and should be a joint project between the Colorado Division of Highways and the City of Denver. A continuous river front drive should be preserved on at least one side of the river. Figure 24 suggests the future treatment of the area and Figure 26 shows the typical section landscape treatment. This replacement land has been recommended for long-range urban renewal by the Denver Planning Board and the Urban Renewal Authority.

Jewell Ave. to Yale Ave.

South of Jewell Ave., the freeway acquisition west of Santa Fe Dr. displaces commercial and a limited amount of residential property. Long-range urban renewal proposals have been made for the area south to Harvard Ave. by the Denver Urban Renewal Authority. Figure 27 schematically indicates the type of development which can result after freeway construction, orienting to the river and western mountain view. The land immediately north of Hampden Ave. is used as an example.

FIG. 22 / DEVELOPMENT POTENTIAL / SANTA FE ROUTE


QUINCY AVE.
BELLEVIEW AVE.
LITTLETON BLVD.
RIDGE RD.
DRY CREEK RD. (PROPOSED)
KEN CARYL RD.
COUNTY LINE RD.
WINDERMERE AVE.
PRINCE ST.
DOWNTOWN
LITTLETON
CENTENNIAL
RACE TRACK
BOWLES AVE.
PLATTE CANYON RD.
ARAPAHOE COUNTY
DOUGLAS COUNTY

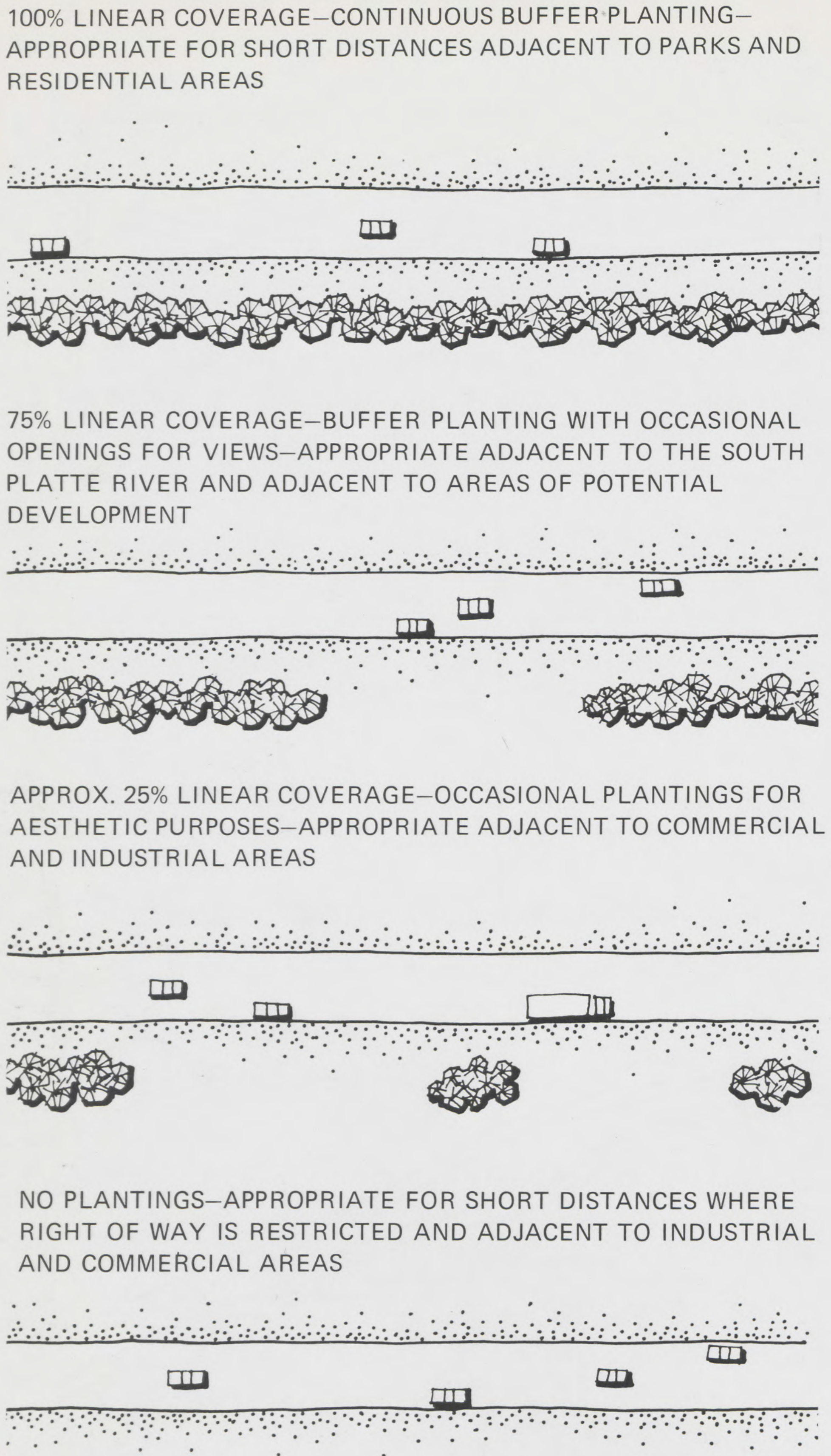


FIG. 23 / ILLUSTRATIVE LANDSCAPE PLANTING

FIG. 24 / SUGGESTED FUTURE LAND USE: OVERLAND PARK–RUBY HILL PARK

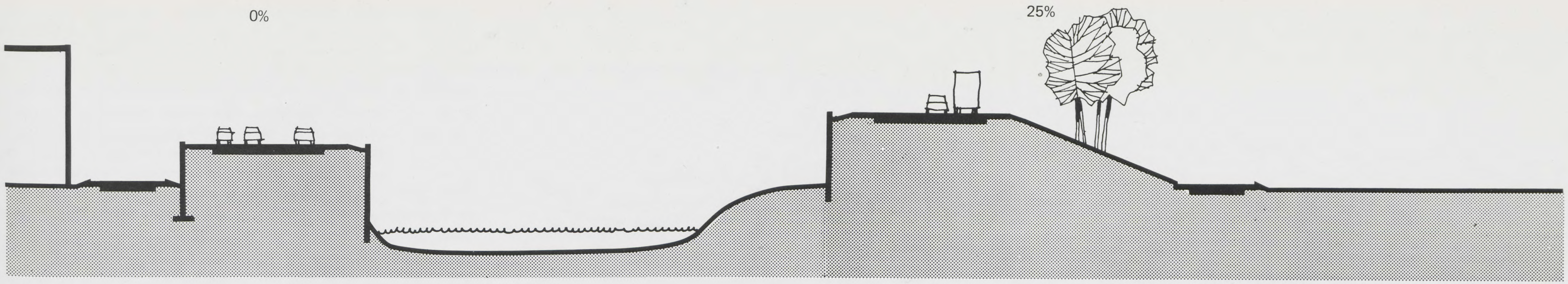


FIG. 25 / TYPICAL LANDSCAPE TREATMENT–VALLEY HIGHWAY

At Evans Ave., the Freeway swings slightly to the west to provide horizontal clearance for an interchange. A diamond interchange is planned at Evans Ave. as shown on Drawing 25, with all ramps having two lanes to provide additional storage and turning movement capacity.

Existing Evans Ave., which now has two lanes in some areas and four lanes in other areas, will be upgraded to a six lane divided major arterial roadway in the future according to DMATS plans. These plans appear quite feasible from Santa Fe Dr. west, but may prove difficult from Santa Fe Dr. east due to the large amount of expensive right of way that would have to be acquired. In any case, Evans Ave. has been considered as six lanes and the interchange bridges have been planned accordingly. The Freeway will be taken at existing grade over Evans Ave. which will be depressed to pass under both railroad tracks. Cost comparisons were made between a viaduct and an undercrossing for Evans Ave., and a substantial cost difference was found favoring an undercrossing. The problem of adequate storm drainage capacity for the underpass and a drainage area southeast of the railroad tracks at Evans Ave. was analyzed. By maintaining the existing 60 inch storm sewer near Asbury Ave. and providing an additional 60 inch storm sewer from the Evans Ave. undercrossing to the River, the storm drainage flowing to this undercrossing can be adequately carried. There is enough elevation differential from the low point in the underpass to the River to permit the storm sewer to flow by gravity.

South of Evans Ave., no frontage road has been planned until the Freeway reaches West Harvard Ave., where a two way frontage road is provided between South Galapago St. and the Yale Ave. interchange. Because a frontage road north of Harvard Ave. would serve only small, unusable properties, it has been eliminated. The remaining properties without access to public streets may have to be acquired. Since Robbins Incubator Company will be eliminated under this freeway plan, it was decided a frontage road was required to provide access for the land between the freeway and the Platte River in that area.

FIG. 26 / TYPICAL LANDSCAPE TREATMENT–FLORIDA AVE. TO EVANS AVE.

Yale Ave. to Oxford Ave.

An interchange is planned for future Yale Ave., as shown on Drawing 27. On the east, Yale Ave. terminates at South Elati St. near General Iron Works and on the west, it is well developed in only one location between Federal Blvd. and the South Platte River near Englewood's Industrial Park. In addition, an undeveloped portion of Yale Ave. east of Federal Blvd. is offset one-half block south of its existing alignment in other areas. According to the Planning Offices of both Denver and Englewood, Yale Ave. will be a four lane major arterial roadway in the area of Santa Fe Dr. The feasibility of providing the Yale Ave. interchange is somewhat questionable because of the problems encountered in considering the construction of Yale Ave. between Elati St. and Federal Blvd.

To construct Yale Ave. through the General Iron Works facility immediately east of South Santa Fe Dr. would require the acquisition of very expensive property and the disruption of the manufacturing process. According to the management of General Iron Works, approximately 500 men are now employed and plans are under way for expansion. Depressing Yale Ave. through the plant area would require shortening of one railroad spur, acquisition of one building immediately south of proposed Yale Ave., and construction of one additional railroad bridge to maintain the spur to the main plant area. The possibility of taking Yale Ave. over the trackage and the Columbine Freeway in this area was investigated, but this plan would also disrupt the manufacturing process because construction is underway for an overhead gantry crane through the plant. It seems that the part of General Iron Works immediately north of Yale is an integral part of the plant south of Yale, and the two cannot be easily separated.

The feasibility or need for construction of Yale Ave. from Santa Fe Dr. west to the Englewood Industrial Park is somewhat questionable and depends upon the development of that area. This area is now served adequately by Dartmouth on the south, Evans on the north, and the two Platte River Drives. It appears that this area is and will continue to be developed into large manufacturing facilities which do not require an intensive or complicated street system.

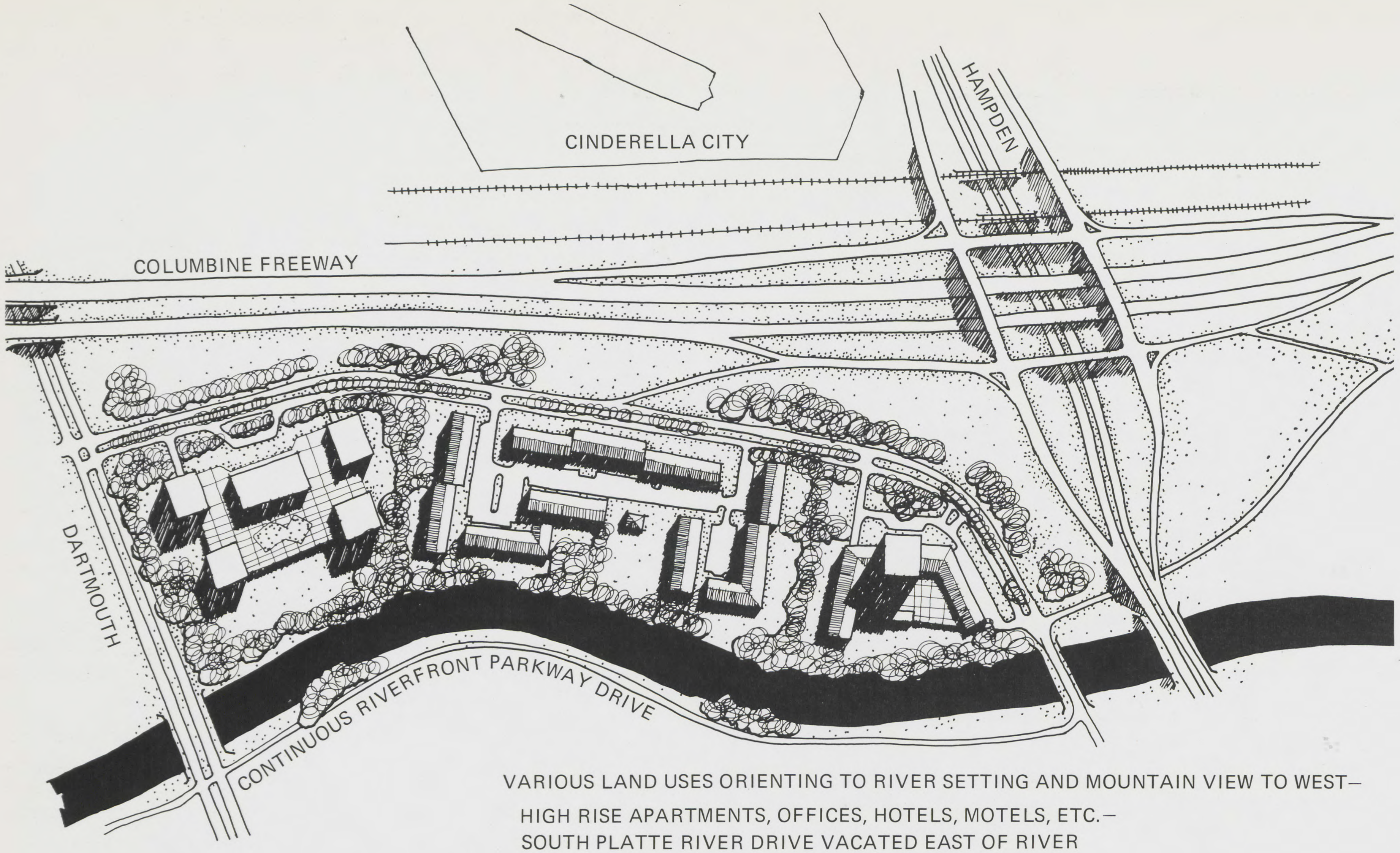


FIG. 27 / SUGGESTED FUTURE LAND USE AT HAMPDEN INTERCHANGE

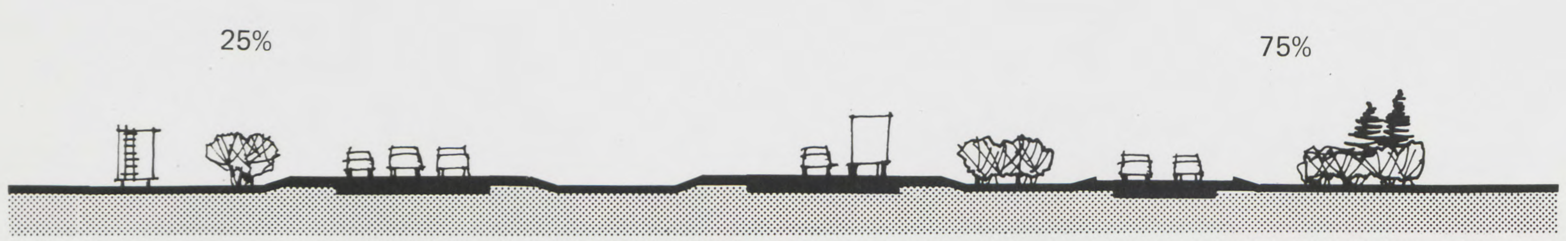


FIG. 28 / TYPICAL LANDSCAPE TREATMENT–EVANS AVE. TO CHENANGO AVE.

An interchange is not planned at Dartmouth Ave. because of its location near Yale and Hampden Avenues where interchanges are planned. Because of Dartmouth's existing and planned traffic capabilities, a grade separation structure has been proposed to take Dartmouth Ave. under the railroad tracks, under the Freeway, and connect with the frontage road as shown on Drawing 10. To provide for this grade separation crossing will require acquisition of an extensive amount of right of way west of Santa Fe Dr. to allow the frontage road to clear existing Little Dry Creek and join Dartmouth Ave. which will be rising to existing grade. On the east, an extensive amount of right of way will have to be acquired and roadway work will have to be accomplished to connect the existing streets into Dartmouth at approximately South Galapago St.

At Hampden Ave. a tri-level diamond interchange is proposed as shown on Drawing 30 to replace the existing partial loop interchange. The proposed interchange would provide for the freeway to be taken at existing grade over Hampden Ave., which would remain unchanged as would the existing railroad bridges over Hampden Ave. An attempt was made to plan an interchange which would utilize practically all of the existing interchange in this area, but because of the existing 175 foot radius loops, the higher design speed required, and the heavier traffic volumes anticipated, a different type of interchange was considered necessary. A simple diamond interchange was ruled out because of the high anticipated ADT volumes and the fact that Hampden Ave. is projected to become a freeway. A cloverleaf or loop interchange was eliminated because of the inherent weaving problems encountered with this type of interchange during heavy traffic. A directional interchange was not considered because of the large amount of right of way required and the inherent large cost for structures. A perspective view of this interchange is shown on Figure 15. A tri-level diamond interchange was chosen at this location because it will carry the expected 1990 ADT volumes and has the advantage of complete freedom for through traffic movement on both freeways with a separate third level for all turning movements.

To evaluate the feasibility of a tri-level diamond interchange and to determine operating characteristics of such an existing interchange, the Bureau of Public Roads in Denver was contacted. The Bureau advised that the State of Virginia was planning a tri-level diamond interchange for a crossing of Interstate Route I-95 and Seminary Road, Route 716 which is referred to as the Shirley Highway improvement Seminary Road Interchange and is located near Washington, D. C. At the time of correspondence with the State of Virginia, the roadway was only 70% complete and no operating characteristics could be obtained on the proposed interchange. The project engineer for the Department of Highways, State of Virginia, did furnish information regarding the layout of the interchange, connections with local roads, and projected traffic volumes.

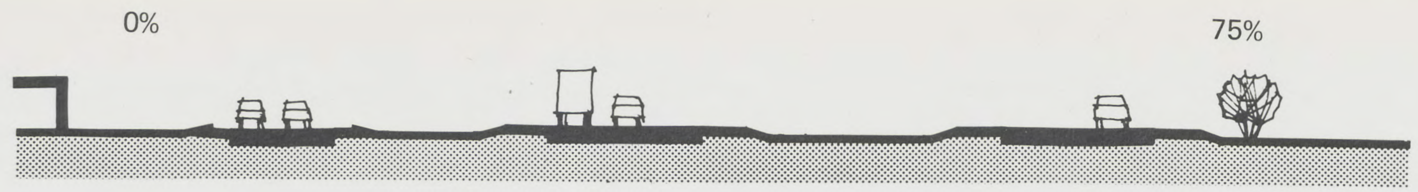


FIG. 29 / TYPICAL LANDSCAPE TREATMENT—CHENANGO AVE. TO BELLEVIEW AVE.

After further study, it was determined that this type of interchange could be adapted to the Columbine Freeway at Hampden Ave. and that such an interchange can carry the projected 1990 ADT volumes. Only turning movements are routed through the rectangular turning level of the interchange, while through traffic movements for Hampden Ave. and the Freeway are uninterrupted by the interchange. A tri-level diamond interchange provides that of the 8 basic turning movements, only the 4 left turning movements have to proceed through traffic signals. The signals can be timed and synchronized to carry the high directional peak hour volumes of traffic while the other 4 turning moves can make the right turns through yield lanes near the traffic signals. The turning level of this interchange was placed on the third and highest level at this particular location to clear the railroad tracks since the other two levels are occupied by Hampden Ave. and the railroads. The proposed frontage road through the Hampden interchange would pass under the existing Hampden Ave. bridge which spans the South Platte River.

Through the area south of Evans Ave., the freeway traverses a relatively constant land use and physical terrain condition. To the east, the railroad right of way provides a wide buffer zone between the freeway and land uses. Only minimum landscape plantings are required. To the west, a continuous screen planting is recommended to preserve the optimum development potential of the area. Occasional openings in the buffer planting will allow excellent, long use of the Platte River Valley. Figure 28 indicates the typical landscape treatment through this area.

Oxford Ave. Through Belleview Ave.

From Hampden Ave. to Belleview Ave., the freeway continues to parallel the railroad tracks, following the existing land development barrier. Acquisition and displacement of adjoining properties on the west of South Santa Fe Dr. is similar to the situation north of Hampden Ave., with the exception that this property is not as highly developed. Between Hampden Ave. and Belleview Ave., provision during initial construction of the Freeway is made for a two lane, two way frontage road. Depending on the development of the Platte River Valley west of the Freeway, the need could arise for a four lane frontage road in the future.

Kenyon Ave. traffic which is to be terminated at the railroad tracks can be carried by Santa Fe Lane to connect with Oxford Ave. No interchange is planned at Oxford Ave. because of its proximity to Quincy Ave. According to the DMATS study, Oxford Ave., which is an existing two way roadway and a major traffic carrier, will be upgraded to a four lane collector. Because of Oxford's potential, it should be continued across the Columbine Freeway. No economical grade separation crossing could be designed in this area for Oxford Ave. and the railroad tracks because of the need for passing the freeway under the D & RGW railroad spur leading west to the Monarch Lumber Company. It can be seen from Drawing 12 that the profile for the freeway passes under Oxford Ave. and the railroad spur in this area, then rises and passes over Quincy Ave.

Quincy Ave., which does not presently exist between Santa Fe Dr. on the east and Irving St. on the west, is planned as a 4 lane major arterial through the area and, as such, will require an interchange with the Freeway. Quincy Ave. does have the potential for a 4 lane major arterial development because it exists from Interstate Highway 225 to Santa Fe Dr. on the east and from South Irving St. to the Hampden freeway near proposed Mt. Carbon dam on the west. Because Oxford Ave. is blocked for future development on the west by the Fort Logan Mental Health Center and on the east by Cherry Hills Country Club, it does not have as much traffic potential as Quincy Ave.

The Quincy interchange plan, Drawing 33, shows that a large amount of right of way is required, some of which allows for a direct connection from the Columbine Freeway under the railroad tracks to Windermere Ave. Windermere Ave. as it now exists is a 4 lane roadway from Belleview Ave. to Littleton Blvd. Because Windermere Ave. is planned to be a 4 lane major arterial roadway in the future, this connection was proposed in the input data for the Columbine Freeway traffic projections and was found to satisfy the needs of the large amount of traffic from the Littleton area. By utilizing this connection, the Belleview interchange could be simplified to a diamond interchange with the heavy traffic flow from the Columbine Freeway to the area east of downtown Littleton carried by the Windermere connection.

South of the Quincy interchange, the freeway follows the Santa Fe alignment with the southbound lanes being depressed to more nearly fit the existing topography. At Belleview Ave., the freeway is carried over that existing roadway to cause the minimum disruption to existing utilities which are heavily concentrated in this area leading to the Littleton Sewage Treatment Plant.

A frontage road west of the freeway between Quincy Ave. and Belleview Ave. is routed westward on Chenango Ave. around the Littleton Sewage Treatment Plant, as shown on Drawing 36. This frontage road appears to cross the South Platte River, but according to the Corps of Engineers' plans for the South Platte channel improvement in this area, this loop of the channel will be eliminated.

In the section of Freeway north of Chenango Ave., the landscape considerations are similar to those discussed for the section of the Freeway north of Hampden Ave. South of Chenango, the freeway turns away from the railroad tracks and follows the original alignment of Santa Fe Dr. which has existing commercial development abutting on both sides. At this location visual orientation of adjoining properties will be an advantage, and no planting is needed on the east side. West of this freeway, substantial buffer landscape plantings are recommended to screen the Littleton Sewage Treatment Plant from view. Figure 29 illustrates typical landscapé treatment for this area.

Belleview Ave. Through Ridge Rd.

South of Belleview Ave., a realignment of the river allows the freeway to fall between downtown Littleton and the river, with a complete interchange at Bowles Ave. The freeway in this location is well situated in relation to the topographic change which separates downtown Littleton from the area west of Santa Fe Dr.

From Belleview Ave. to Bowles Ave., the freeway has been designed with only one frontage road on the east because of the adjacent South Platte River. Relocation of the River westerly will be required even with the full use of existing Santa Fe Dr., as shown on Drawings 14 and 15.

Preliminary investigation of the South Platte River relocation has been coordinated through the Colorado Water Conservation Board with the Corps of Engineers, Omaha, Nebraska. As soon as an alignment determination is made by the Division of Highways for either the Santa Fe Route or the Western Route, a request should be forwarded to the Colorado Water Conservation Board for the South Platte River relocation.

Whether the Western Route or the Santa Fe Route is selected, the bridge on Crestline Ave. which carries a private road serving the Centennial Race Track will have to be reconstructed if that connection is maintained. As shown on Figure 30, it is proposed that the existing road adjacent to the west side of the Littleton Public Works grounds be improved by the City of Littleton, connecting West Berry Ave. with Bowles Ave. to provide access from the Race Track directly to Bowles Ave. Considering the Race Track's existing access to Belleview Ave. and Federal Blvd. and with the proposed access to Bowles Ave., elimination of the Crestline Ave. bridge is recommended.

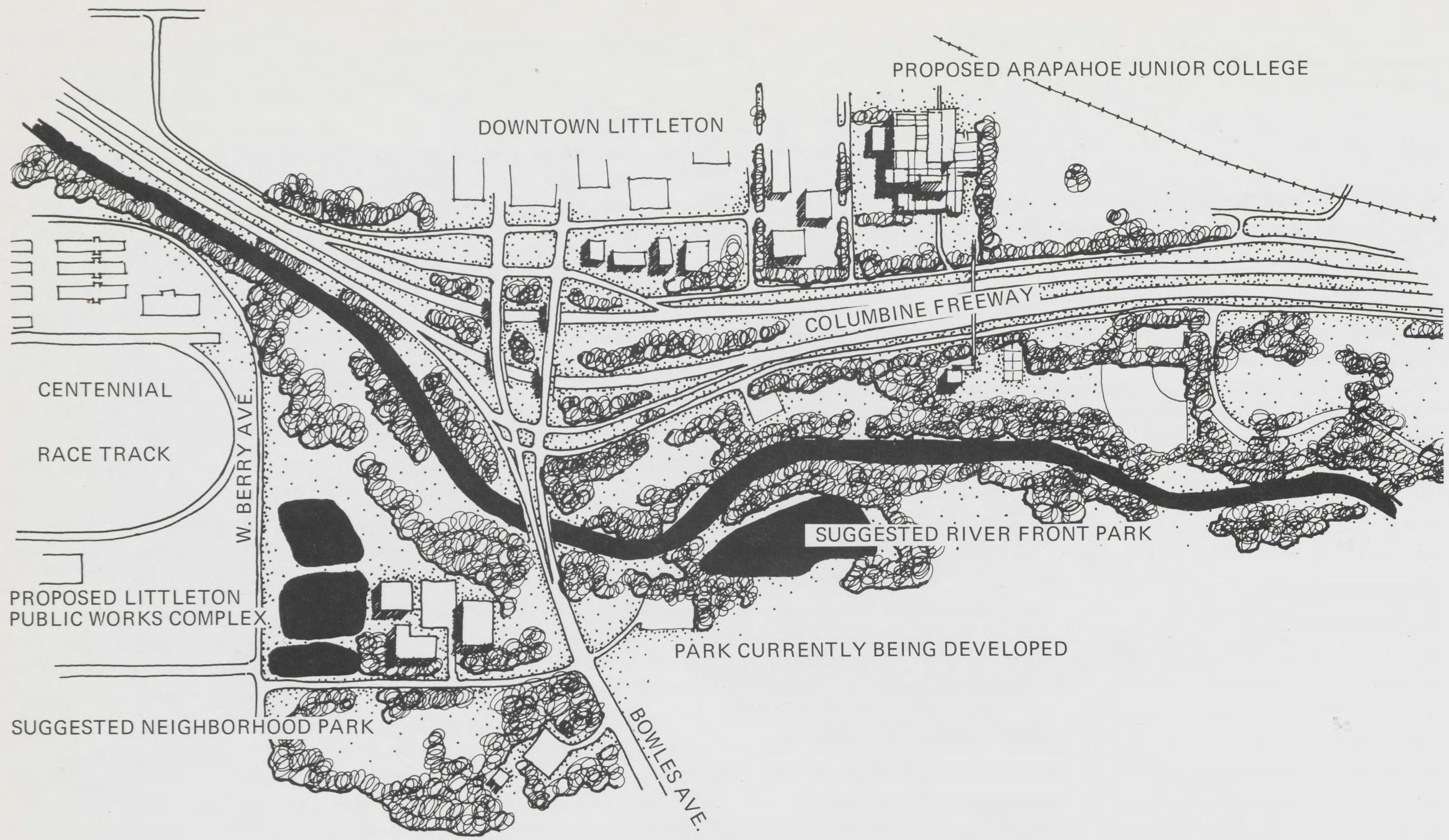


FIG. 30 / SUGGESTED FUTURE LAND USE—BOWLES AVE. INTERCHANGE

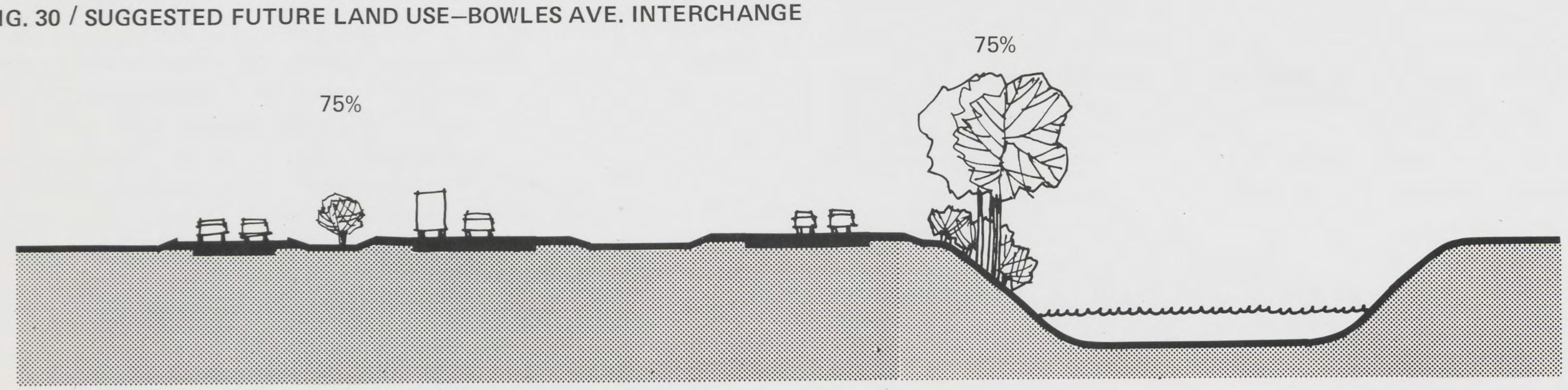


FIG. 31 / TYPICAL LANDSCAPE TREATMENT—BELLEVIEW AVE. TO BOWLES AVE.

At the Bowles interchange, Drawing 38, Main St. through Littleton, which is one way westbound, would be extended through the interchange and would connect to Bowles Ave. Alamo Ave., which is now one way eastbound through downtown Littleton, would also be extended westerly and connect with Bowles Ave. A diamond interchange with a double left turn provision for the heavy traffic flow from Bowles Ave. eastbound to the Columbine Freeway northbound has been designed for this interchange. The spread between the northbound and southbound lanes of the Freeway through this interchange will allow for a 10 foot drop in elevation between these lanes. An illustration of this interchange is shown in Figure 32. To construct this interchange, the Littleton Police building located in line with the west end of Main St. will have to be acquired and relocated.

From Bowles Ave. south to Chatfield Rd., a two lane, two way frontage road is planned west of the Freeway to provide local service. As was mentioned for the case between Hampden Ave. and Belleview Ave., a four lane frontage road may be required in the future, depending on development of the area between the Freeway and the River. Right of way to be acquired for initial Freeway construction in this area is shown on Drawings 16 through 21.

South of Bowles Ave., the Freeway is lower than Santa Fe Dr. By depressing the Freeway, a slope east of the northbound freeway lanes can be provided to allow more open space between the Freeway and the proposed Arapahoe Junior College. Additionally, the noise factor in the college area can be measurably reduced.

A two way frontage road is planned on existing Santa Fe Dr. east of the Freeway in this area to provide service for the existing businesses and the future Arapahoe Junior College. In discussions with representatives of the Arapahoe Junior College, it was learned that plans call for this Junior College to reach a design capacity of 7,500 students in approximately 5 years. Because of the potential student load using a parking facility on Church Ave., a direct on-ramp was considered from Church Ave. to the Freeway. This was found to conflict with the Bowles interchange and therefore was not provided. See Drawings 16 and 17 for the final recommended ramp design.

At Ridge Rd., shown on Drawing 17, no interchange is planned because of Ridge Road's location near the proposed Bowles Ave. interchange. According to the DMATS study, Ridge Rd., which is an existing two lane road, is to be widened to a four lane major arterial roadway. Access is provided to Ridge Rd. from Freeway northbound traffic and from Ridge Rd. to northbound on the Freeway. As planned, Freeway traffic southbound to Ridge Rd. is routed through the Bowles Ave. interchange, eastbound on Alamo Ave. to Prince St., and then south on Prince St. to Ridge Rd.

North of Bowles Ave., major buffer plantings are proposed adjacent to the residential and park areas. Substantial landscape screening is suggested on the east side of the river to screen a potential park development south of Berry Ave. from the freeway (See Figure 31). In the Bowles interchange, increased right of way requirements provide the opportunity for substantially larger plant groupings than are recommended along the freeway between interchanges.

ton, which
and would
nd through
nnect with
ion for the
e Freeway
etween the
nterchange
llustration
hange, the
in St. will

ntage road
tioned for
e frontage
f the area
for initial
rough 21.

depressing
provided
Arapahoe
n be mea-

the Free-
the future
Arapahoe
to reach
use of the
direct on-
found to
ided. See

ecause of
Accord-
ane road,
ovided to
to north-
to Ridge
mo Ave.

nt to the
d on the
of Berry
ncreased
ly larger
en inter-

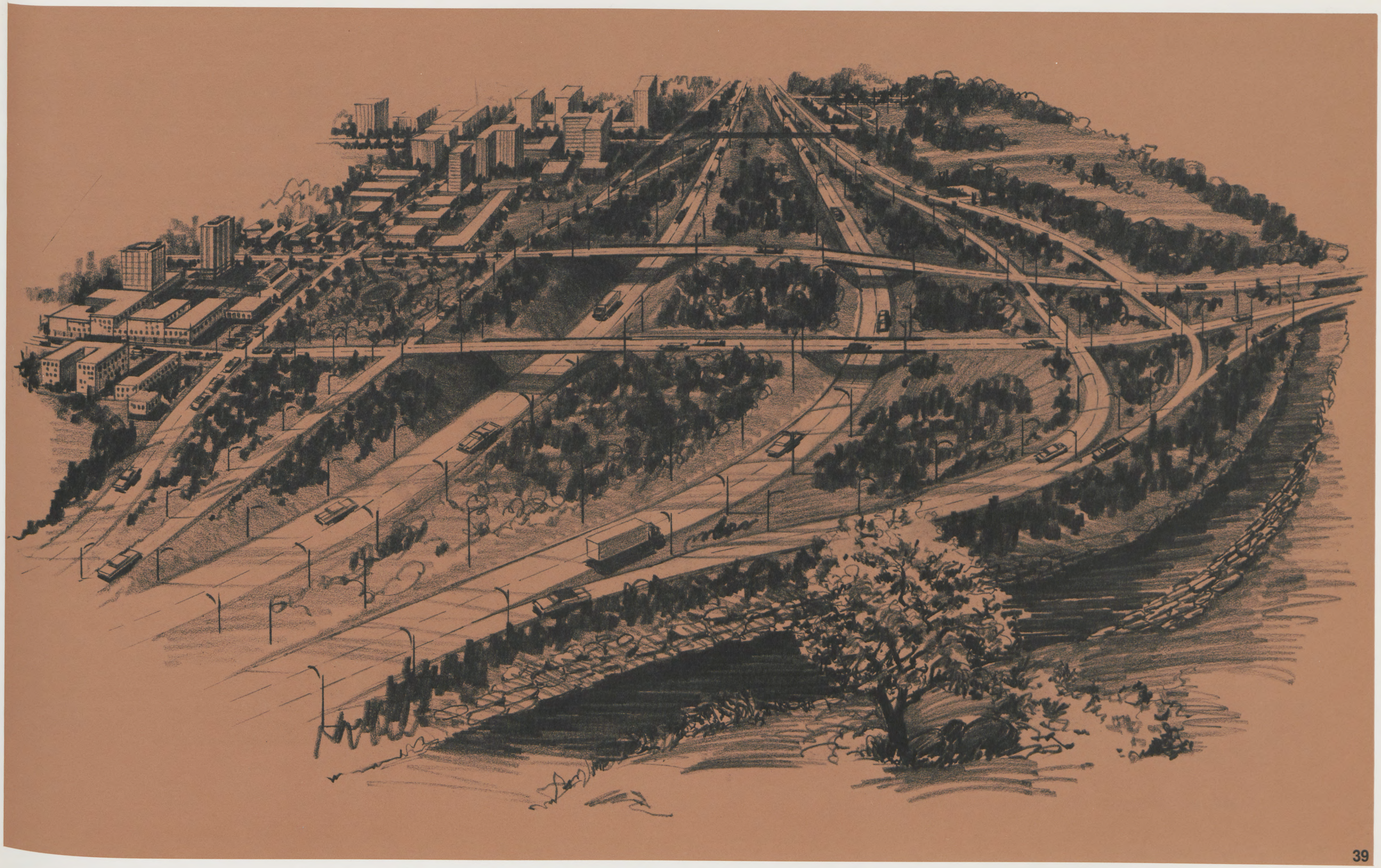


FIG. 32 / BOWLES INTERCHANGE

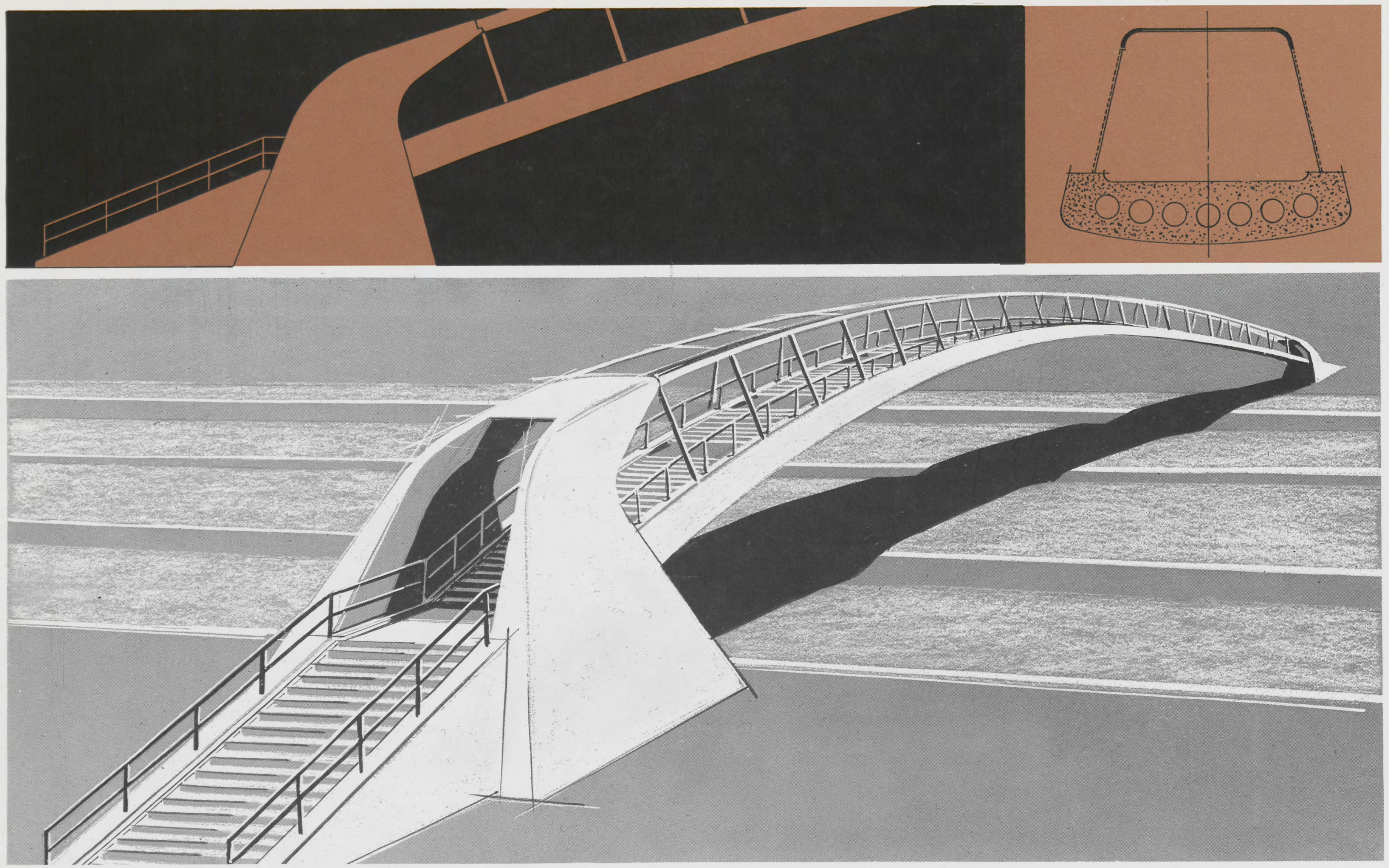


FIG. 33 / PEDESTRIAN OVERPASS

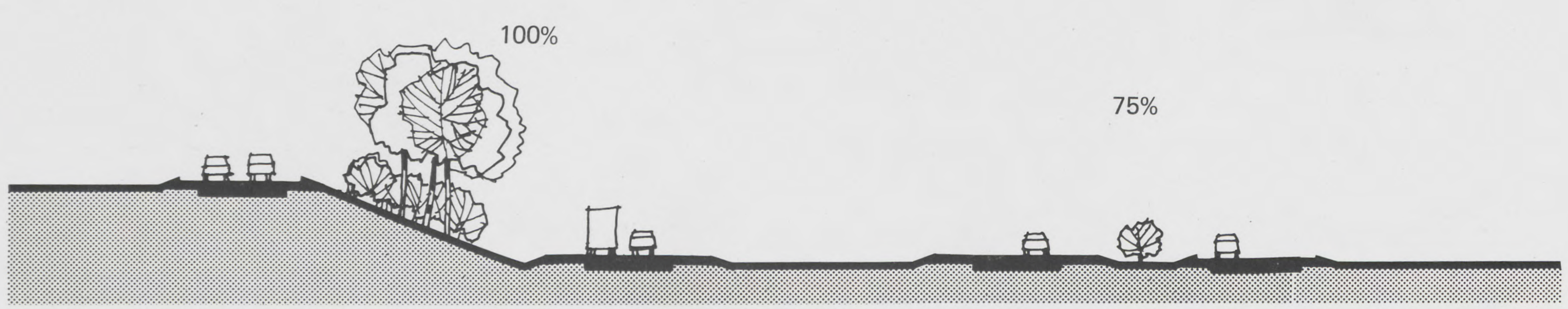


FIG. 34 / TYPICAL LANDSCAPE TREATMENT—BOWLES AVE. TO RIDGE RD.

South of Bowles Ave., the high density uses and the Junior College site require major landscape screening from the freeway. Extensive planting is recommended on the embankment east of the Freeway to strengthen physical separation between the Junior College and the Freeway (See Figure 34). West of the Freeway, a river front park is recommended, relating to the Junior College via a pedestrian overpass over the Freeway (See Figure 33). The park, which will be accessible from the west frontage road system, will require landscape buffering from the Freeway.

Ridge Rd. to Chatfield Rd. Interchange

This alignment is adjacent to rural land which will inevitably be developed in substantial urban densities. It is anticipated that the area west of Santa Fe Dr. will be developed into large planning units with a road circulation system composed of independent loop streets which will tie to the west frontage road of the Freeway. Development is anticipated to have maximum exposure and orientation to the river in this area.

South of Ridge Rd., the Freeway has at least an 80 foot median between northbound and southbound lanes to provide cross slope for the split profile.

From near Ridge Rd. to Ken Caryl Rd., the existing City Ditch (See Drawings 18 and 19) is located on the west embankment slope of South Santa Fe Dr. Because of the extensive problems involved in relocating City Ditch west of the proposed frontage road where a large drop in elevation is encountered, City Ditch will remain in the median of the Freeway. The Ditch can be piped for its length where located in the median for approximately the same cost as for earthwork if the Freeway lanes were set at the elevation of Santa Fe Dr. and the Ditch were relocated to the west. With the Ditch piped in the median, it could serve irrigation requirements west of the Freeway by constructing one or two culverts under the southbound lanes of the Freeway with control devices located west of the frontage road.

An interchange is planned for Ken Caryl Rd. near the Jackass Hill Rd. intersection with Santa Fe Dr. At this location, the Freeway passes over Ken Caryl Rd., with Ken Caryl Rd. passing under the railroad tracks. In studying the need for this interchange, it was found that Arapahoe County has made a commitment to the Gates Rubber Company and the AT & SF Railroad that the County would construct the road from Santa Fe Dr. to connect with South Broadway (See Figure 4).

Arapahoe County's plan for this interchange, which was accepted by Gates Rubber Company, has Ken Caryl Rd. located south of the existing railroad spur and crossing the Freeway in an overhead structure. After a detailed study of that situation plan, it was decided that Ken Caryl Rd. should be located north of the existing railroad spur to provide a better connection with the extension of South Prince St. A cost comparison between an overhead structure and a depressed section for Ken Caryl Rd. at this interchange strongly favored the interchange shown (See Drawing 40).

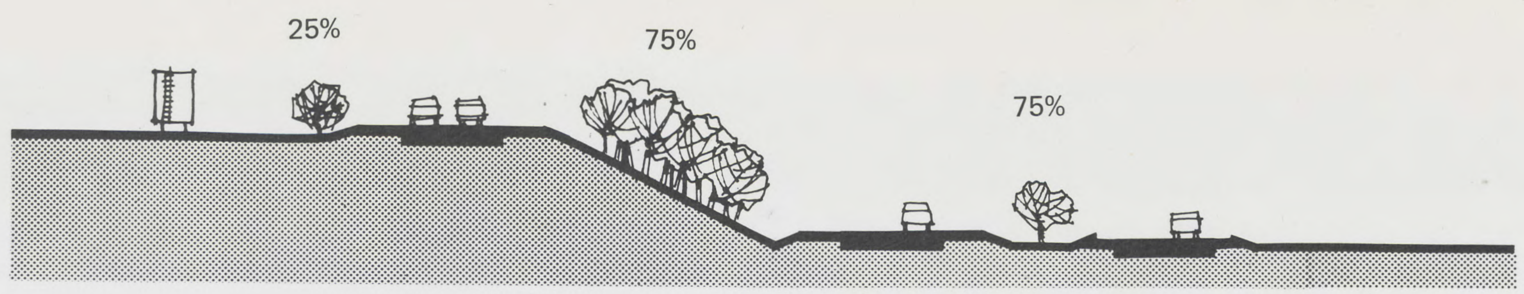


FIG. 35 / TYPICAL LANDSCAPE TREATMENT—RIDGE RD. TO COUNTY LINE RD.

Because Gates Rubber Co. has made a commitment to Arapahoe County that the right of way for new Ken Caryl Rd. would be provided south of the railroad spur when Ken Caryl Rd. was to be constructed, discussions were held with representatives of the Gates Rubber Co. engineering department concerning this matter. Those representatives explained that if Ken Caryl Rd. should be located north of the railroad spur, Gates Rubber Co. would assure that the necessary right of way would be made available to Arapahoe County for construction of the road. Ken Caryl Rd. west of the Freeway is shown to connect with existing Ken Caryl Rd. on Drawing 40. Present plans west of the Freeway in this area include construction of a golf course which would block development of Ken Caryl Rd. to the west on a continuation of its present alignment. This interchange provides flexibility in that Ken Caryl Rd. can be routed north or south around the proposed golf course and connect with existing Ken Caryl Rd. in the area of the Platte Canyon Rd., as shown on Figure 4.

Access to the three residences in the area located immediately east of the railroad tracks near Dad Clark Gulch can be provided along the AT & SF Railroad service road. This road can be connected to Ken Caryl Rd. immediately east of the railroad spur in a manner similar to that shown for the service road connection of Santa Fe Lane to Quincy Ave. (See Drawing 33). This connection has not been shown or included in the estimate of cost because it is felt that the properties needing service will be acquired by Gates Rubber Co. and included in their overall development plans for that area.

The interchange shown on Drawing 21 between the proposed Columbine Freeway and Chatfield Rd., State Highway 75, was designed for the Colorado Division of Highways by others. It is a diamond interchange that will allow Chatfield Rd. to cross under the Columbine Freeway and the railroad tracks. As planned, this interchange will require four traffic signals on existing Santa Fe Dr. and will allow uninterrupted traffic movements on Chatfield Rd. At the connection with Chatfield Rd., the freeway lanes are brought together at the same elevation to pass over Chatfield Rd. on bridge structures.

In the wider median for the area south of Ridge Rd., there is an opportunity to do substantial planting unlike other areas of the Freeway. Major buffer plantings are suggested on the west side of the freeway to preserve the maximum development potential in the area. Occasional openings can be designed to provide long views of the valley area from the freeway. On the eastern side, planting is only recommended occasionally for visual variety as shown in Figure 35. There is no need for screening on the east because of the wide railroad right of way and substantial topographic change which separates the residential areas from the Freeway.

STORM DRAINAGE

The drainage study which was made for the Santa Fe Route includes all of the storm drainage areas east of Santa Fe Dr. which cross the roadway at various points between the Valley Highway and the Douglas County line. These drainage areas, as shown on Drawing 42, were defined utilizing USGS existing topography maps and reports which had been prepared for individual municipalities. A field inspection was made of the drainage area division lines to assure that they were correctly located.

It should be noted that the major drainage areas will require additional storm sewer systems as they develop, but these systems have been assumed to be in place in this drainage study. It will be the community or county's responsibility to assure that as development occurs, adequate storm sewer systems are installed.

Some of the basic assumptions of this drainage study are as follows:

1. No storm drainage is assumed to be intercepted by any irrigation ditches or canals. These ditches are assumed to be running full at the time of a storm, and the storm drainage will either run under the ditch in a siphon or overflow the ditch into the natural drainage swales.

2. All of the areas have been assumed to be more substantially built up than at present. An assumption of developed areas has influenced the choice of 0.5 for a runoff coefficient in most cases.

3. The rational method for calculating storm runoff was used in the drainage study because of the urban area assumed east of the Freeway. Each of the individual drainage areas was planimetered to obtain the area, the runoff coefficient was set at approximately 0.5, and the rainfall intensity was determined based on the size and shape of the drainage basin and the length of time required for the concentration of flow to occur. A cross check with the drainage results and Figures 5-802.1B and 5-802.1C of the Colorado Division of Highways' Design Manual indicates a relatively close correlation for the small basins. For larger basins, the rational method is more conservative than the Design Manual and results in higher calculated runoffs.

4. It has been assumed that all ponding capacity which could reduce peak runoff for small areas was full and, therefore, such ponding has been ignored. For areas such as the McClellan Reservoir on Dad Clark's Gulch and the Englewood Flood Control Dam on Little Dry Creek, the calculated flood was routed through these reservoirs to obtain a realistic downstream flow.

The results of the drainage study for the Santa Fe Route are summarized in Table 2.

UTILITIES

As a part of this study, all major public utilities were to be depicted as derived from the utility companies and city and county plats. These existing utilities, including existing street right of way in the area of the Freeway, are shown on line Drawings 43 through 56. An inspection of these utility drawings reveals that some major feeder or trunk lines are crossing existing Santa Fe Dr. or have been constructed on either side of the roadway. For Freeway construction, the utilities which would run parallel under the Freeway will have to be relocated to a suitable area outside of the Freeway. This requirement is necessary so that people and maintenance vehicles servicing utilities will not have to cross Freeway lanes. Utilities crossing the Freeway at approximately right angles are allowed. Generally, those utilities requiring relocation are planned to be placed beneath the frontage roads and existing streets adjacent to the Freeway.

The following assumptions were used in determining feasible locations for the affected utilities:

1. Minor utilities serving only improvements which would be destroyed by the Freeway were assumed abandoned in place. Included are sewerage and water service lines to houses and businesses.

2. The 72" steel conduit at Radcliff Ave. and the 60" concrete conduit at Crestline Ave. would not be disturbed. Water lines up to 42" diameter would be relocated as required to clear Freeway construction.

3. Bridges proposed for traffic can be utilized for supporting utilities at grade separation crossings.

TABLE 2 / DRAINAGE SUMMARY—SANTA FE ROUTE

Drainage Area Designation	Area (Acres)	Discharge for a 50 Yr. Storm (cfs)	Existing Major Structures	Proposed Major Structure	Remarks
A	1,174	1,148	7′ x 4′ CBC @ Mississippi Ave.	Existing 7′ x 4′ CBC @ Mississippi	The proposed structure is not adequate (a 12′ x 8′ or 10′ x 9′ CBC is required for a 50 year storm), but to propose the necessary structure would require a major improvement in the Denver storm sewer system leading to this outlet. This improvement was not considered probable in the foreseeable future.
A-1	235	227	60″ RCP @ Asbury Ave.	Existing 60″ RCP @ Asbury Ave.	The 33″ storm sewer on Broadway in this area is assumed to be full during a severe rainstorm and will not intercept any appreciable runoff from Area A-1. See Remarks for Area D for further explanation.
B	1,721	1,290	10′ x 4′ CBC @ Arizona Ave.	Existing 10′ x 4′ CBC @ Arizona Ave.	The proposed structure should be much larger (12′ x 8′ CBC). A complete revision of the storm sewer system along the Valley Highway and Arizona Ave. leading into this culvert would need to be performed. Now the drainage flow in excess of the culvert capacity ponds in the Valley Highway depressed section under South Logan St.
C & C-1	48 + 66 = 114	183	30″ line @ Iowa then 36″ line north	Existing 30″ & 36″ lines	When Denver improves its storm sewer system, an improvement for this area can be constructed at that time with no disruption to the freeway.
D	64	128	60″ RCP @ Asbury Ave.	An additional 60″ RCP @ Evans Ave.	The need for the additional capacity at Evans Ave. is obvious because runoff from Area A-1 must cross in this same general area. The two 60″ pipes will be adequate assuming the network east of the railroad tracks is designed to channel approximately equal flow to each pipe.
E	3,956	2,670	15′ x 9′ CBC @ Wesley Ave.	Existing 15′ x 9′ @ Wesley Ave.	This structure is adequate. Should Denver desire in the future, some runoff could be channeled from Areas A-1, D, and F to this system.
F	168	265	2 small box culverts near Bates	66″ RCP @ Yale Ave.	A ditch should be provided between the railroad tracks to carry the flow from under the AT & SF Railroad at Bates Ave. up to Yale Ave. The interchange drainage plus a possible 33″ line from Englewood at this location resulted in the proposed 66″ line.
G	10,600 (below dam)	4,960	54′ bridge on Santa Fe Dr. @ Little Dry Creek	A 12′ x 10′ double CBC @ Little Dry Creek	The 6,050 acres above the dam were disregarded because two 50 year storms could occur within 24 hours without causing overflow of the spillway. For the crossing of the freeway, box culverts were chosen because of the proximity of Dartmouth Ave. to Little Dry Creek. Dartmouth Ave. is proposed to pass under the freeway and railroad tracks in this location.
H	213	330	54″ RCP @ Hampden Ave.	Existing 54″ RCP @ Hampden Ave.	Englewood is installing a 48″ line from Kenyon Ave. to join the existing 54″ line at Hampden Ave. to carry this runoff. During a design storm, the 54″ line will not carry the entire flow and any excess will pond east of the railroad tracks. There is no way (existing or proposed) for the runoff to flow across the tracks to the west.
I	1,108	943	None operating	66″ RCP approximately 750′ north of Oxford Ave.	The 66″ pipe conforms with Englewood's plans for the future. A 12′ x 7′ CBC is theoretically required to carry the 50 year storm runoff, but because any excess flow will pond east of the tracks, a larger culvert under the freeway would serve no purpose. The culvert is located approximately 750′ north of Oxford Ave. to avoid the deep cut in the freeway profile in the vicinity of Oxford Ave.
J	12,285	3,850	54′ bridge on Santa Fe Dr. @ Big Dry Creek	Matching bridges	A 10′ x 10′ double CBC would carry the expected flow but since the existing bridge can be saved, it was decided to propose matching bridges.
K	1,601	1,260	10′ x 10′ CBC near Prince St. & Santa Fe Dr.	9′ x 6′ double CBC approx. 600′ S. of existing culvert	The capacity of the existing 10′ x 10′ CBC has been cut in half by a 48″ sanitary sewer passing directly through it. The drainage from Area K now passes through an undersized concrete culvert 60″ (more or less) to reach the existing 10′ x 10′ CBC. From Prince Street to the river, a joint project with Arapahoe County, City of Littleton, and the State Highway Division should be undertaken to provide the proposed structure. This proposed structure is shown on Drawing 15 of the Santa Fe Route.
L	1,867	1,385	4′ x 4′ CBC near Low Ave. in Ltn.	13′ x 9′ CBC near Low Ave. in Ltn.	The City of Littleton has very little storm sewer system, either existing or proposed. Since it could be as much as 10 years before the freeway is constructed in this area, another analysis of Littleton plans at a later date may indicate a smaller culvert.

Drainage Area Designation	Area (Acres)	Discharge for a 50 Yr. Storm (cfs)	Existing Major Structures	Proposed Major Structure	Remarks
M	1,700	1,190	20′ bridge over Lee Gulch on Santa Fe Dr.	Matching bridges	As in the case of Area J above, a culvert would be adequate, but matching bridges are planned to match the existing bridge.
N	418	645	6′ x 7′ CBC @ approx. Sta. 472+70	Extension of 6′ x 7′ CBC	Theoretically a 10′ x 6′ CBC would have been required if the six detention ponds plus the constricting 6′ x 7′ CBC under the railroad tracks did not exist. Because of the upstream conditions, the existing 6′ x 7′ CBC is assumed to be adequate.
O	83	206	4 small culverts	60″ RCP @ approx. Sta. 500+00	It has been assumed that all runoff can be channelled to a single collection point and will be carried across the railroad tracks.
P	349	524	6′ x 2′ CBC just south of existing Ken Caryl Rd.	9′ x 6′ CBC south of proposed Ken Caryl Rd.	This culvert is rerouted further to the south of the natural drainage draw in the proposed interchange location and is best shown on the Ken Caryl Rd. interchange, Drawing 40.
Q	5,916	2,300	60′ bridge across Dad Clark Gulch	14′ x 10′ CBC in Dad Clark Gulch	Flow was routed through the McClellan Reservoir Dam system for a 50 year design storm, assuming the reservoir level was at spillway crest. This resulted in maximum discharge over the spillway of 2,300 cfs.
R	113	147	3 small culverts	54″ RCP north of County Line Rd.	Same assumption as Area O above.

A study of grades along the Santa Fe Route indicated that all sanitary sewer lines can be relocated satisfactorily to flow by gravity. No detailed design was made for utilities, but each was individually considered to insure that its proposed relocation was realistic.

It was found that utilities do constitute a major portion of the construction costs for the Santa Fe Route, but because of the utilities which can be abandoned in place, utilities relocations are not as serious as a first inspection of the utility drawings would suggest.

CONSTRUCTION PHASING

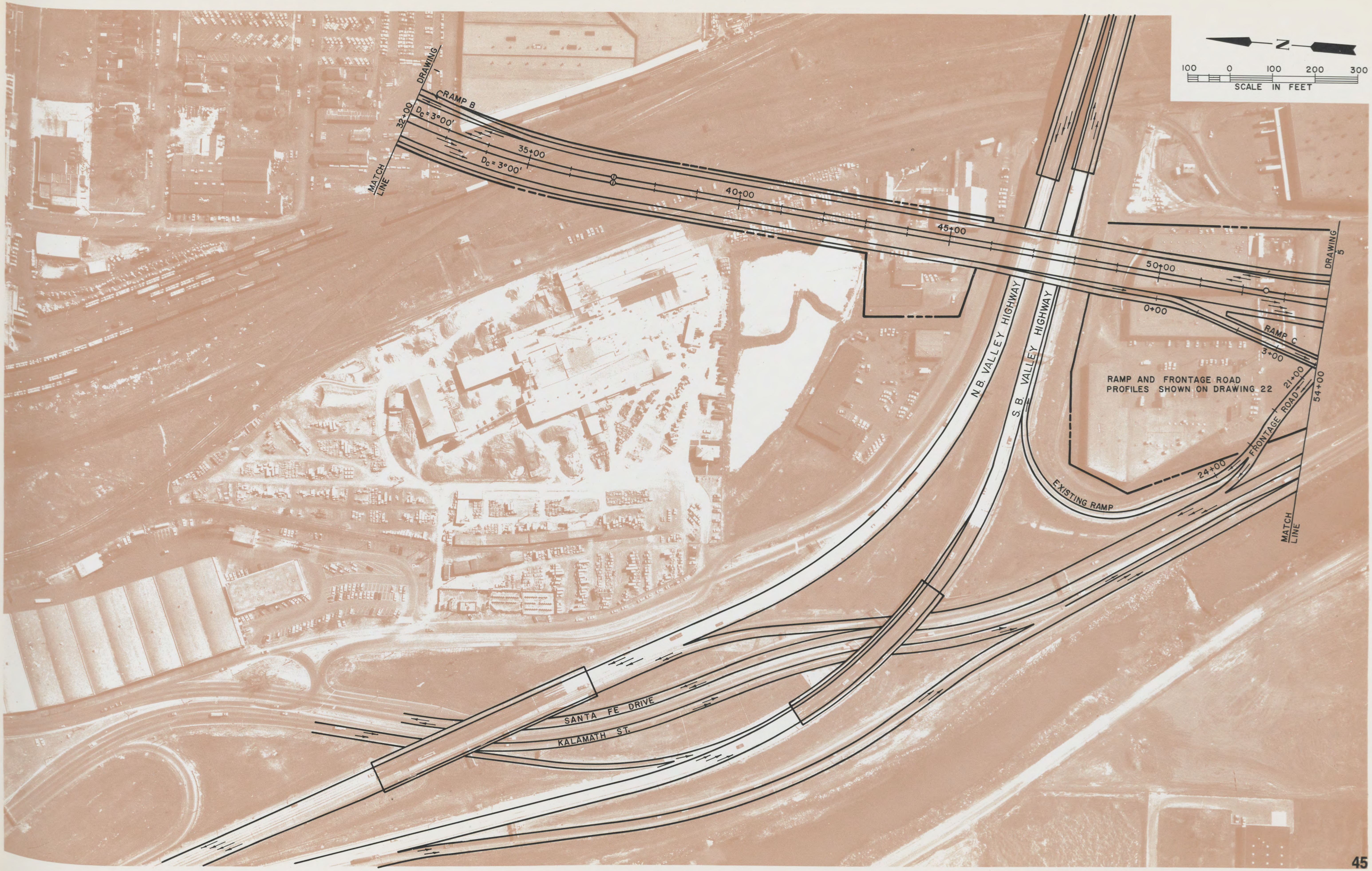
The high cost of the total project along the Santa Fe Route will probably require its construction in at least six segments. Six possible segments are (1) Valley Highway through Evans Ave.; (2) Evans Ave. through Hampden Ave.; (3) Broadway—Lincoln viaduct to Valley Highway; (4) Hampden Ave. through Belleview Ave.; (5) Belleview Ave. through Ridge Rd.; and (6) Ridge Rd. to end of project.

Traffic from Santa Fe Dr. can be expected to use all segments of the completed Freeway along its route, including the viaduct structure to Lincoln—Broadway as soon as it is completed. However, construction along Santa Fe Dr. can be expected to disrupt the corridor's existing traffic for an extended period irregardless of what is done to make construction detours as serviceable as possible. A minimum of 4 lanes of traffic must be maintained during construction of the Santa Fe route. Federal Blvd., Broadway, and both Platte River Drives can carry some of the Santa Fe Dr. traffic during construction, but Santa Fe Dr. traffic will have to be provided for during construction. In general, the southbound Freeway lanes and frontage roads west of Santa Fe Dr. should be constructed as a first phase. This would allow Santa Fe traffic to continue relatively undisturbed until a time when the traffic would be detoured onto the new southbound lanes and frontage road.

Interchanges at Evans, Yale, and Quincy Avenues can be constructed in their entirety with exception of the easterly ramps during the first phase of Freeway construction. Through traffic on Evans, Yale, Dartmouth, Quincy, Oxford, and Bowles Avenues will have to accept considerable detouring because either the existing street must be excavated or it must bridge an excavated freeway. This interruption of street traffic would be continuous for the duration of the interchange construction.

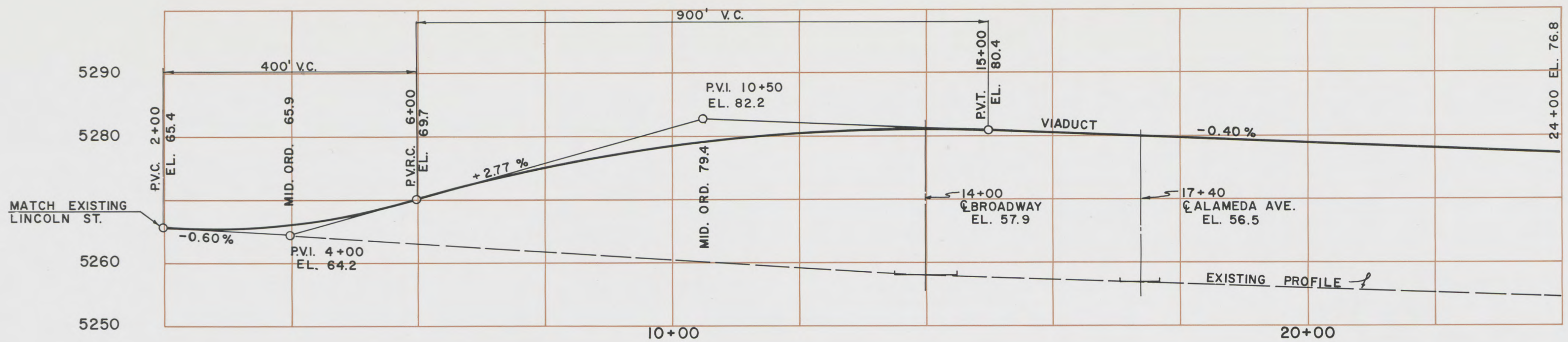
The Evans interchange offers a typical example of what may be involved in the detouring of traffic for the interchange construction. All detours should be one way with sharp turns rounded as much as possible to assist smooth traffic flow. Eastbound traffic on Evans could be detoured south on Galapago St., east on Iliff Ave., and north on Cherokee St. to Evans Ave. Traffic westbound on Evans could detour north on Cherokee St., west on Jewell Ave., and south on Galapago St. to Evans Ave. Construction of a rail crossing would be required for both Jewell Ave. and Iliff Ave., with installation of safety signals at the railroad tracks. A railroad track diversion (shoo-fly) would have to be constructed for use between the existing tracks during the railroad bridge construction. Santa Fe Dr. would have to be detoured far enough west to allow excavation room for the railroad bridges. It is estimated that approximately 12 to 15 months would be required to complete a typical grade separation crossing interchange. It is possible to detour traffic at all interchanges along the Santa Fe Route, although a considerable expense will be involved in all cases.

DRWG—1 / PLAN STA. 5 TO 32

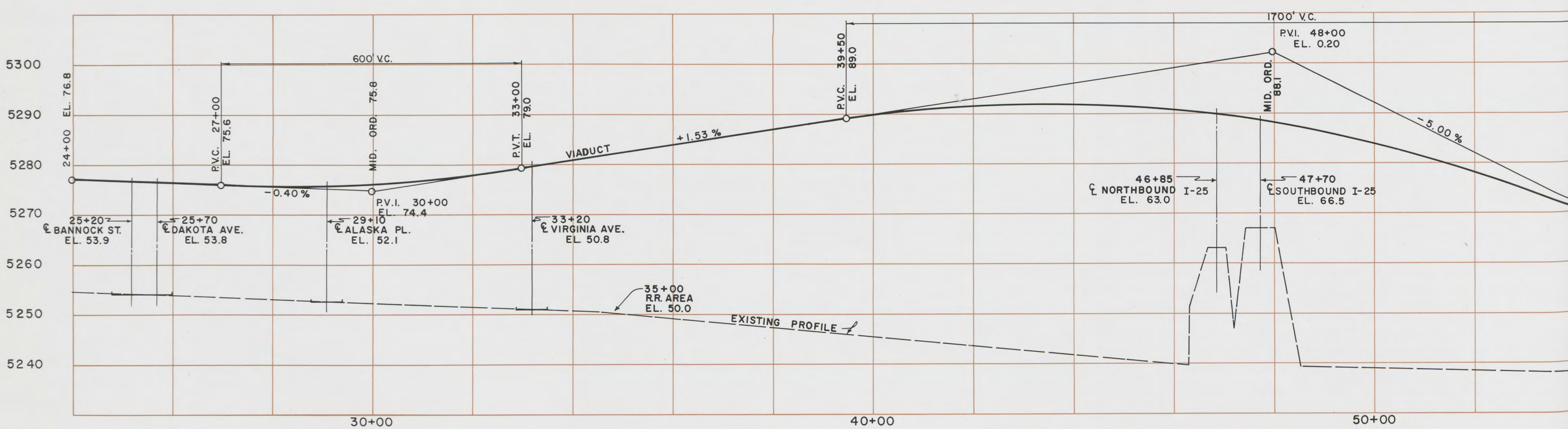


DRWG—2 / PLAN STA. 32 TO 54

DRWG—3 / PROFILE—NORTHBOUND STA. 2 TO 54

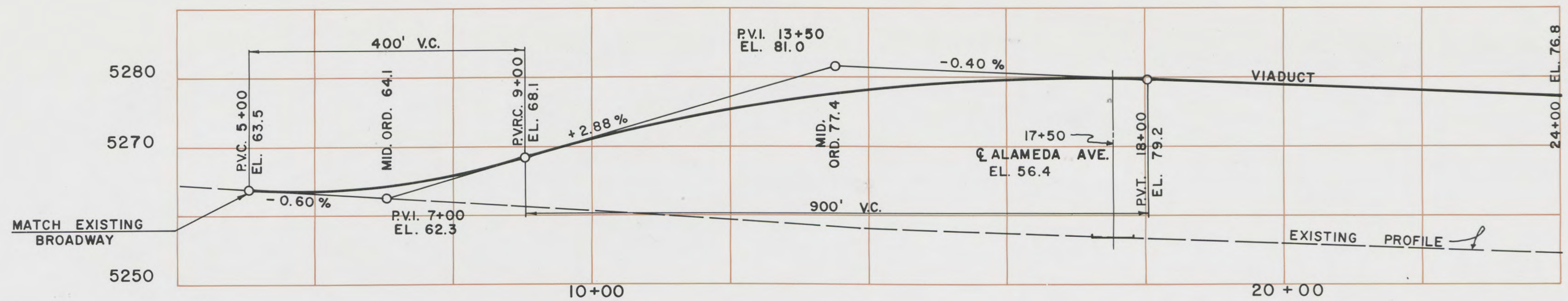


NORTHBOUND

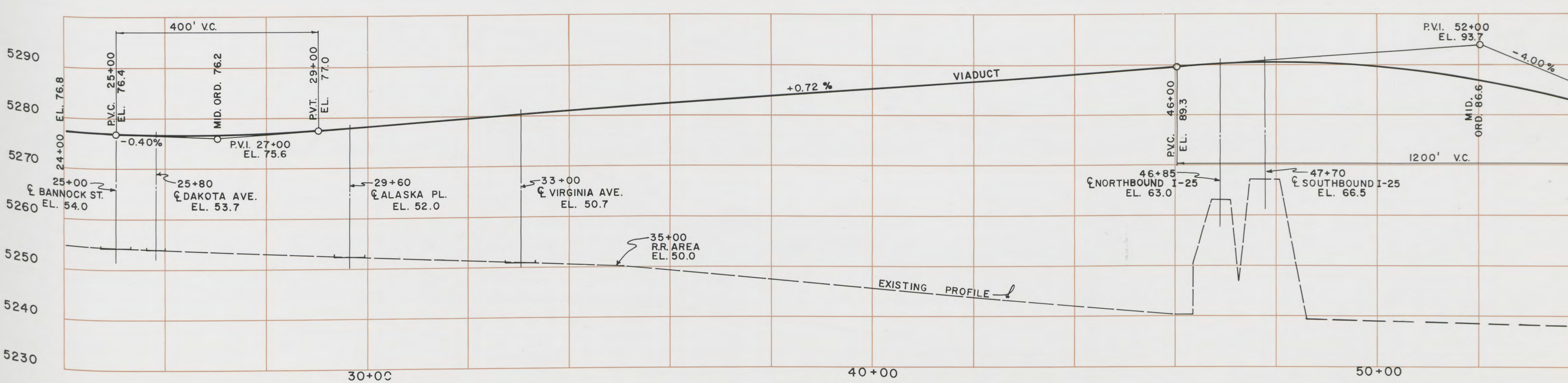


NORTHBOUND

DRWG—4 / PROFILE—SOUTHBOUND STA. 5 TO 54

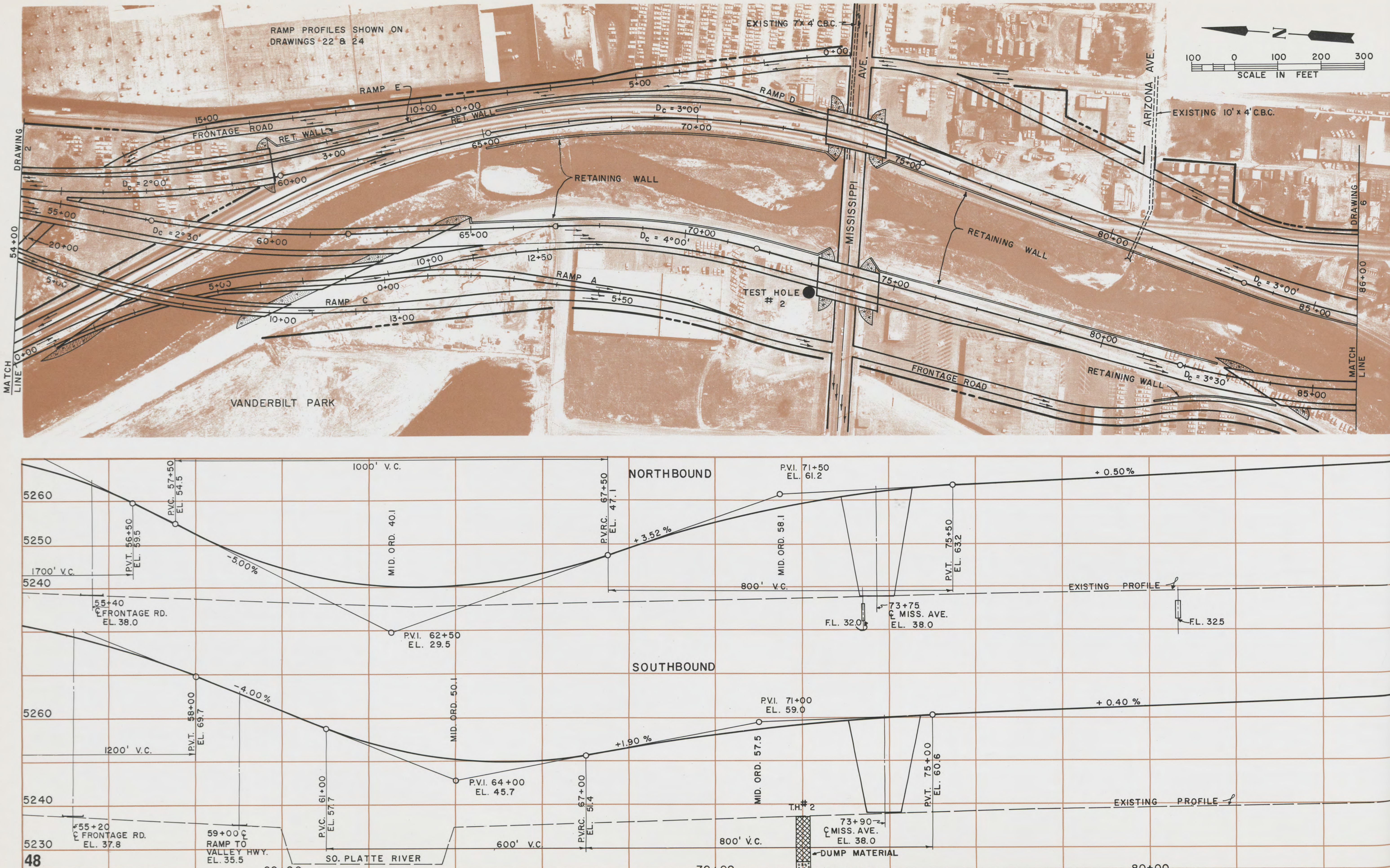


SOUTHBOUND

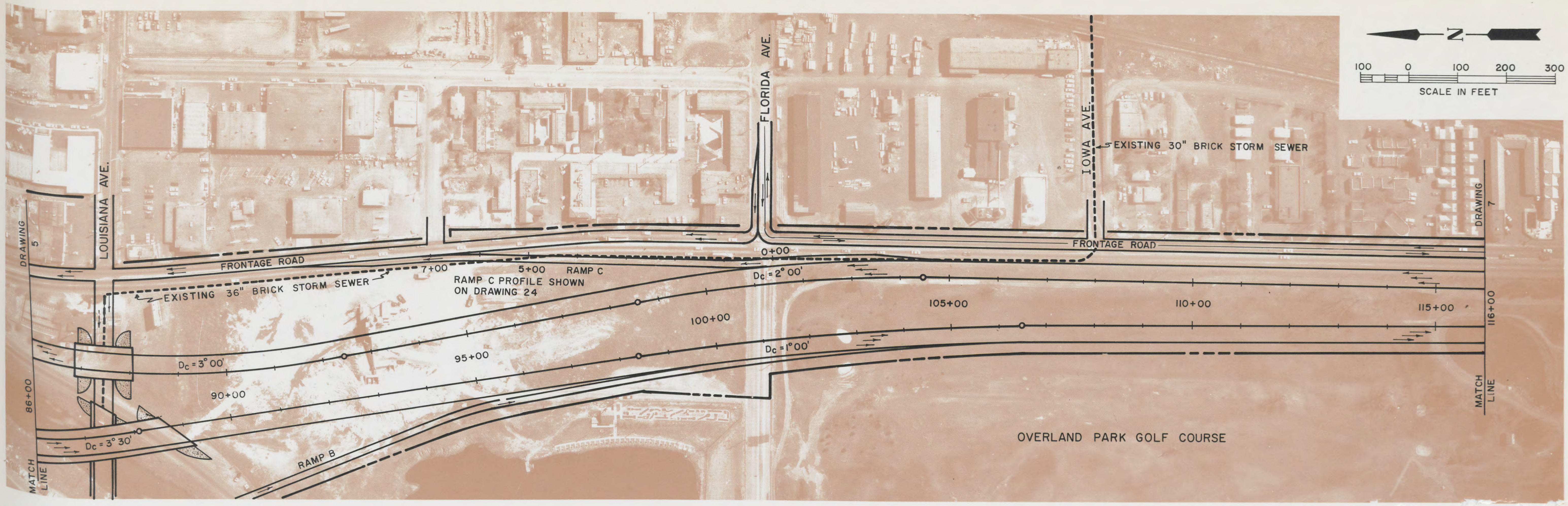


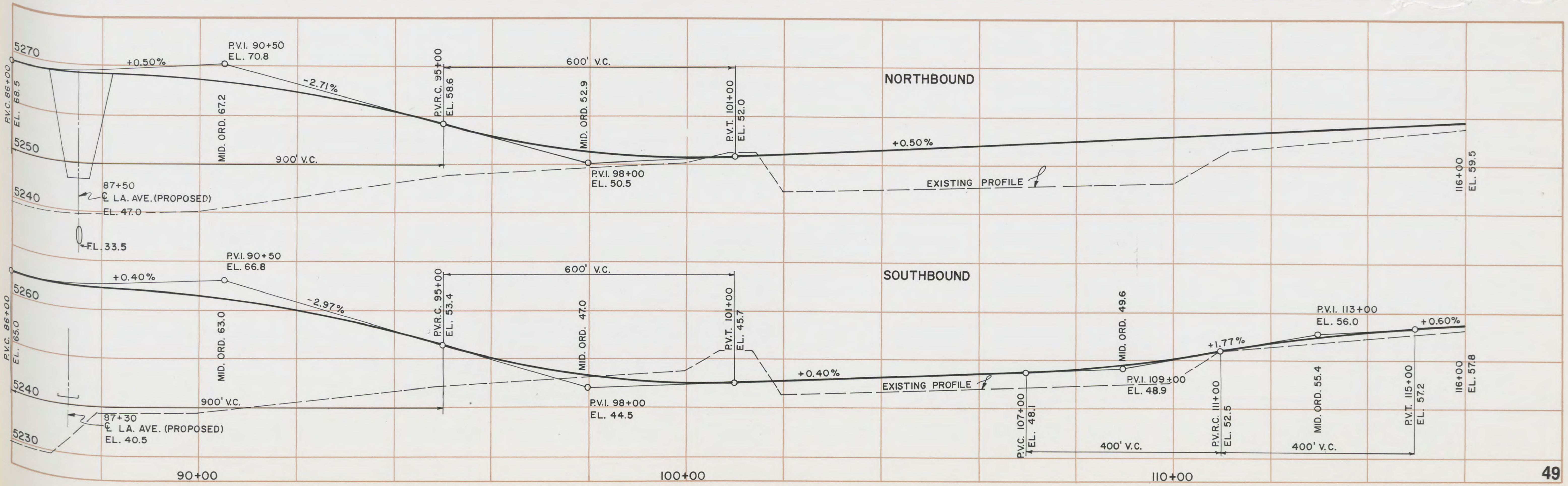
SOUTHBOUND

DRWG—5 / PLAN—PROFILE STA. 54 TO 86

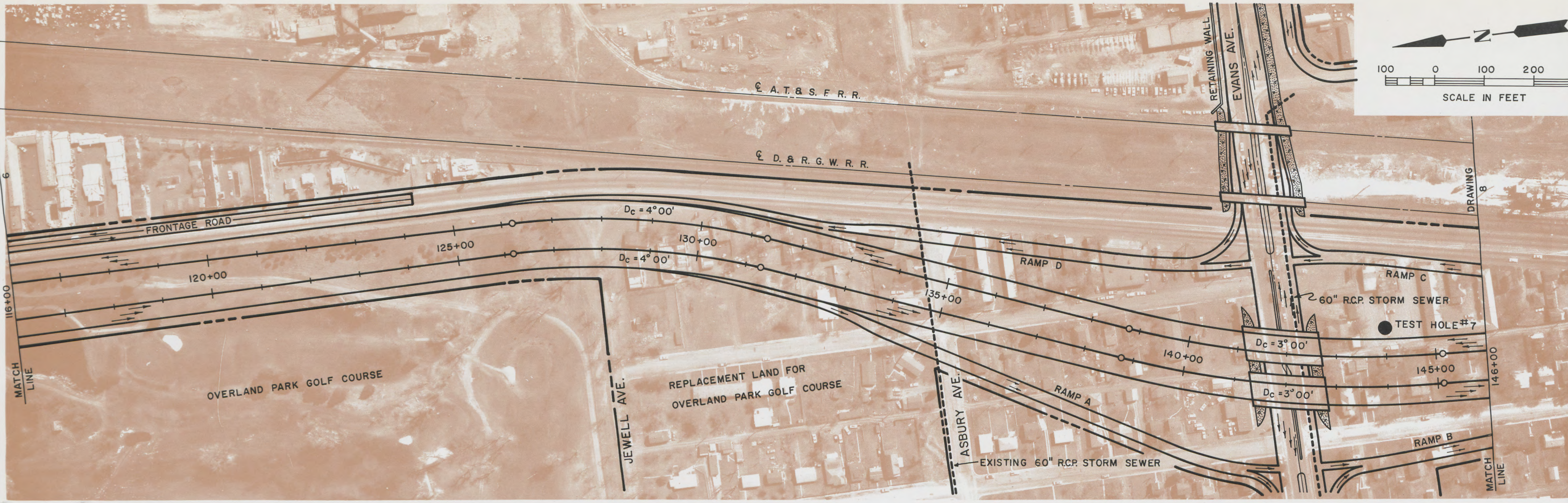


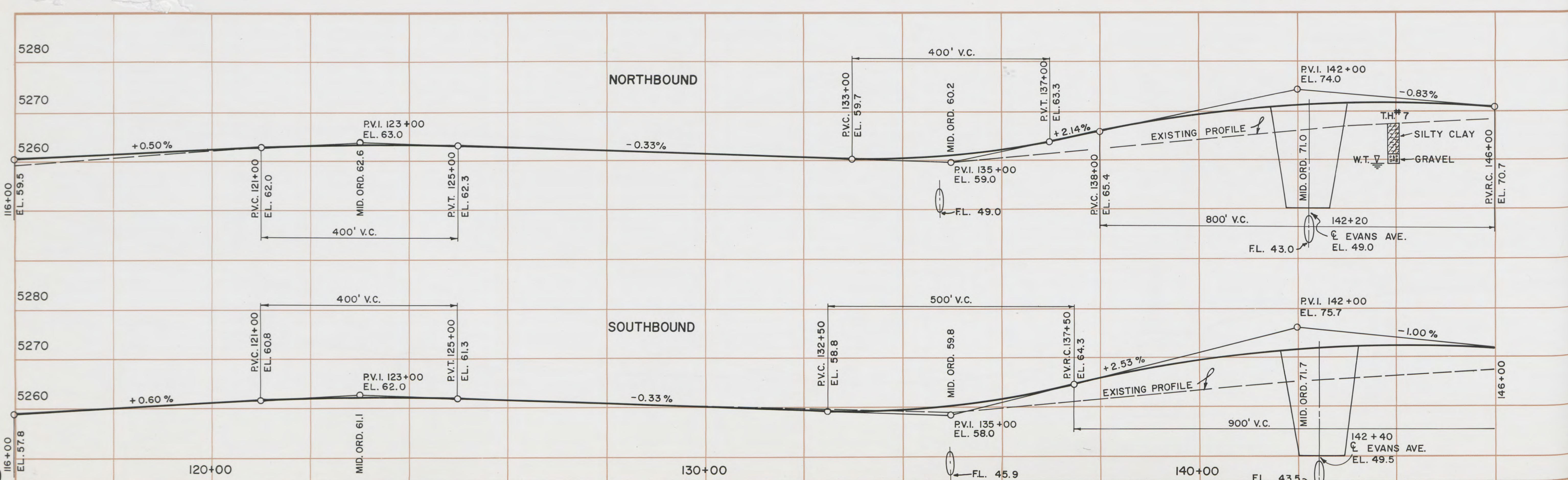
DRWG—6 / PLAN—PROFILE STA. 86 TO 116



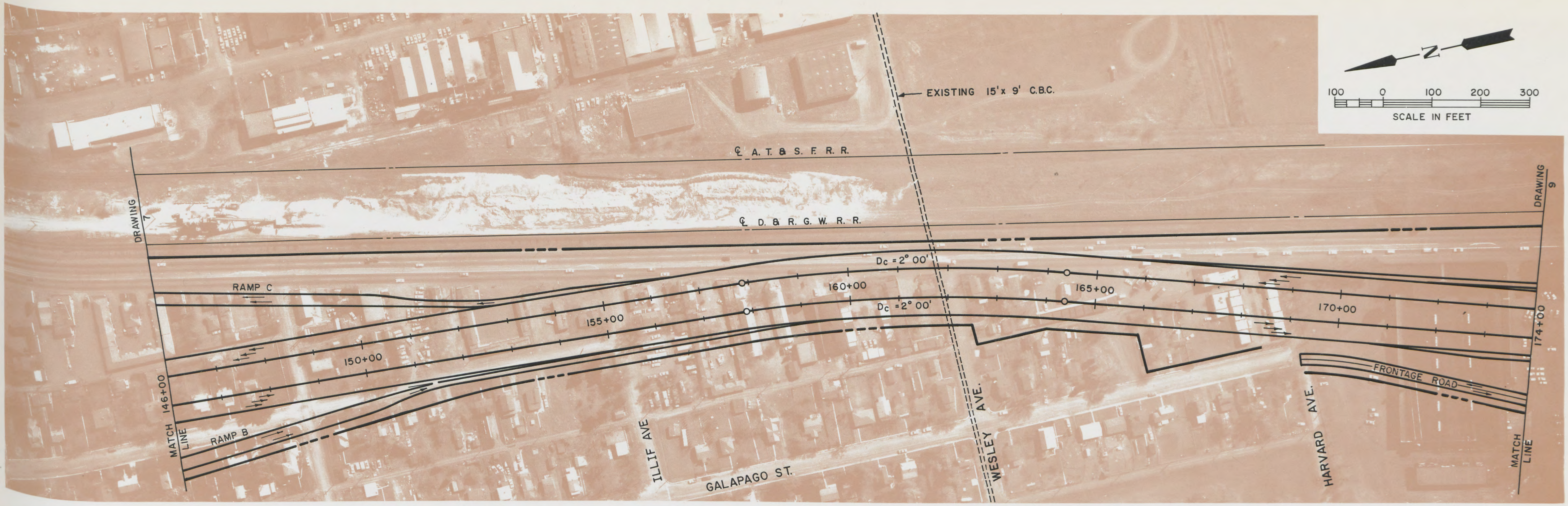


DRWG—7 / PLAN—PROFILE STA. 116 TO 146

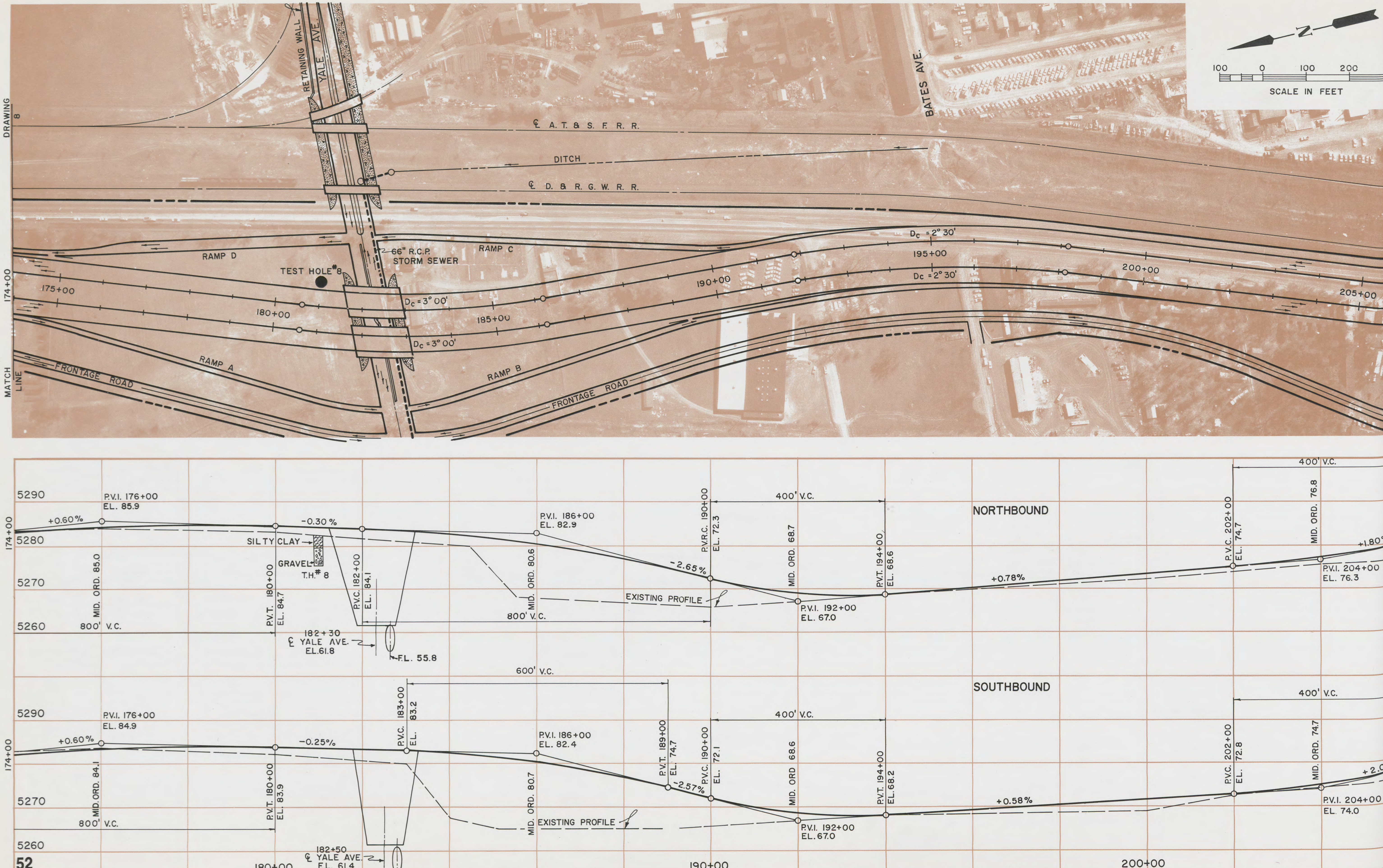




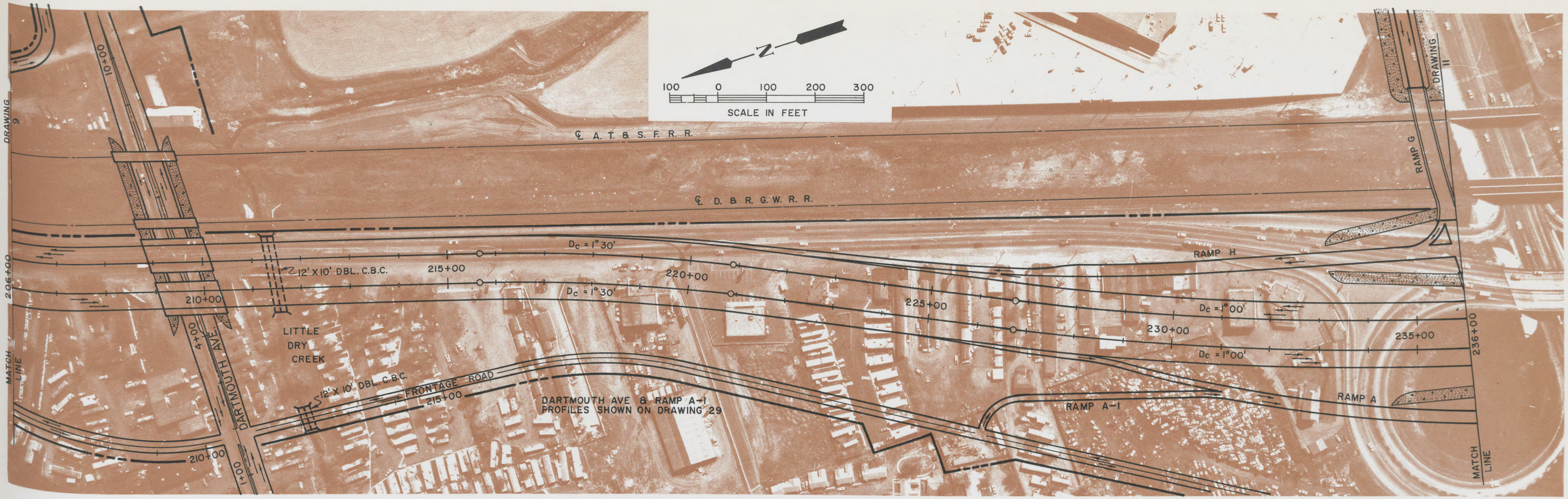
DRWG—8 / PLAN—PROFILE STA. 146 TO 174

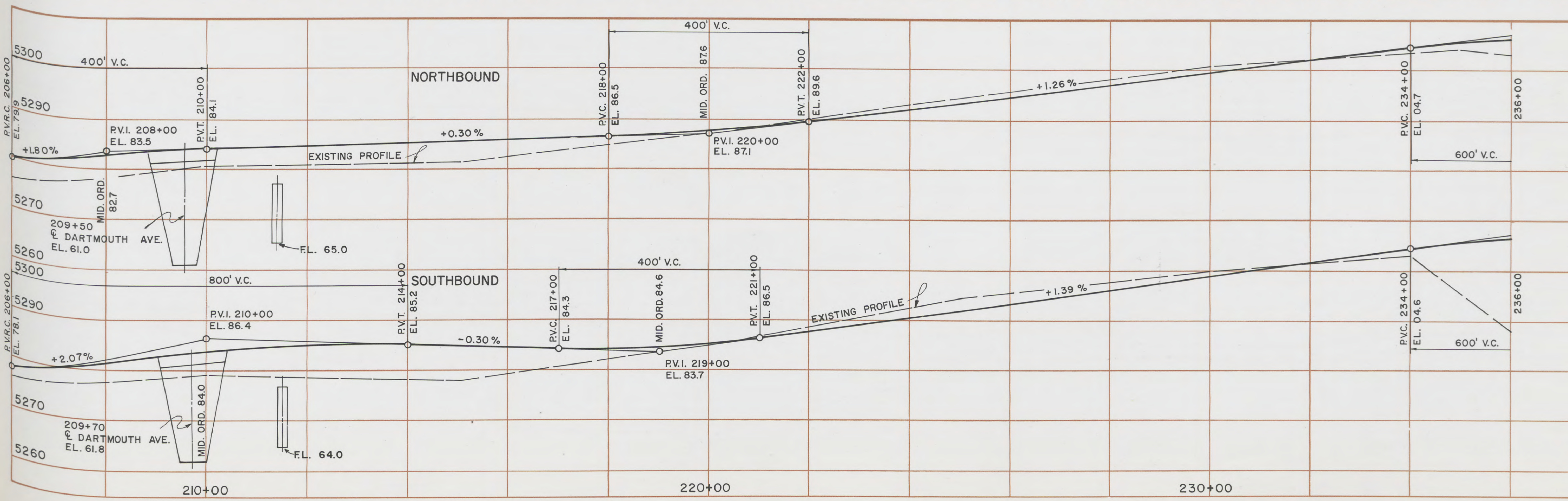


DRWG—9 / PLAN—PROFILE STA. 174 TO 206

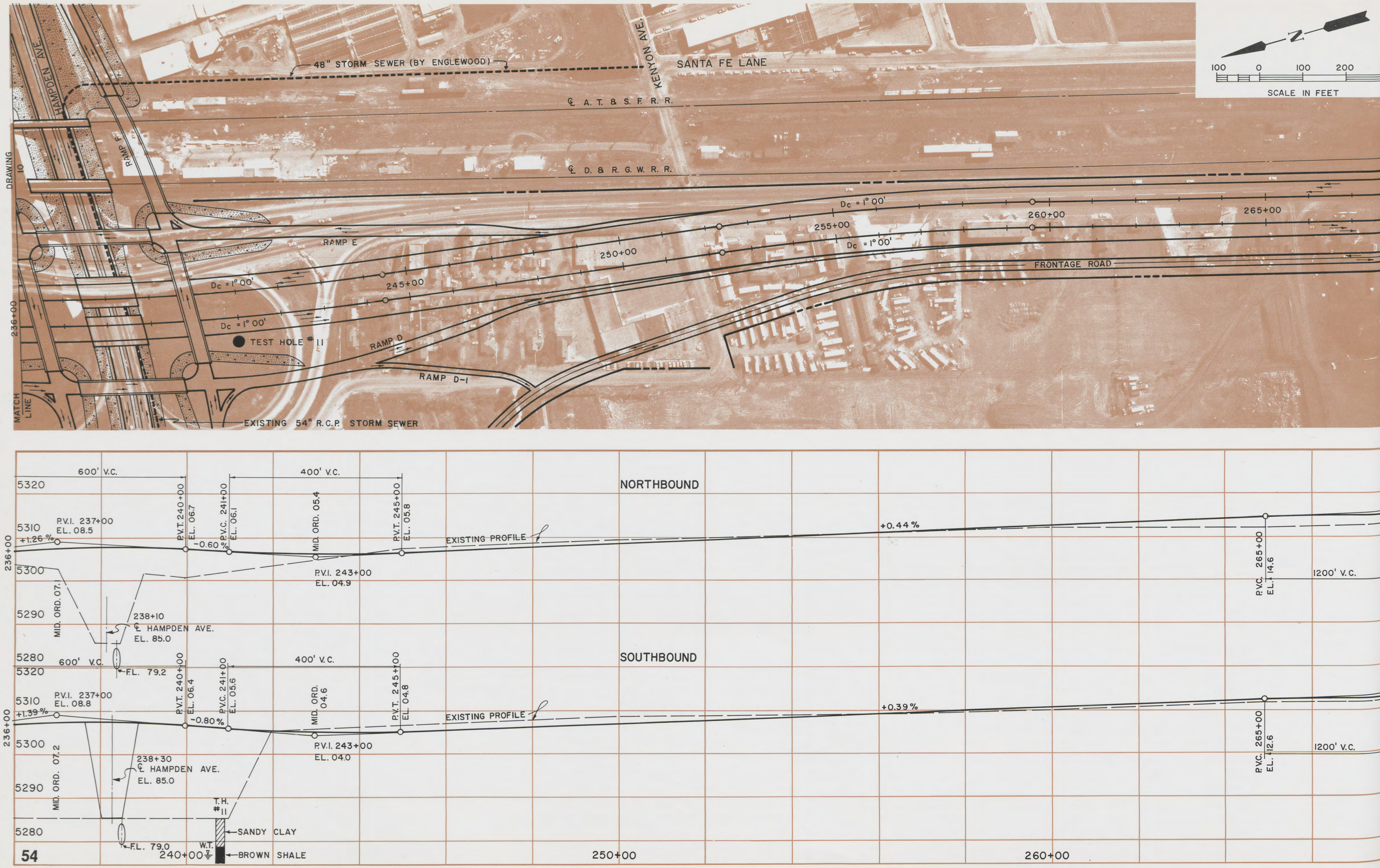


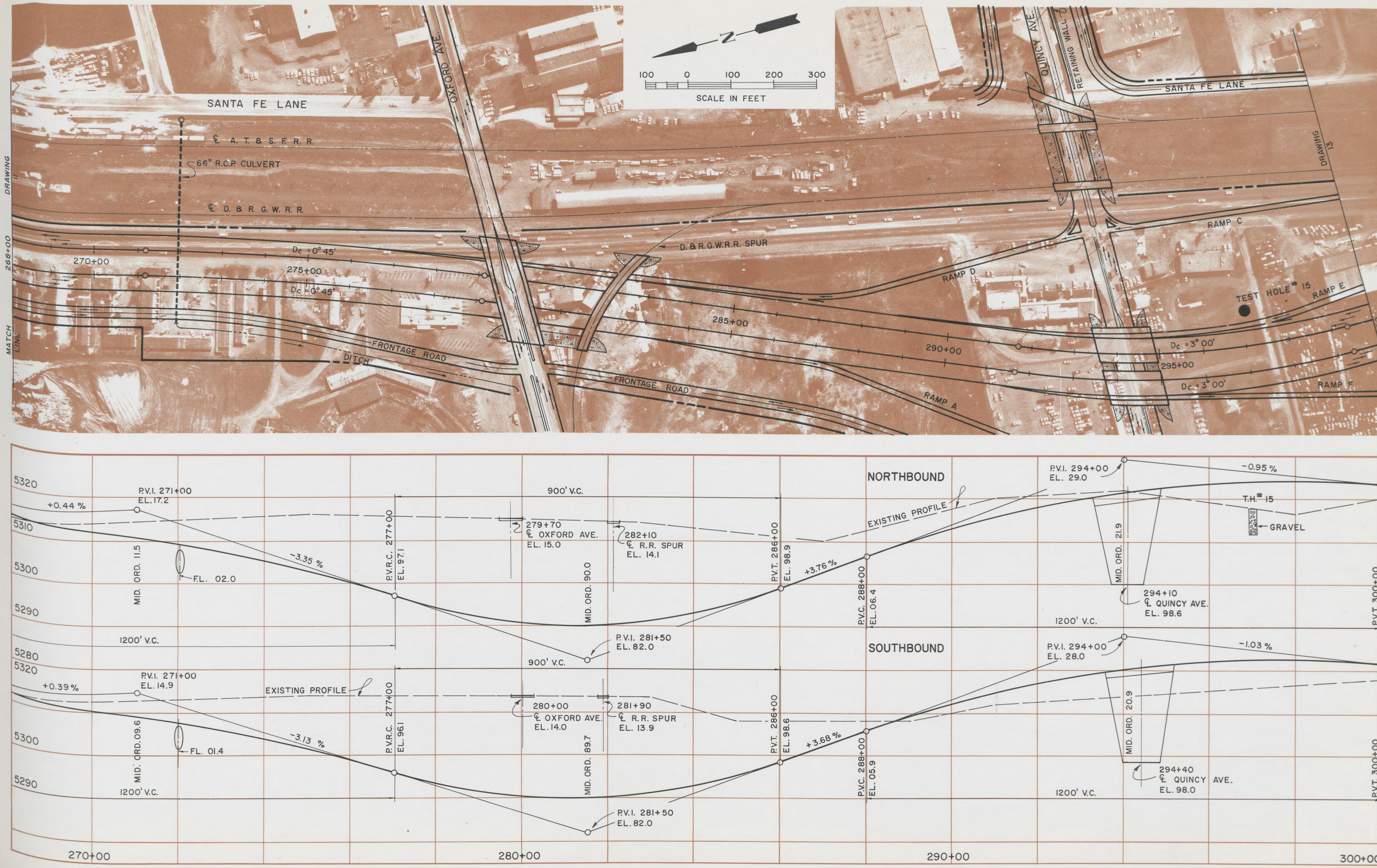
DRWG—10 / PLAN—PROFILE STA. 206 TO 236





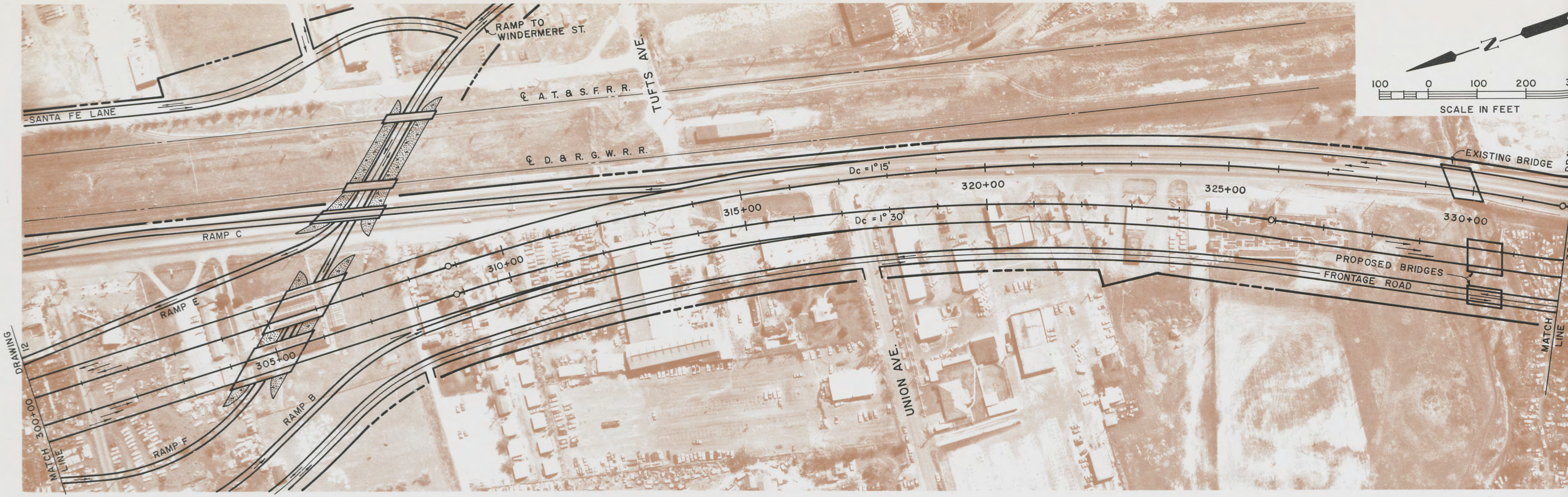
DRWG—11 / PLAN—PROFILE STA. 236 TO 268

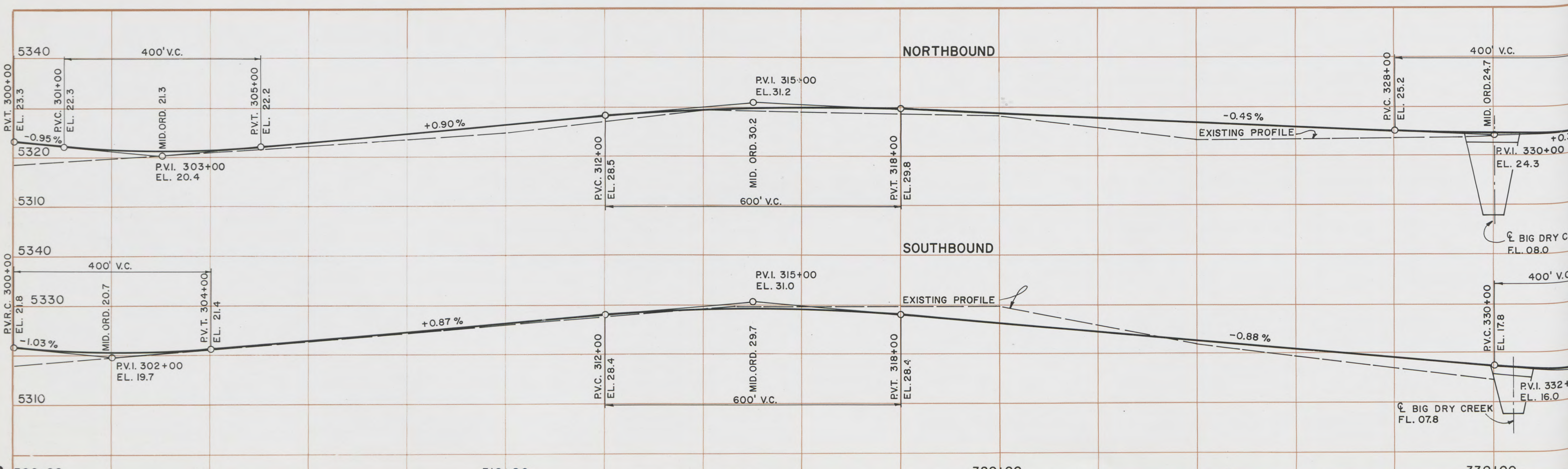


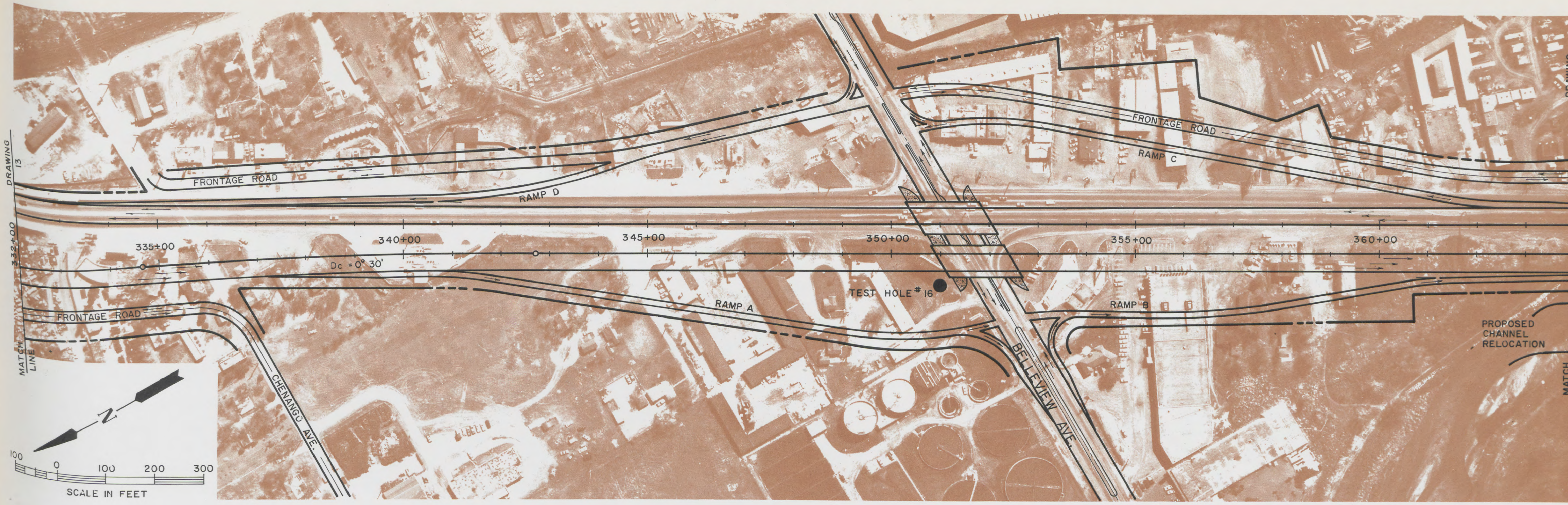


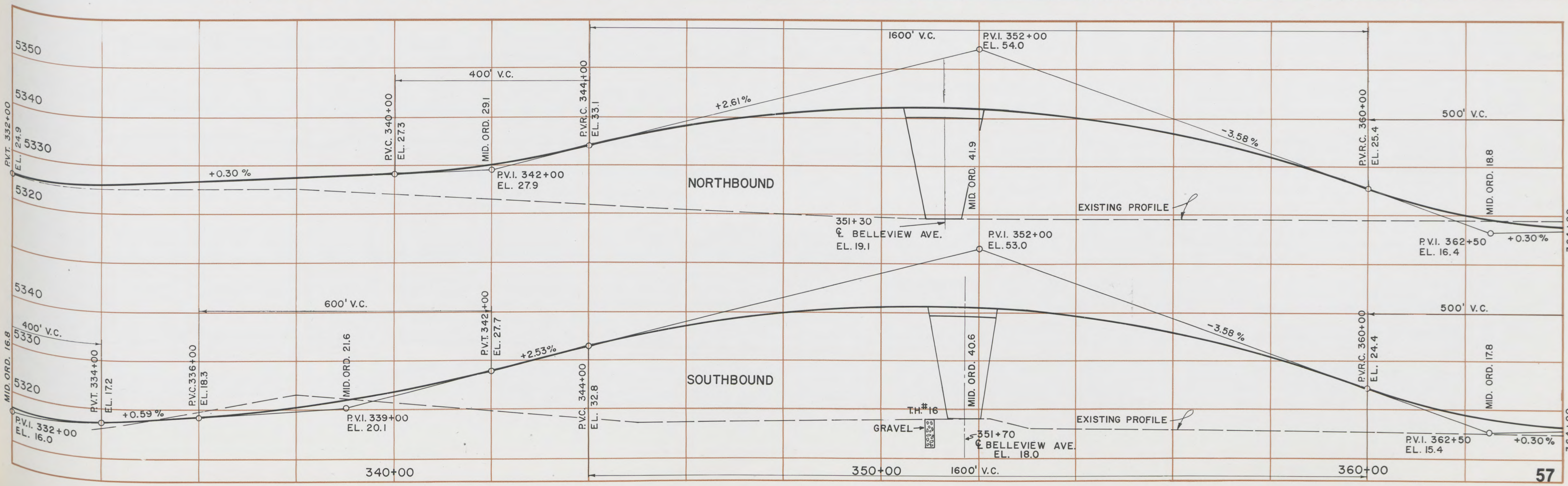
DRWG—12 / PLAN—PROFILE STA. 268 TO 300

DRWG—13 / PLAN—PROFILE STA. 300 TO 332



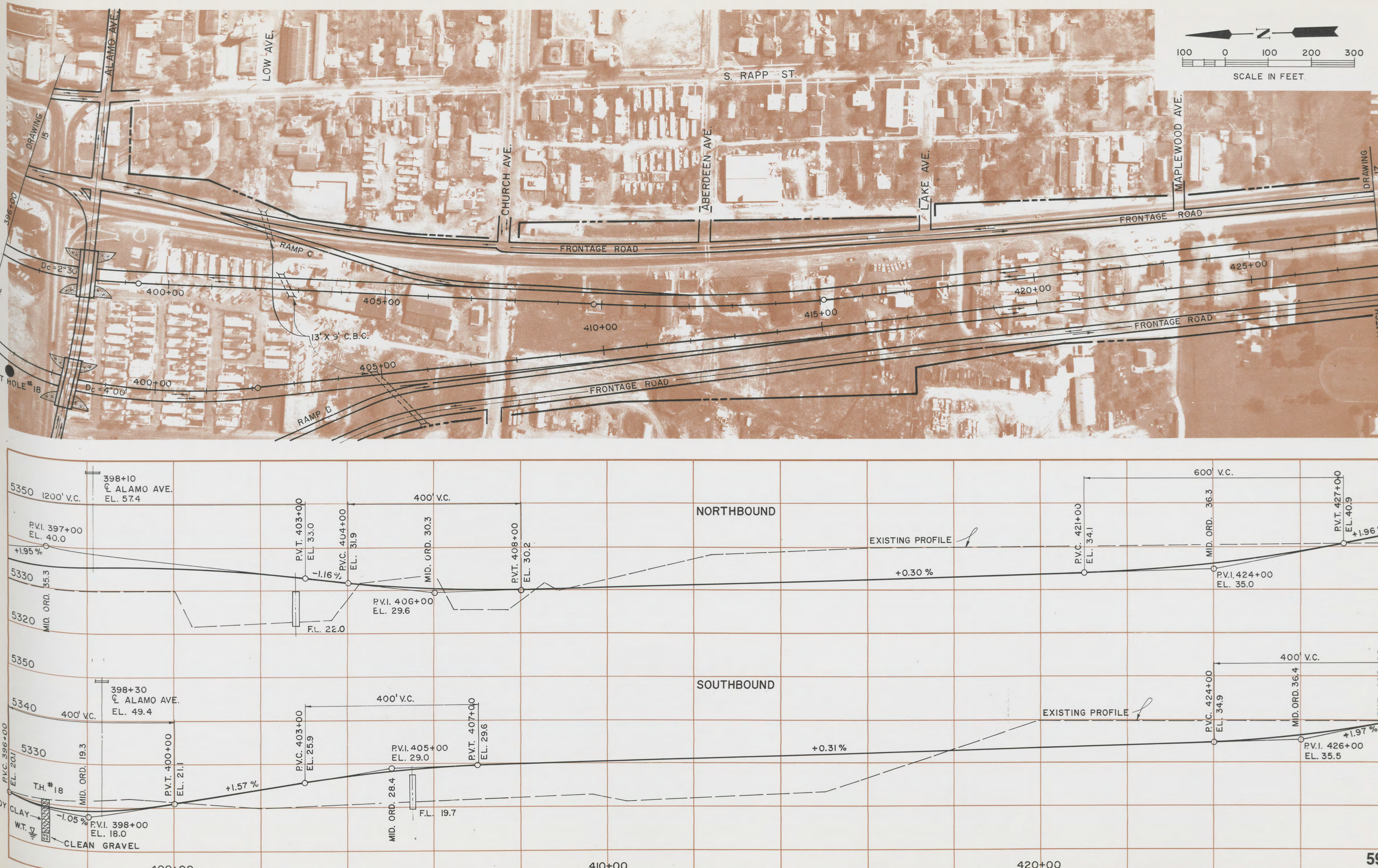






DRWG—14 / PLAN—PROFILE STA. 332 TO 364

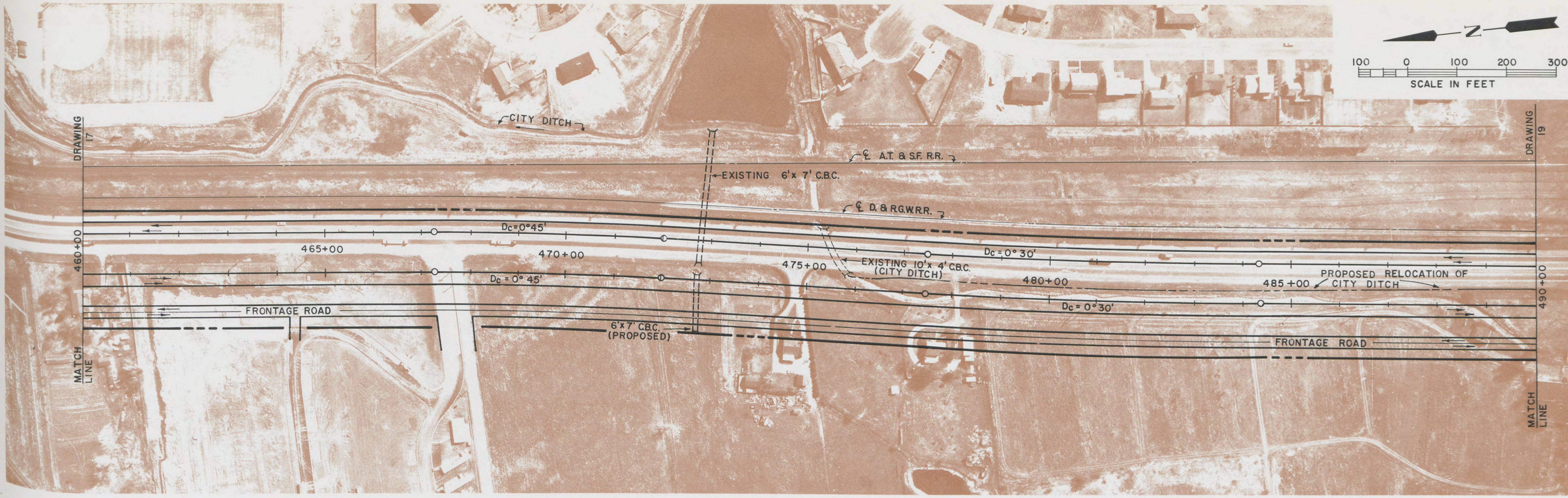
DRWG—15 / PLAN—PROFILE STA. 364 TO 396

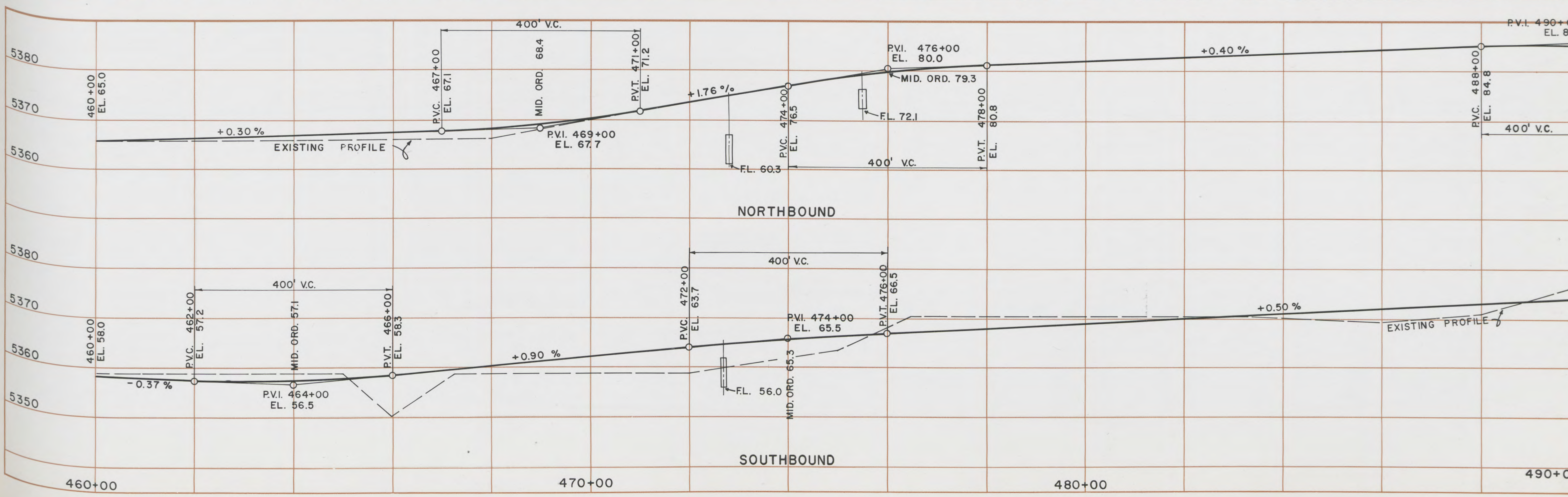


DRWG–16 / PLAN–PROFILE STA. 396 TO 428

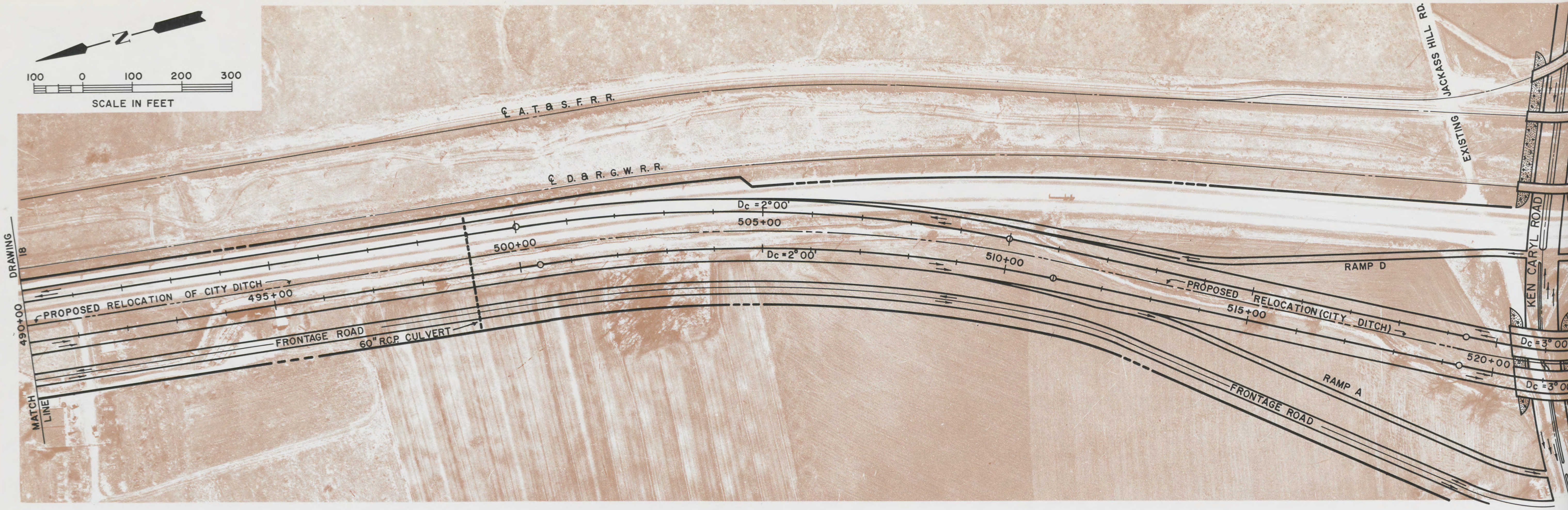
DRWG—17 / PLAN—PROFILE STA. 428 TO 460

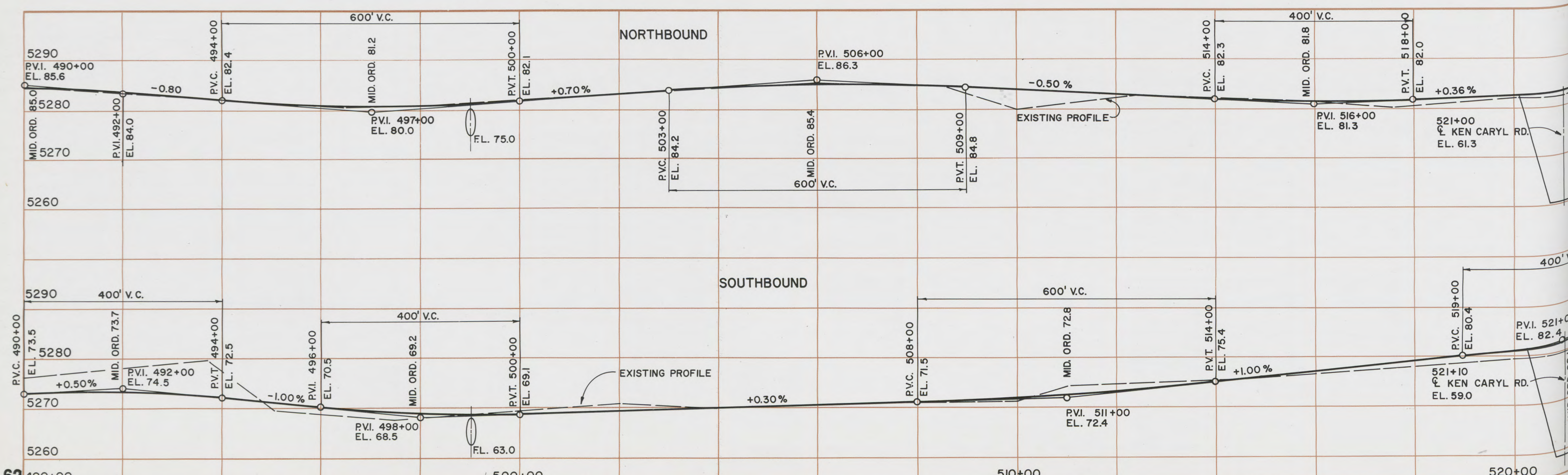
DRWG—18 / PLAN—PROFILE STA. 460 TO 490



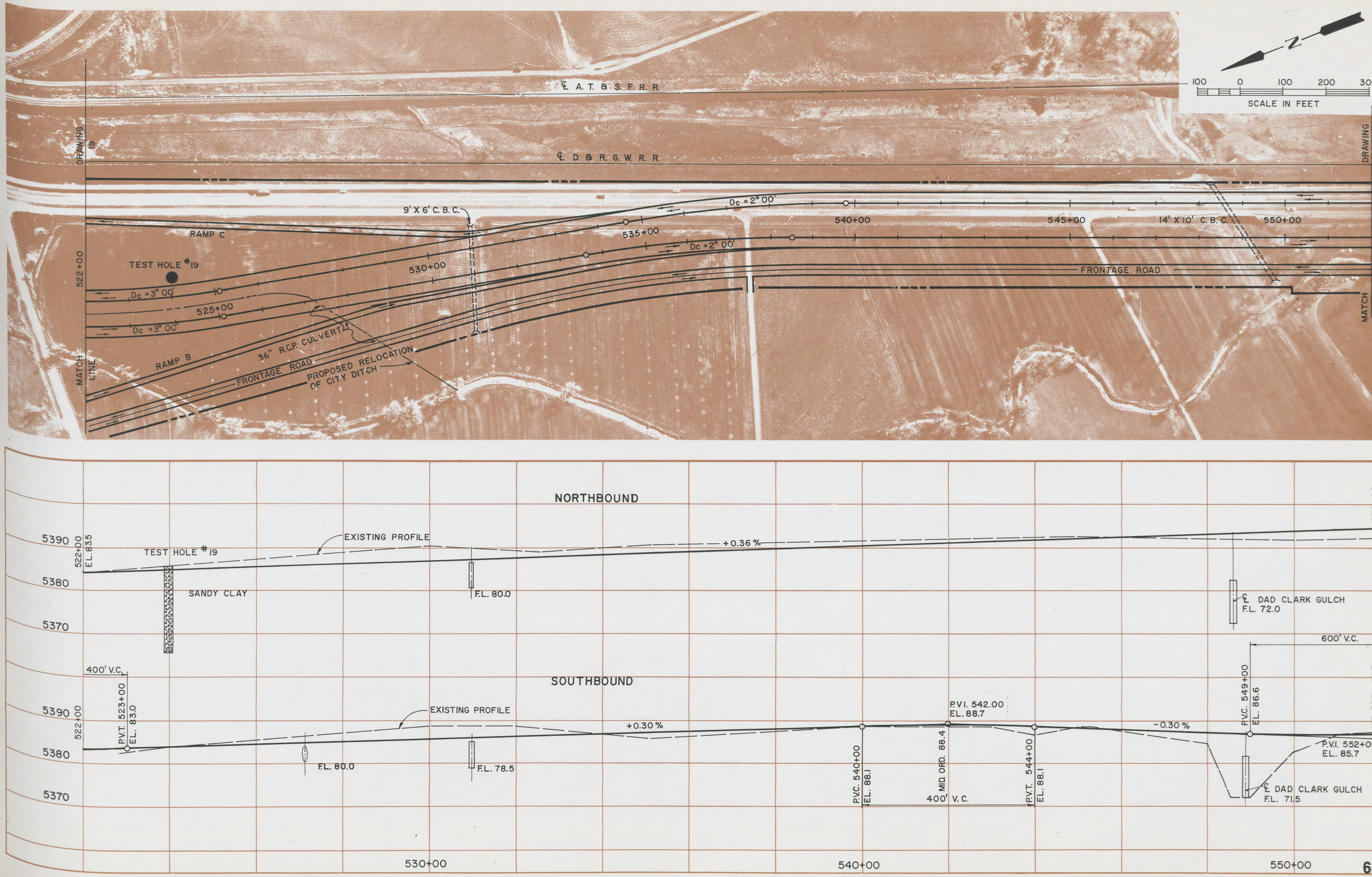


DRWG—19 / PLAN—PROFILE STA. 490 TO 522

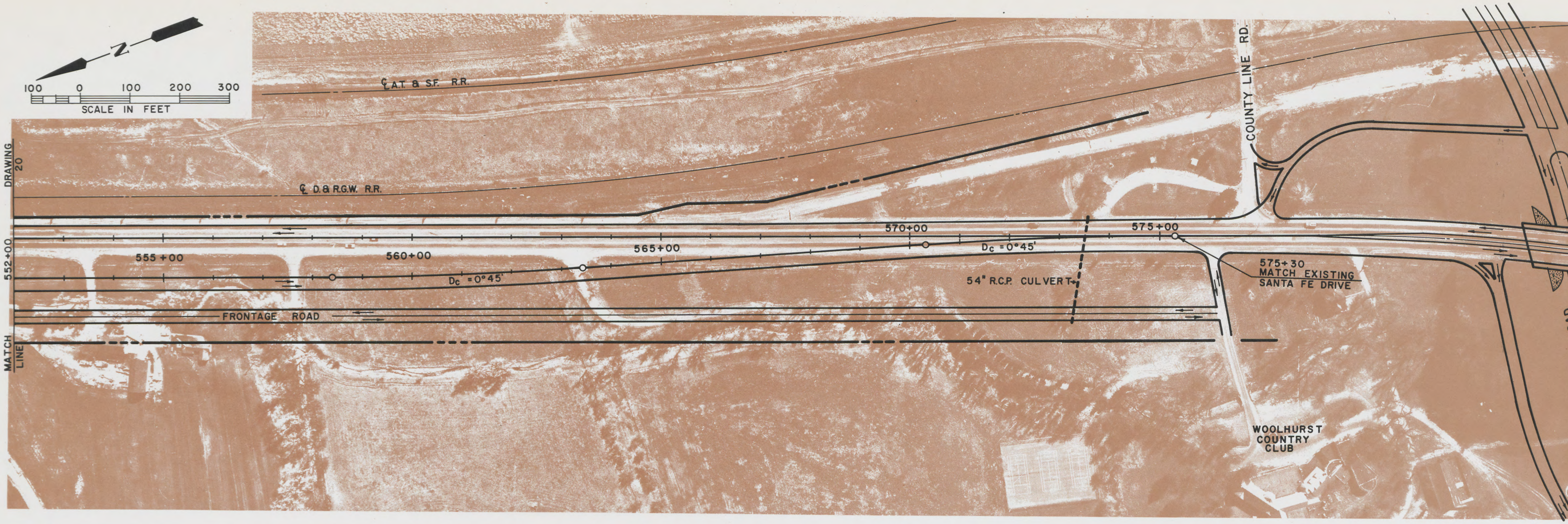


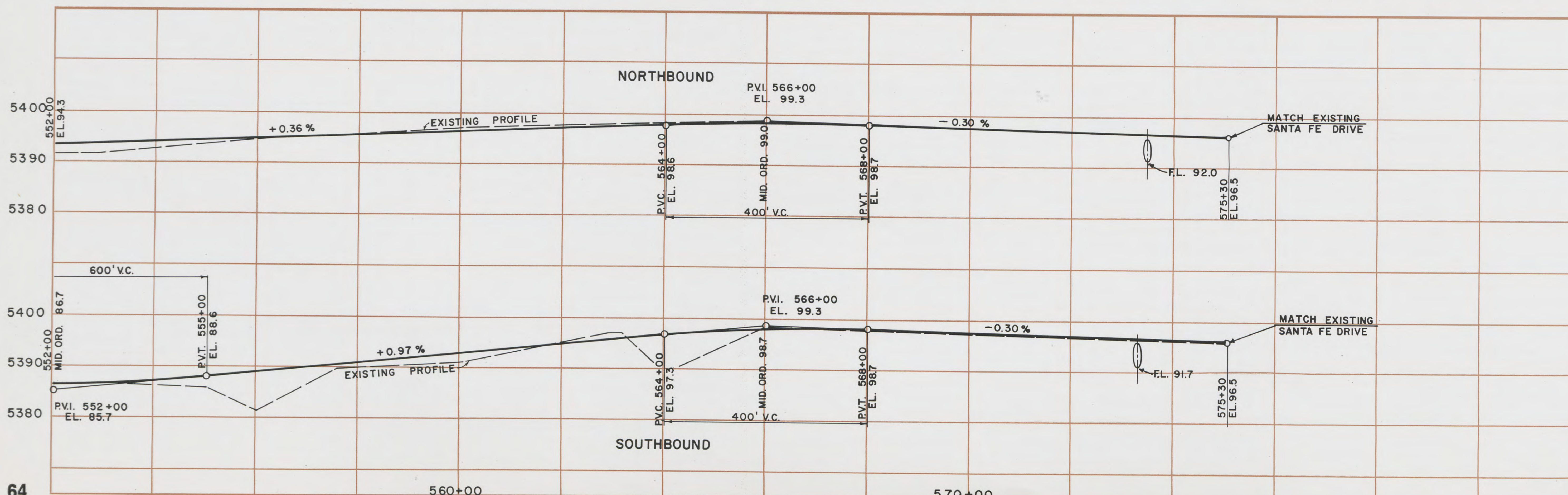


DRWG—20 / PLAN—PROFILE STA. 522 TO 552

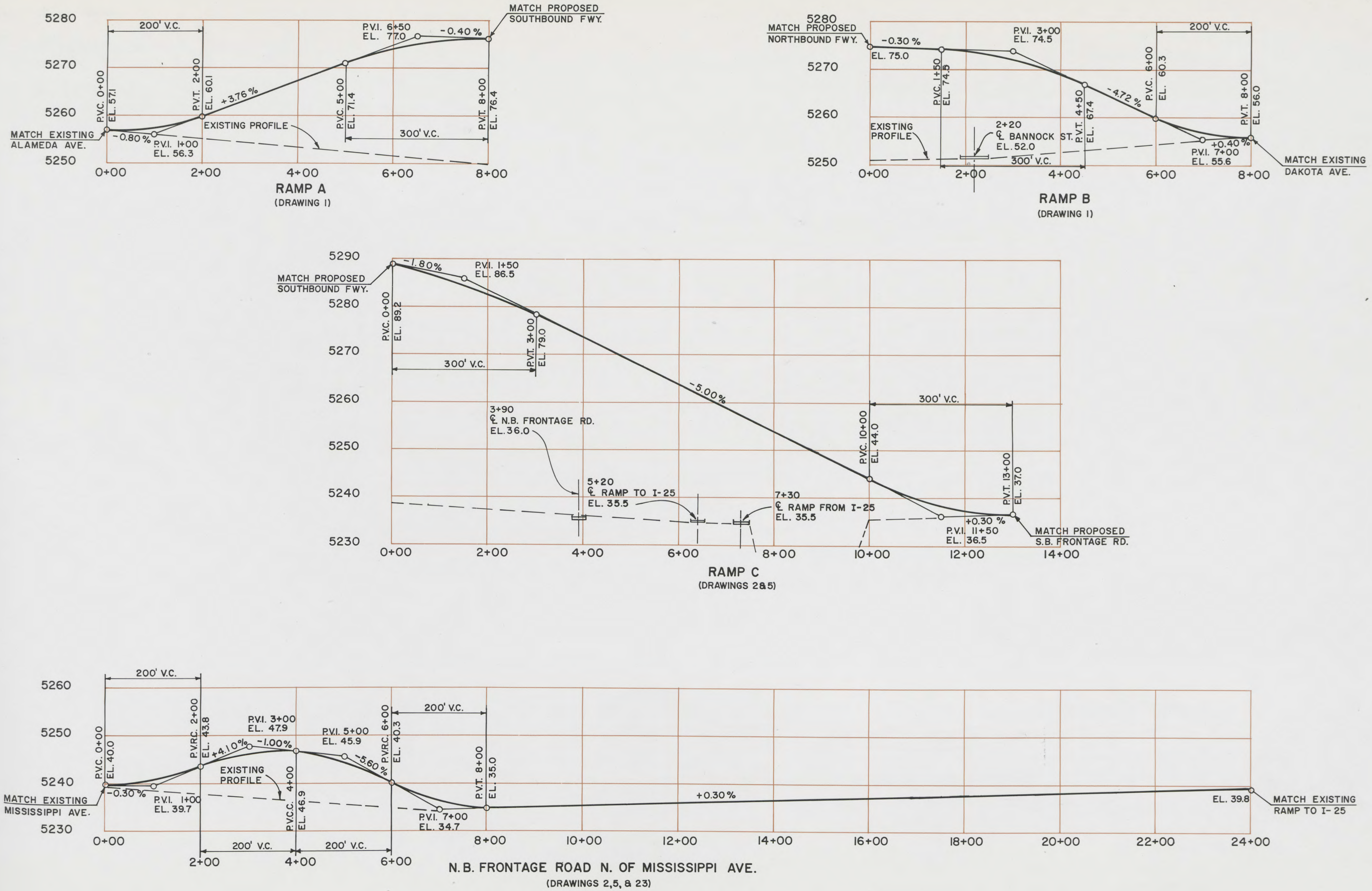


DRWG—21 / PLAN—PROFILE STA. 552 TO CHATFIELD ROAD

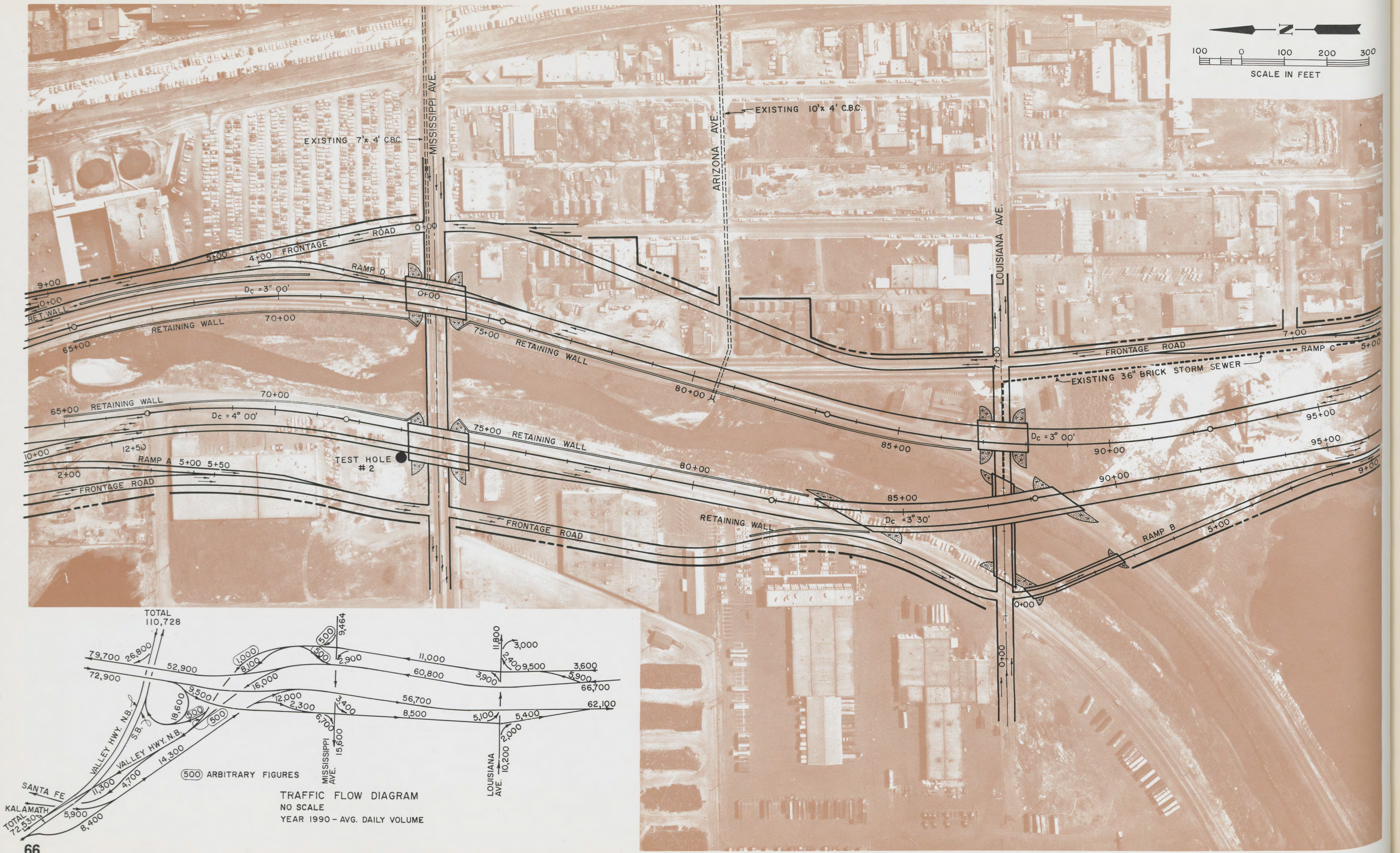




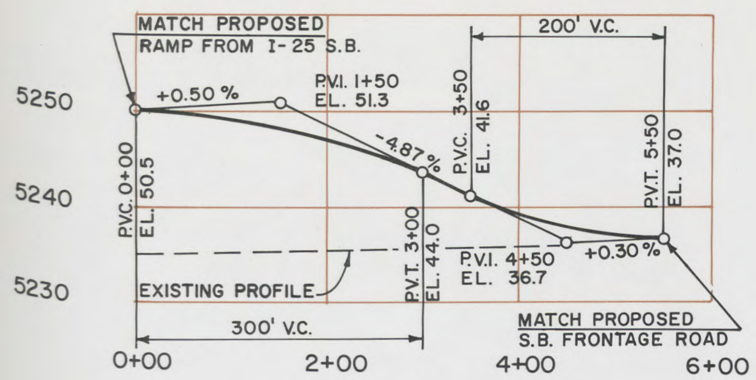
DRWG—22 / RAMP GRADES—NORTH OF VALLEY HIGHWAY



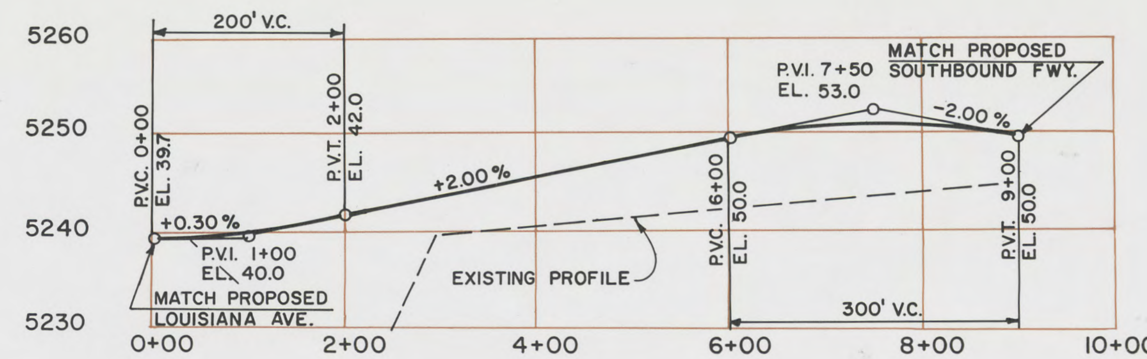
DRWG—23 / MISSISSIPPI—LOUISIANA INTERCHANGE



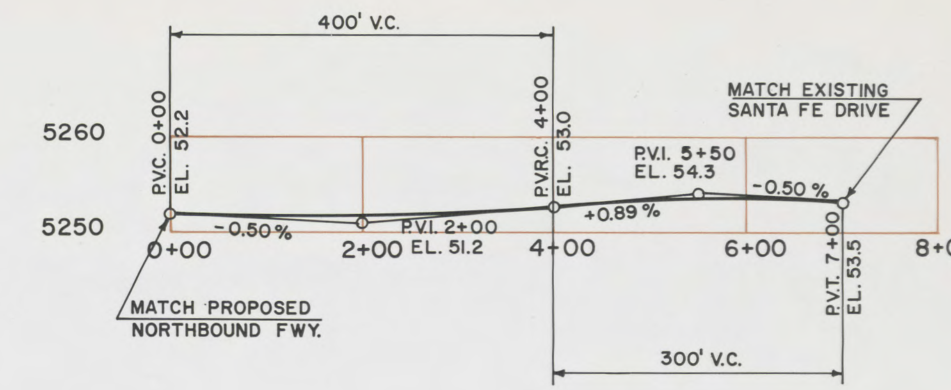
DRWG—24 / MISSISSIPPI—LOUISIANA INTERCHANGE GRADES



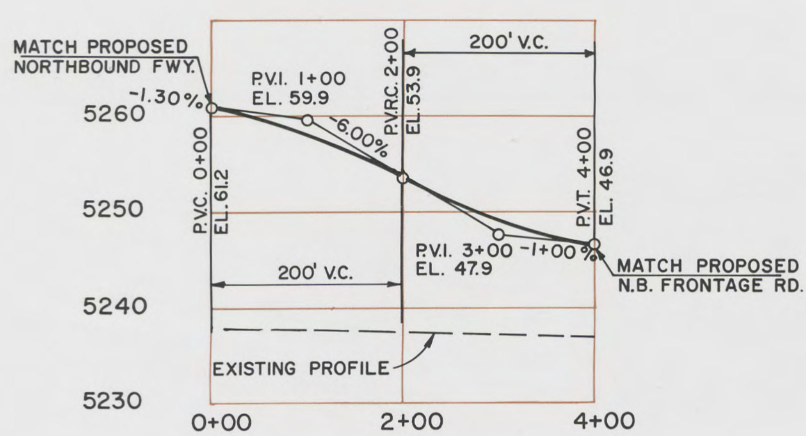
RAMP A



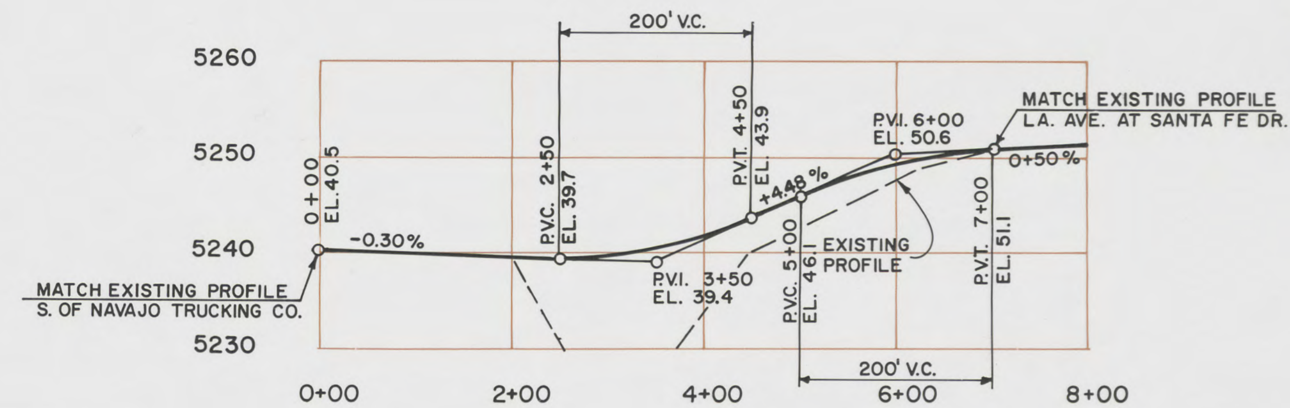
RAMP B



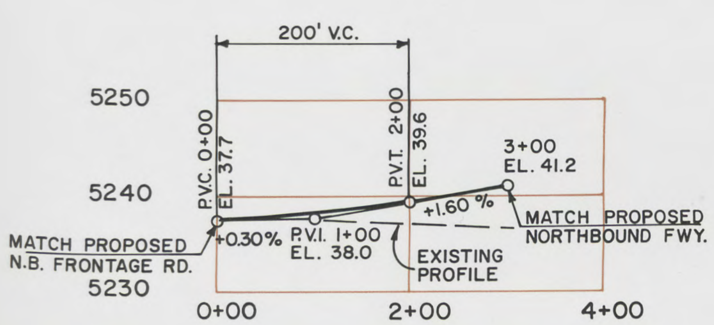
RAMP C



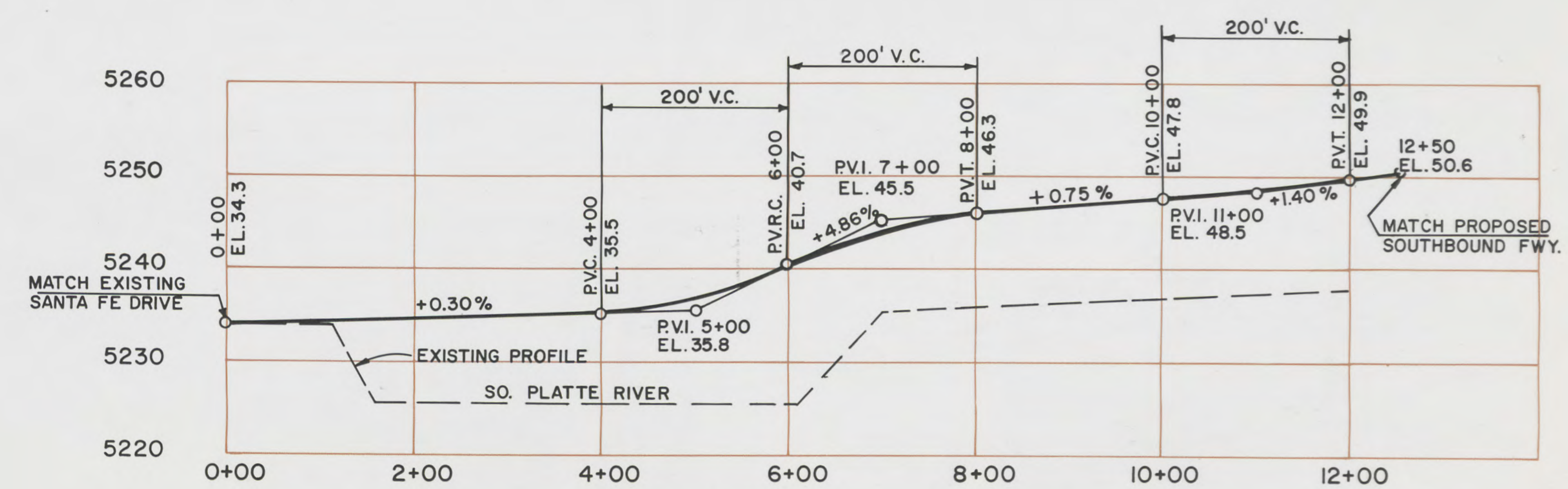
RAMP D



PROPOSED LOUISIANA AVE.

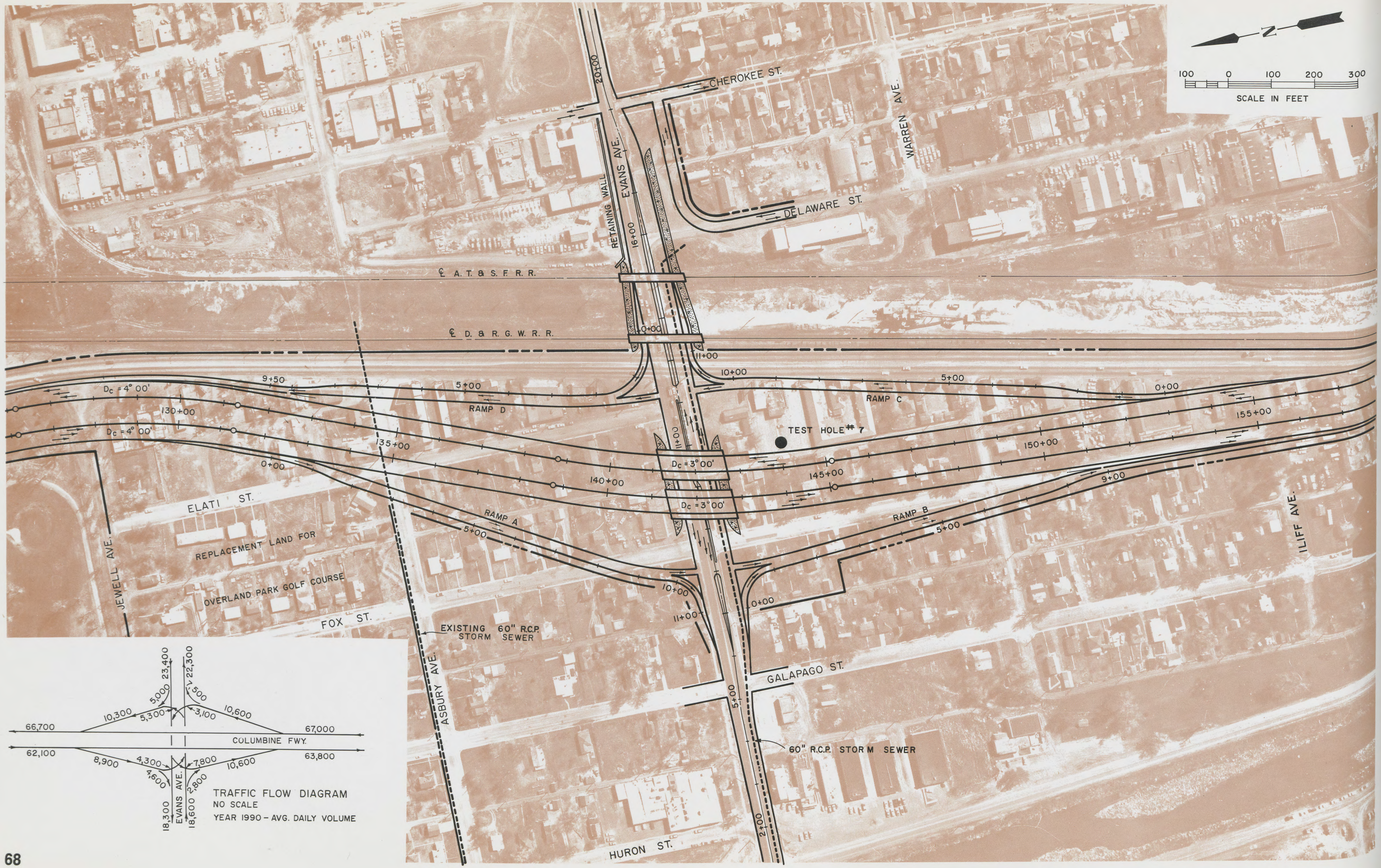


RAMP E
(DRAWING 5)

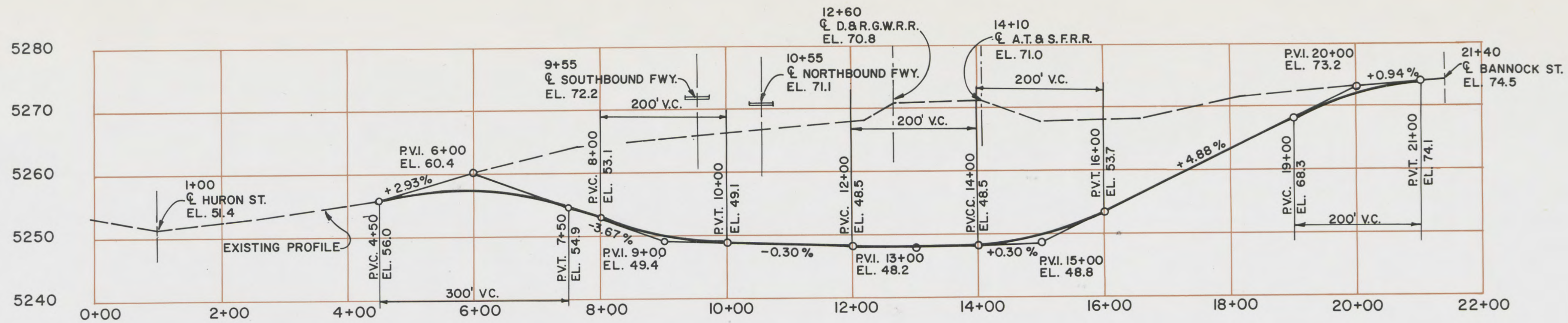


RAMP FROM SO. BOUND I-25 TO S.B. FREEWAY

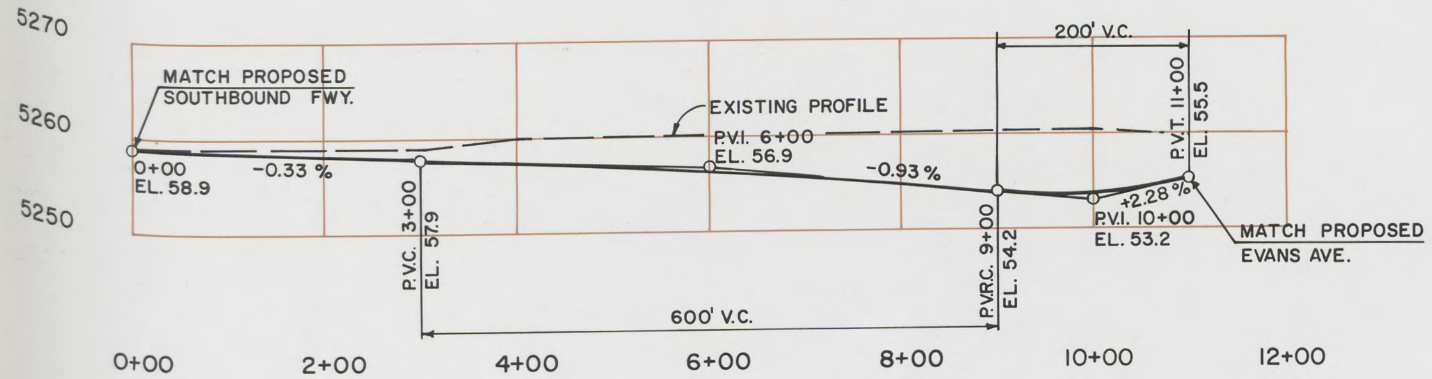
DRWG—25 / EVANS INTERCHANGE



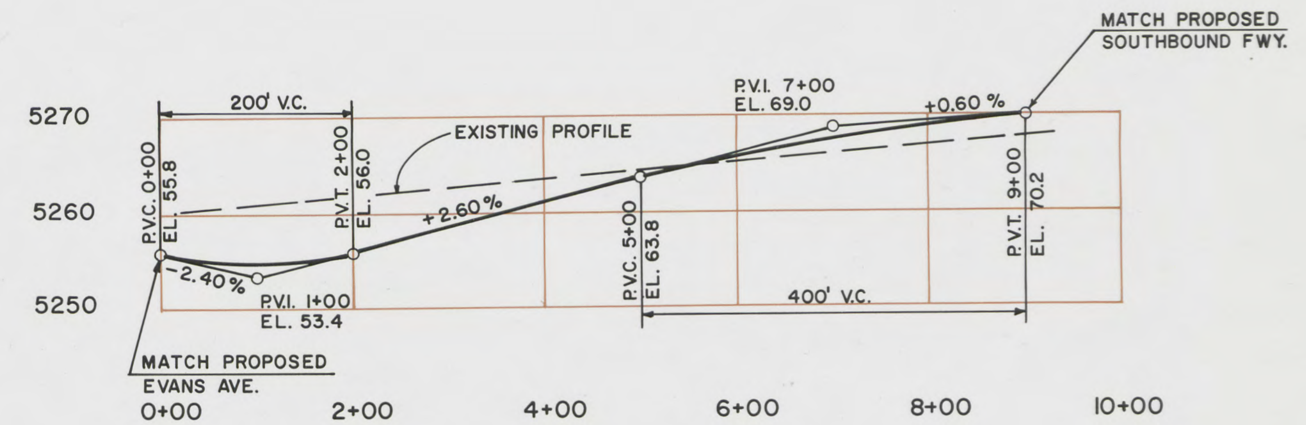
DRWG—26 / EVANS INTERCHANGE GRADES



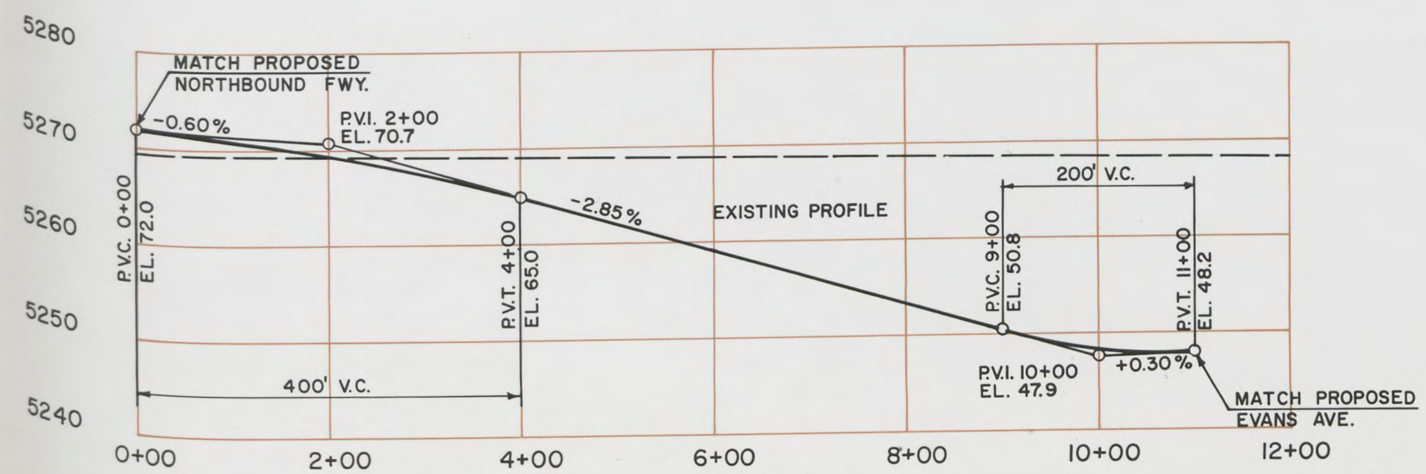
PROPOSED EVANS AVE.



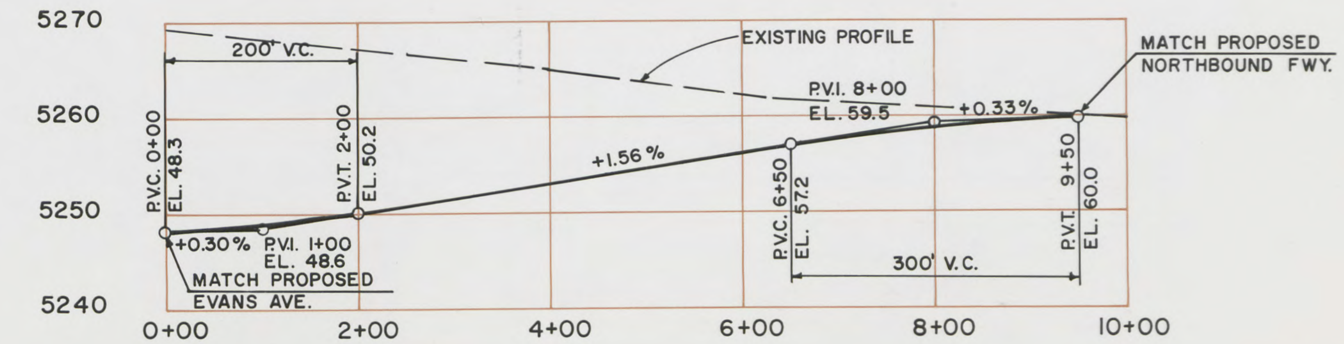
RAMP A



RAMP B

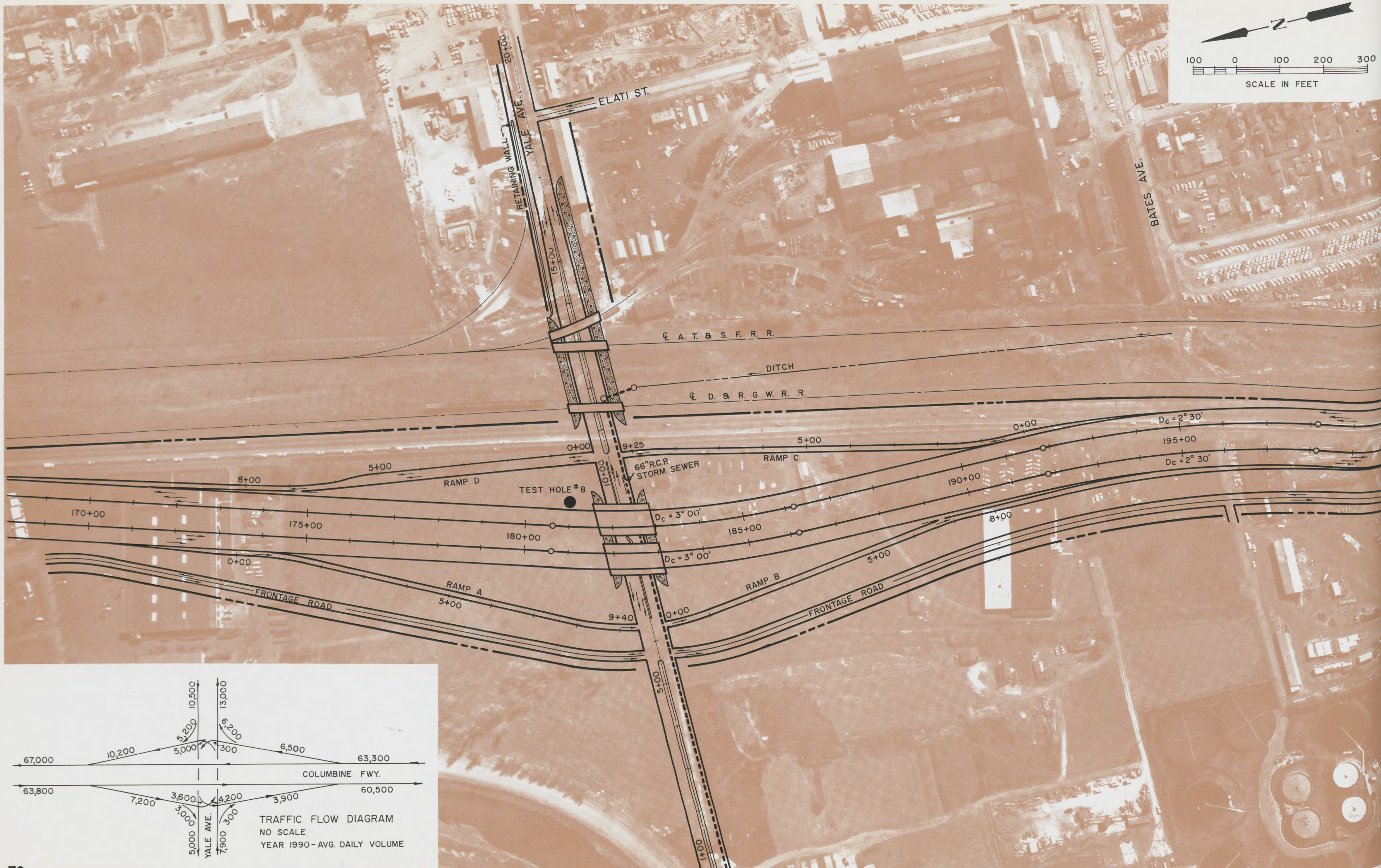


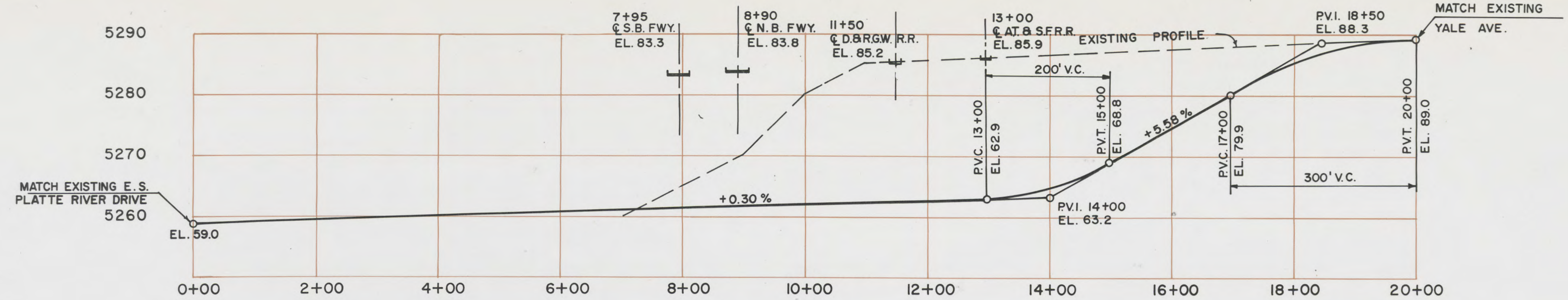
RAMP C



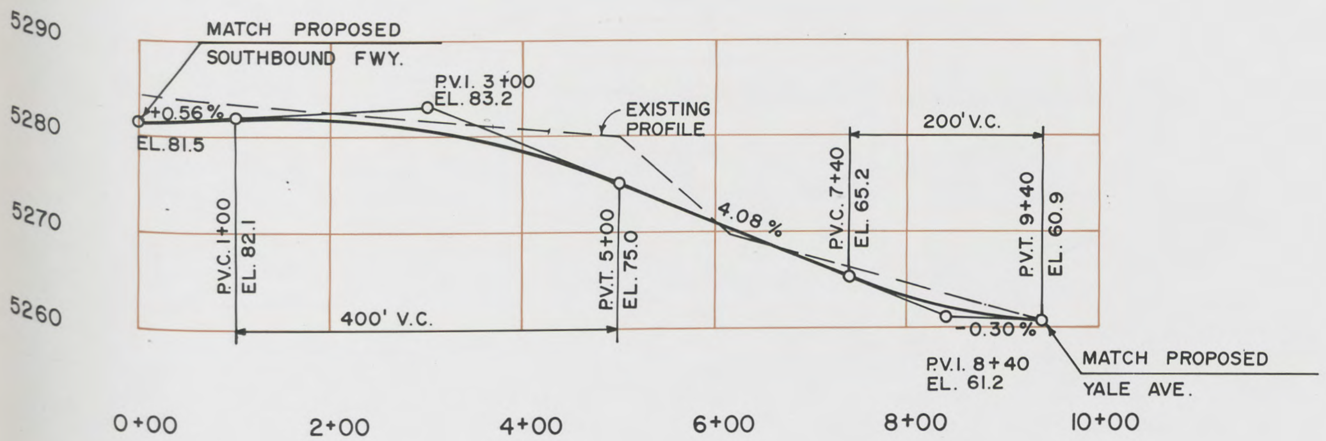
RAMP D

DRWG—27 / YALE INTERCHANGE

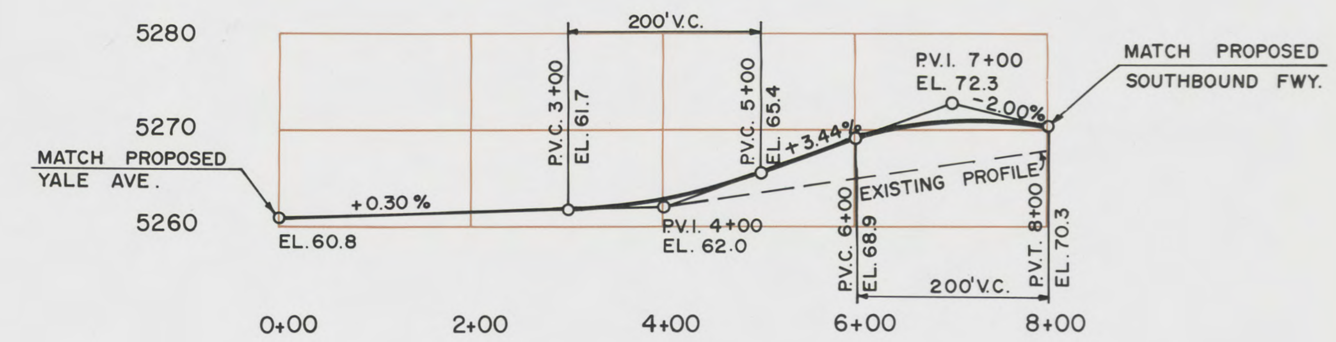




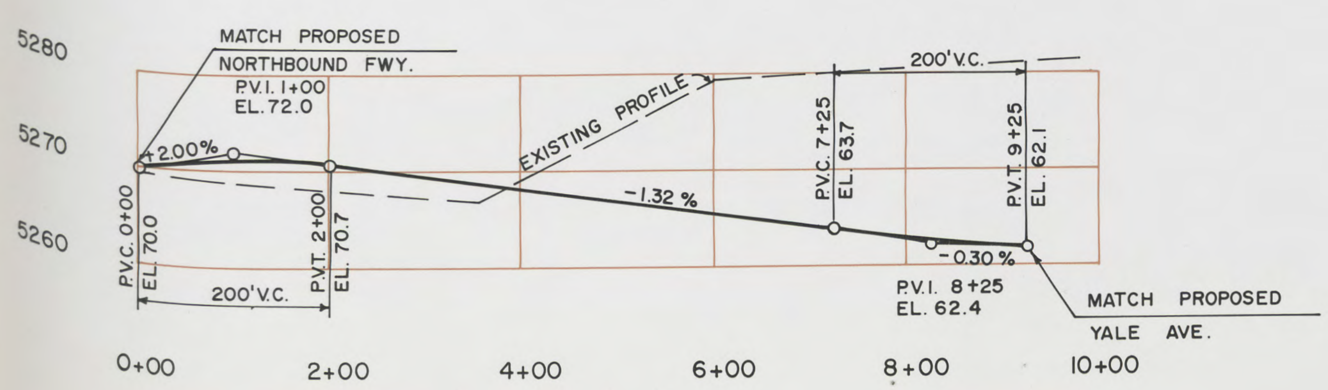
PROPOSED YALE AVE.



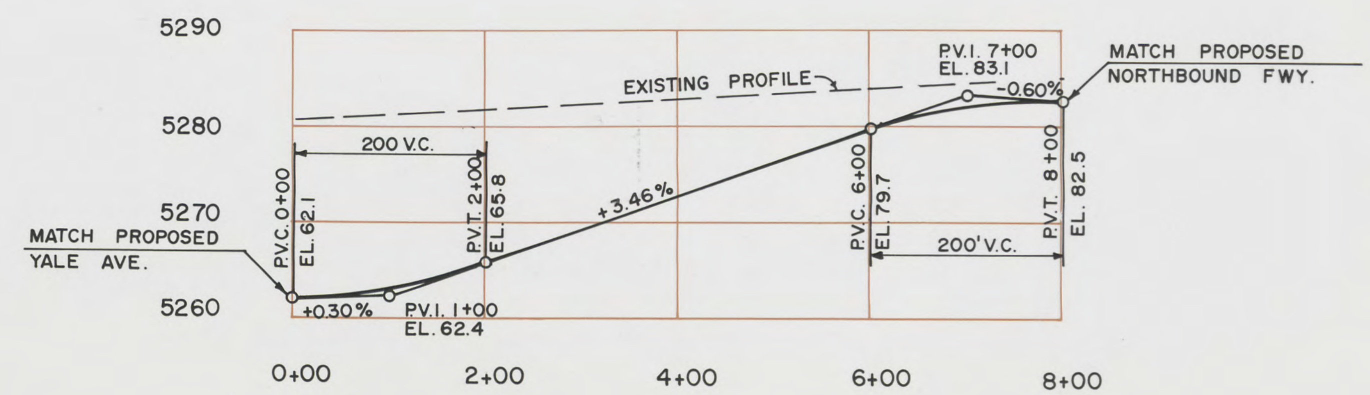
RAMP A



RAMP B



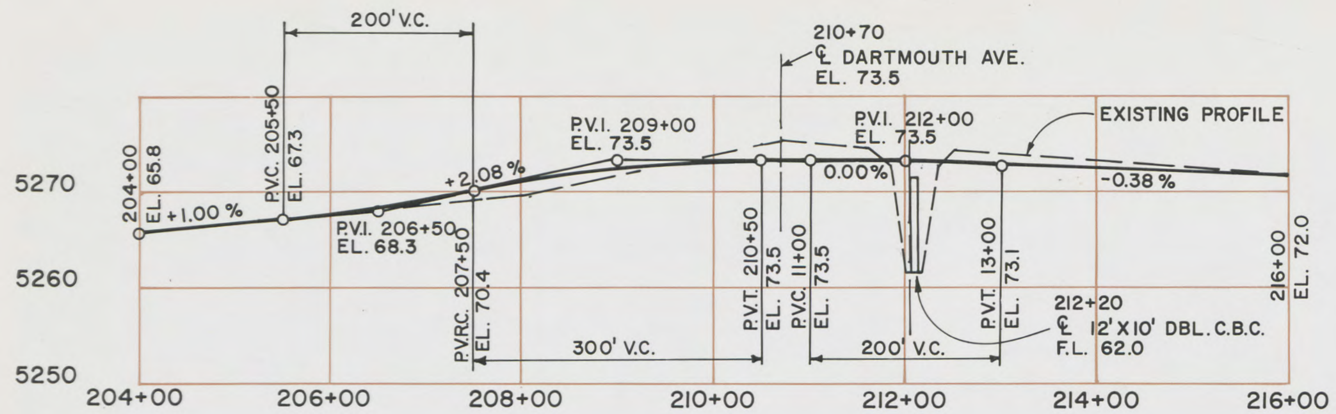
RAMP C



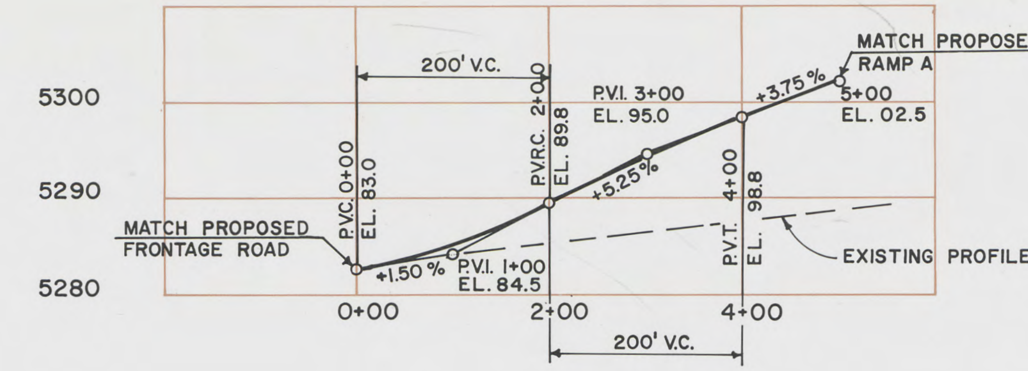
RAMP D

DRWG—28 / YALE INTERCHANGE GRADES

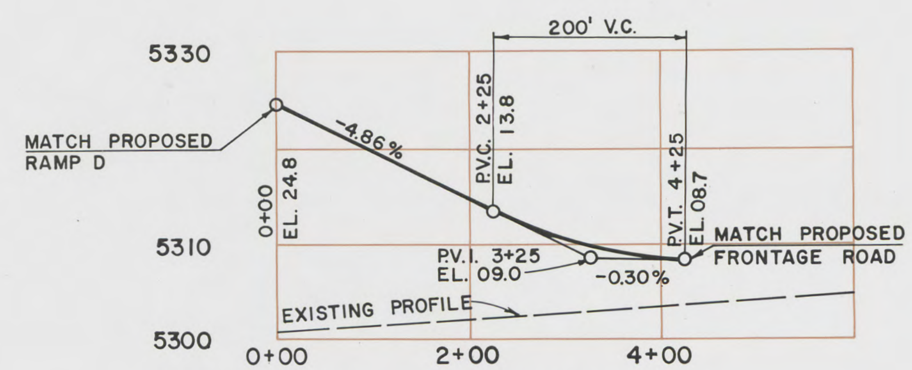
DRWG—29 / DARTMOUTH CROSSING GRADES



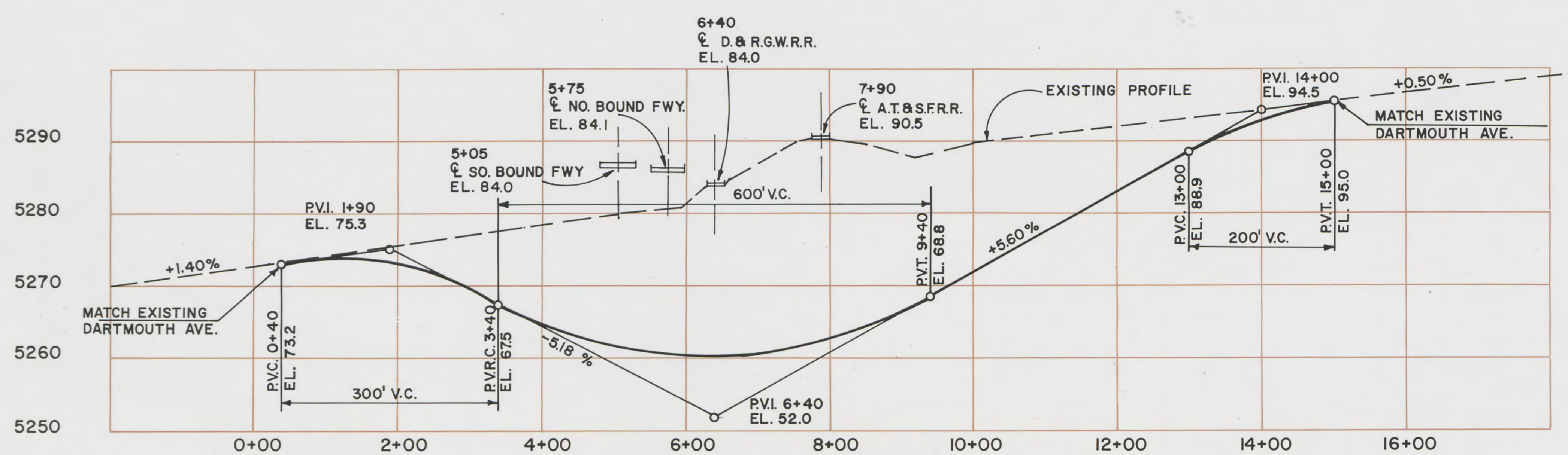
FRONTAGE ROAD IN DARTMOUTH AVE. AREA
(DRAWINGS 9 & 10)



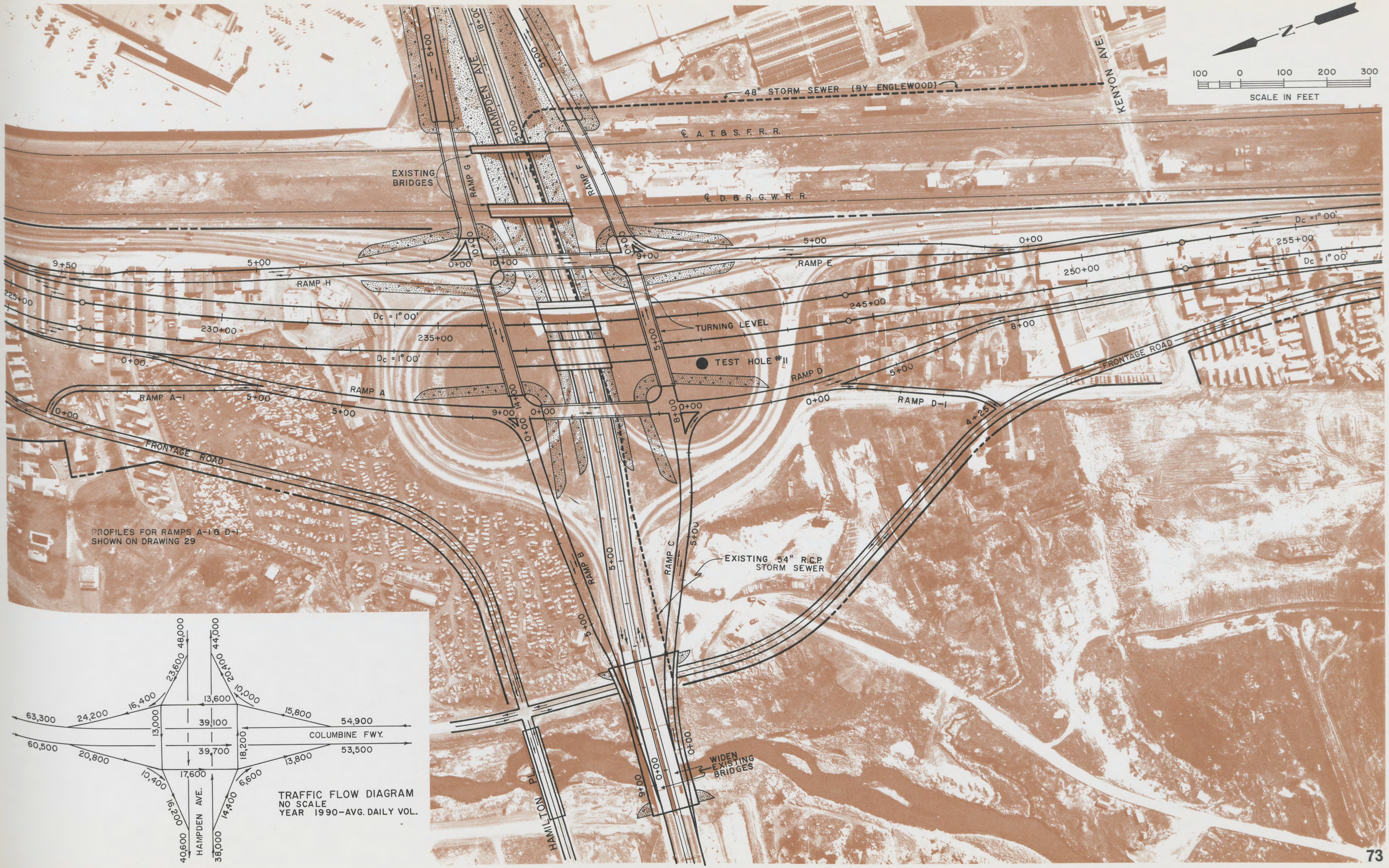
RAMP A-1
(DRAWINGS 10 & 30)



RAMP D-1
(DRAWINGS 11 & 30)

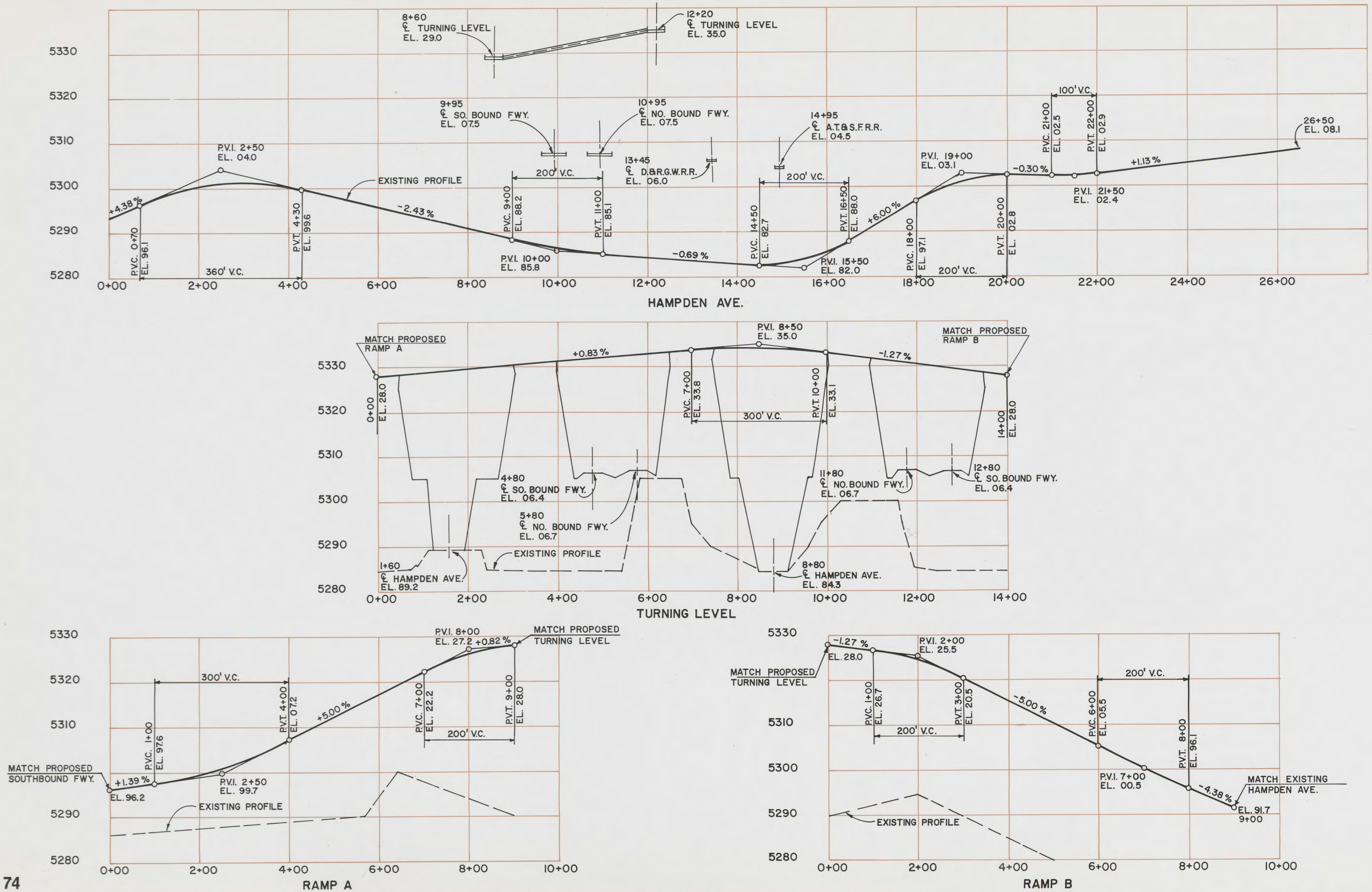


DARTMOUTH AVENUE
(DRAWING 10)

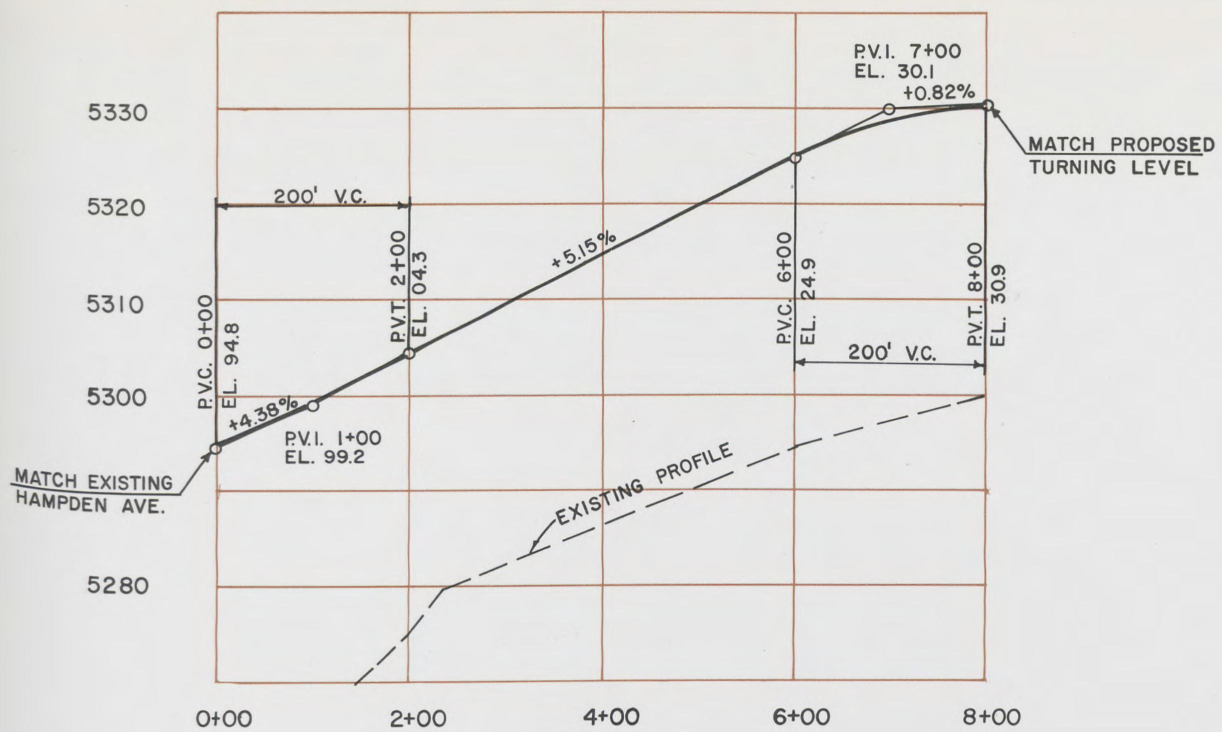


DRWG—30 / HAMPDEN INTERCHANGE

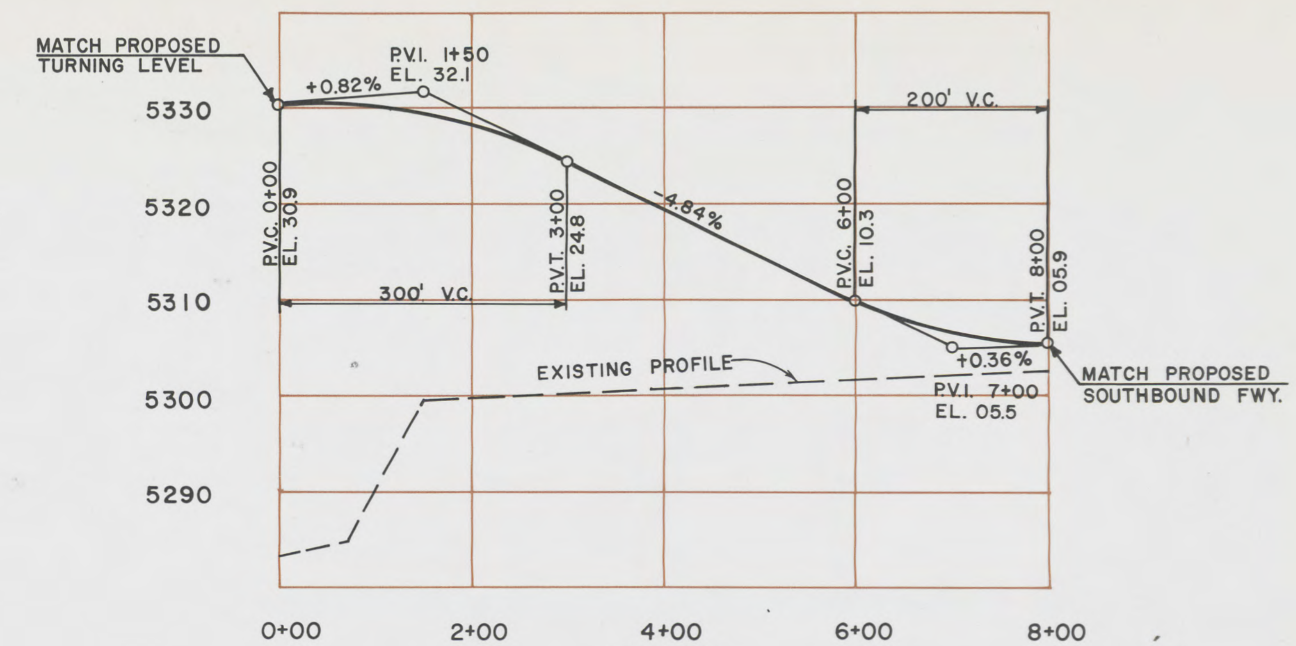
DRWG—31 / HAMPDEN INTERCHANGE GRADES



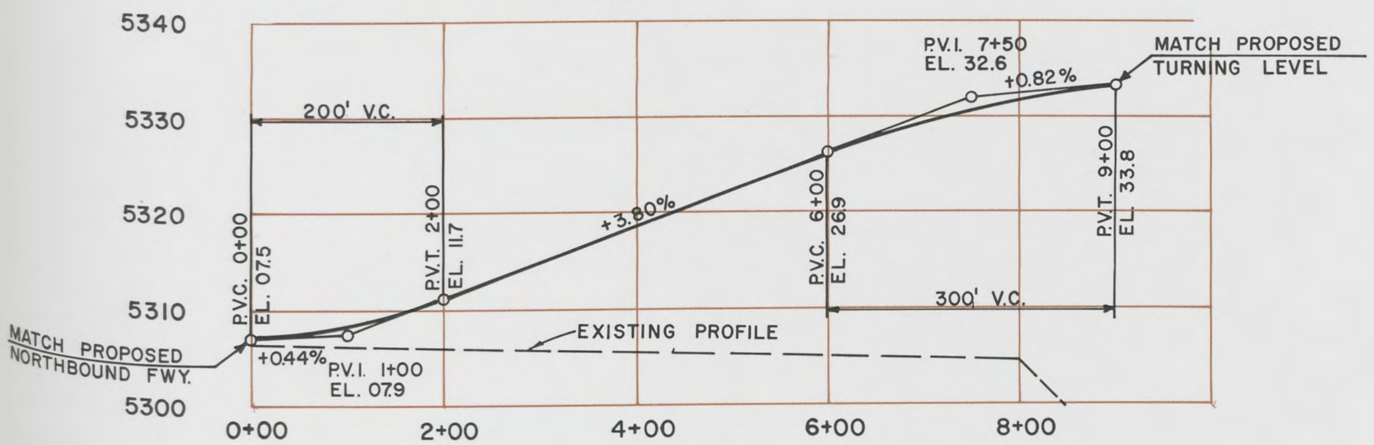
DRWG—32 / HAMPDEN INTERCHANGE GRADES



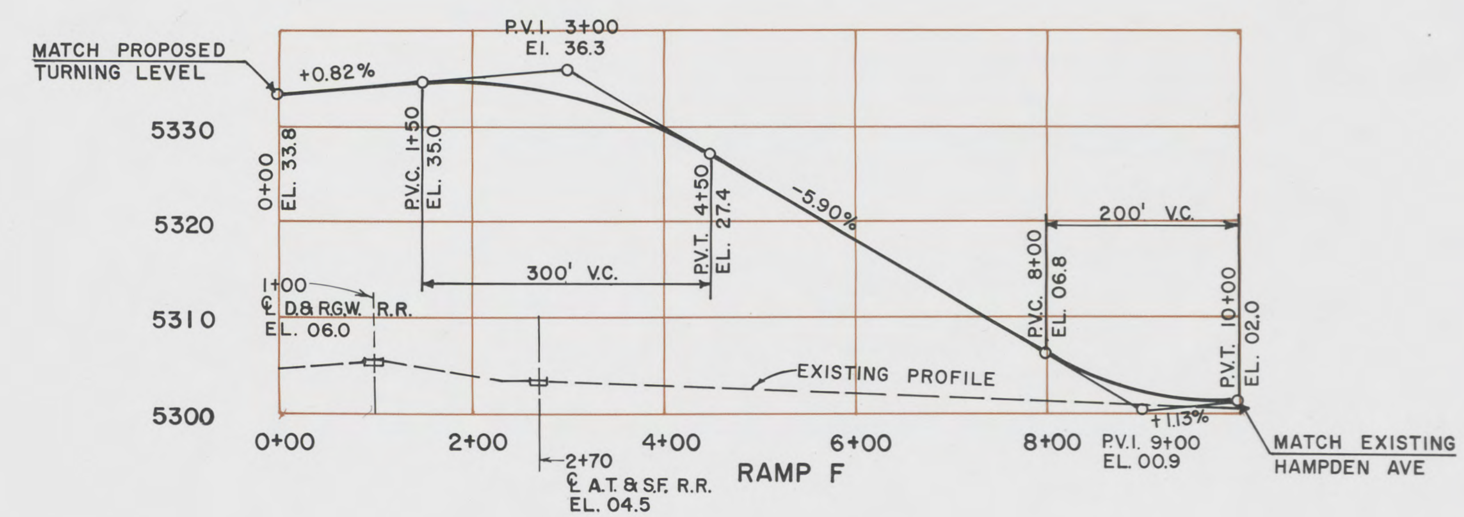
RAMP C



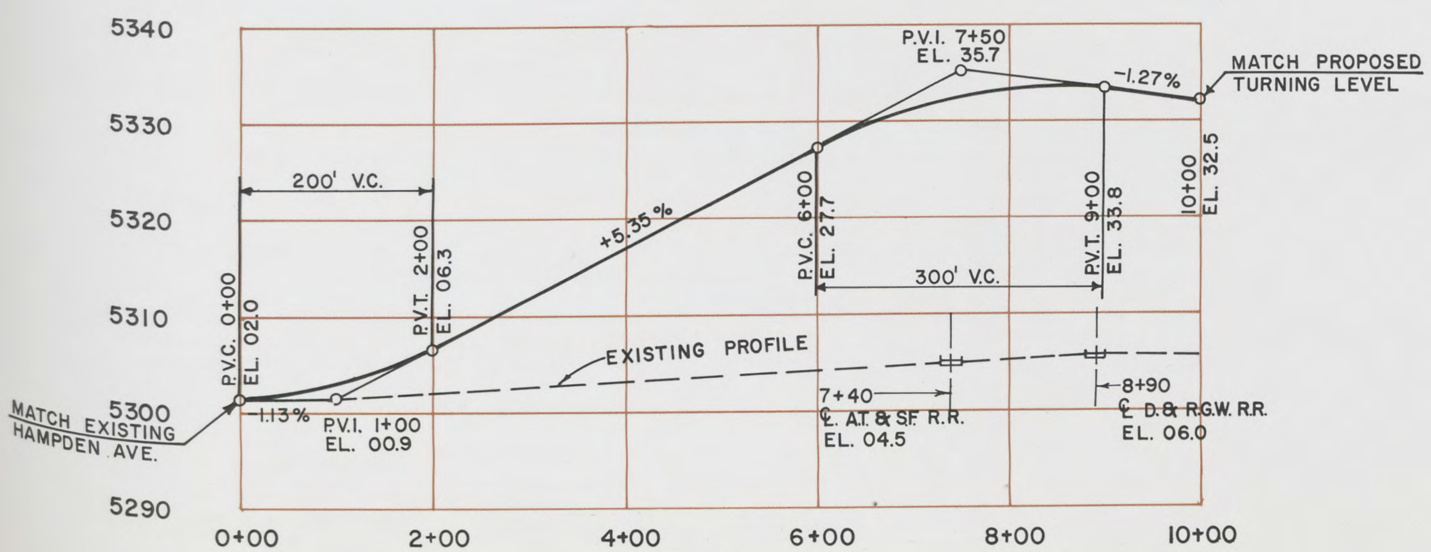
RAMP D



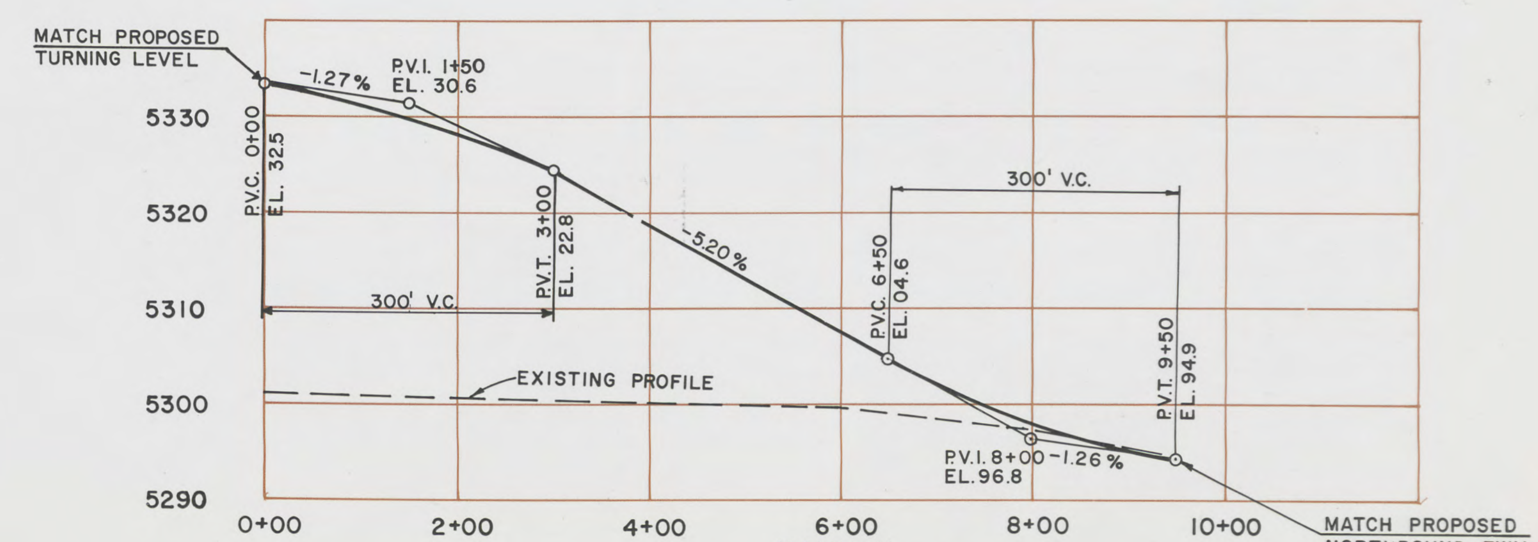
RAMP E



RAMP F

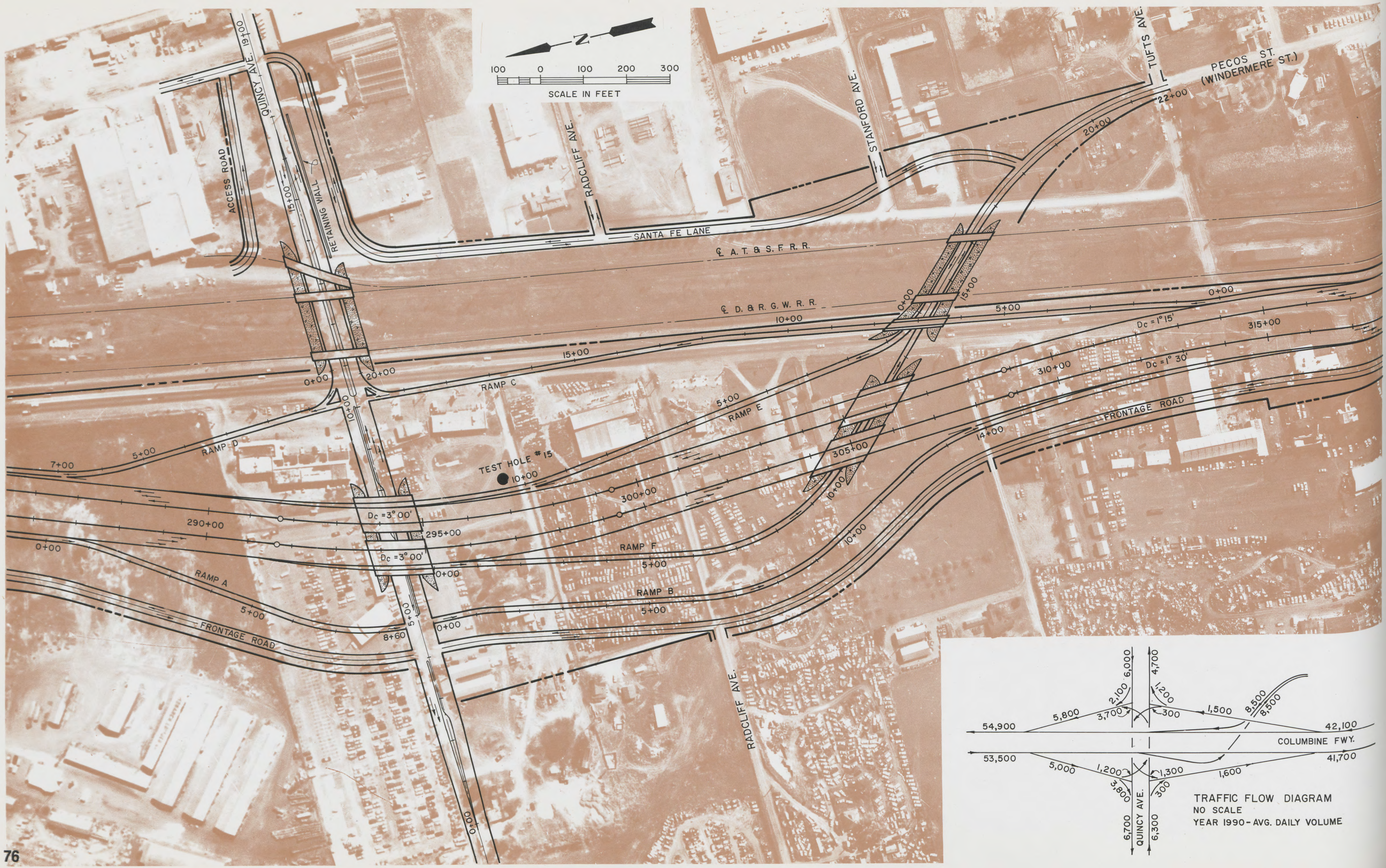


RAMP G

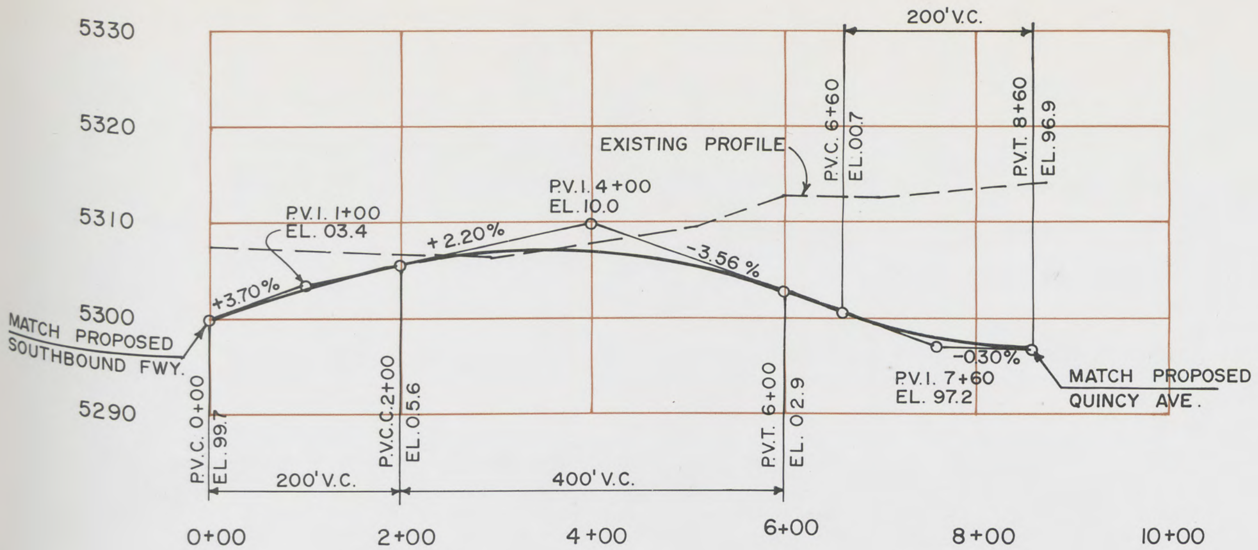


RAMP H

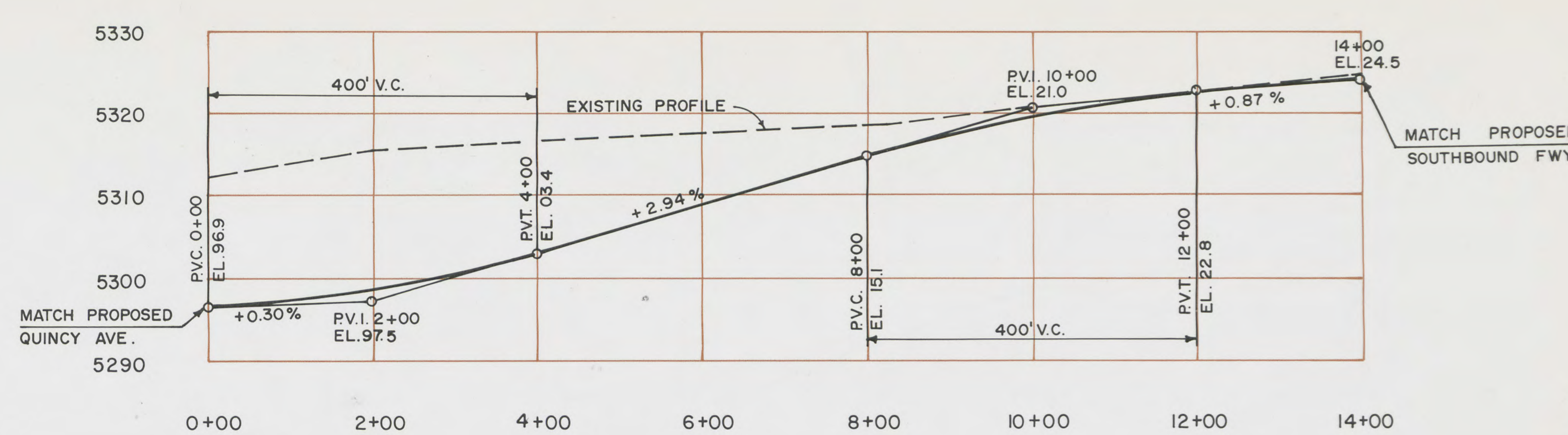
DRWG—33 / QUINCY INTERCHANGE



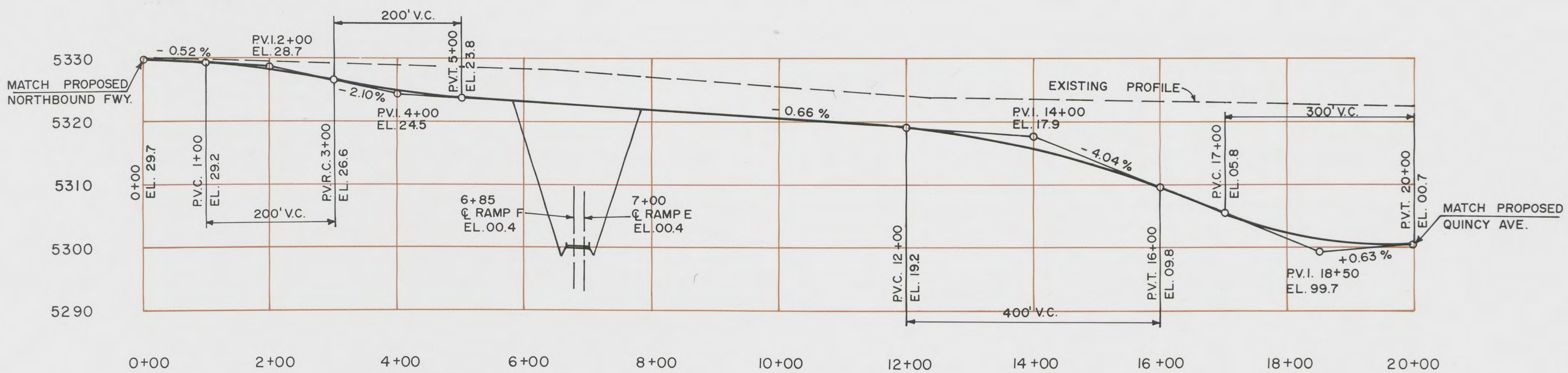
DRWG—34 / QUINCY INTERCHANGE GRADES



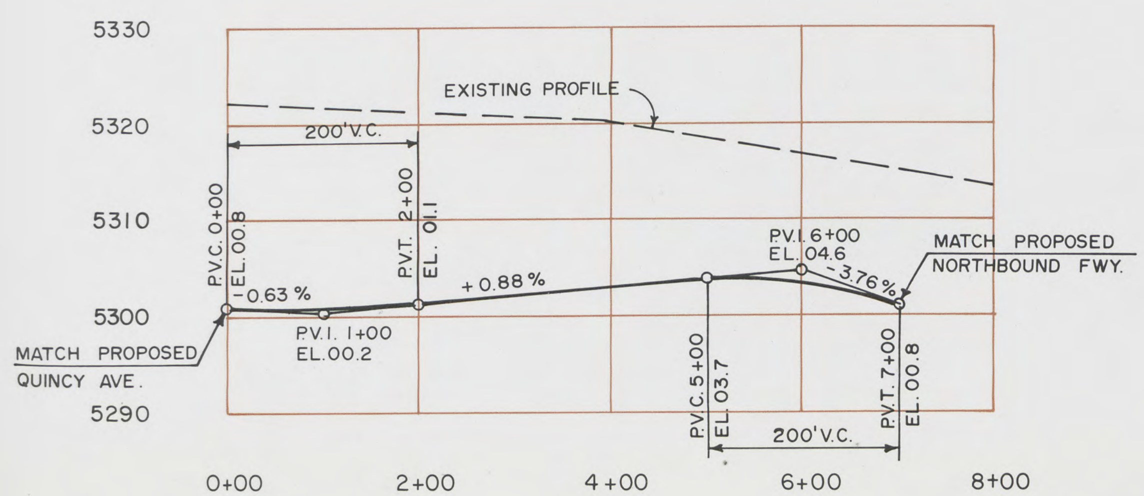
RAMP A



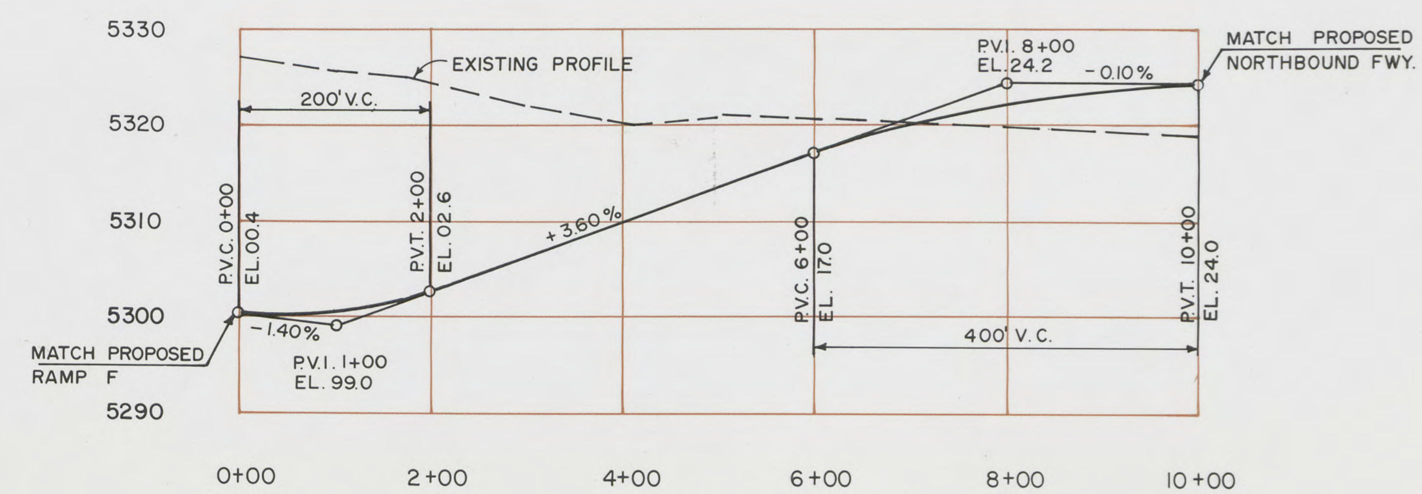
RAMP B



RAMP C

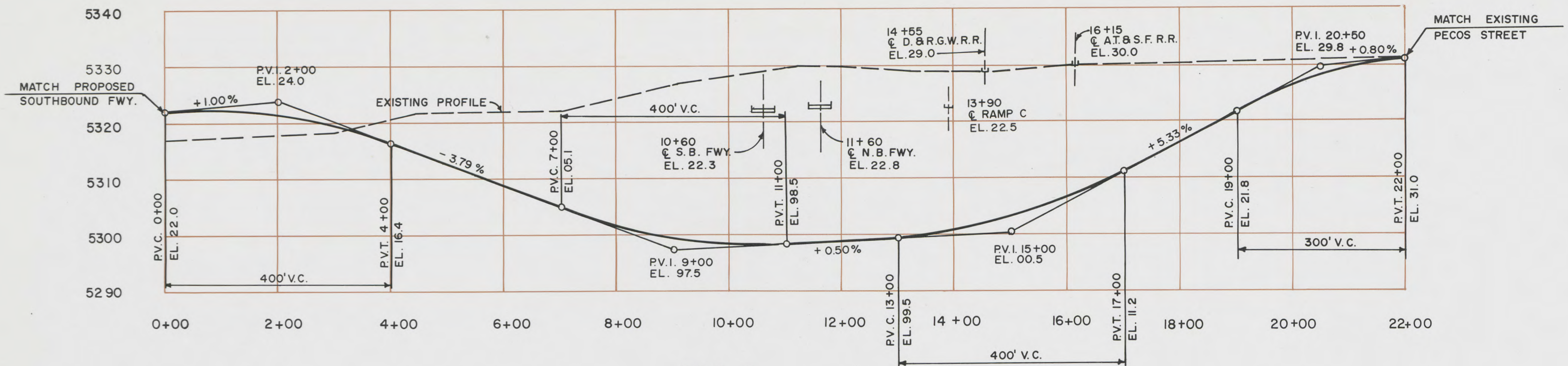


RAMP D

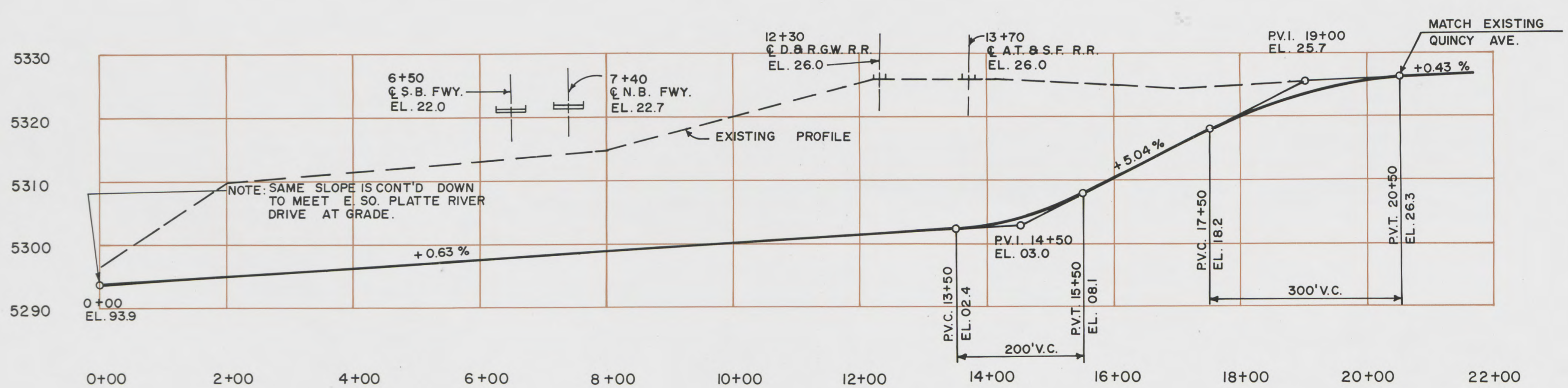


RAMP E

DRWG—35 / QUINCY INTERCHANGE GRADES

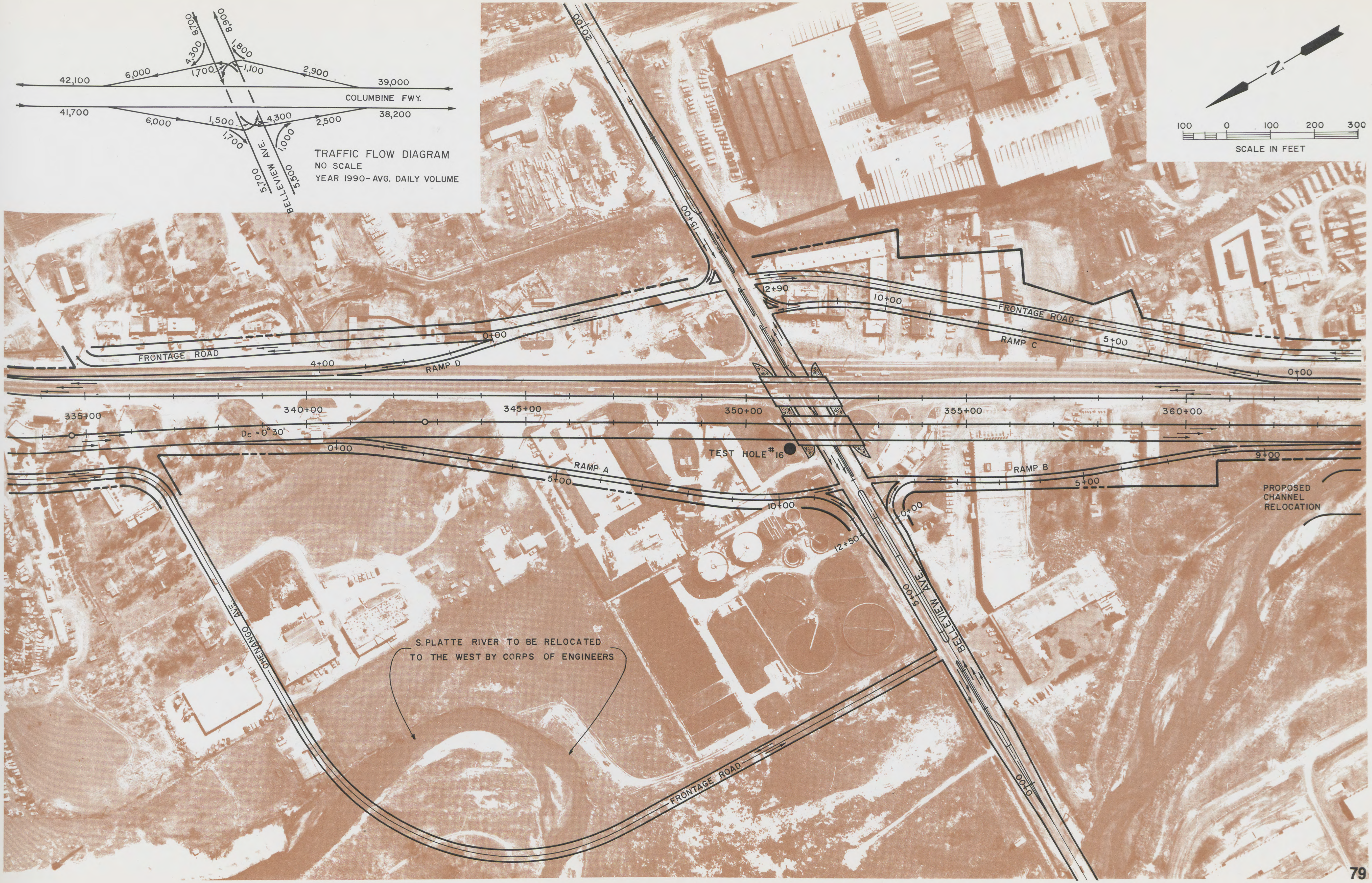


RAMP F

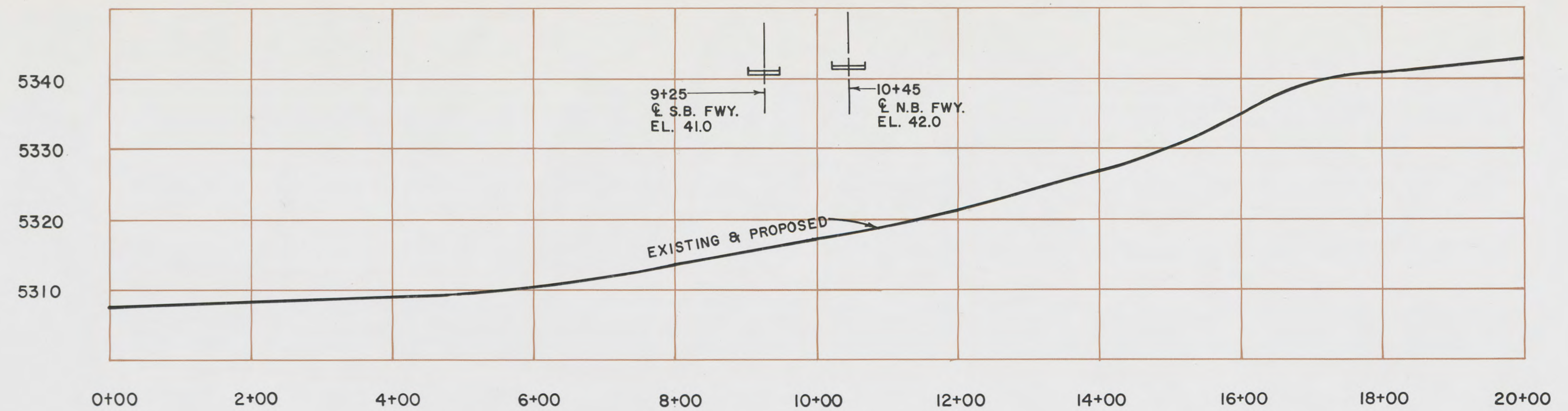


QUINCY AVE.

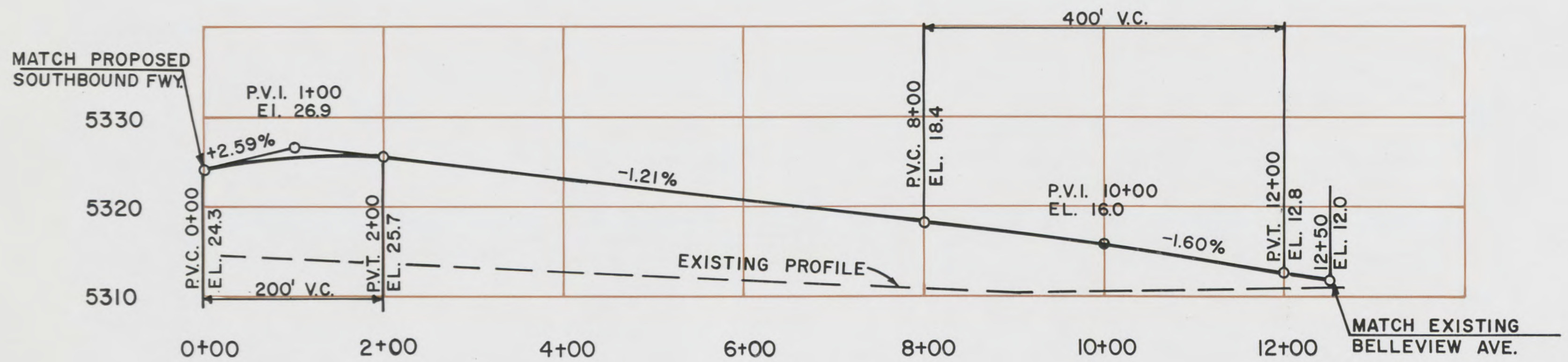
DRWG—36 / BELLEVIEW INTERCHANGE



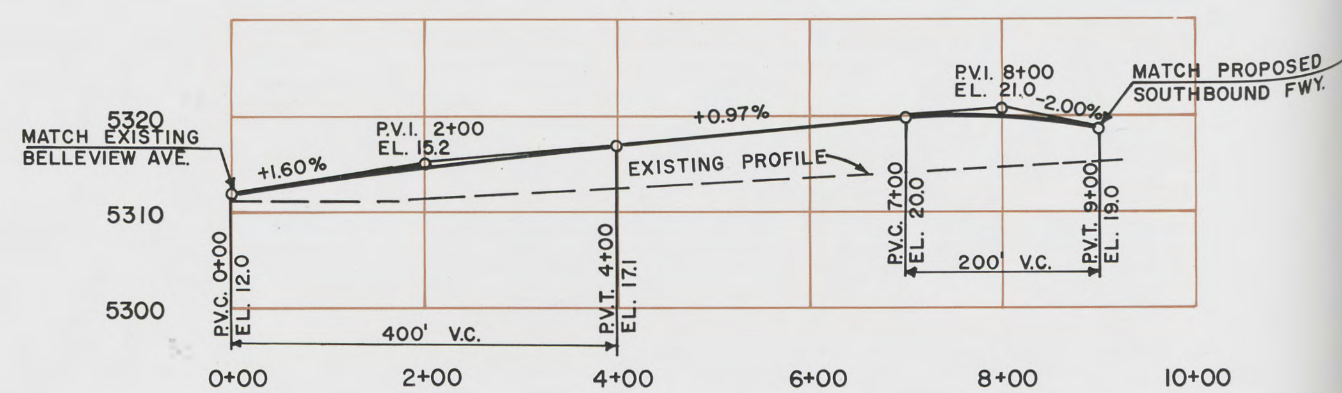
DRWG—37 / BELLEVIEW INTERCHANGE GRADES



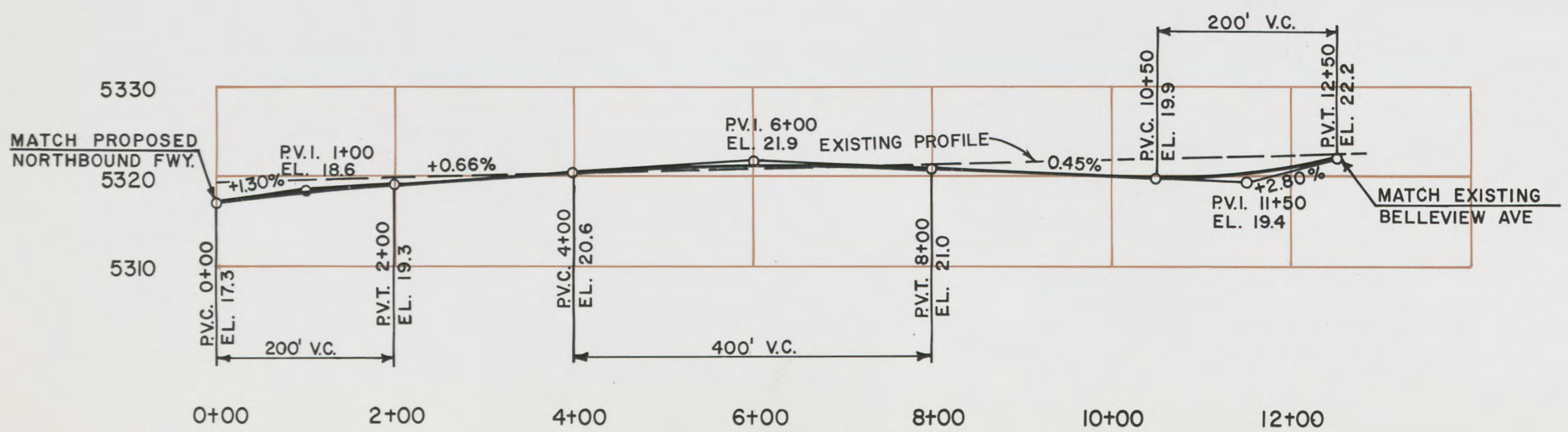
BELLEVIEW AVE.



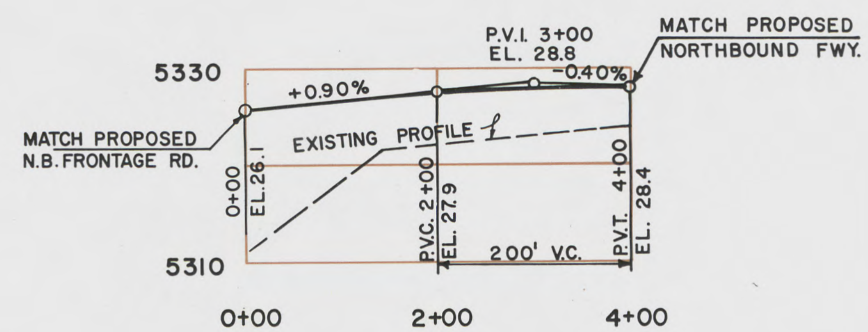
RAMP A



RAMP B



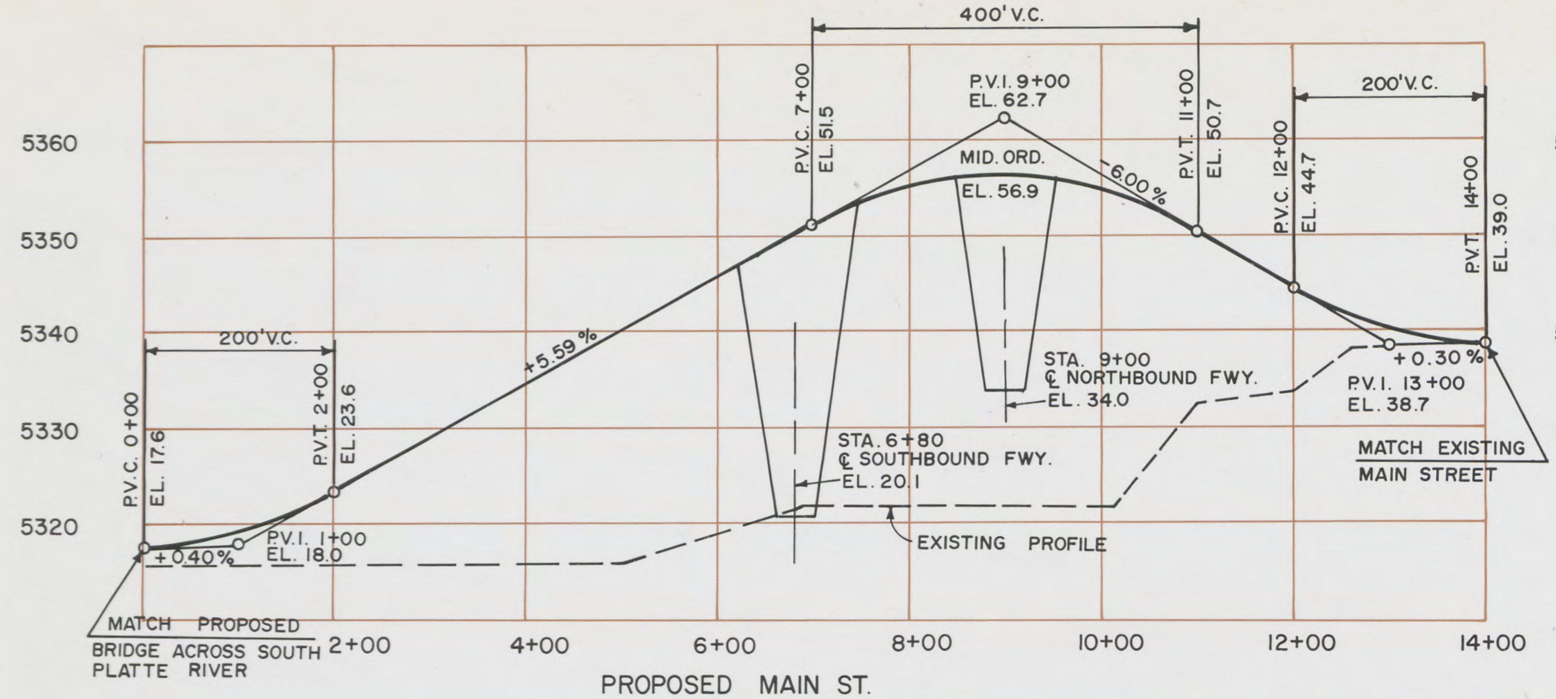
RAMP C



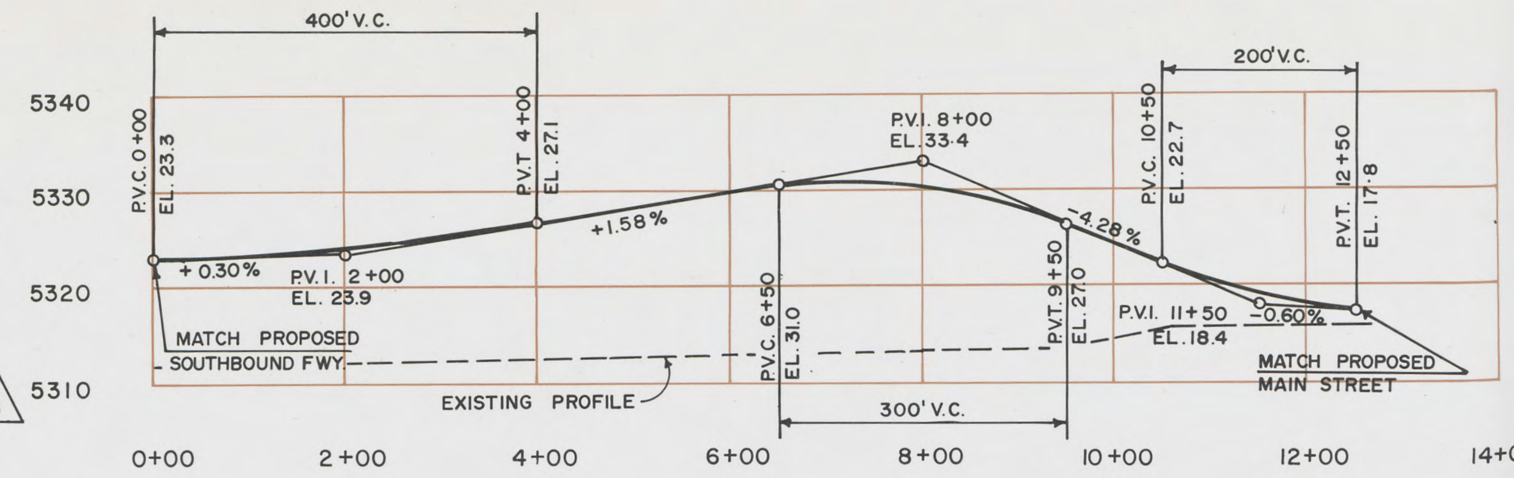
RAMP D

DRWG—38 / BOWLES INTERCHANGE

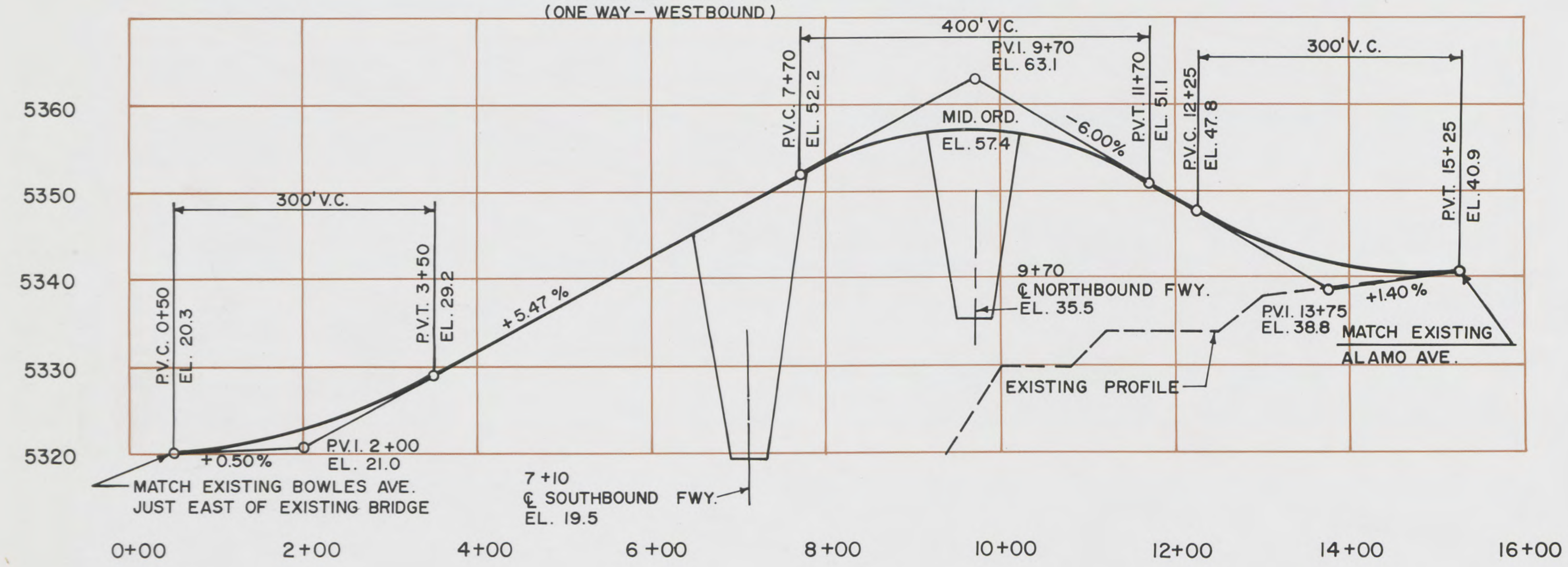
DRWG—39 / BOWLES INTERCHANGE GRADES



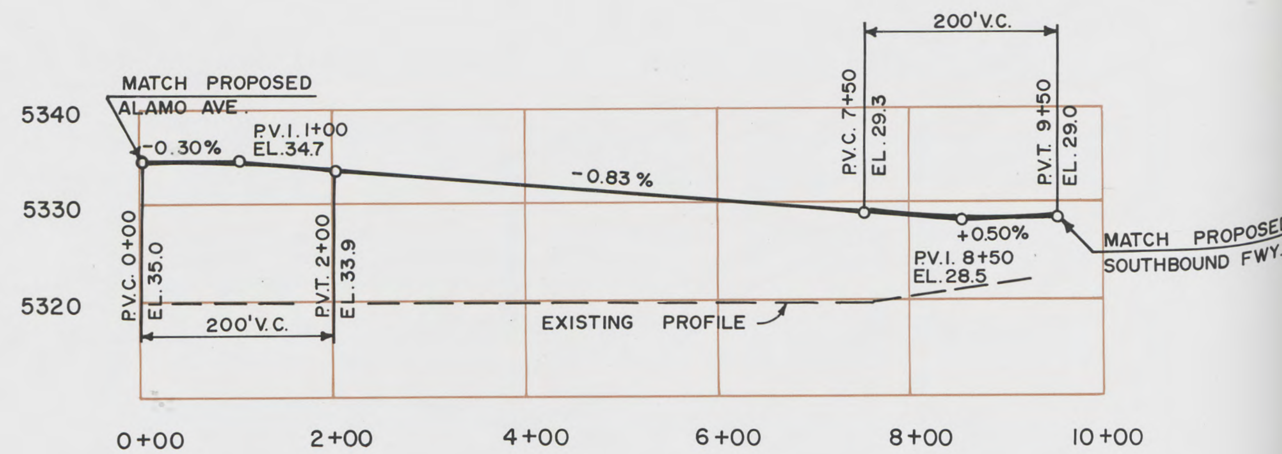
PROPOSED MAIN ST.
(ONE WAY - WESTBOUND)



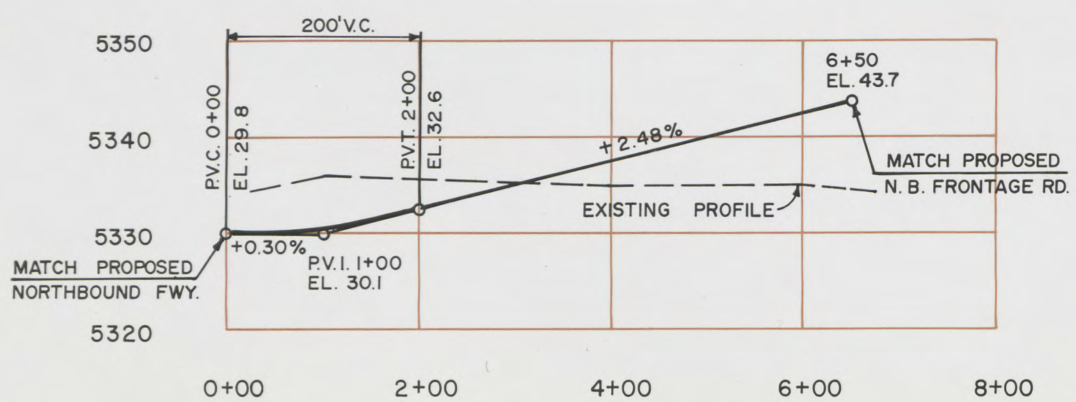
RAMP A



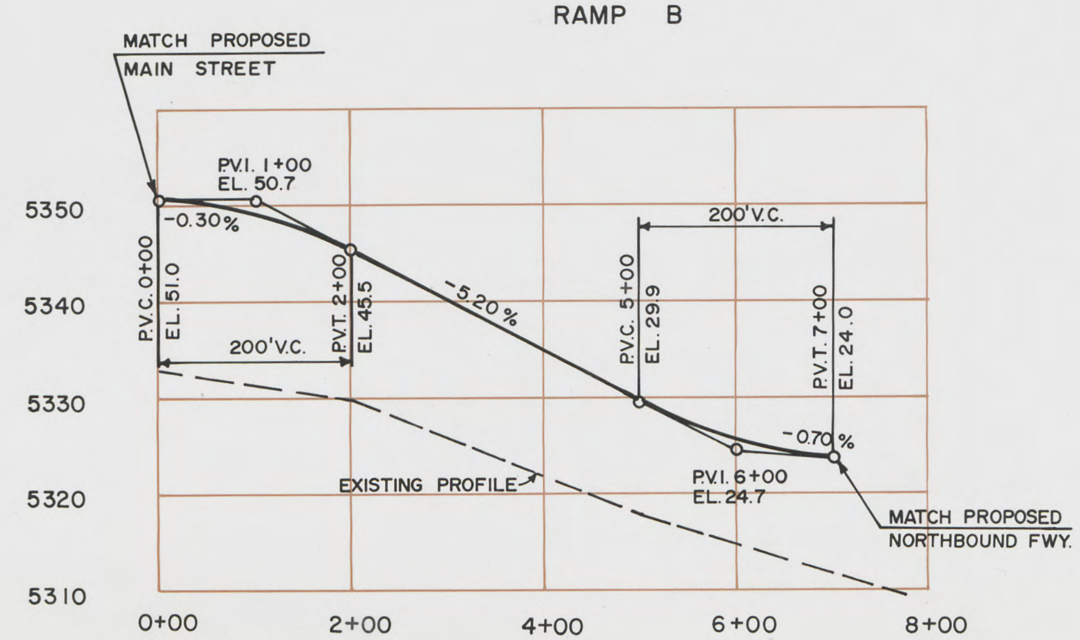
PROPOSED ALAMO AVE.
(ONE WAY - EASTBOUND)



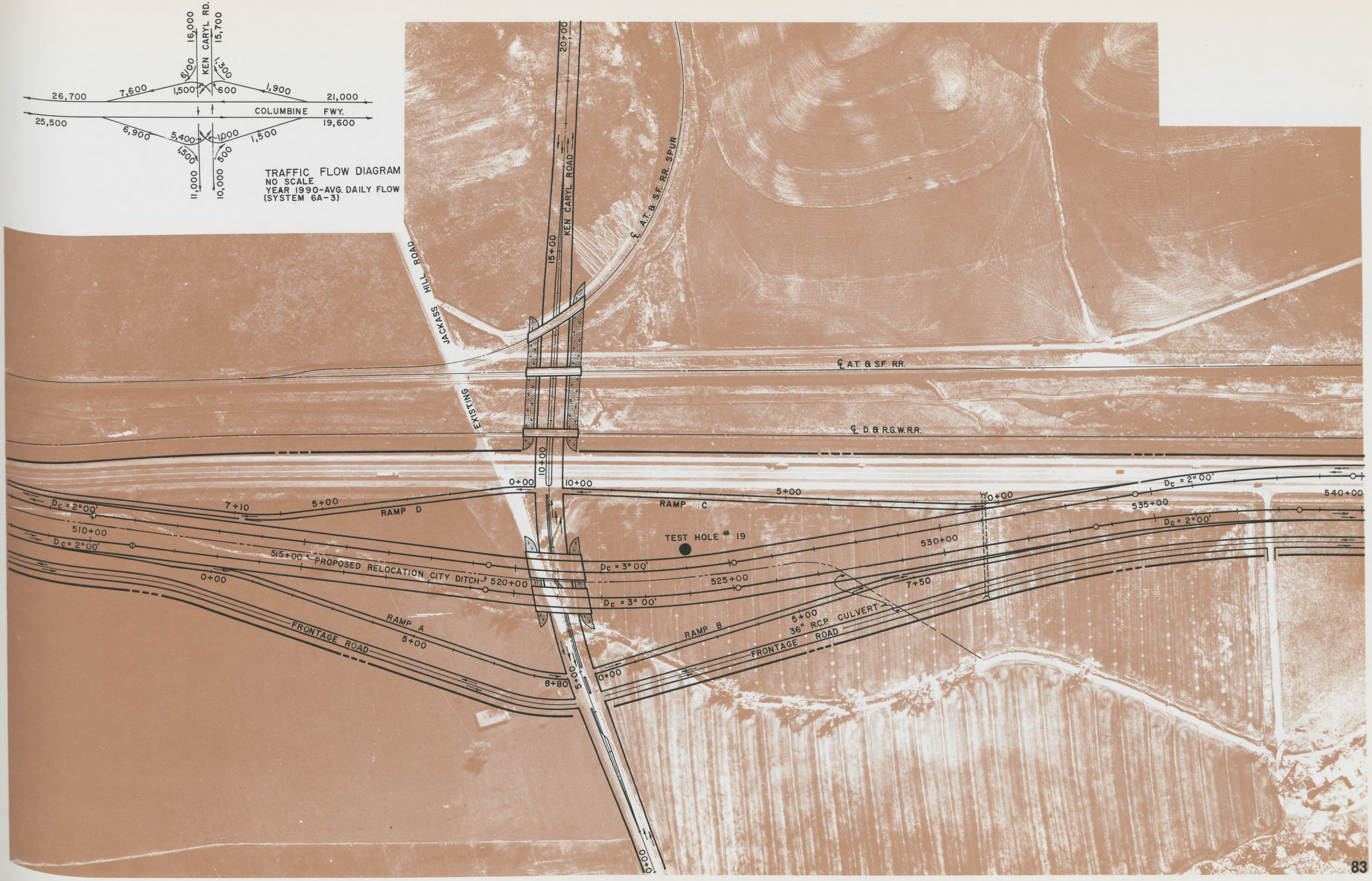
RAMP B



RAMP C

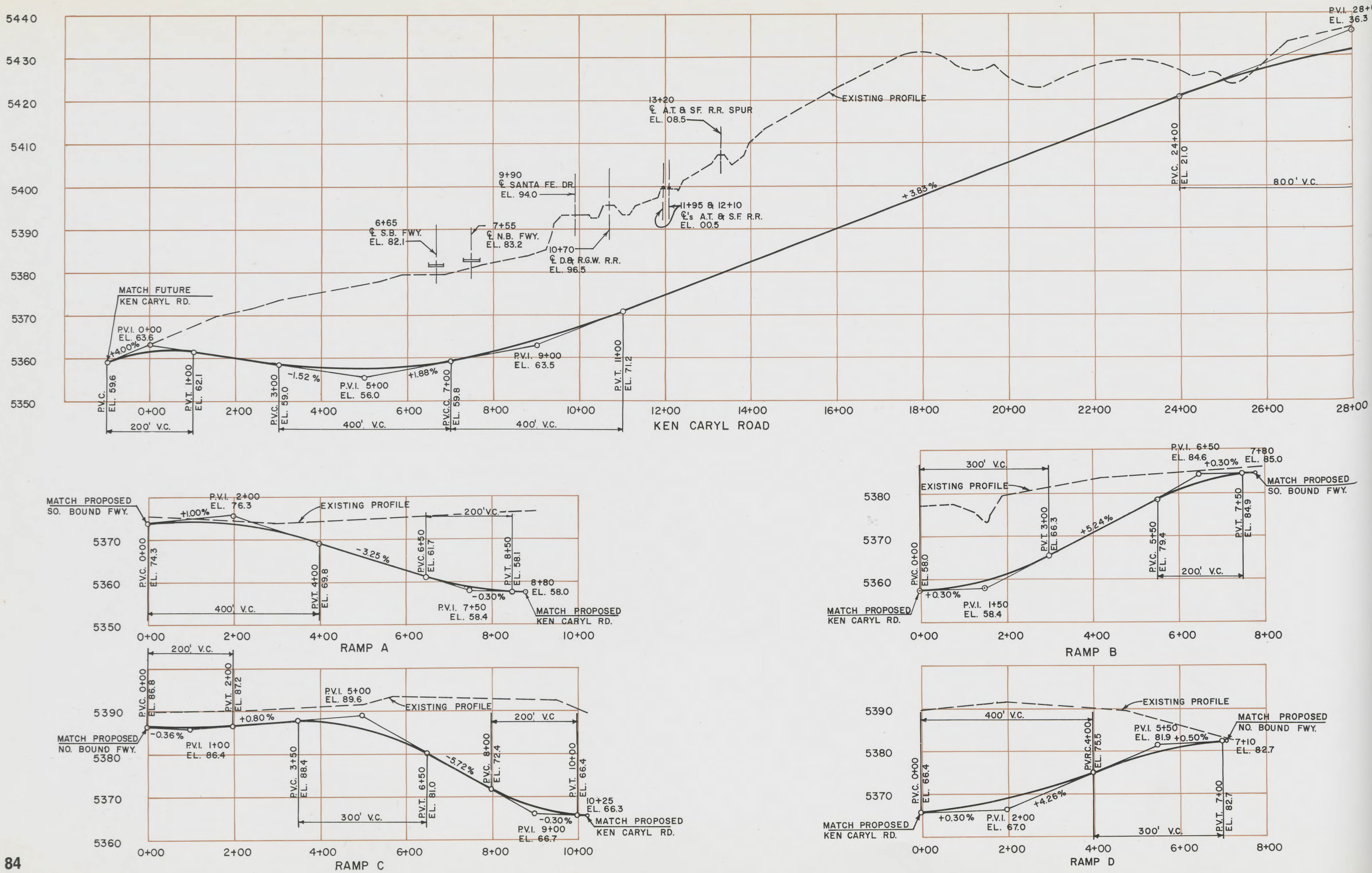


RAMP D



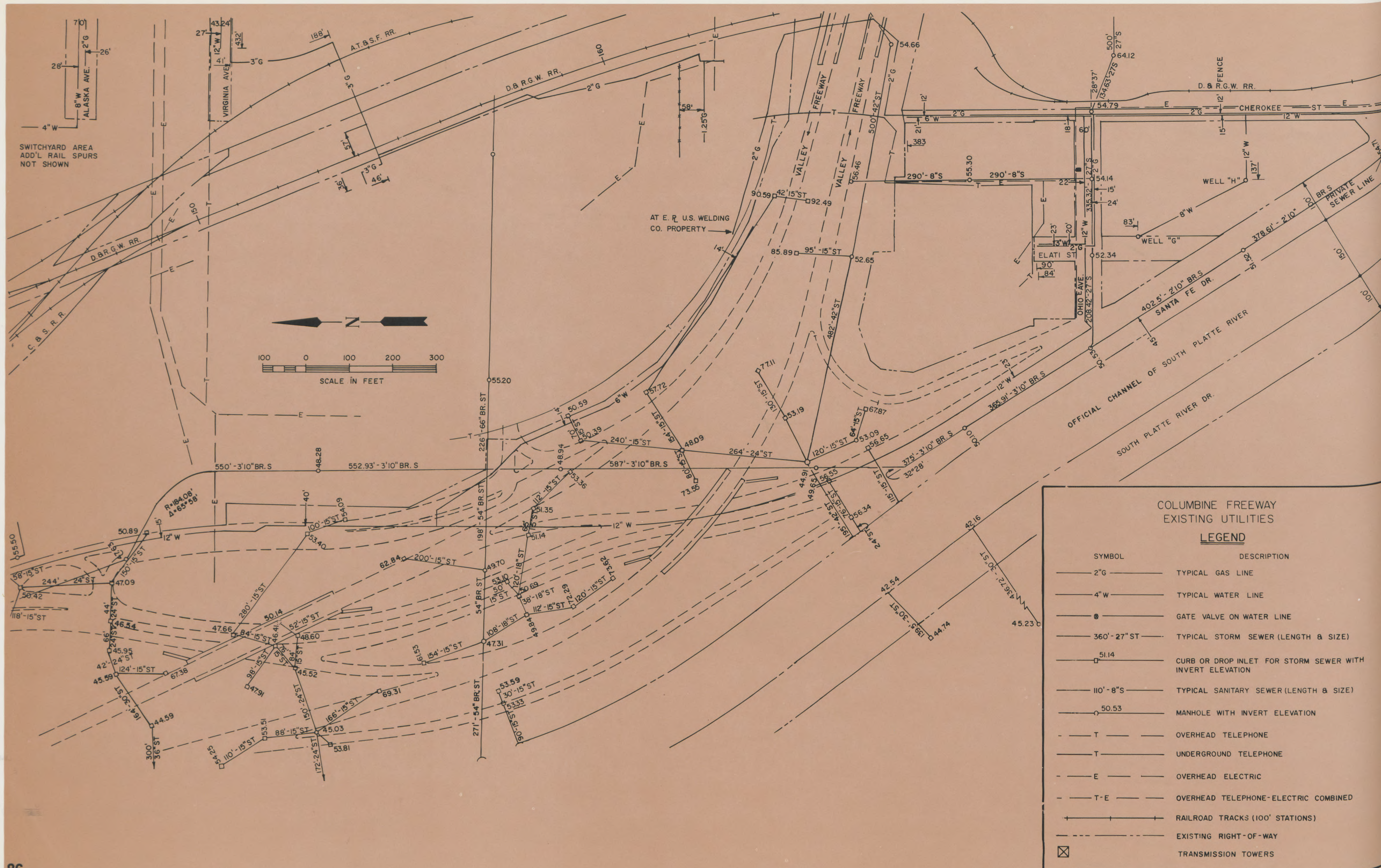
DRWG—40 / KEN CARYL INTERCHANGE

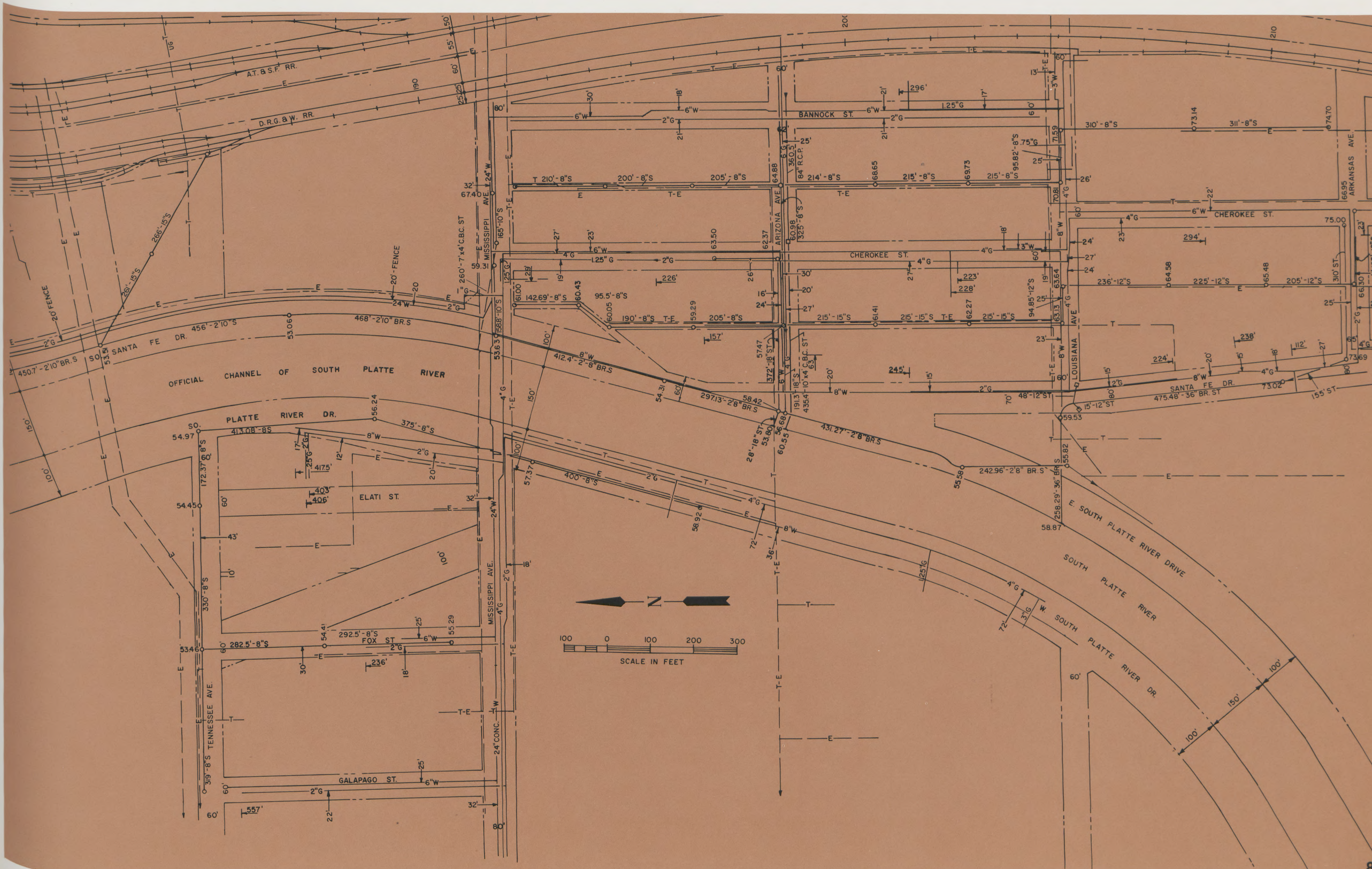
DRWG—41/KEN CARYL INTERCHANGE GRADES



DRWG—42/PLAN—STORM DRAINAGE

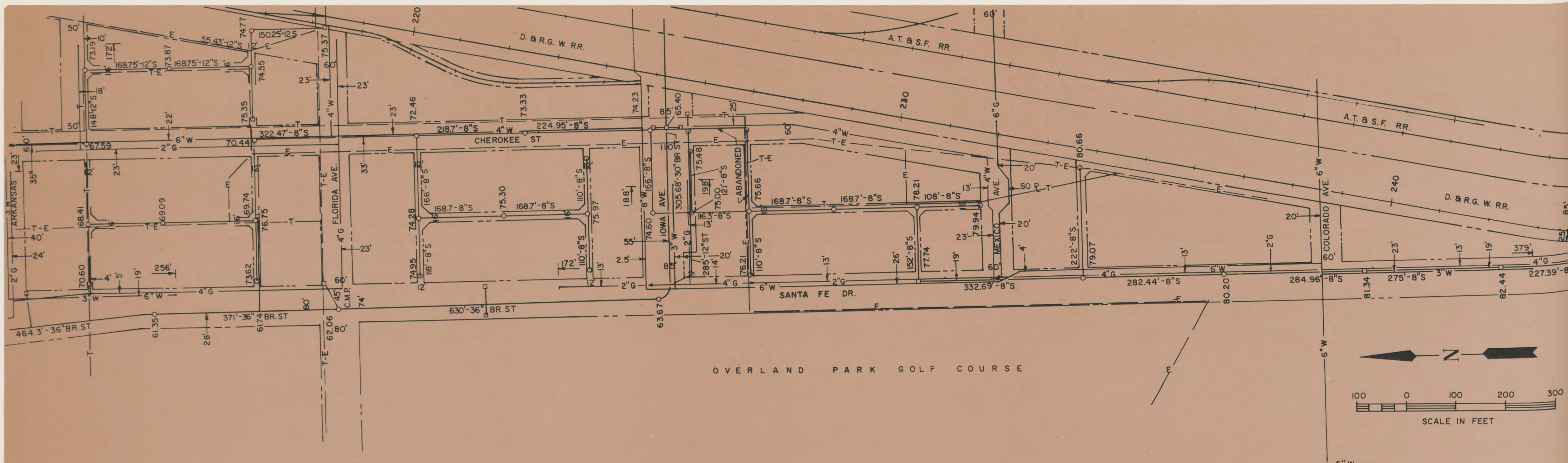
DRWG—43 / UTILITIES—VALLEY HIGHWAY





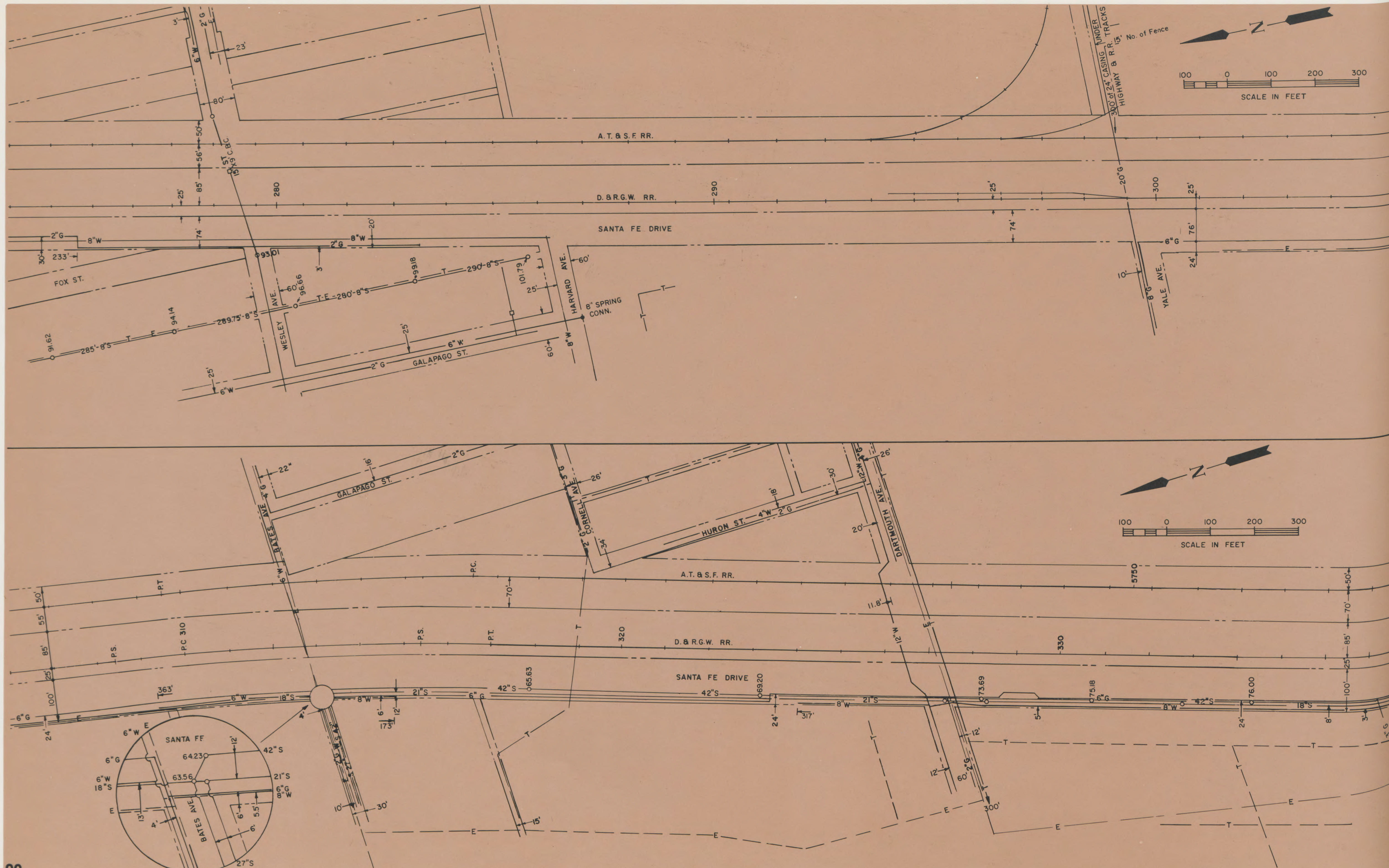
DRWG—44 / UTILITIES—TENNESSEE TO ARKANSAS

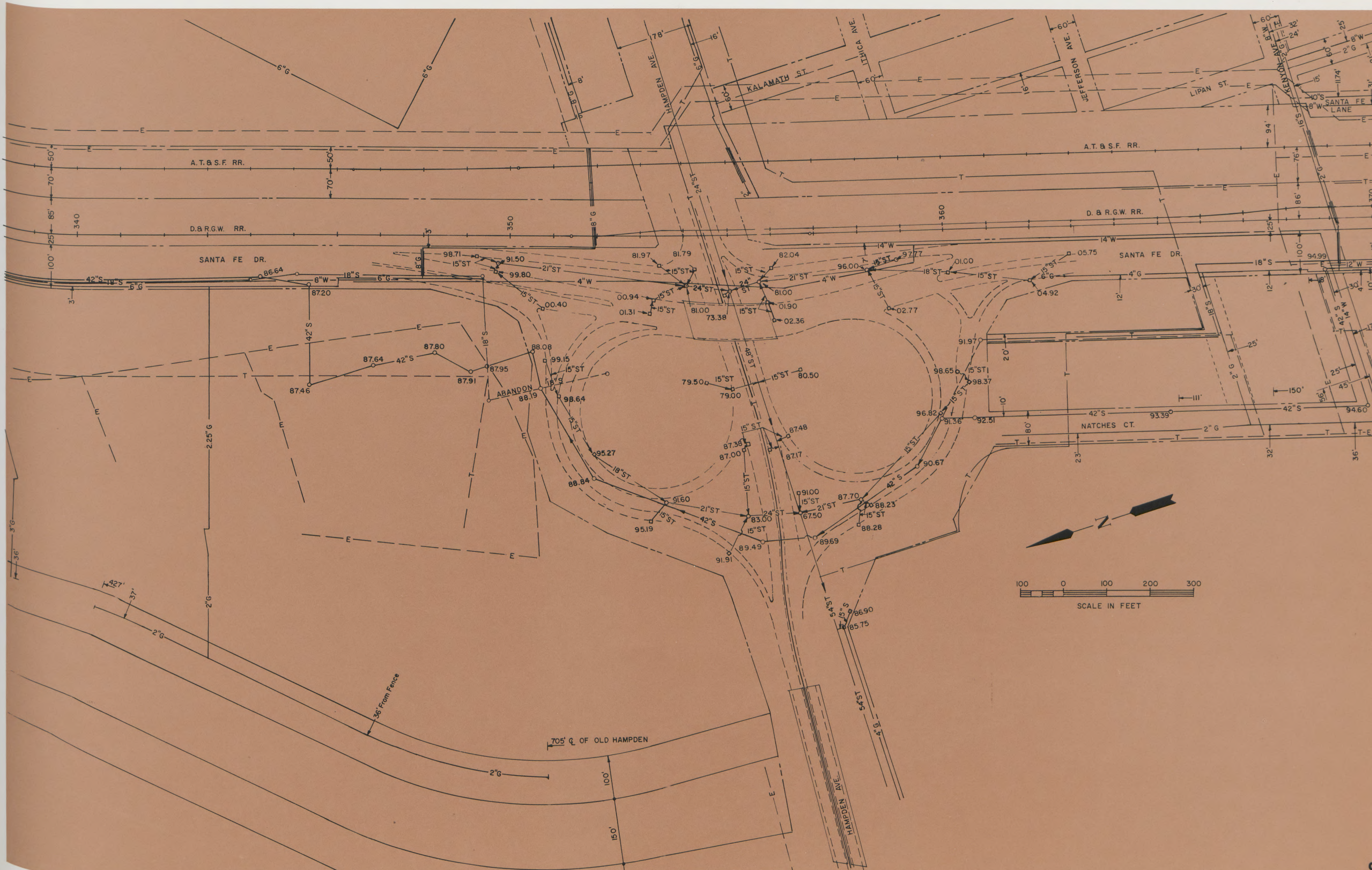
DRWG—45 / UTILITIES—ARKANSAS TO JEWELL



DRWG—46 / UTILITIES— JEWELL TO ILIFF

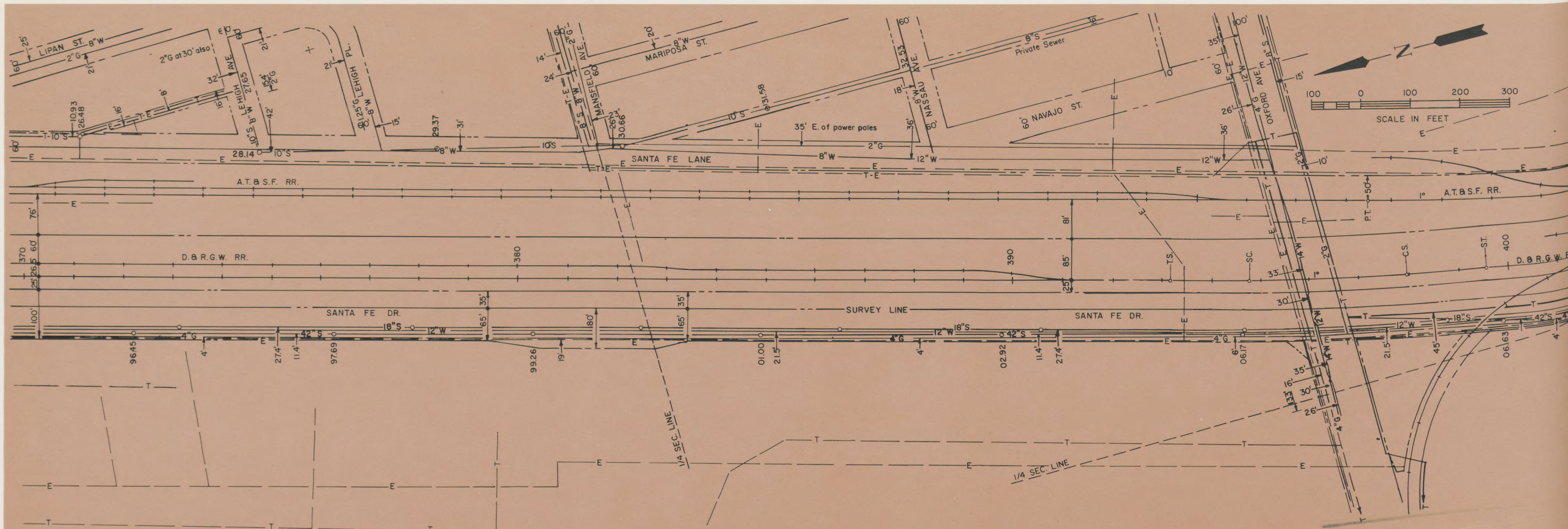
DRWG—47 / UTILITIES—ILIFF TO DARTMOUTH





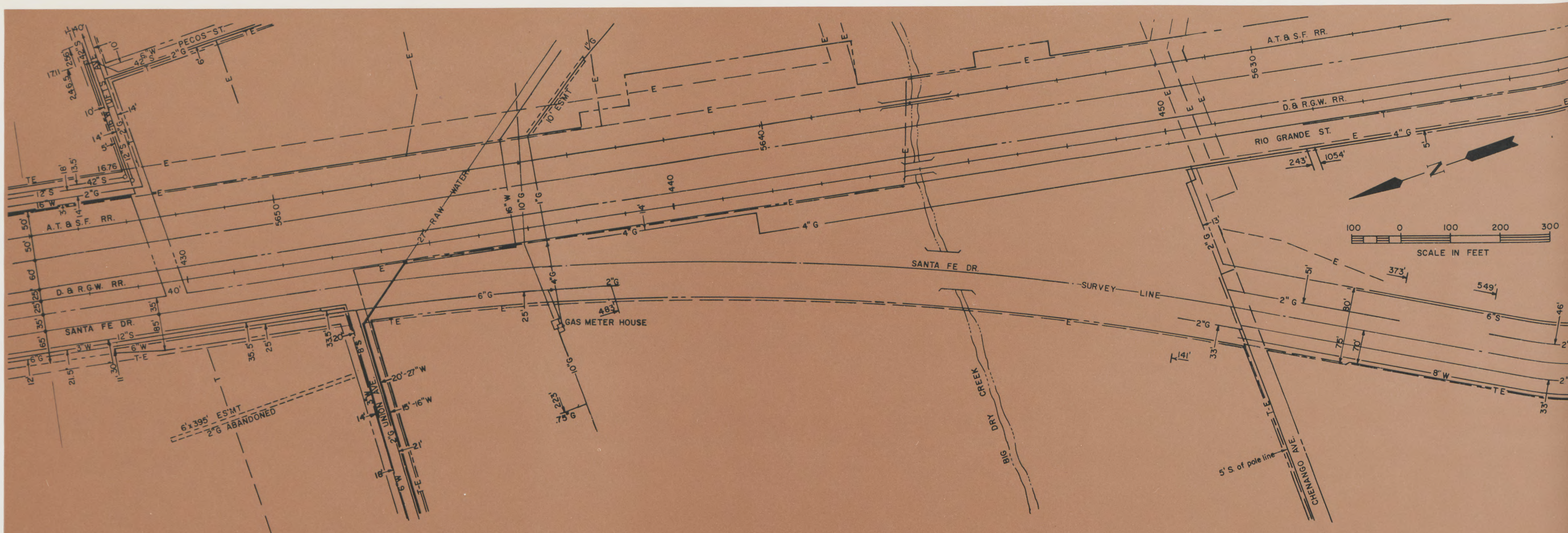
DRWG—48/UTILITIES—DARTMOUTH TO KENYON

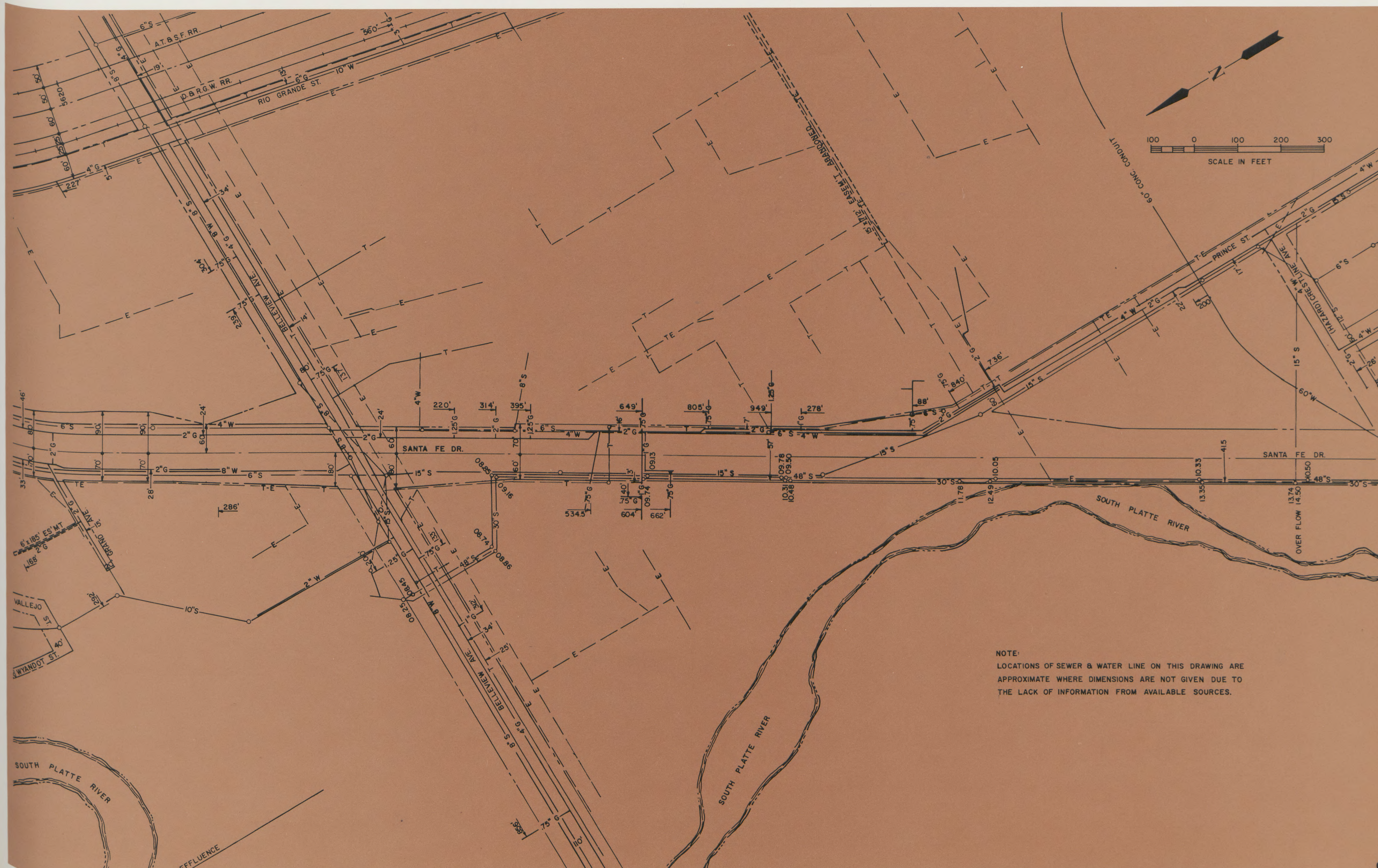
DRWG—49/UTILITIES—KENYON TO OXFORD



DRWG—50/UTILITIES—OXFORD TO STANFORD

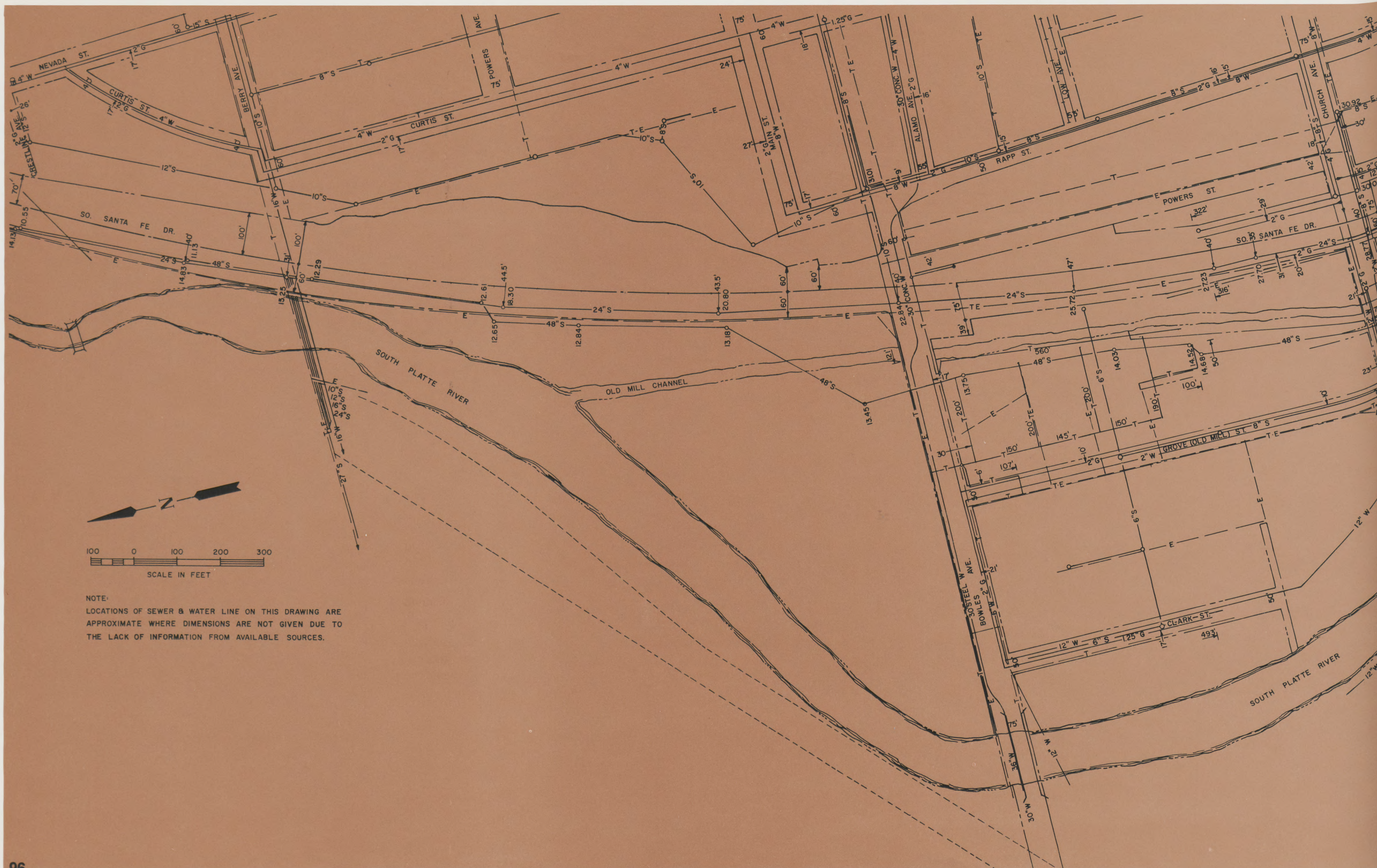
DRWG—51/UTILITIES—STANFORD TO CHENANGO



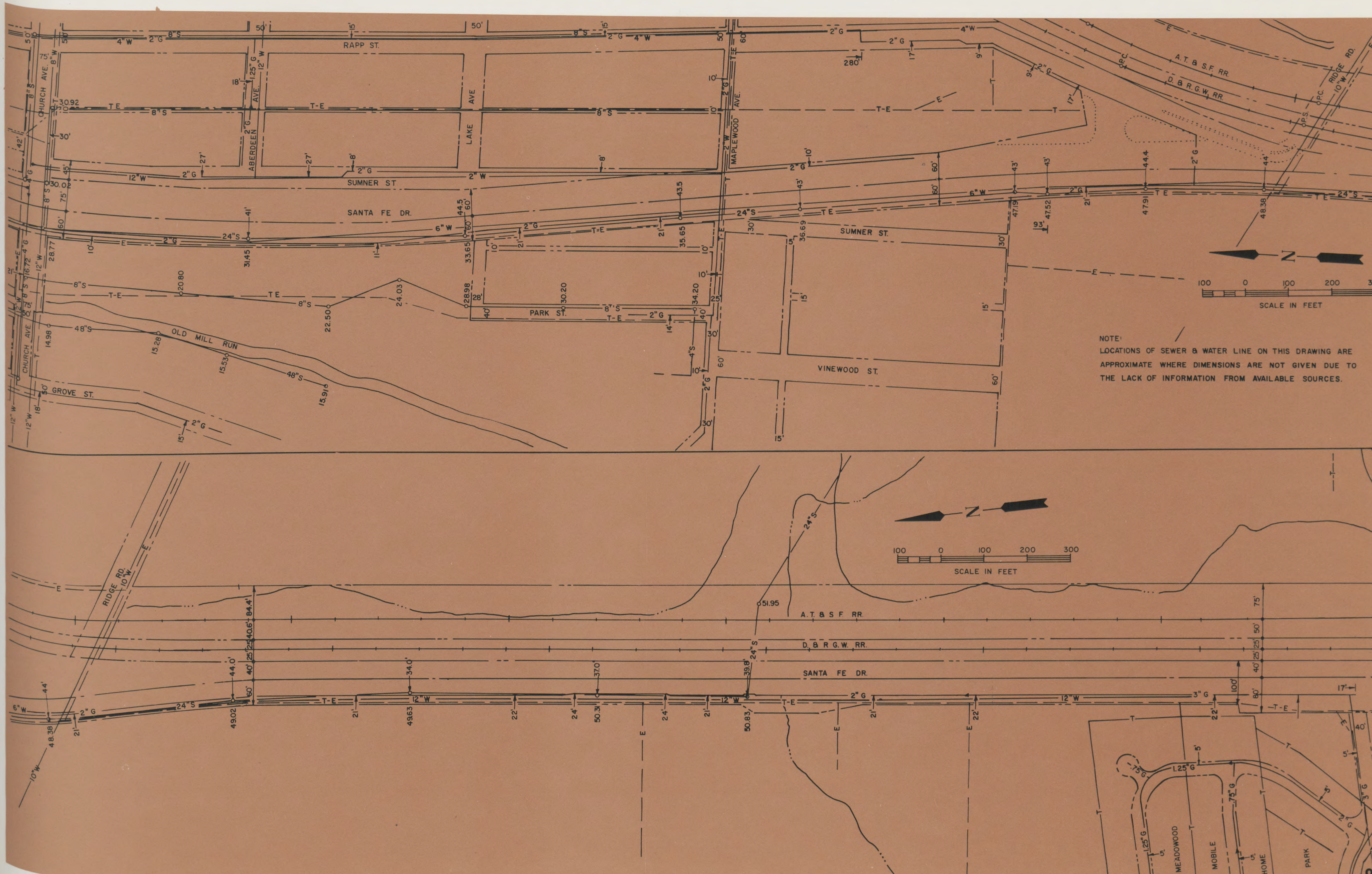


DRWG—52 / UTILITIES—CHENANGO TO CRESTLINE

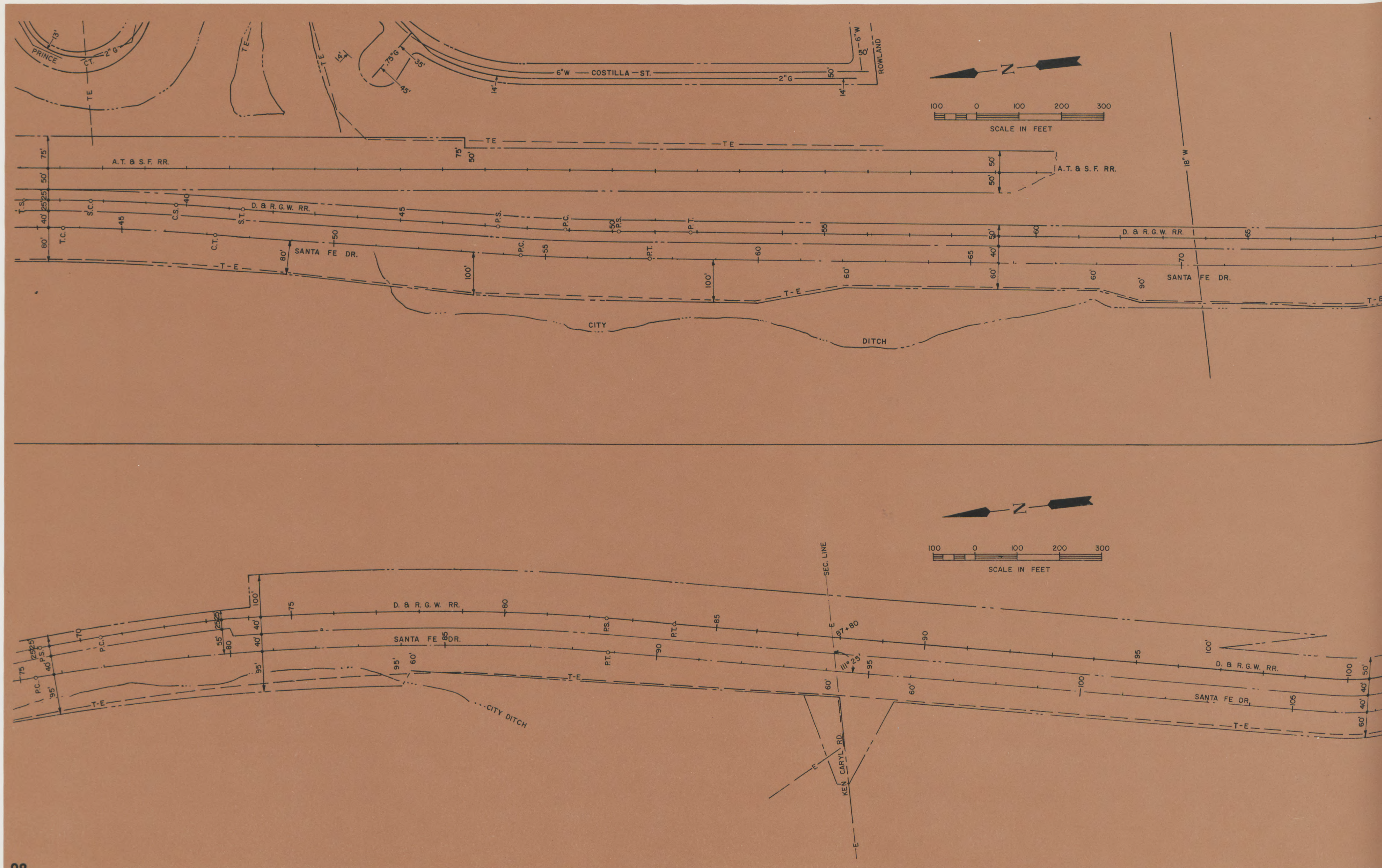
DRWG—53 / UTILITIES—CRESTLINE TO CHURCH

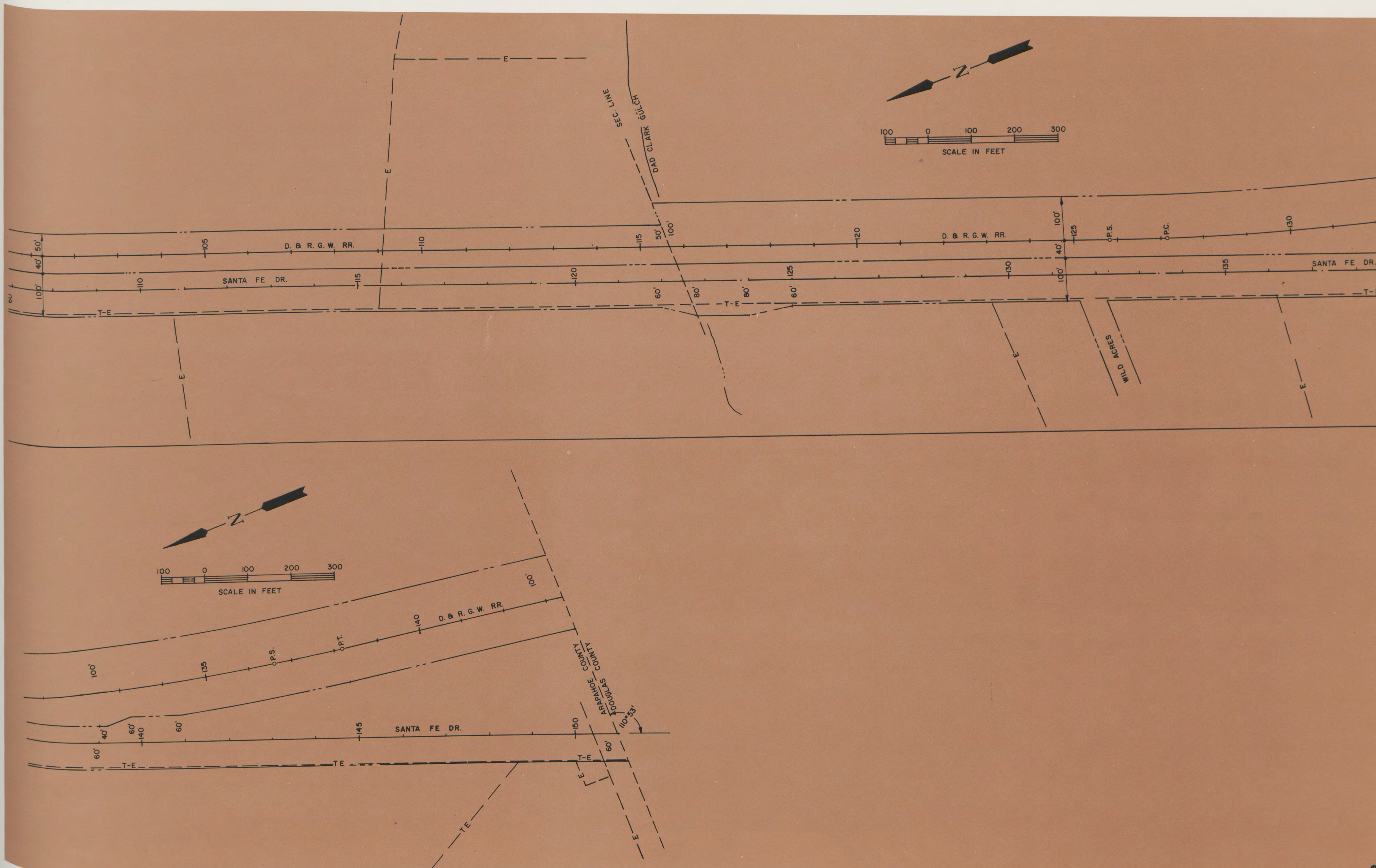


DRWG—54 / UTILITIES—CHURCH TO PRINCE CT.



DRWG—55 / UTILITIES—PRINCE CT. TO KEN CARYL





DRWG—56 / UTILITIES—KEN CARYL TO CHATFIELD RD.

WESTERN ROUTE

INTRODUCTION

This chapter of the report discusses the Western Route from the vicinity of the Valley Highway through the Belleview interchange immediately east of the Centennial Race Track. The Western Route joins the Santa Fe Route at Prince St. and proceeds to the Chatfield Rd. interchange, as explained in Chapter VI. The planning fundamentals of this alignment study are based on an effort to find an alignment which is compatible with the overall development potential of the corridor, but which offers an alternate to the Santa Fe alignment in terms of:

- Utilizing as much vacant, under-utilized, or minimum-cost land as possible.
- Providing an alignment which allows the continued function of Santa Fe Dr. as a major collector street during and after freeway construction.
- Avoiding the engineering and construction restrictions and costs of adjoining the D & RGW and AT & SF railroad tracks.
- Avoiding the costs of utility relocations.

As has been discussed in earlier sections, a number of western alignments were studied in preliminary form. It is felt that the alignment discussed in this chapter is clearly the best of those possibilities. Figure 37 is a summary of the future development potential of the corridor with the freeway in this alignment. The land use and circulation elements which are indicated are consistent with the plans and policies of the public bodies involved in the corridor. General land uses are indicated where existing patterns are expected to continue, or where future patterns are known. As has been discussed in earlier sections of this report, a major premise of the planning has been to leave as much development flexibility and opportunity as possible. Consequently, in Figure 37 contiguous development areas with alternate future use potentials are indicated separately.

PLANNING, PRELIMINARY DESIGN, AND LANDSCAPE CONSIDERATIONS

Preliminary design drawings for this route are included at the end of this chapter. These are Drawings 57 through 71, plan and profiles, and Drawings 72 through 83, interchange layouts including ramp and cross street grades. Frontage road grades are proposed to be at or near the existing ground line and therefore are not shown in these plans. In isolated cases where the frontage road grade is critical, a segment of it is shown with the interchange grade sheets.

Discussion and recommendations are included for planning and landscape considerations as they affect the freeway and adjacent lands. Items which typically affect adjacent lands are community improvement and development opportunities created by the freeway construction. Landscape design cross sections and plans are presented to indicate the typical freeway landscape possibilities.

Valley Highway to Overland Golf Course

As shown on Drawings 57 and 58, the initial construction would include a viaduct north of the Valley Highway with a two lane ramp to Lincoln St. northbound and a two lane ramp from Broadway southbound. This alignment, which passes between the Denver Tramway building and the Robinson Brick and Tile facility, was chosen to avoid as much business and industry as possible. One lane ramps to Dakota Ave. and from Alameda Ave. to the Freeway are proposed. This initial construction will allow for future construction of the Columbine Freeway in a northerly direction somewhere in the area east of Broadway. For initial construction, only those turning movements required considering the Columbine Freeway ends at the Valley Highway are shown. Should the Columbine Freeway be extended north of the Broadway—Alameda intersection in the future, five additional turning movements could be added at the Valley Highway interchange to provide for all turning movements between the two freeways.

At the Valley Highway—Columbine Freeway interchange, full connections are not provided to the Santa Fe—Kalamath Street one way pair. The traffic from this one way pair will continue through the Valley Highway interchange with the northbound traffic using existing Santa Fe Dr. east of the Platte River, and the Kalamath St. traffic southbound using the west side of the Platte River between the Valley Highway and South Inca St. Kalamath St. traffic southbound would cross the Platte River in the vicinity of the Valley Highway as shown on Figure 36 and proceed along Platte River Dr. to South Inca St., where freeway-bound traffic would turn left and enter the Freeway. Referring to the same Figure, northbound traffic for Santa Fe Dr. would leave the Freeway immediately north of Florida Ave., make a right turn on the west side of the Platte River, and proceed to Louisiana Ave., which will connect to Santa Fe Dr. The initial construction of the Western Route should provide for these movements, as shown on Figure 36, to relieve the present serious traffic problem at the intersection of Mississippi Ave. and Santa Fe Dr. To relieve this traffic problem, the following items of work should be accomplished as an immediate first phase of the Freeway construction:

1. Designation of Louisiana Ave. one way eastbound and designation of Mississippi Ave. one way westbound. This one way system would be from the Valley Highway on the east to Pecos St. on the west.
2. Construction of Louisiana Ave. from Santa Fe Dr. through the Navajo Trucking facilities on the existing 60 foot right of way west to Pecos St.
3. Construction of a bridge for Louisiana Ave. across the Platte River.
4. Construction of a Mississippi Ave. bridge across the Valley Highway near South Logan St.
5. Construction of one bridge over the Platte River for the southbound traffic of both Kalamath St. and the Valley Highway.
6. Paving of the West South Platte River Dr. from this Valley Highway connection to Louisiana Ave.
7. Construction of a bridge carrying southbound Santa Fe traffic across the Platte River to join existing Santa Fe Dr.
8. Acquisition of right of way occupied by the Dumb Friends League.

For the Freeway location between the Valley Highway and the proposed Mississippi—Louisiana one way pair, the horizontal alignment was chosen to lie entirely within the block between Huron St. and Inca St. because of the relatively large amount of existing open space. This location also misses Denver's proposed Vanderbilt Park.

One way frontage roads have been designed as a part of the Western Route to serve existing and potential development adjacent to the Freeway. Use of one way frontage roads allows interchanges with crossing streets to be greatly simplified. This is accomplished by allowing off and on ramps to merge with the frontage road traffic before the cross street intersection. Hence, the need for a frontage road plus a ramp intersection with the cross street in the same area on both sides of the Freeway can be replaced with only the frontage road intersection. At each interchange, only two traffic intersections are required, one each side of the Freeway, instead of the normal four. Additionally, with one way continuous frontage roads, traffic can be readily diverted from the Freeway to frontage roads in case of an accident.

Immediately south of the Valley Highway and west of the Platte River, Huron St. will serve as the one way frontage road northbound and Inca St. as a new one way frontage road southbound The Freeway through this area, as shown on Drawings 61 and 62, will be carried on an embankment approximately 22 feet high. An embankment was used in this area to keep the right of way requirements at interchanges at a minimum and best utilize the existing street surface system. Access to the Freeway in the vicinity of Mississippi and Louisiana is provided through on and off ramps north of Mississippi Ave. and south of Louisiana Ave.

In landscape treatment for the section south of the Valley Highway, it is recommended that the Freeway contain major buffer plantings along its east side to preserve the physical integrity of Vanderbilt Park. Considering the industrial nature of the area south of Mississippi Ave., the fill section is not detrimental and minimal plantings of the slopes are recommended. Figure 38 indicates typical landscape treatment between the Valley Highway and Florida Ave.

Overland Golf Course to Dartmouth Ave.

North of Florida Ave. the Freeway will cross the River and descend to the level of the existing golf course land. Frontage roads are discontinued as the Freeway enters the golf course to keep the requirement for right of way an absolute minimum. The existing bridge on Florida Ave. would be maintained to provide additional access to the Freeway. Platte River Dr. on the west side of the River would be carried under the Freeway immediately south of Louisiana Ave. and would be maintained in its present condition adjacent to Ruby Hill Park. At Jewell Ave., the Freeway is to be carried over Platte River Dr. and the existing Colorado & Southern railroad spur to an interchange with West Evans Ave. near South Osage St. The alignment was chosen through the Ruby Hill—Overland Golf Course complex on the east side of the River to avoid the problems involved with relocating the Colorado & Southern railroad spur, interchanging with Florida Ave. at the railroad spur crossing and with disruption of Carberry Field, the railroad spur, Jewell Ave.

CHAPTER VII

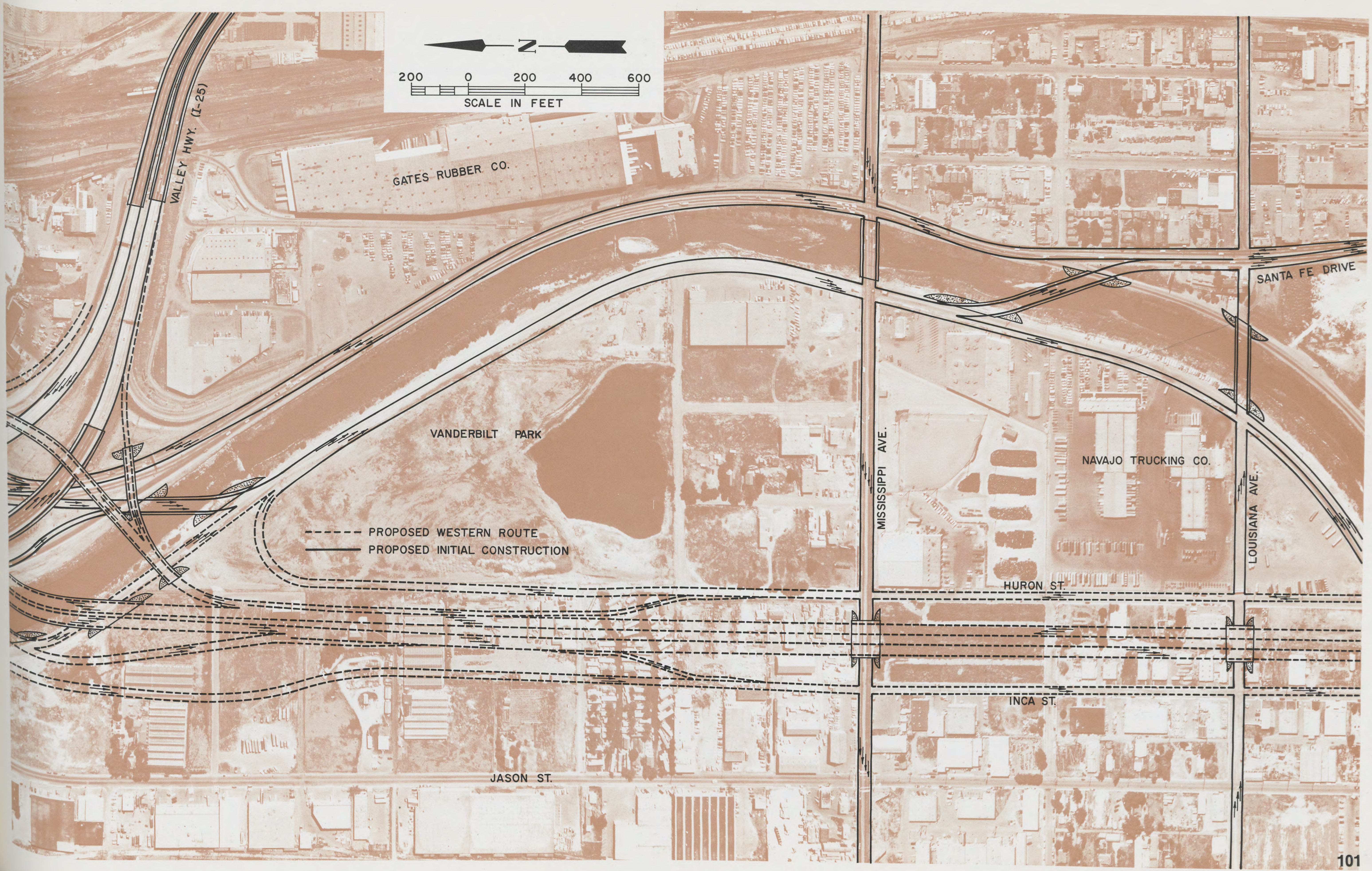


FIG. 36 / MISS. AVE.—SANTA FE DR. IMPROVEMENT

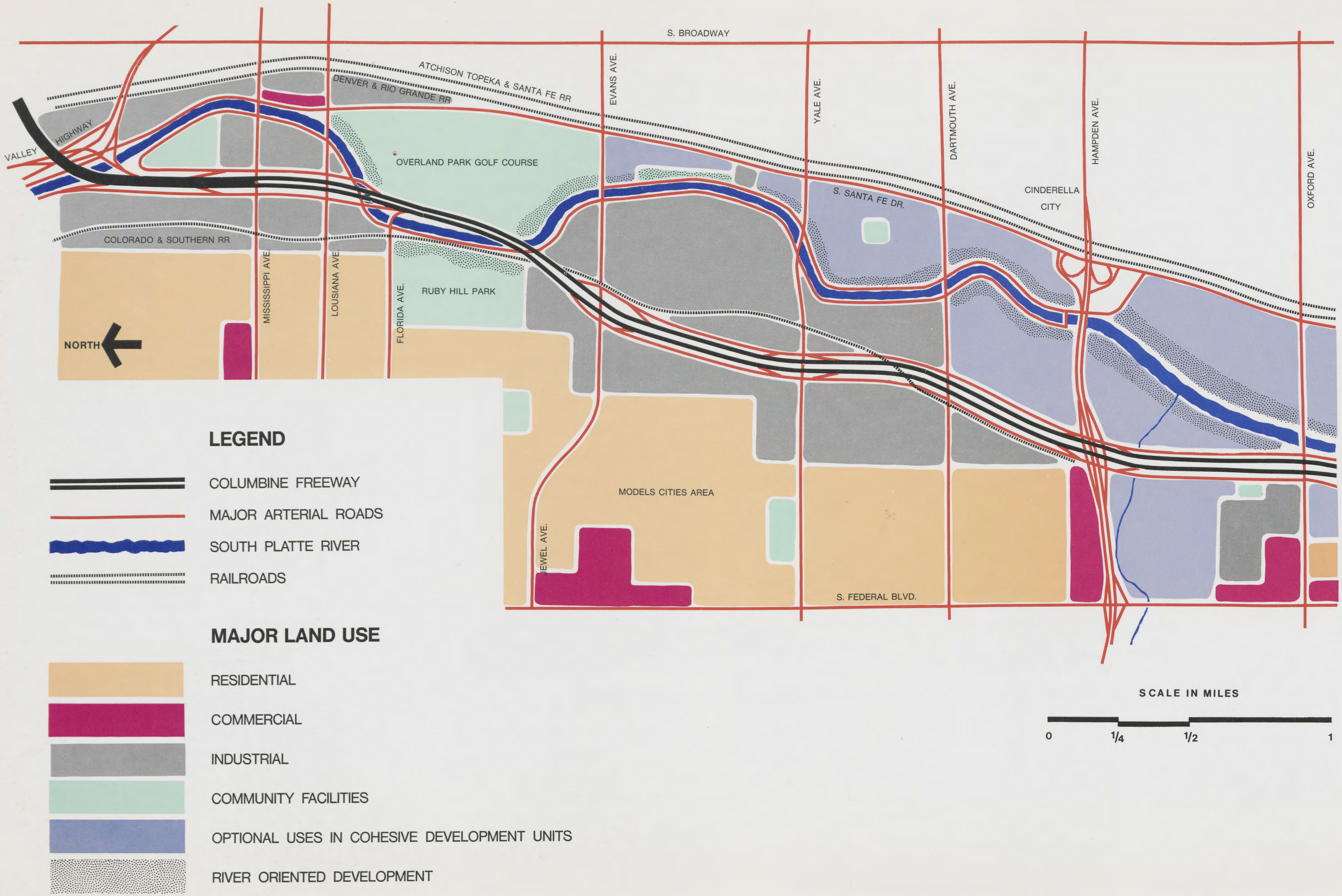
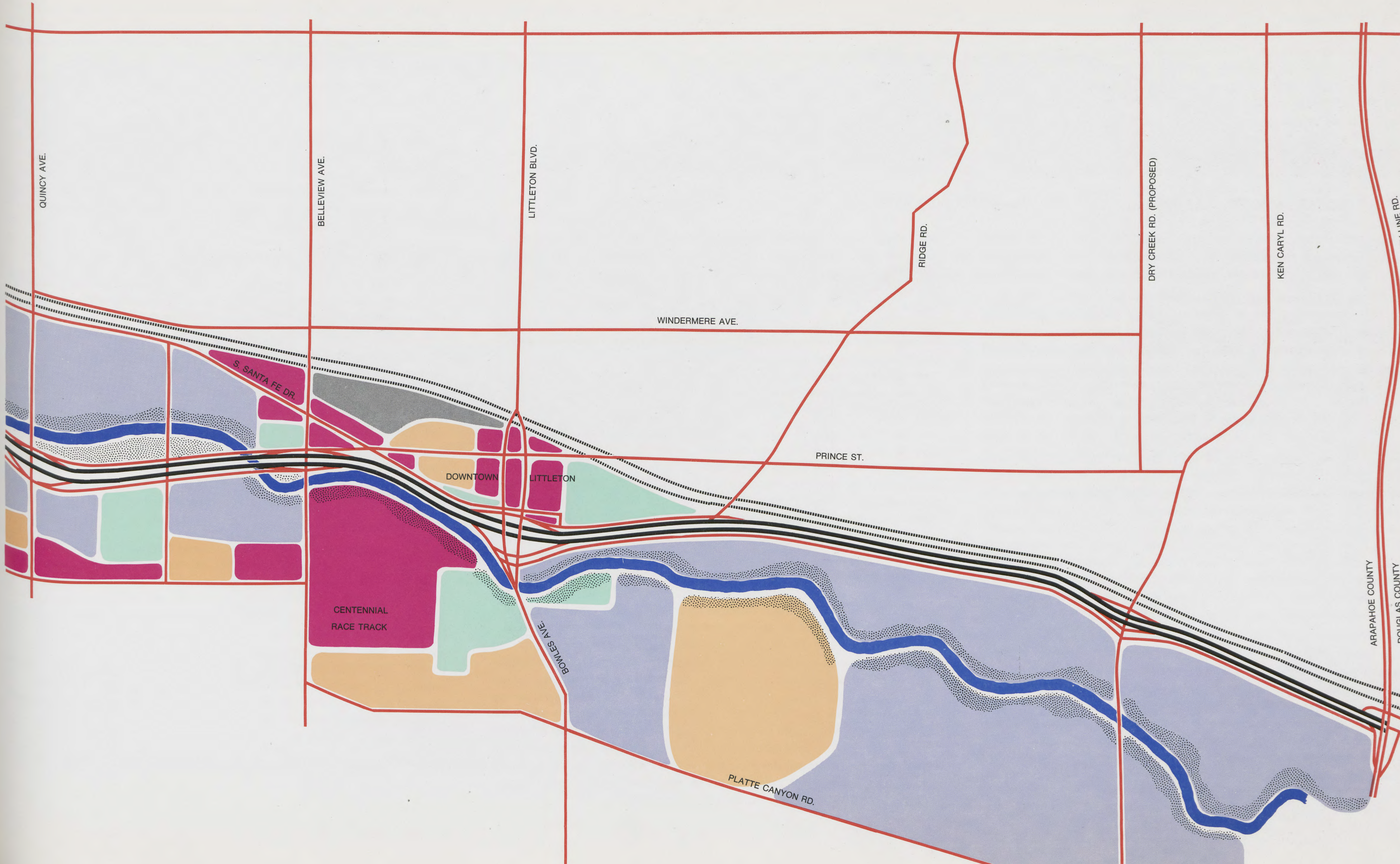


FIG. 37 / DEVELOPMENT POTENTIAL / WESTERN ROUTE


QUINCY AVE.
BELLEVIEW AVE.
LITTLETON BLVD.
RIDGE RD.
DRY CREEK RD. (PROPOSED)
KEN CARYL RD.
COUNTY LINE RD.
WINDERMERE AVE.
S. SANTA FE DR.
PRINCE ST.
DOWNTOWN
LITTLETON
CENTENNIAL
RACE TRACK
BOWLES AVE.
PLATTE CANYON RD.
ARAPAHOE COUNTY
DOUGLAS COUNTY

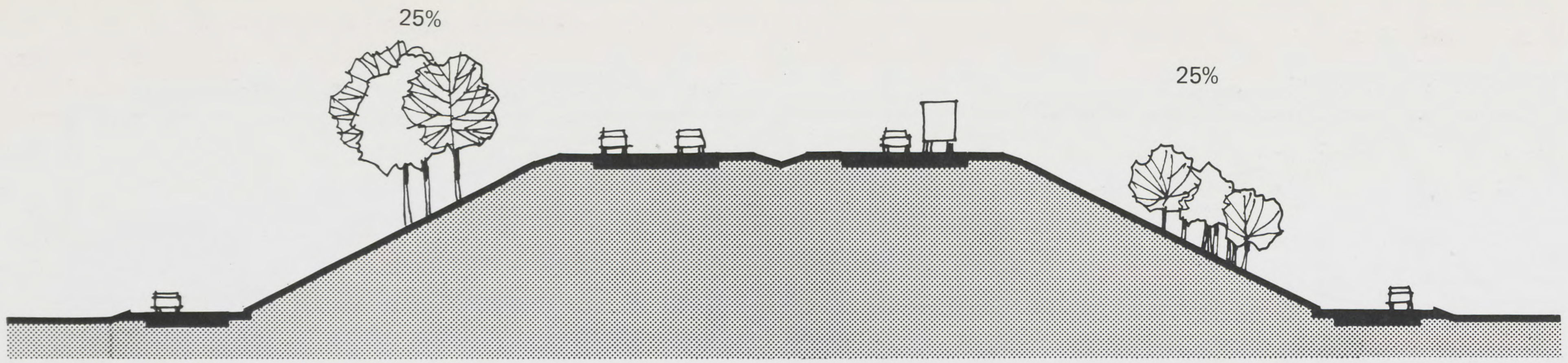


FIG. 38 / TYPICAL LANDSCAPE TREATMENT—VALLEY HIGHWAY TO FLORIDA AVE.

and West Platte River Dr. at the southeast corner of the park. For both the Santa Fe Route and the Western Route, Florida Ave. will be discontinued north of the existing golf course, which is consistent with Denver's plans.

By depressing the Freeway adjacent to the golf course and by berm construction with landscaping through this area, minimum impact on the surrounding areas will occur. The golf course at this location is lower than the elevation of the road which separates it from the South Platte River. The golf course does not currently take advantage of the River visually or functionally. Additional land will be required to replace and reconstruct portions of the golf course immediately south of Jewell Ave. The right of way cost to the Freeway should include the equivalent cost of acquisition of land south of Jewell Ave. and the cost of the Freeway construction should include the necessary golf course reconstruction. Figure 39 indicates the proposed future land use and park development in this vicinity.

A very intensive buffer planting is recommended in this area, together with depression of the Freeway, and the construction of 10 foot earth berms flanking both sides. A continuous green planting on the berm is recommended, including both eye-level shrubs and large trees. Figure 40 summarizes the landscape treatment in this area. It is recommended that the river front drive on the west side of the River be retained as a landscaped parkway from Alameda Ave. to Evans Ave. South of Evans Ave., the river front drive can be developed on both sides of the River.

At the southeast corner of Ruby Hill Park, as the Freeway passes over the railroad spur it clears the existing street intersection of West Platte River Dr., Jewell Ave., and South Lipan St., leaving these streets undisturbed. At Evans Ave., as shown on Drawing 75, a diamond interchange is planned and the one way frontage road system is reinstated to the south. The existing foundry shown at Evans Ave. has been completely dismantled and that property is presently vacant. South of Evans Ave., the Freeway alignment follows the natural terrain with the northbound lanes being set approximately two feet lower than the southbound lanes. There is also a two foot drop between each of the frontage roads and the Freeway lanes.

With the exception of a block of industrial properties in the New Englewood Industrial Park, this alignment crosses vacant and low-intensity use land. The disruption of economic activity in the valley is minimum. Moreover, the alignment generally follows the route of the Colorado & Southern railroad tracks and, as such, does not provide any new or additional barrier which would disrupt development in the corridor. It can be anticipated that the completion of the Freeway with access points at Evans, Yale and Hampden Avenues will substantially improve the development potential of this area. This alignment, which has been coordinated with Denver and Englewood Planning Departments, avoids any conflict with the Denver Model Cities neighborhood program which is proposed for the College View area.

At a point just north of Yale Ave., the Freeway, after it clears the drainageway in that location, becomes depressed south to Bear Creek. A diamond interchange with slip ramps is planned for Yale Ave., with the Yale Ave. bridge set at the street's existing grade. Through this area of newly developed light industry, one full block and part of another block south of Bates Ave. will be taken by the Freeway. Several alignments through this area were investigated, and they are discussed as follows:

1. An alignment was investigated which would cross the Denver Glass Co. plant near the Colorado & Southern railroad spur north of Yale Ave. Because of the depth of the drainageway north of Yale, depressing the Freeway would require that the drainageway be carried under the Freeway in a siphon. If the Freeway were carried on an embankment, the drainage problem would be solved but the ramp to Yale Ave. from the Freeway northbound would conflict with the railroad spur. Further, the frontage road connection with Yale Ave. would meet very close to the Colorado & Southern railroad spur crossing. With this alignment, a large portion of the open ground owned by Robinson Brick and Tile Co. east of the railroad spur which is scheduled for future expansion would be taken. Acquisition of the Robinson Brick and Tile Co. land would leave that facility without a direction for plant expansion. This alignment would also conflict with a Public Service Co. overhead transmission line south of Yale Ave. It was determined that no saving in right of way cost could be realized by using this alignment.

2. Another alignment investigated for this area was between Tejon St. and Shoshone St. Tejon St. has recently been improved and is the only good north-south two way street providing service for the industrial area and should not be taken for use as the one way southbound frontage road. In addition, much of the present open land east of Tejon St. will be developed by the time of Freeway construction.

3. Another alignment through this area along Zuni St. was investigated and was discarded because of its conflict with the Denver Model Cities program.

The alignment selected was found to be the most feasible location that would (1) clear the Colorado & Southern railroad spur which must be maintained; (2) preserve as much expansion land of Robinson Brick and Tile Company's facility as possible; (3) clear the Denver Glass Company's manufacturing facility and leave some usable industrial land west of the railroad spur; and (4) clear the drainageway north of Yale Ave. Further, it was noted that there are many prime industrial sites available in the immediate area for relocation of the light industry which will be taken.

In the event that Yale Ave. cannot be used for an interchange location, Dartmouth Ave. can be substituted in this Freeway plan without major disadvantage or cost. If Dartmouth is substituted as the interchange point, Yale Ave. would be carried across the Freeway in a grade separation crossing.

With the proposed alignment, it is recommended that the Colorado & Southern railroad spur be relocated from Dartmouth north to obtain a reasonable crossing angle for the railroad bridge, as shown on Drawing 66. The railroad relocation requires relocating the connection between Tejon St. and Dartmouth Ave. slightly to the west and acquiring a small amount of additional right of way.

In the section north of Yale Ave., only minimum landscape planting is recommended as shown in Figure 41 due to the industrial nature of the area. From Yale Ave. south, with the Freeway depressed only a limited amount of planting to provide visual interest is recommended, as shown in Figure 42.

Dartmouth Ave. to Quincy Ave.

South of Dartmouth Ave., the Freeway passes through the Lowdermilk Construction yard and an open area north of Hampden Ave. The open area is currently occupied by 3 sets of double overhead transmission towers owned by Public Service Co. which would have to be relocated in new right of way east of the Freeway. From Dartmouth Ave. through Hampden Ave. to Bear Creek, the Freeway continues depressed, and at Hampden Ave. a tri-level diamond interchange is proposed as shown on Drawing 78. For this interchange, the turning level would be approximately 10 feet above existing ground with Hampden Ave. carried over the turning level. Two bridges are required for the turning level lanes and one long bridge is required for Hampden Ave., as shown in Figure 18.

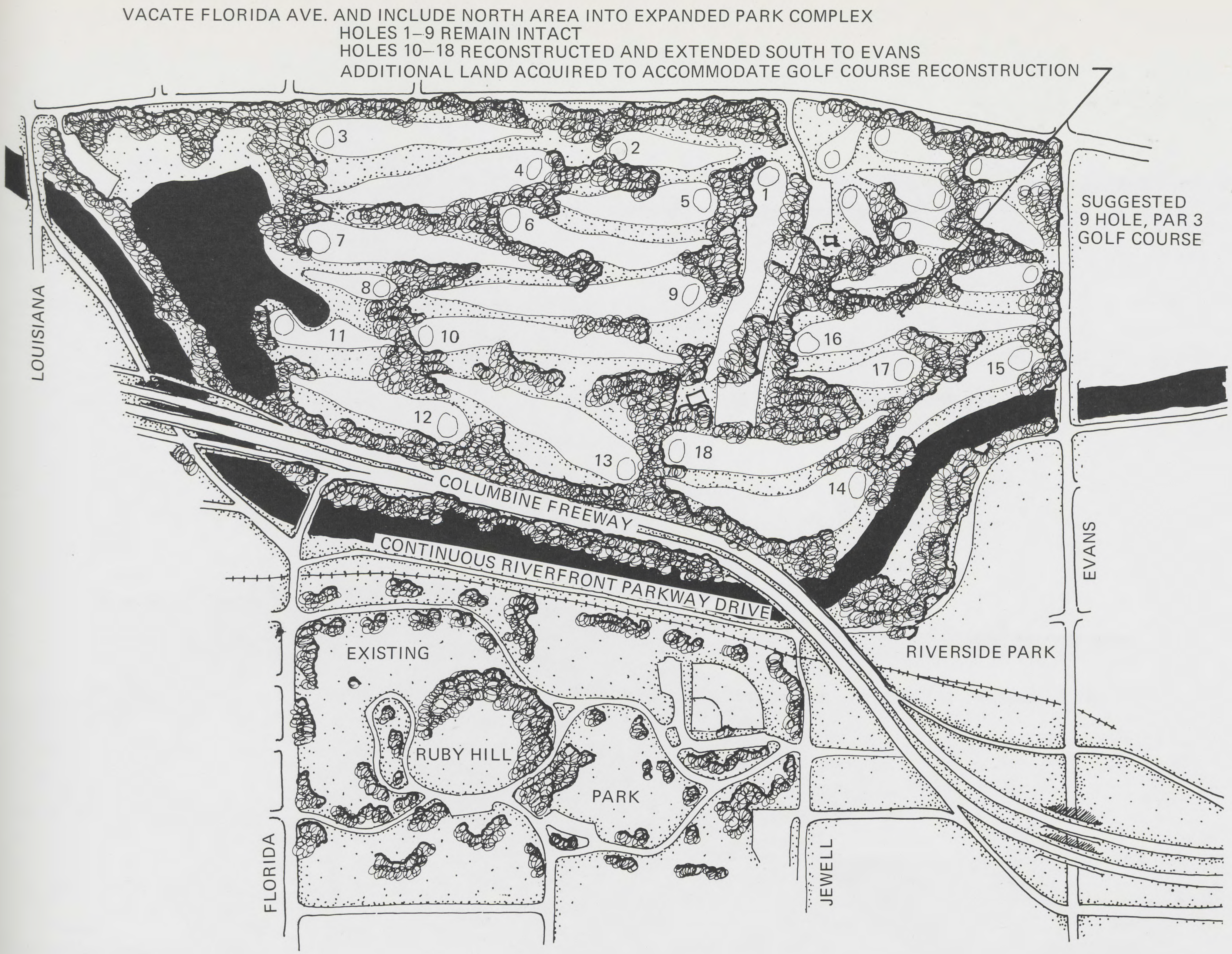


FIG. 39 / SUGGESTED FUTURE LAND USE: OVERLAND PARK–RUBY HILL PARK

From Hampden Ave. to Belleview Ave., the Freeway alignment will traverse virtually undeveloped ground. The alignment of the Freeway adjoins the proposed realignment of the Platte River south of Oxford Ave. In this location the alignment does not disturb existing development patterns, and of the various western alignments studied, this one is preferred by the majority of public planning jurisdictions involved. It is possible that future public and private policies may change and may seek to achieve substantial development and recreational facilities oriented specifically to the river through this section. If that should occur, and if the Freeway in this western alignment should become a detriment to river-oriented development, an optional alternate alignment is possible. The Freeway could traverse from the western interchange on Hampden Ave. southeasterly to connect with Santa Fe Dr. in the vicinity of Quincy Ave. The latter would provide a freeway alignment which crosses the river almost perpendicularly, preserving maximum river-oriented development potential through this section. It will be desirable to keep this option open. Construction in the freeway section south of Hampden will occur in the later phases, and both the development conditions and public policies may have changed by that time.

South of Hampden Ave., the Freeway crosses Bear Creek, which will be carried in a concrete box culvert. South of Bear Creek, the profile is set at approximately existing ground elevation of the area to the west. Much of this Freeway area will have to be filled to provide the profile elevations shown on Drawing 68. It is anticipated that the fill required for this location would be available from the excavation obtained in the depressed section between Yale Ave. and Hampden Ave.

Oxford Ave. will be carried on new bridge structures over the Platte River and over the Freeway approximately 10 feet above its present elevation. The existing Oxford Ave. bridge over the River will have to be reconstructed to raise its elevation to match the proposed bridge elevation over the Freeway. In addition, the River will have to be relocated slightly to the east in this area. Clearances and elevations have been designed for the Oxford crossing so that the existing D & RGW railroad spur can be constructed across the River and the Freeway in the future, should the industries or the railroad wish to pay for such bridge construction. The railroad bridge across the river was washed out in the 1965 flood and has not been replaced at the time of this report writing. The assumption was made in determining proposed grades for the Freeway from Oxford Ave. south that the Corps of Engineers' Platte River downstream channel improvements would be completed prior to the Freeway construction.

Quincy Ave. to Prince St.

The diamond interchange planned at Quincy Ave. (Drawing 69) will provide access to the planned extension of Quincy Ave., as discussed in Chapter VI. The channel bottom of the Platte River will be lowered between Quincy Ave. and Belleview Ave., and the lowering will vary from approximately 13 feet at Quincy Ave. to approximately 8 feet at Belleview Ave. South of Quincy Ave., the Freeway appears to cross the River in two areas where the River makes a loop. This loop will be removed with the River downstream channel improvements. A request has been made by the Colorado Water Conservation Board that the Corps of Engineers remove this loop. Representatives of the Corps have indicated that this requested revision is no particular problem, and the necessary redesign for elimination of the loop will be incorporated in the construction plans. Immediately south of this loop and north of Union Ave., as shown on Drawing 70, the Freeway is slightly depressed and is located immediately east of Englewood's proposed Centennial Park. A crossing bridge will be provided at West Union Ave. even though it has a limited potential as a traffic carrier. Englewood has plans to locate a fire station in the planned park, and fire equipment from this station would need access both directions on Union Ave.

Through the area from Hampden Ave. to Belleview Ave. continuous, major buffer plantings are recommended along the entire west side of the Freeway. Figure 43 indicates the typical landscape treatment through this area. South of Union Ave., a proposed park and river front open area is suggested on land between the Freeway and the river. A schematic plan of this area is included in Figure 44.

As shown on Drawing 70, in the area of Sta. 340+00 the Freeway and frontage roads will be carried across the river on four separate bridge structures. The Freeway is carried over Belleview Ave. on twin bridge structures, and south of Belleview Ave. the alignment curves to join the Santa Fe Route alignment at Sta. 370+00. From Station 370+00 to the Chatfield interchange, the Western Route and the Santa Fe Route are identical.

A diamond interchange is planned for Belleview Ave., as shown on Drawings 71 and 82, with an additional channel relocation of the River required between Belleview Ave. and Crestline Ave. to accommodate the Western Route. South of Crestline Ave., as explained in Chapter VI, channel relocation will be required for both Routes. The Belleview interchange is held to the west to avoid conflict with the Littleton Sewage Treatment plant. Commercial properties fronting on Santa Fe Dr. at Belleview Ave. are substantially preserved.

At the Belleview interchange as well as at the Quincy interchange, three southbound lanes have been provided on the frontage roads to allow for the high anticipated turning volumes from the Freeway southbound to eastbound. South of Belleview Ave., as shown on Drawing 71, a two way frontage road connection has been provided to allow a direct traffic connection between Prince St. and Belleview Ave. The two way connection with Prince St. is aligned directly with the frontage road north of Belleview Ave. to provide a direct connection from downtown Littleton to northbound on the Freeway.

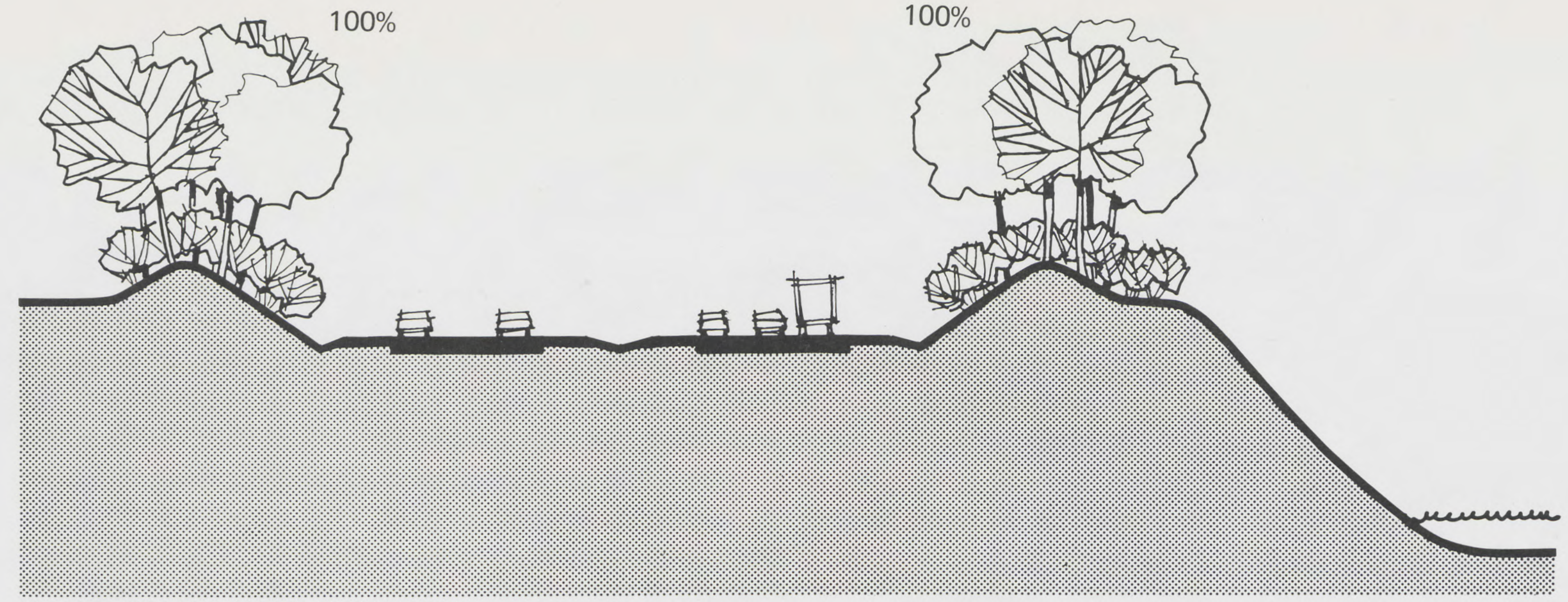


FIG. 40 / TYPICAL LANDSCAPE TREATMENT—FLORIDA AVE. TO JEWELL AVE.

FIG. 41 / TYPICAL LANDSCAPE TREATMENT—JEWELL AVE. TO YALE AVE.

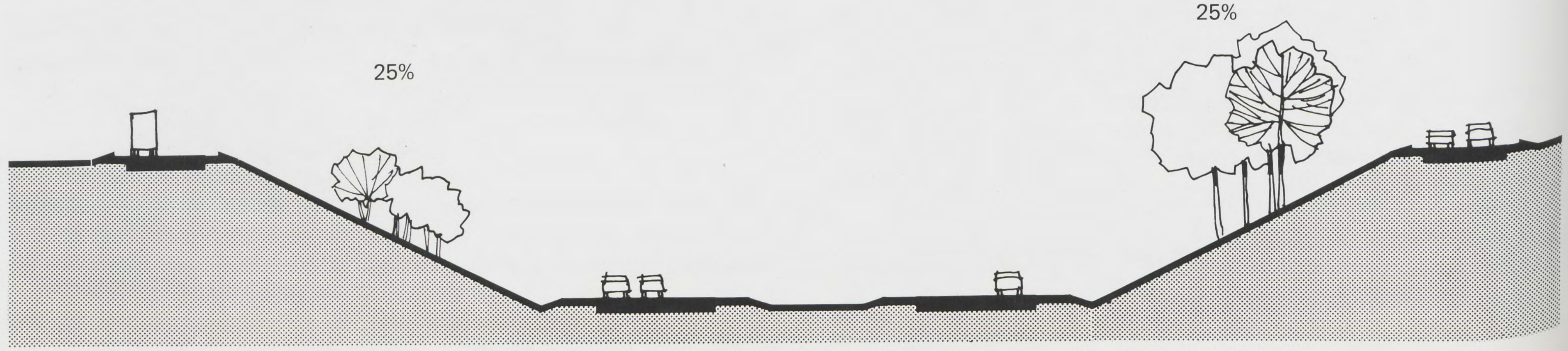


FIG. 42 / TYPICAL LANDSCAPE TREATMENT—YALE AVE. TO HAMPDEN AVE.

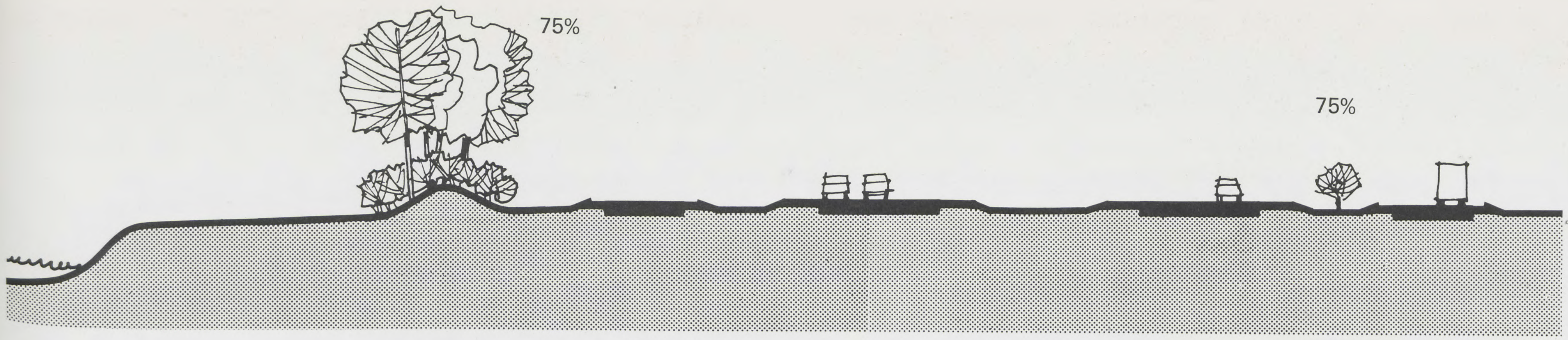


FIG. 43 / TYPICAL LANDSCAPE TREATMENT—HAMPDEN AVE. TO BELLEVIEW AVE.

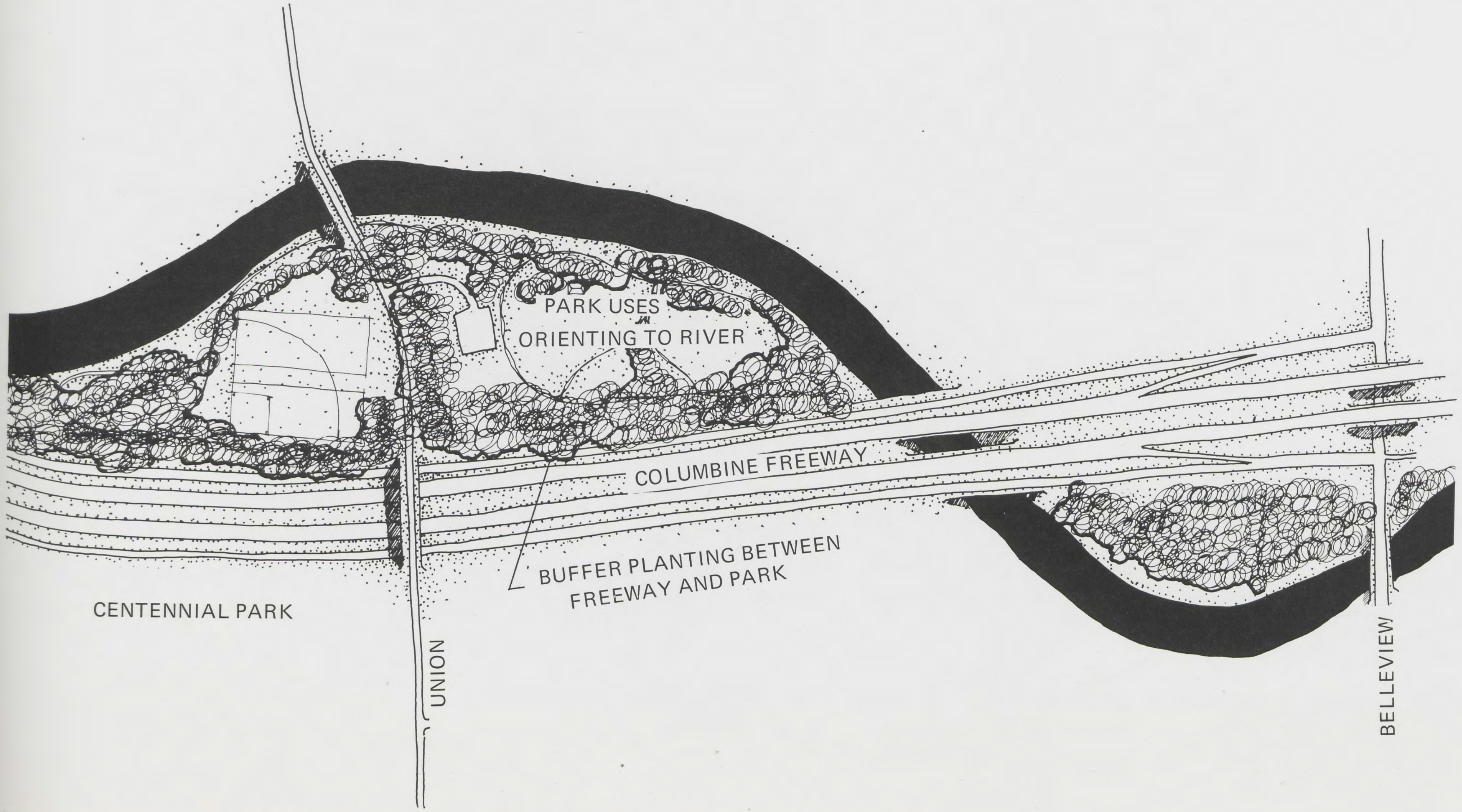


FIG. 44 / SUGGESTED FUTURE LAND USE BETWEEN FREEWAY & RIVER AT UNION AVE.

STORM DRAINAGE

The drainage study which was made for the Western Route encompassed all of the anticipated storm drainage areas west of the proposed Freeway which will have to cross the roadway at various points between the Valley Highway on the north and Belleview Ave. on the south. These drainage areas, as shown on Drawing 84, were defined utilizing USGS existing topography maps and the existing storm sewer system in the area. A field inspection was made of the drainage division lines to insure that they were located properly.

Basic assumptions were the same as used for the storm drainage study on the Santa Fe Route. The results of the Drainage Study for the Western Route are summarized in Table 3.

UTILITIES

Utility relocation for the Western Route is greatly reduced in comparison to the Santa Fe alignment. The largest water line to be moved is 14" diameter and the largest sewer is 24". No extraordinary problems are anticipated in the relocation of any underground utilities for the Western Route. The only large expense for utility adjustment will accrue in relocating the Public Service Co. power transmission towers. At some locations, two new towers will be required to replace the one tower which is in the proposed alignment. Only four tower relocations will be encountered on the Santa Fe Route compared with thirteen for the Western Route. Costs of new right of way for relocation of the Public Service Company's power lines, where required, have been included in the overall right of way costs for the Western Route. In addition, costs of all new or relocated power line towers have also been included in the construction costs for utilities on the Western Route.

CONSTRUCTION PHASING

As for the Santa Fe Route, the high cost of the Western Route would require at least six segments of construction for completion of the Freeway. The six segments are recommended to be the same as for the Santa Fe Route, noted in Chapter VI.

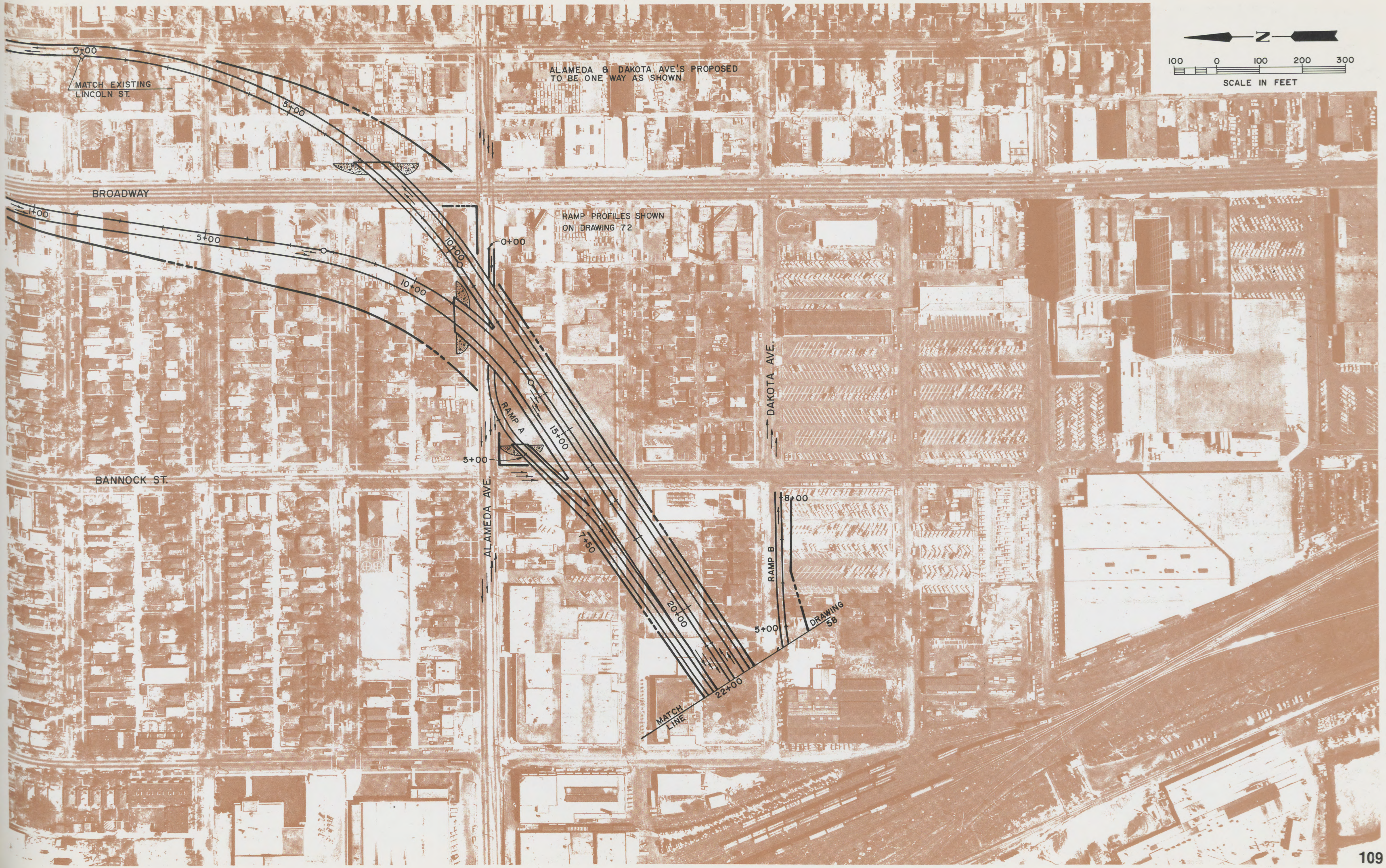
The Western Route could be "a road to nowhere" unless a segment to at least Evans Ave. is constructed. It is expected that some traffic on Santa Fe Dr. would detour west to a freeway at Evans Ave., but not until the Columbine Freeway connected with Hampden Ave. would a large amount of traffic relief be provided for Santa Fe Dr.

Along the Western Route, no problem exists in maintaining the existing corridor traffic north of Belleview Ave. Considerably less involved detouring and traffic control of arterial streets will be required over the entire route than would be required for a freeway located on Santa Fe Dr. north of Belleview Ave. Union Ave. and Dartmouth Ave. will require detouring of their through traffic. At Hampden Ave., the eastbound and westbound turning level bridges and ramps should be constructed initially and used by the Hampden traffic while the remainder of the interchange is constructed. Traffic on Oxford Ave. would have to be terminated to allow for construction of a new Platte River bridge at an elevated level.

All other streets through interchanges on the Western Route to Bowles Ave. are to remain at existing grade and, thus, minimum interruption of their traffic can be expected during the construction.

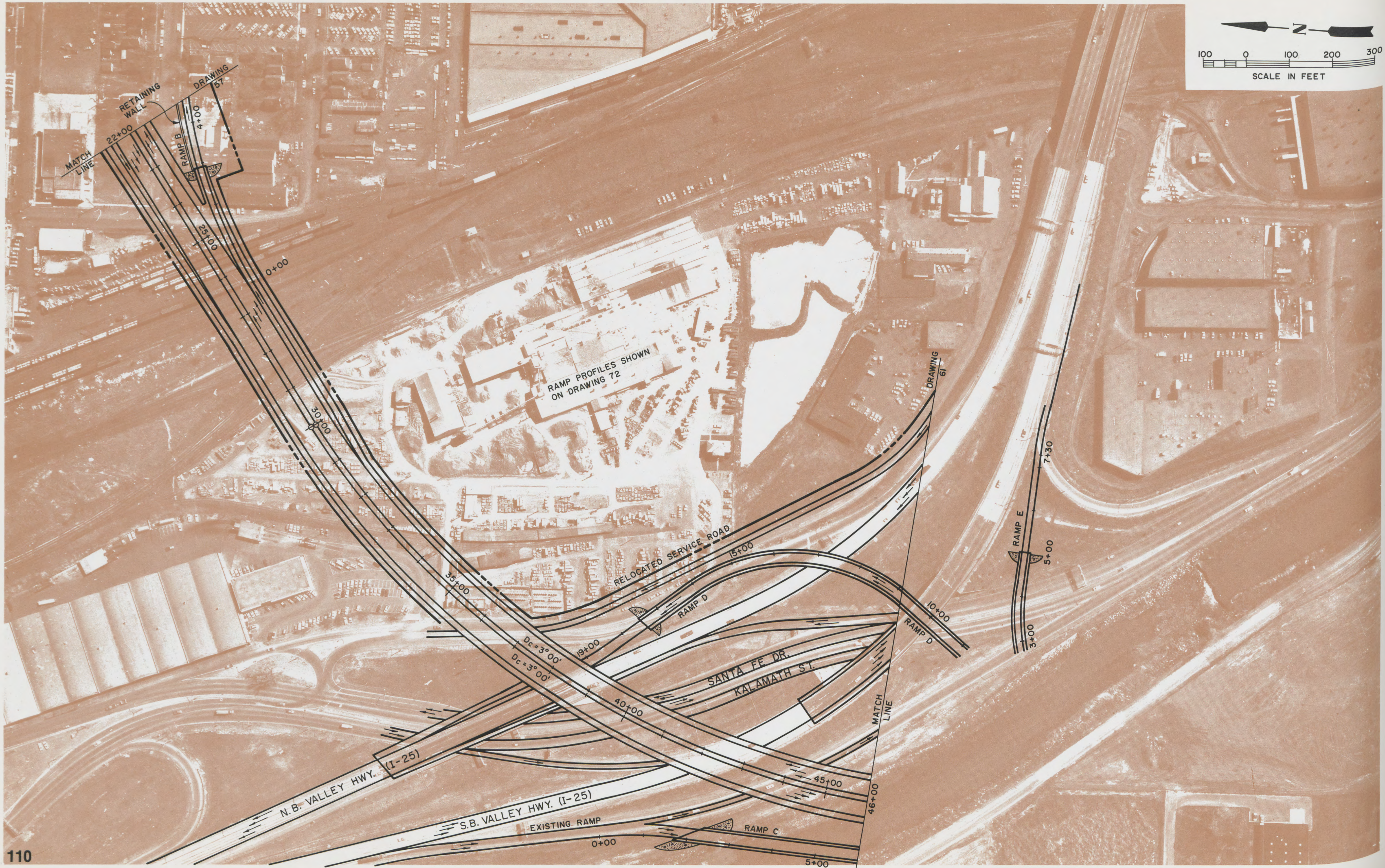
TABLE 3 / DRAINAGE SUMMARY—WESTERN ROUTE

Drainage Area Designation	Area (Acres)	Discharge for a 50 Yr. Storm (cfs)	Existing Major Structures	Proposed Major Structure	Remarks
1	551	682	27″ x 43″ arch storm sewer on Mississippi Ave.	Existing 27″ x 43″ storm sewer	No additional culvert is planned at this point because the existing excess drainage flow is carried in Mississippi Ave. and the Freeway will cross Mississippi Ave., leaving the existing storm sewer facilities as they are.
2	5,326	2,130	12′ x 15′ CMP arch under West S. Platte River Dr. north of Florida Ave.	Existing 12′ x 15′ arch	This drainage draw, Sanderson Gulch, does not cross the Freeway because the Freeway is located east of the South Platte River on Overland Golf Course at this location.
3	101	217	30″ x 30″ wood BC approx. 700′ north of Jewell Ave. & 36″ CMP approx. 1100′ south of Florida Ave.	Existing Structures	Since the proposed Freeway is still east of the South Platte River in this area, no damage to the Freeway will result by leaving the existing structures as they are, even though larger structures would theoretically be required to handle the discharge for a 50 year design storm.
4	367	586	None	9′ x 6′ CBC @ Sta. 154+00	Presently the drainage for this area empties into a ditch at the southeast corner of Evans Ave. and Raritan St. and is then carried through a pipe and open ditch in a southeast direction (See Drawing 74) to Area 5. In Area 5, this drainage then flows under the Colorado & Southern spur in two existing pipes, one a 96″ RCP and one a 60″ RCP.
5	73	146	None	54″ RCP @ approx. Sta. 167+50	This pipe will be in line with an existing 60″ RCP that passes under the C & S railroad spur just to the east of this location.
6	918	959	None	12′ x 7′ CBC @ Sta. 184+00	This is presently a very well defined drainage draw.
7	266	465	None	8′ x 6′ CBC @ approx. Sta. 215+00	The existing drainage flow for this area is concentrated at the intersection of Tejon St. and Dartmouth. At the time of Freeway construction the drainage could be picked up west of Tejon St. and carried across the Freeway in an aerial box culvert.
8	—	2,600	None	12′ x 8′ Dbl. CBC @ Bear Creek	The 2,600 cfs is the design flow east of Federal Blvd. for a 100 year storm, assuming the construction of the Mount Carbon Dam. This figure was furnished by the Corps of Engineers, Omaha, Nebraska.
9	275	322	None	8′ x 5′ CBC @ approx. Sta. 305+00	At present the drainage draw is ill defined east of Federal Blvd. because of the gravel pit operations. When the Freeway is constructed and the area develops to its potential, this major drainage structure will be required.
10	459	620	None	None	This area is presently quite flat east of Federal Blvd., but when developed the drainage flow for this area can be concentrated at the southeast corner of the drainage area and directly into the South Platte River.
11	597	604	None	None	No drainage structure is planned to cross the Freeway for this area because the Freeway will be located on the east side of the South Platte River before reaching Belleview Ave.

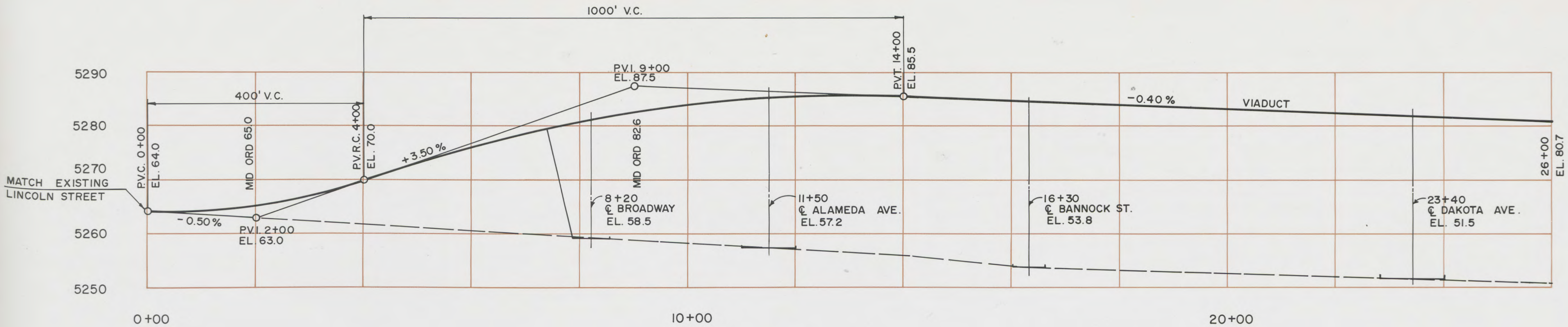


DRWG—57 / PLAN STA. 0 TO 22

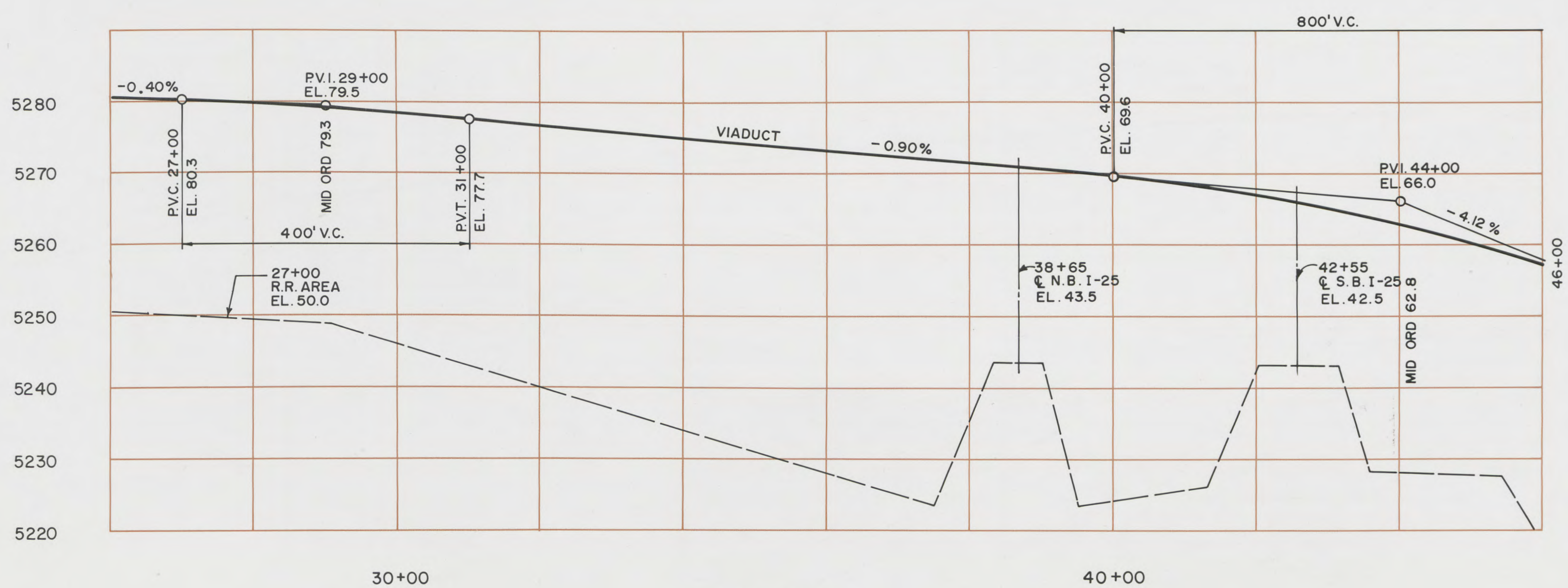
DRWG—58 / PLAN STA. 22 TO 46



DRWG—59 / PROFILE—NORTHBOUND STA. 0 TO 46

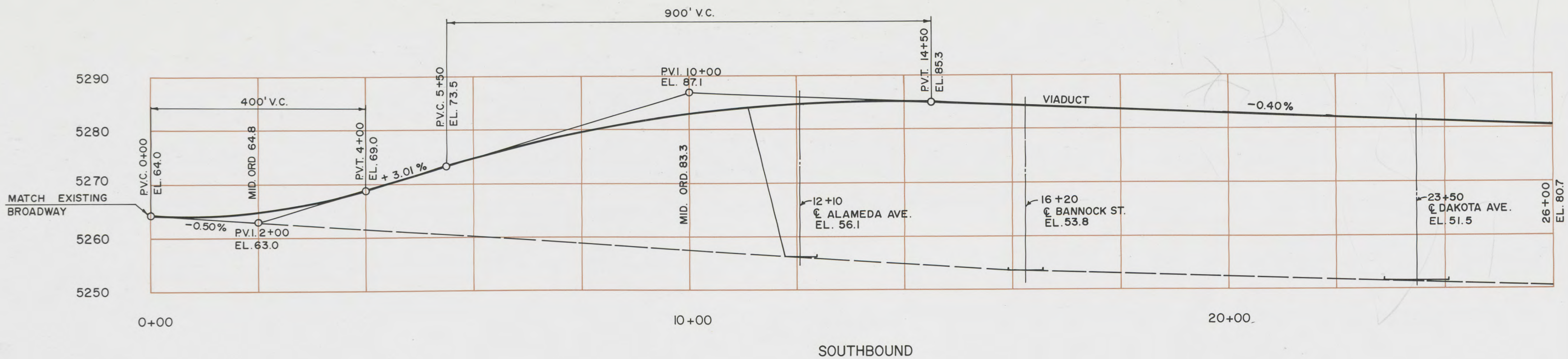


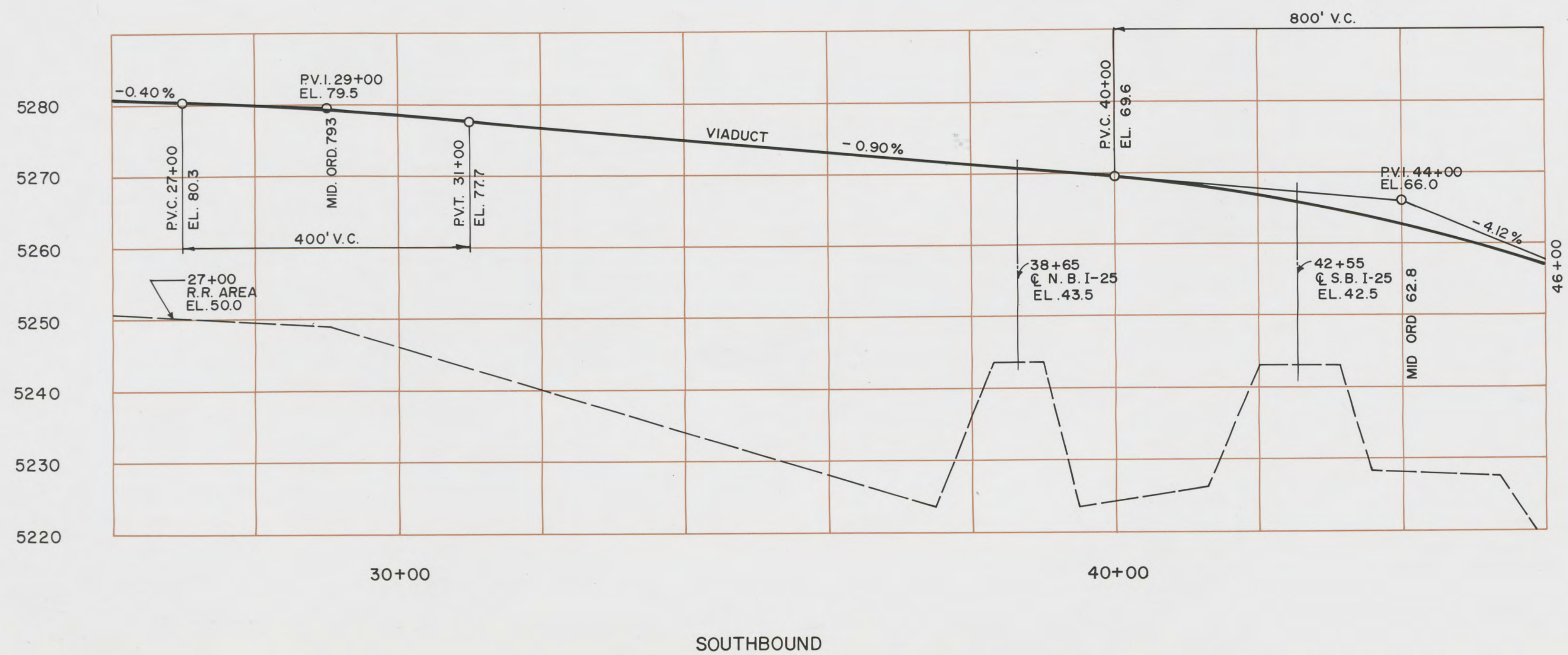
NORTHBOUND

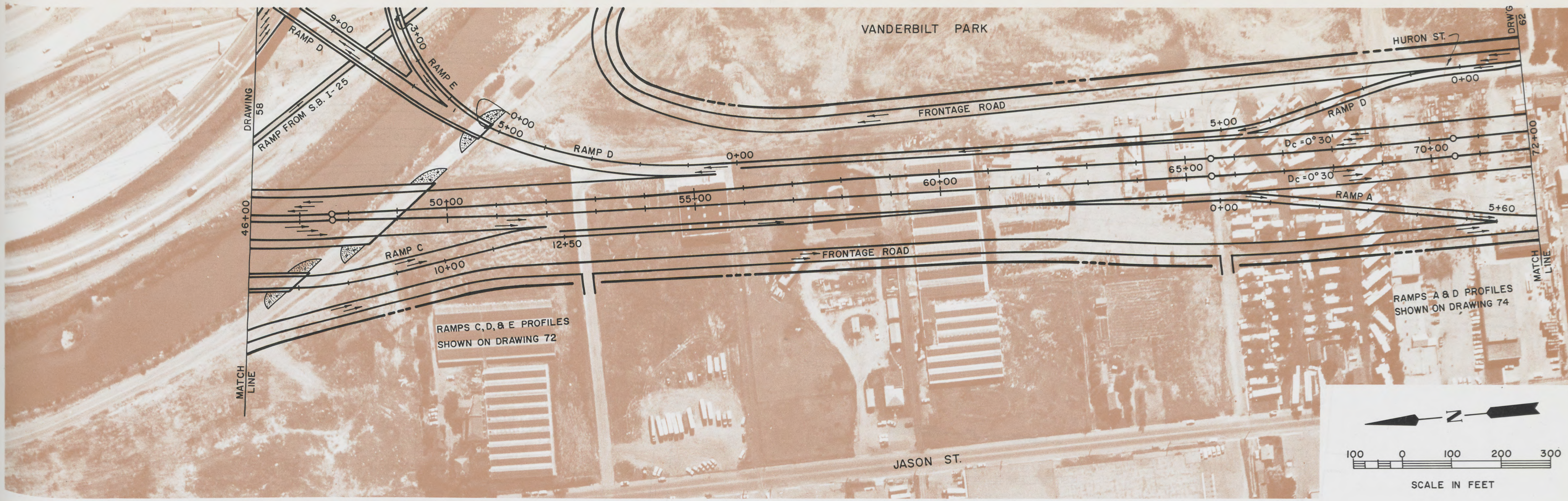


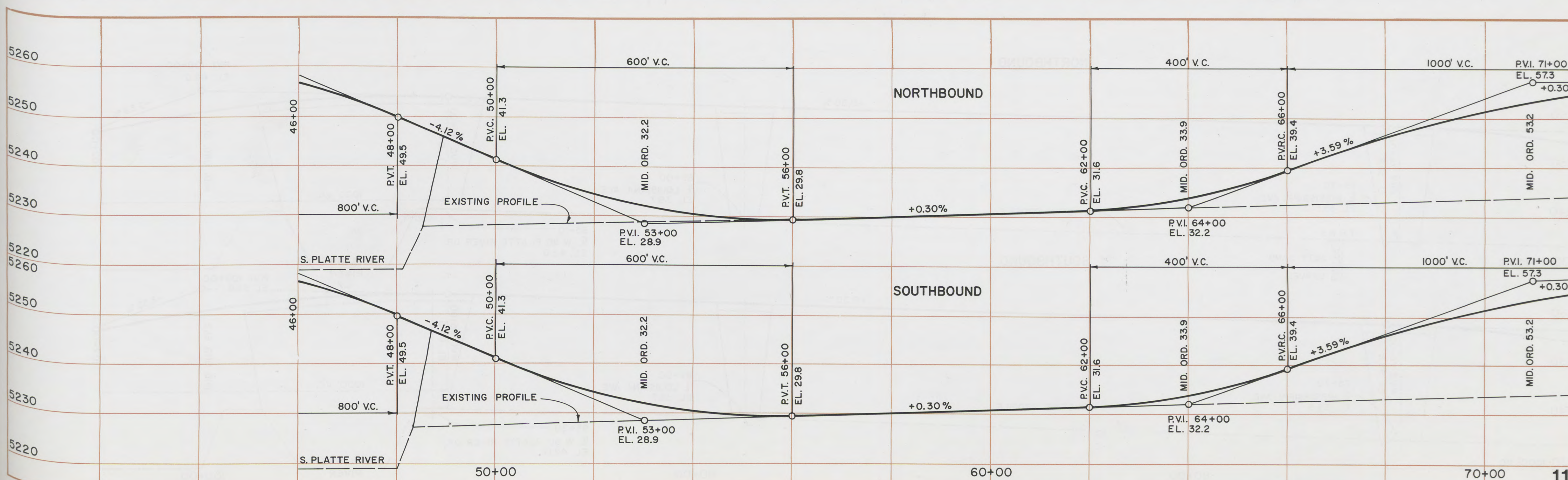
NORTHBOUND

DRWG—60 / PROFILE—SOUTHBOUND STA. 0 TO 46



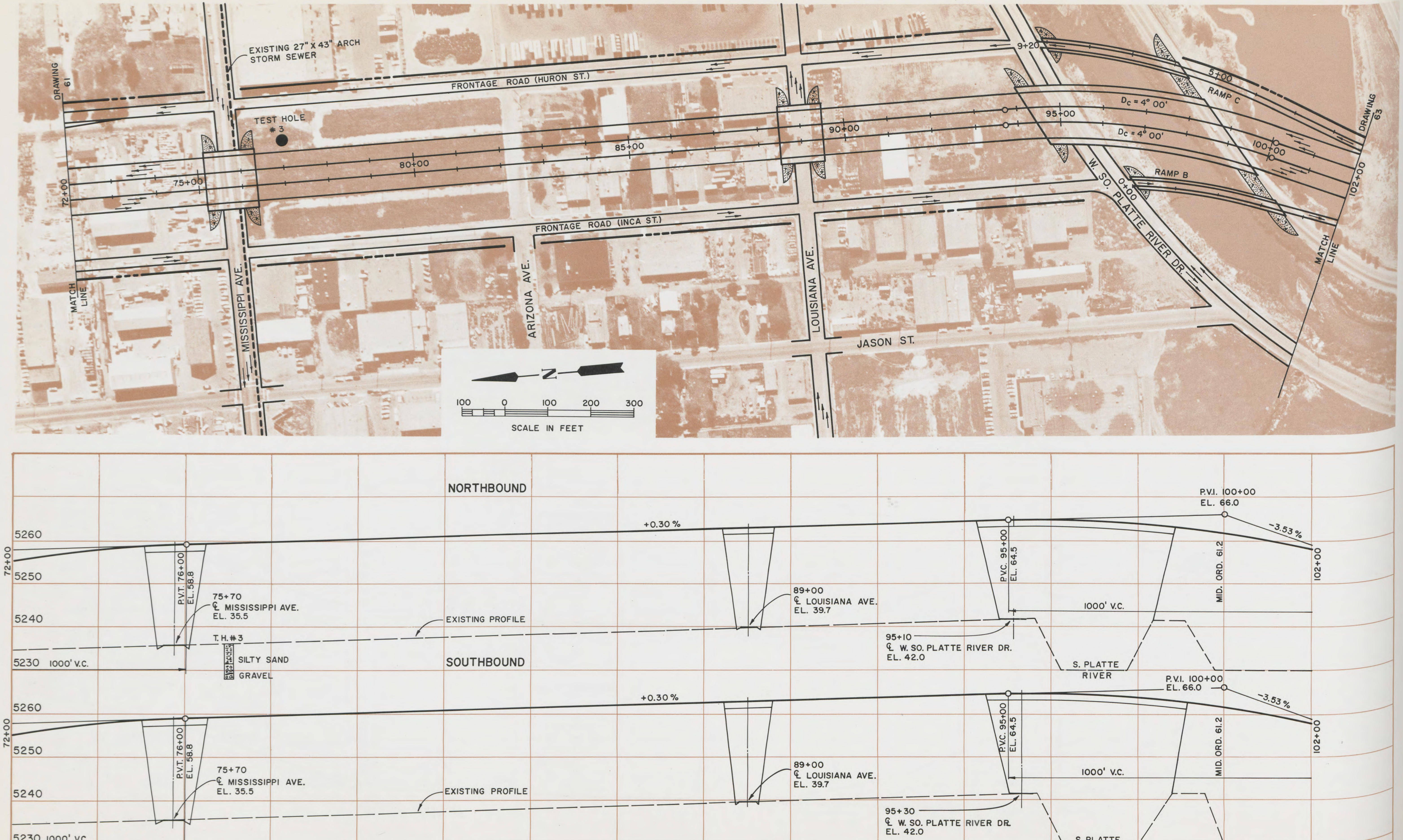


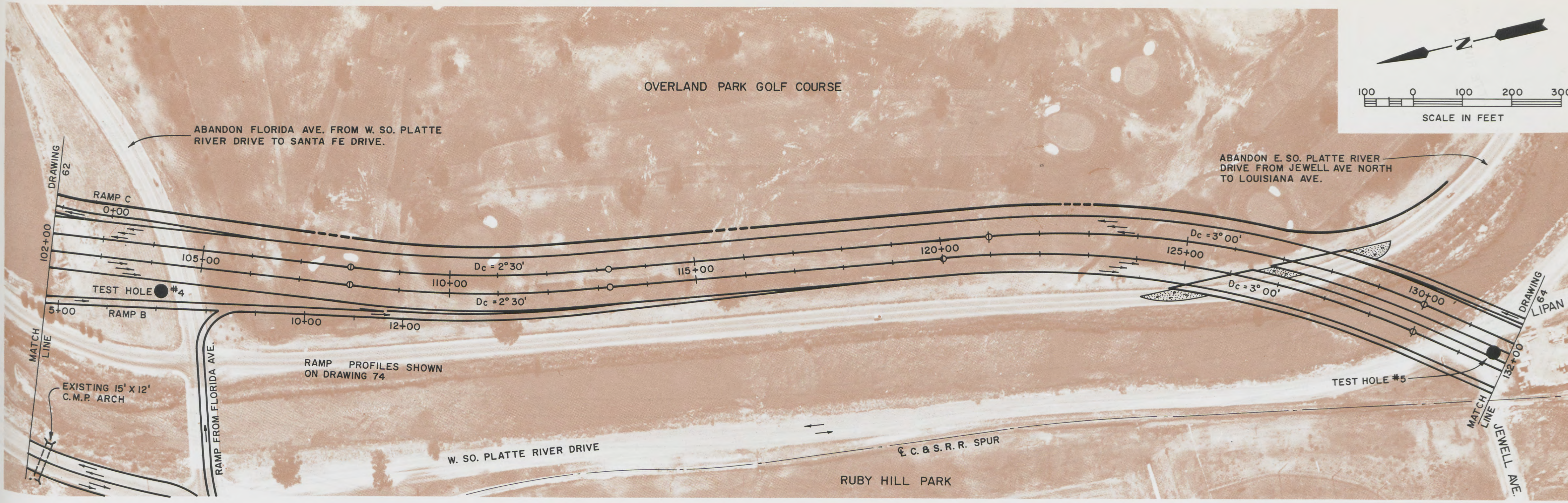


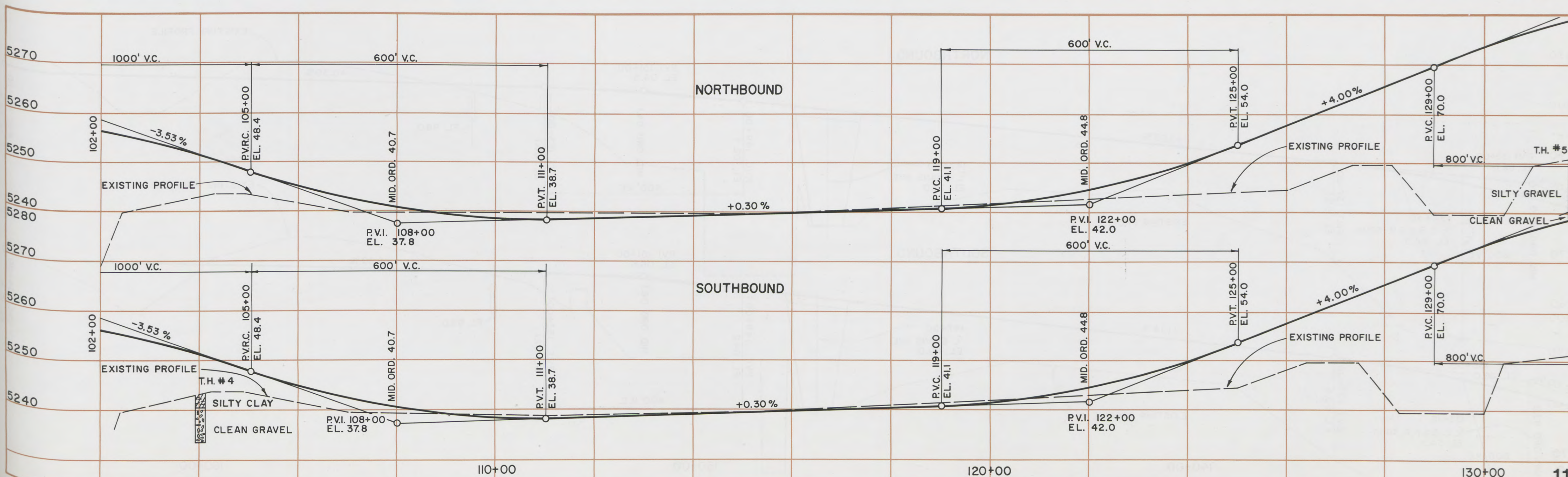


DRWG—61 / PLAN—PROFILE STA. 46 TO 72

DRWG—62 / PLAN—PROFILE STA. 72 TO 102

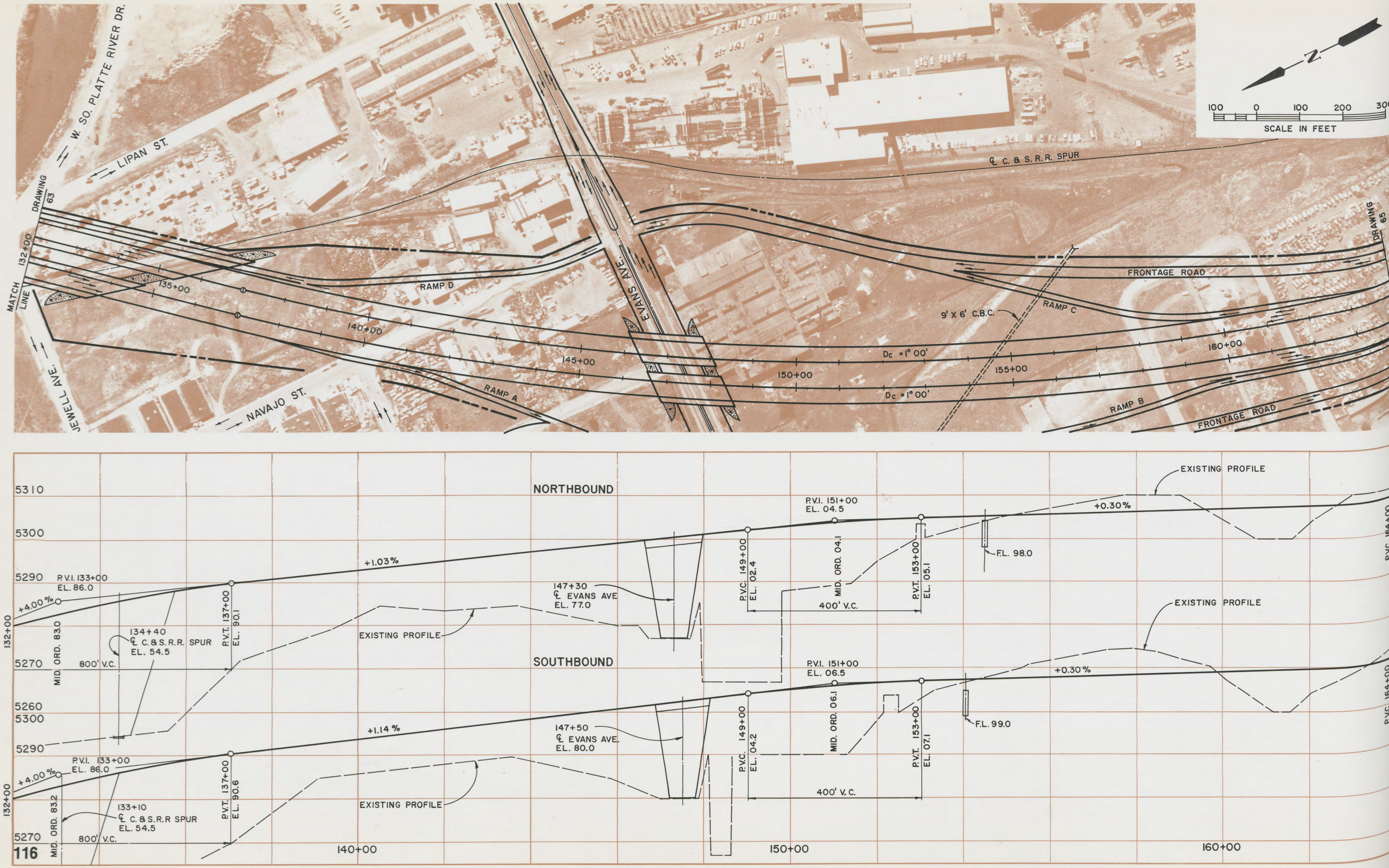




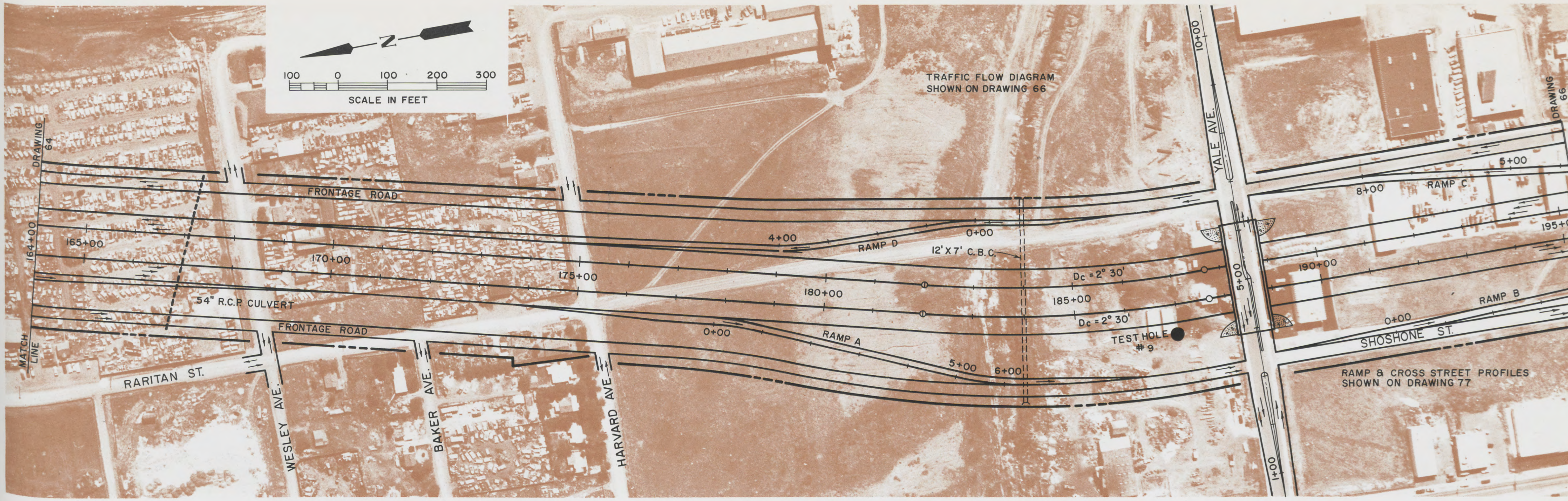


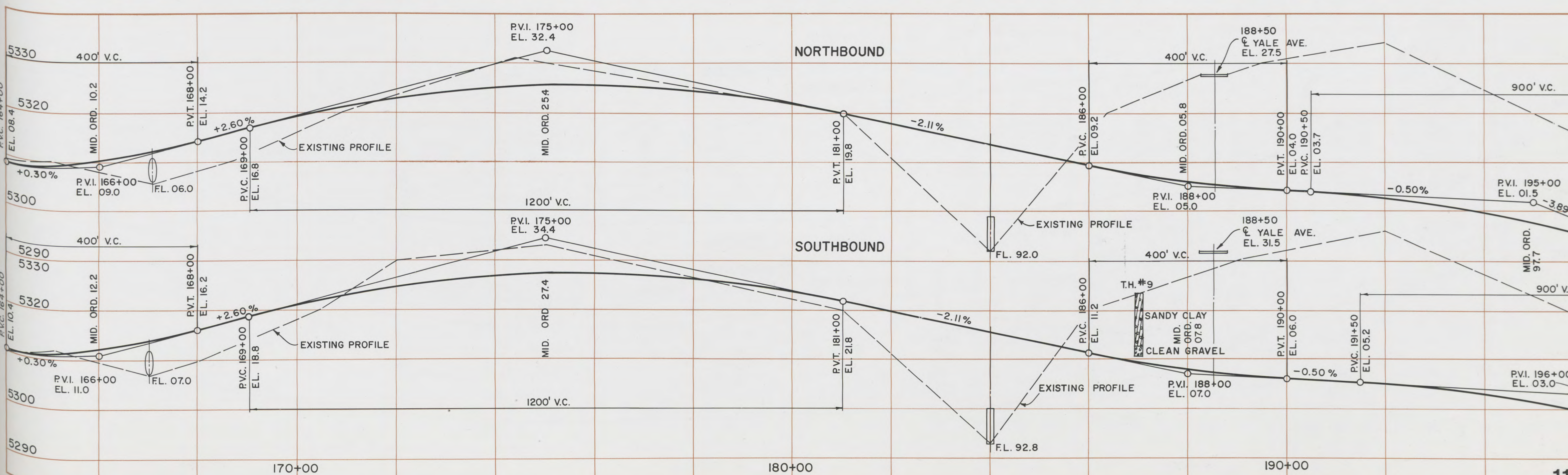
DRWG—63 / PLAN—PROFILE STA. 102 TO 132

DRWG—64 / PLAN—PROFILE STA. 132 TO 164

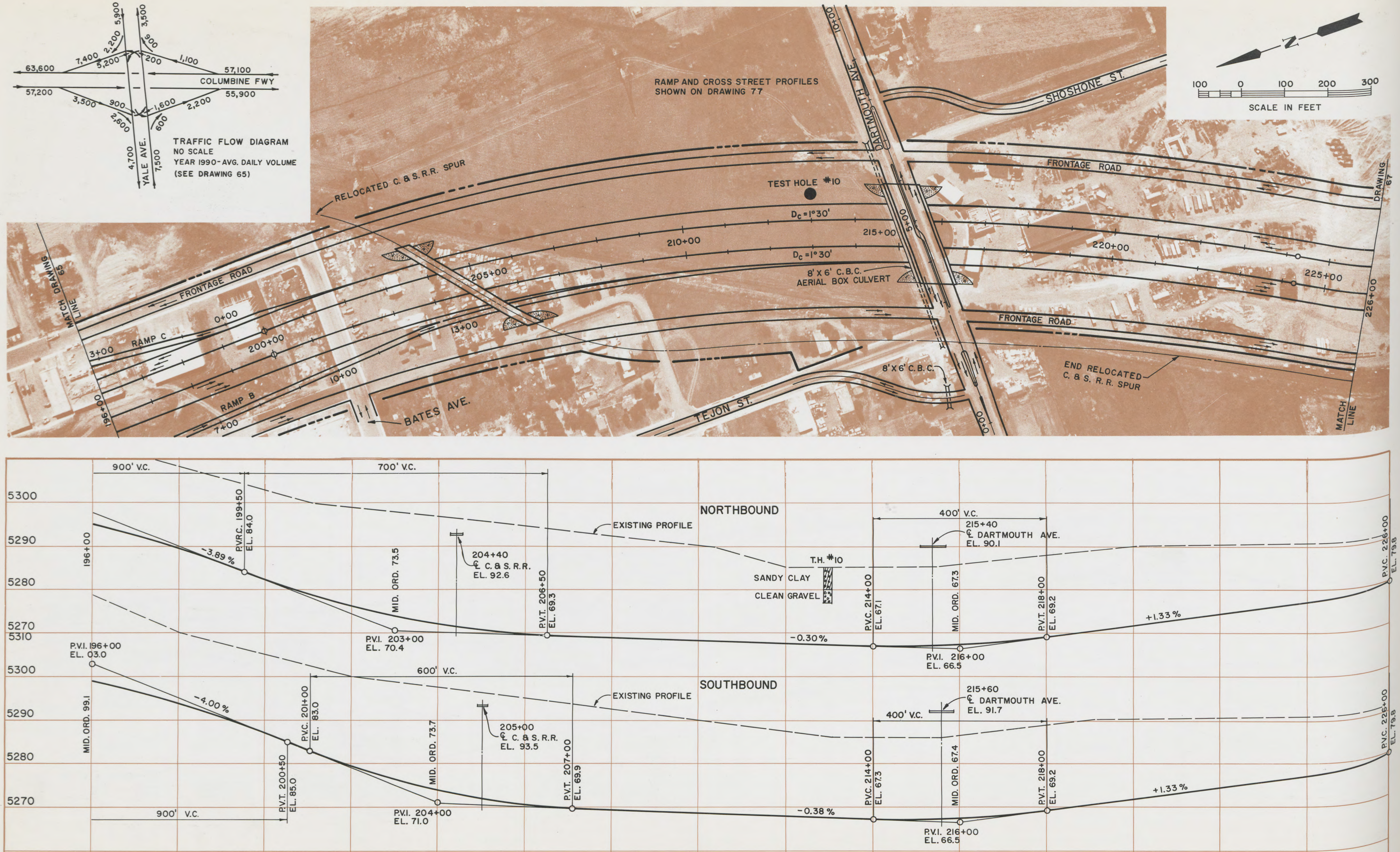


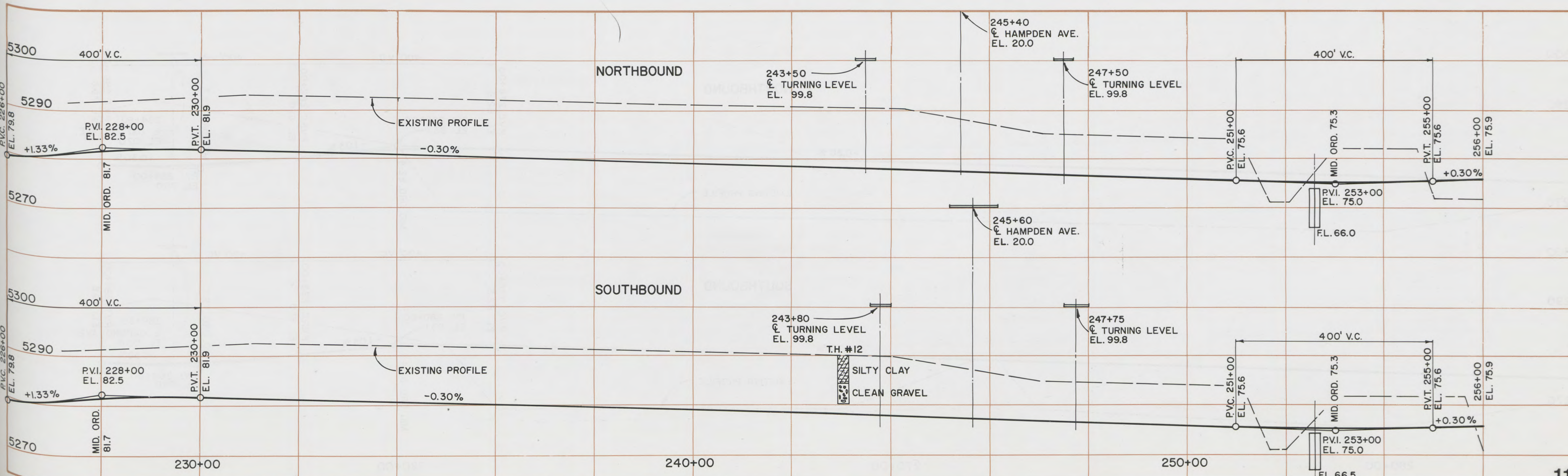
DRWG—65 / PLAN—PROFILE STA. 164 TO 196





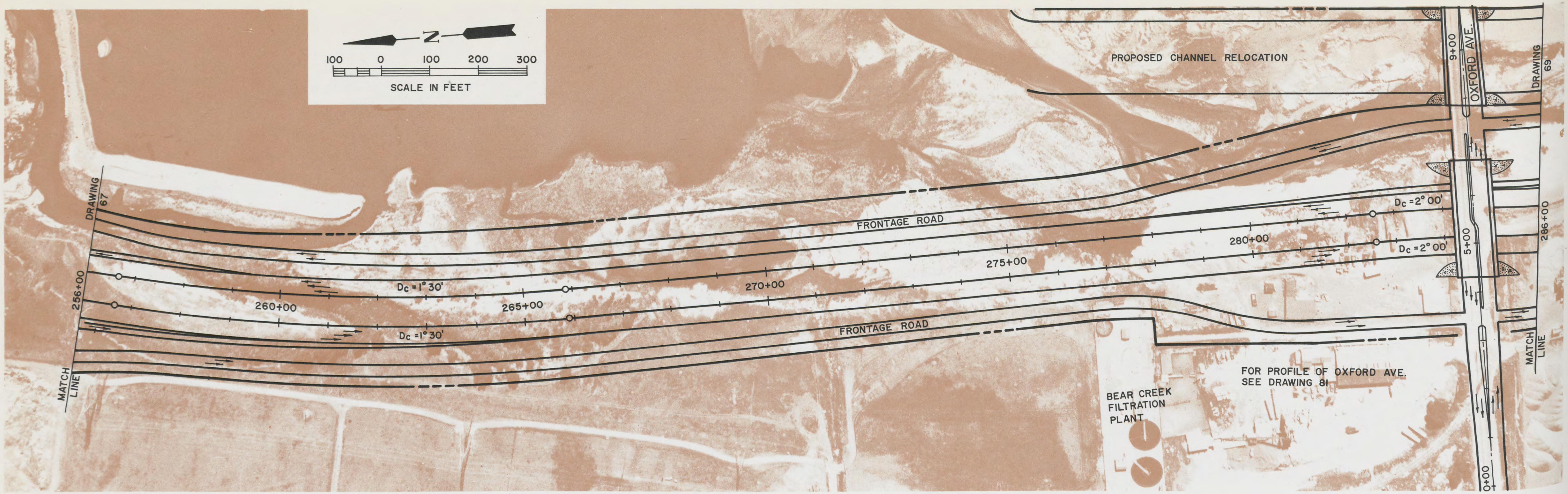
DRWG—66 / PLAN—PROFILE STA. 196 TO 226

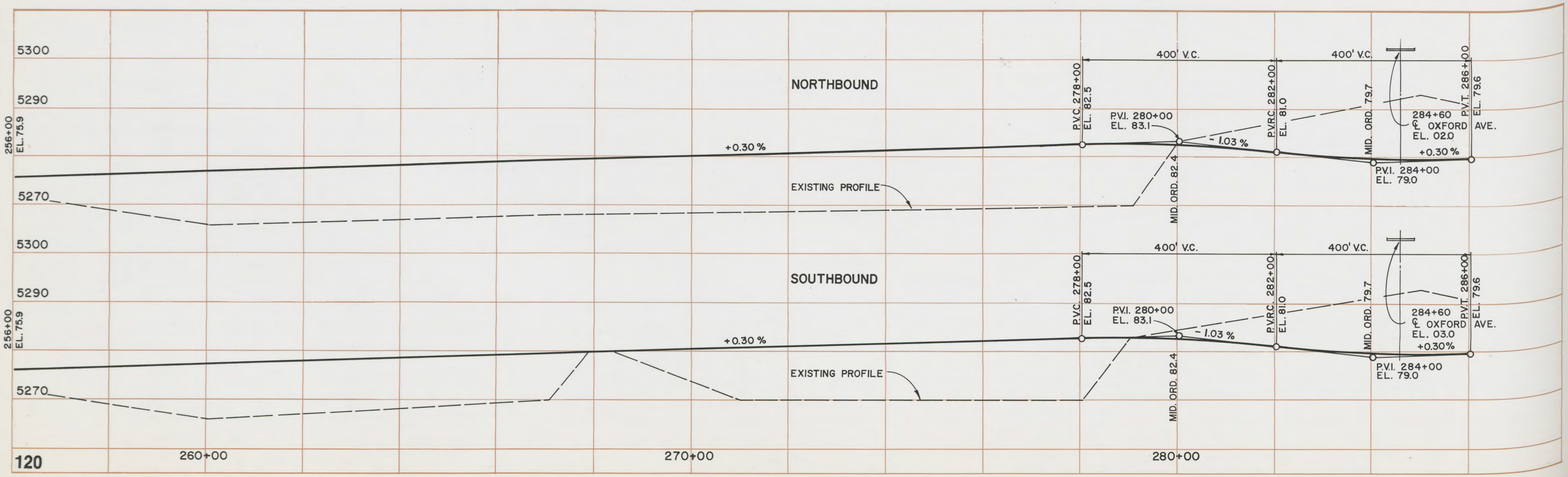




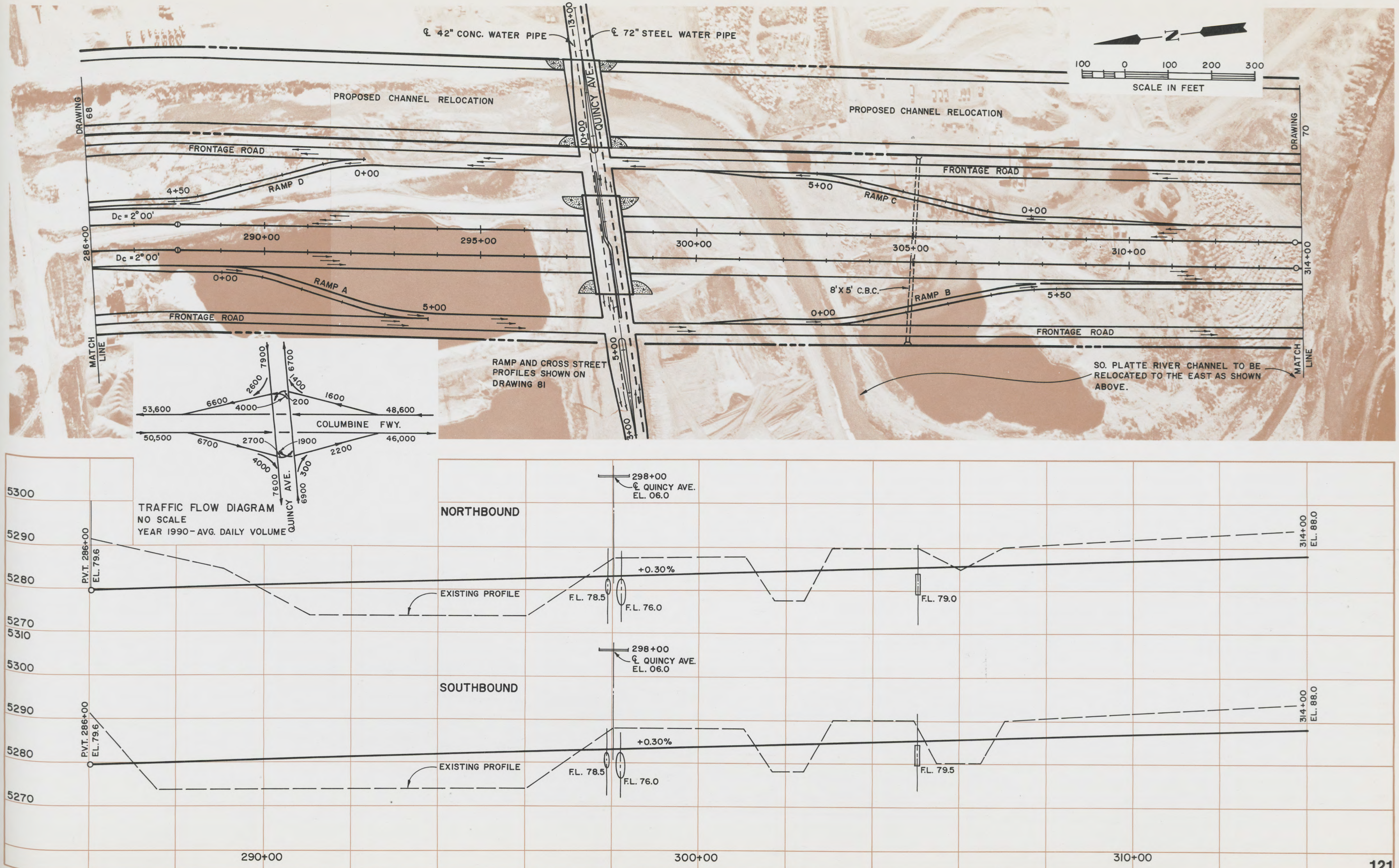
DRWG—67 / PLAN—PROFILE STA. 226 TO 256

DRWG—68 / PLAN—PROFILE STA. 256 TO 286

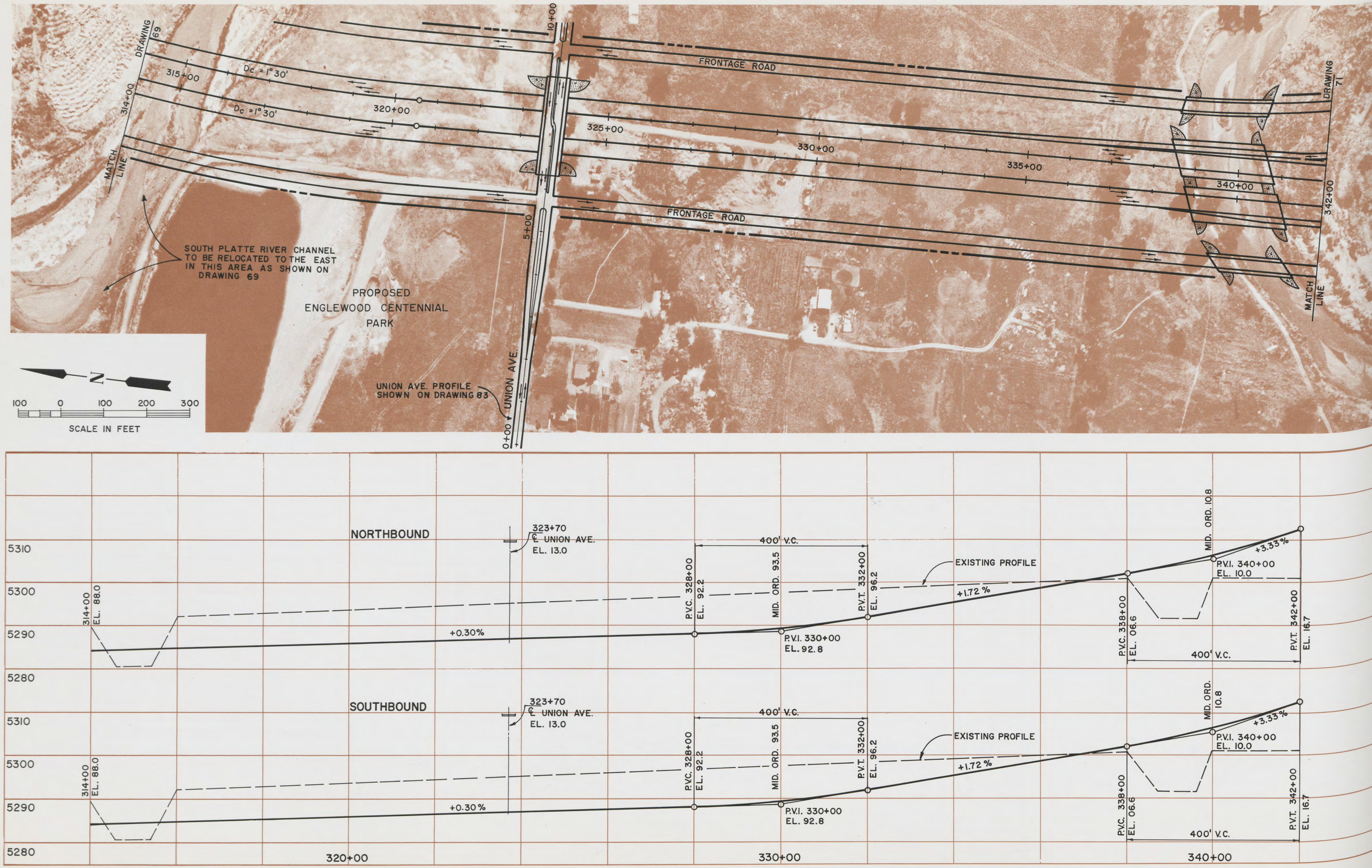




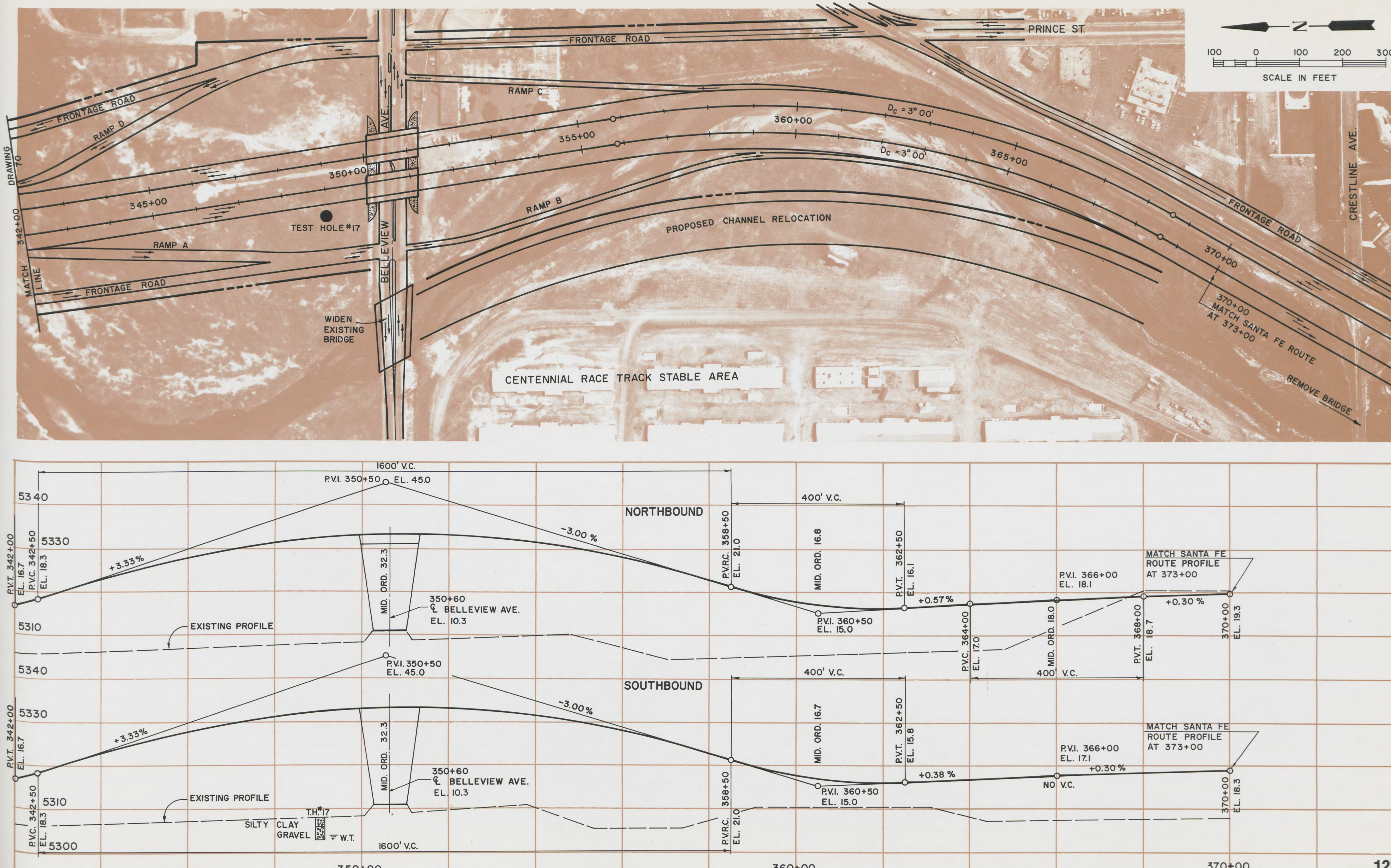
DRWG—69 / PLAN—PROFILE STA. 286 TO 314



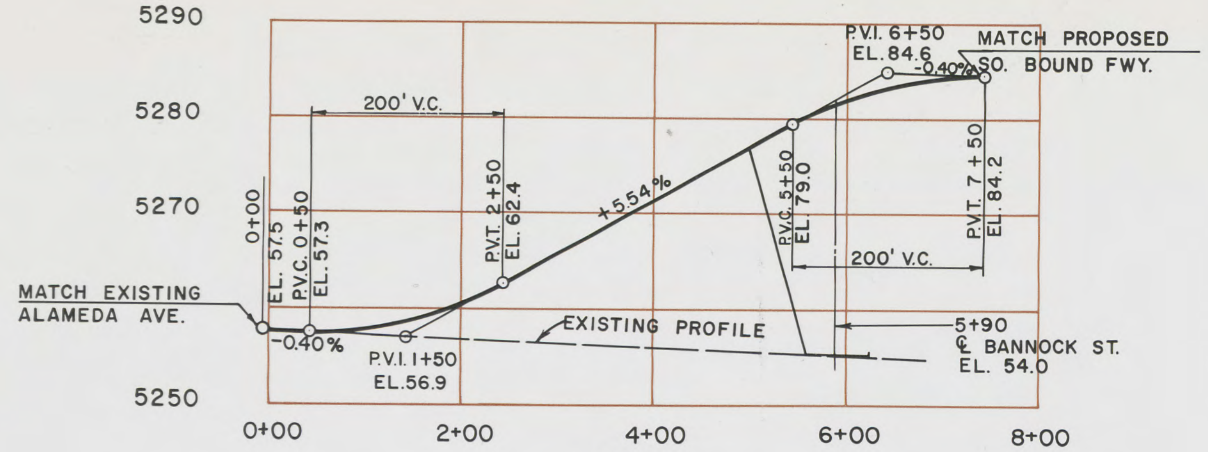
DRWG—70 / PLAN—PROFILE STA. 314 TO 342



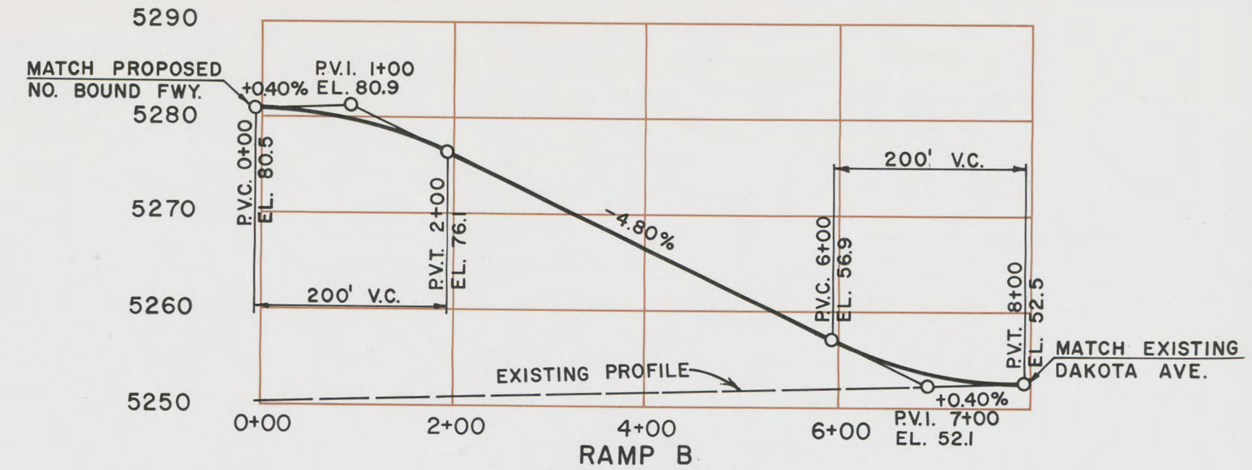
DRWG—71 / PLAN—PROFILE STA. 342 TO 370



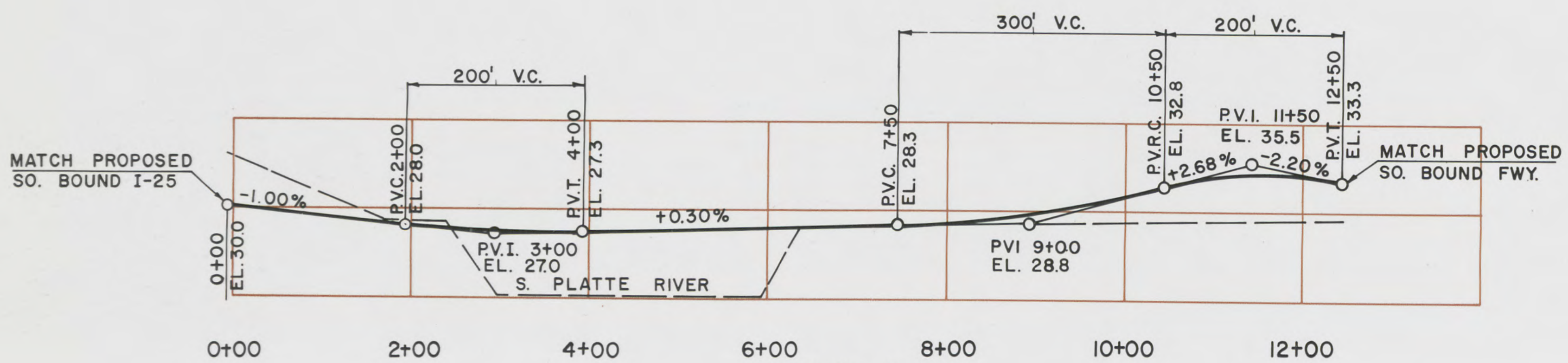
DRWG—72 / RAMP GRADES—NORTH OF VALLEY HIGHWAY



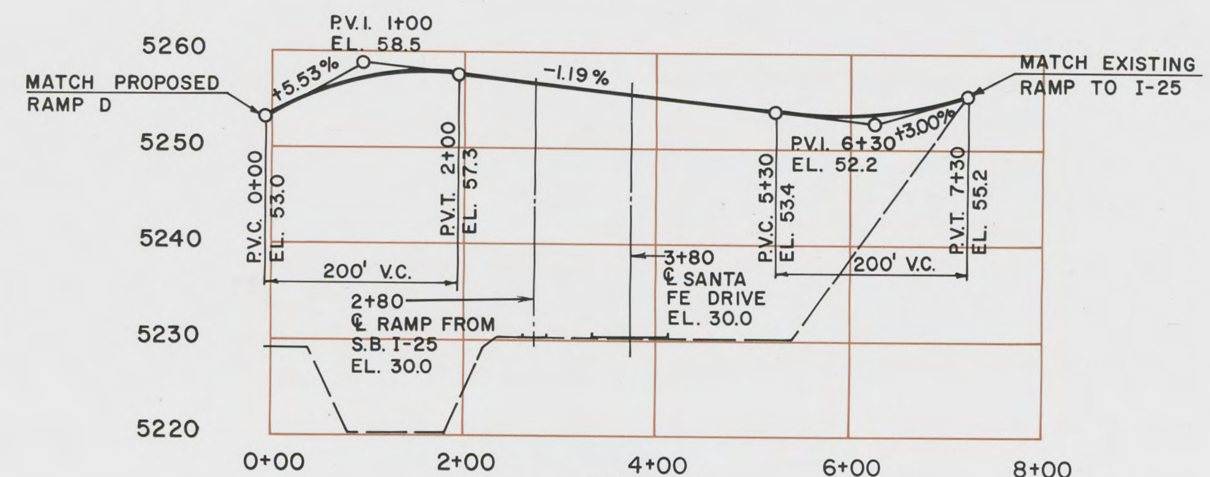
RAMP A
(DRAWING 57)



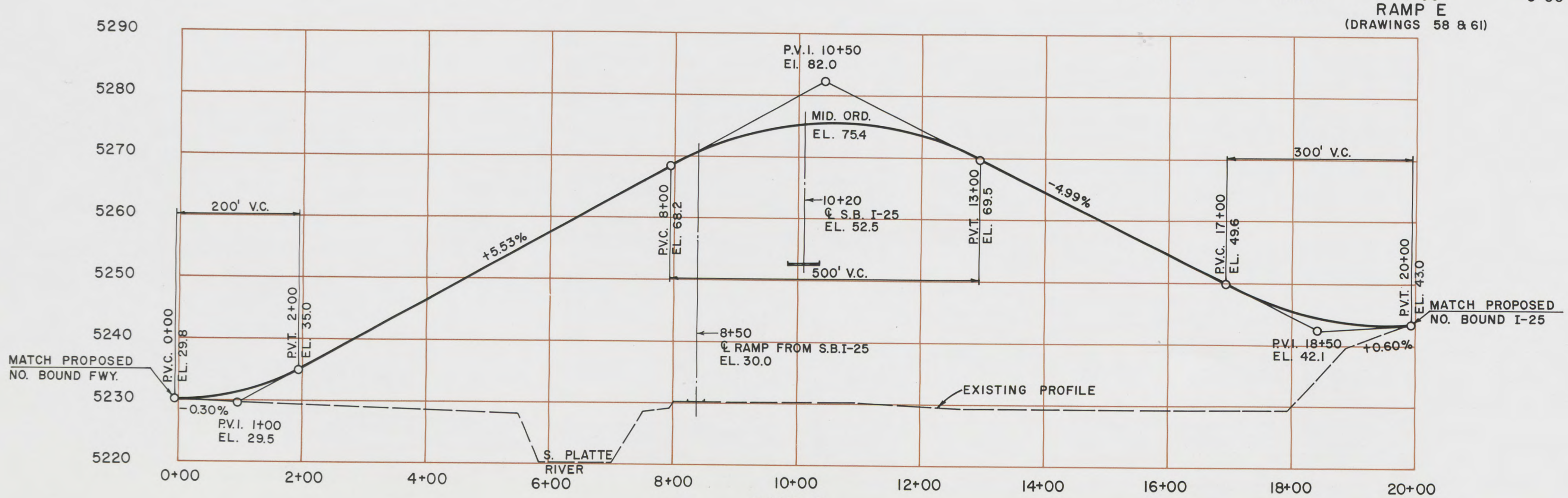
RAMP B
(DRAWINGS 57 & 58)



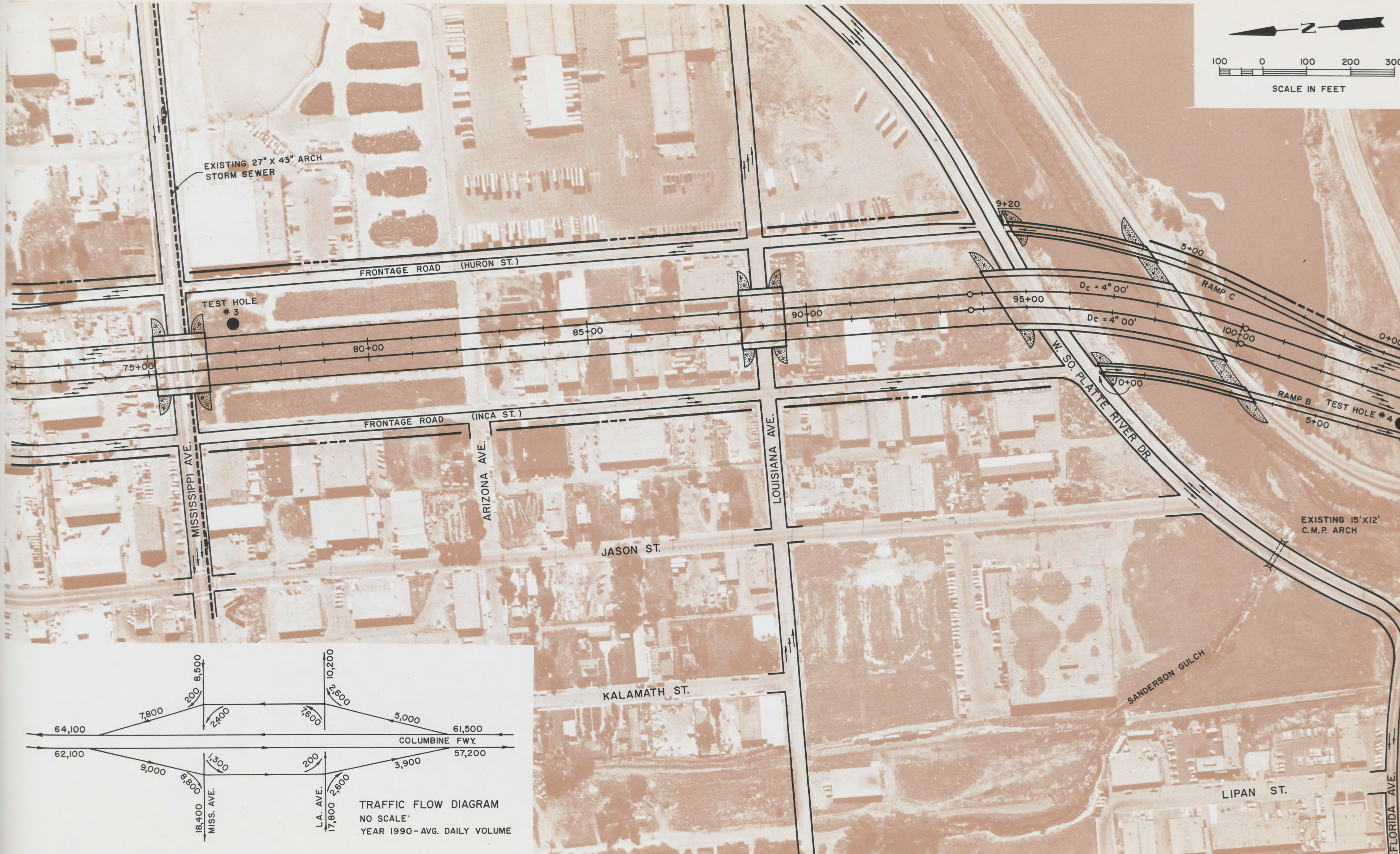
RAMP C
(DRAWINGS 58 & 61)



RAMP E
(DRAWINGS 58 & 61)

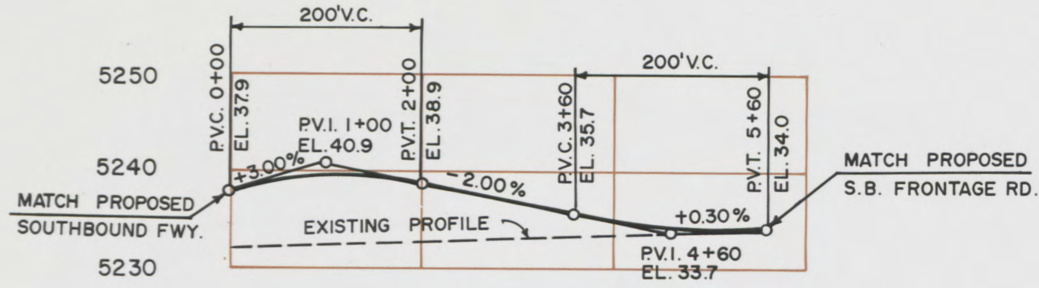


RAMP D
(DRAWINGS 58 & 61)

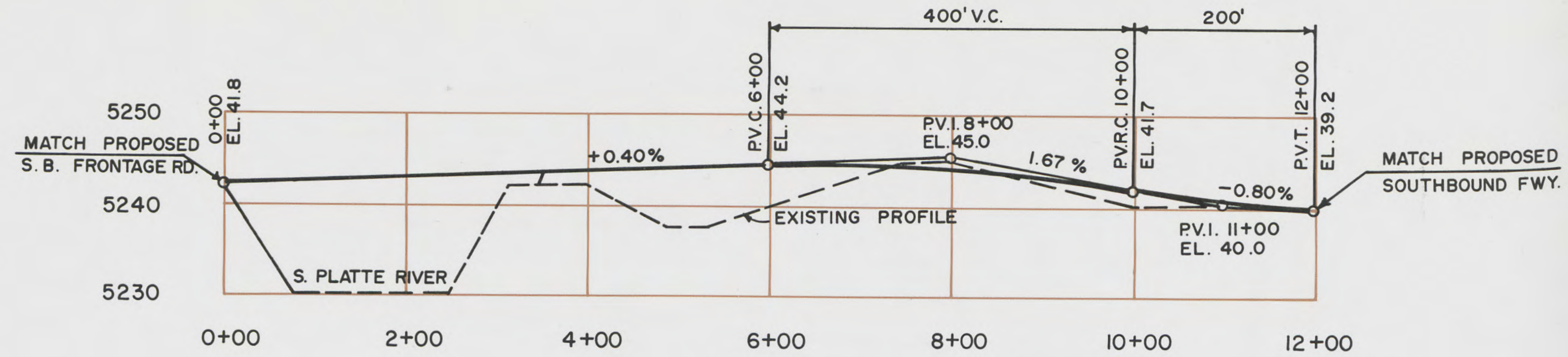


DRWG—73 / MISSISSIPPI—LOUISIANA INTERCHANGE

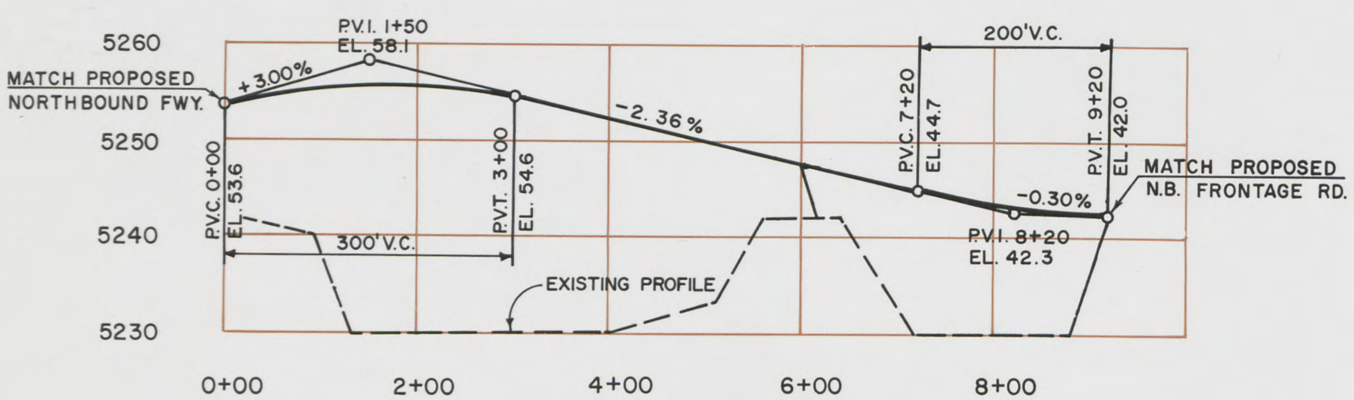
DRWG—74 / MISSISSIPPI—LOUISIANA INTERCHANGE GRADES



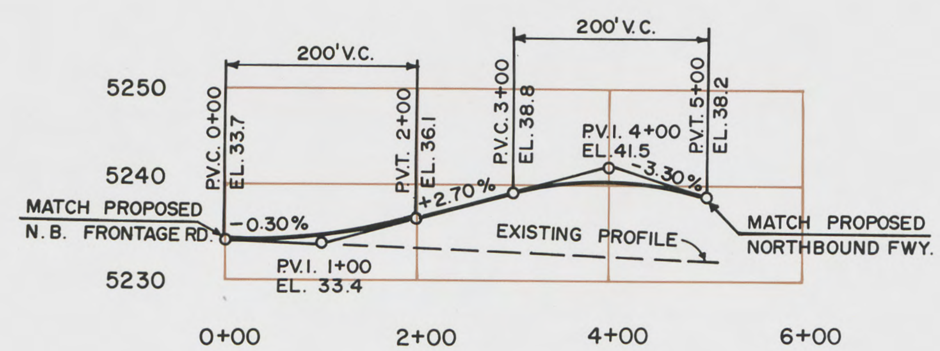
RAMP A



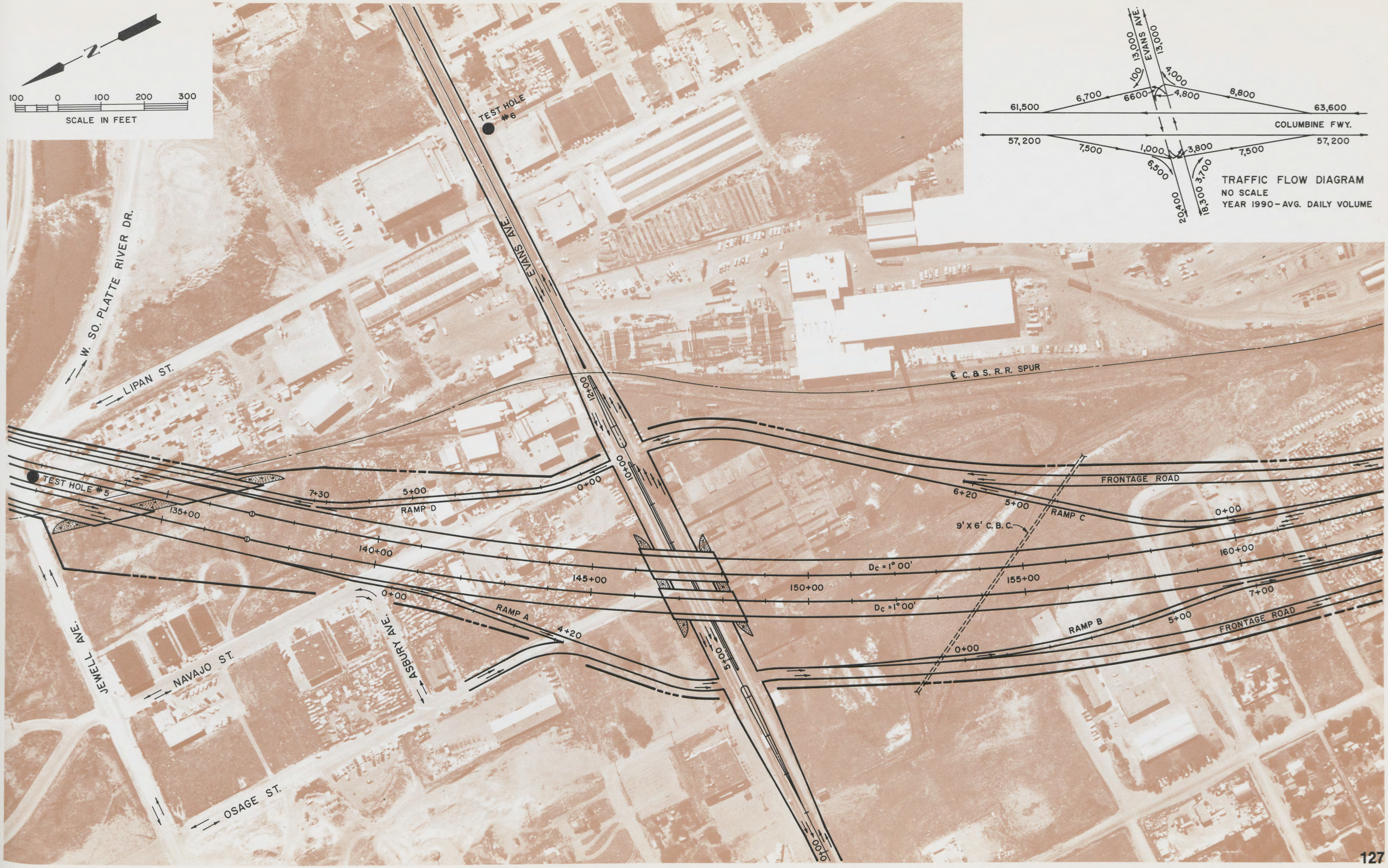
RAMP B



RAMP C

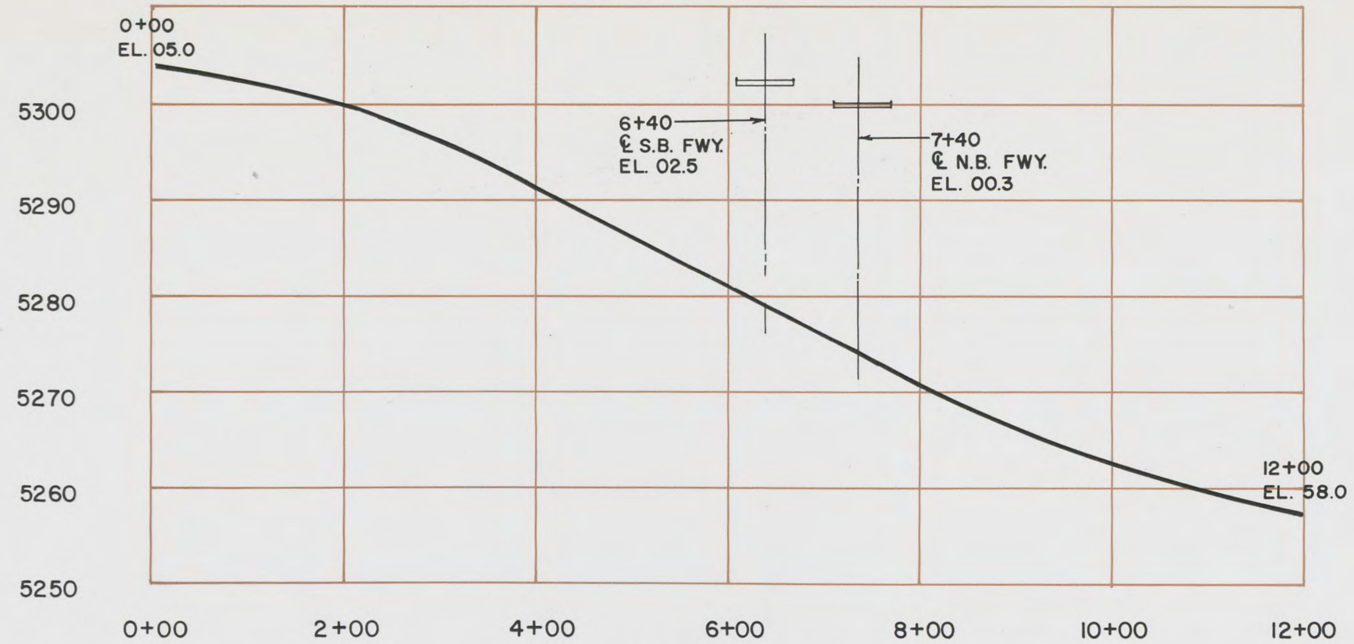


RAMP D

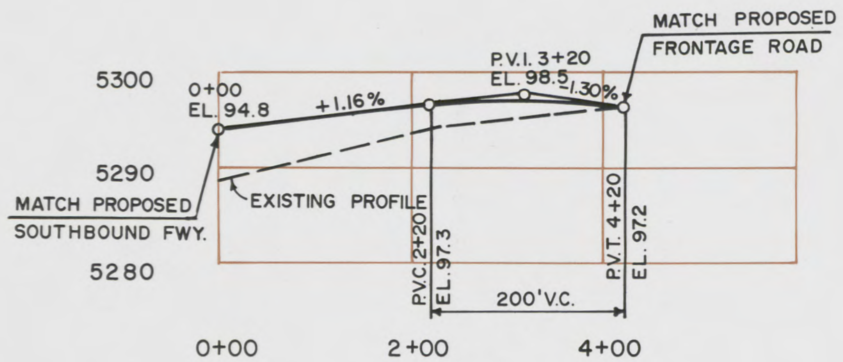


DRWG—75 / EVANS INTERCHANGE

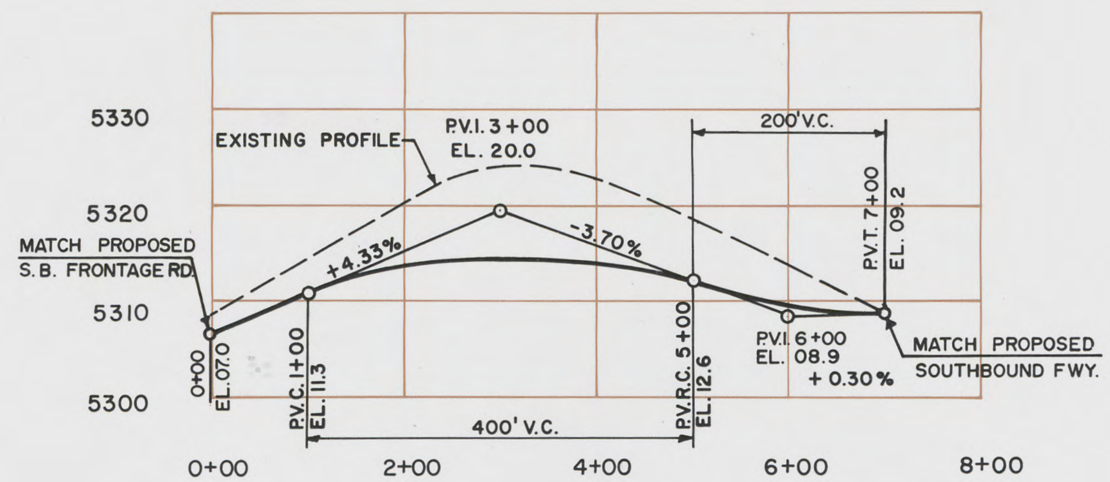
DRWG—76 / EVANS INTERCHANGE GRADES



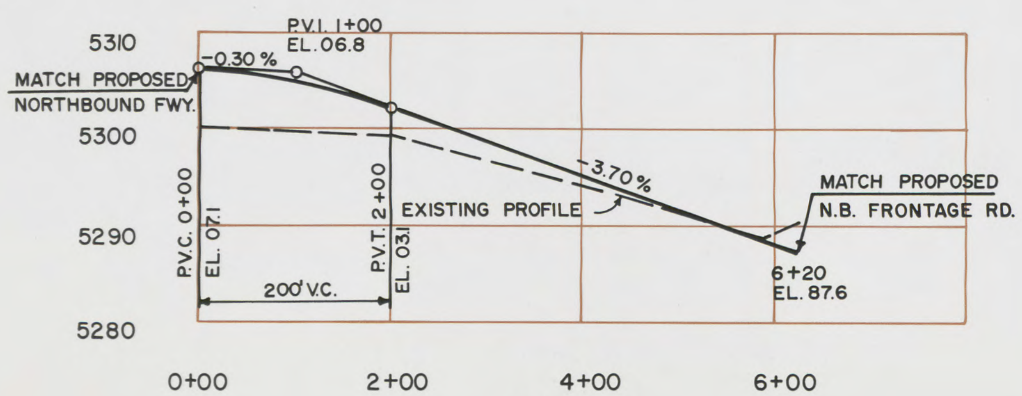
EVANS AVENUE
(EXISTING AND PROPOSED)



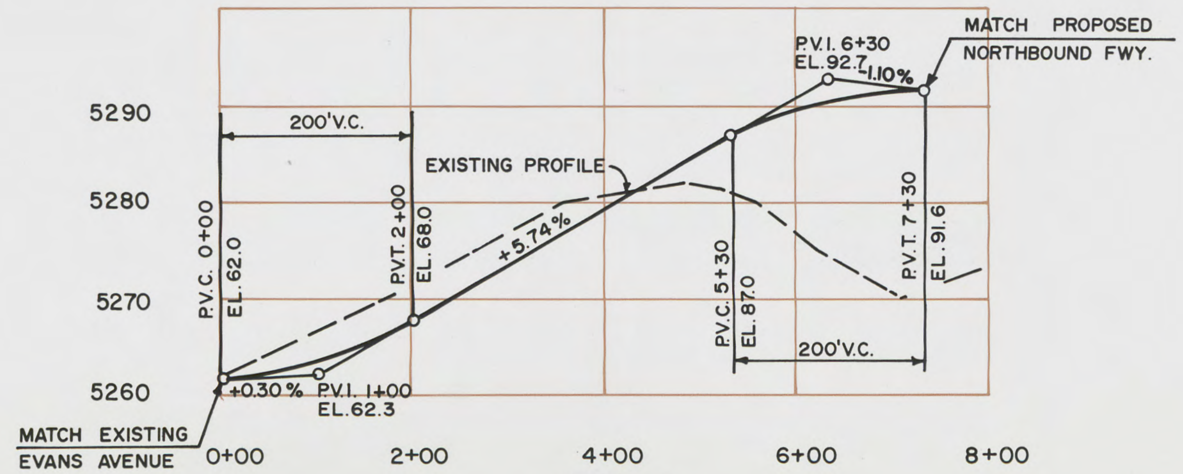
RAMP A



RAMP B

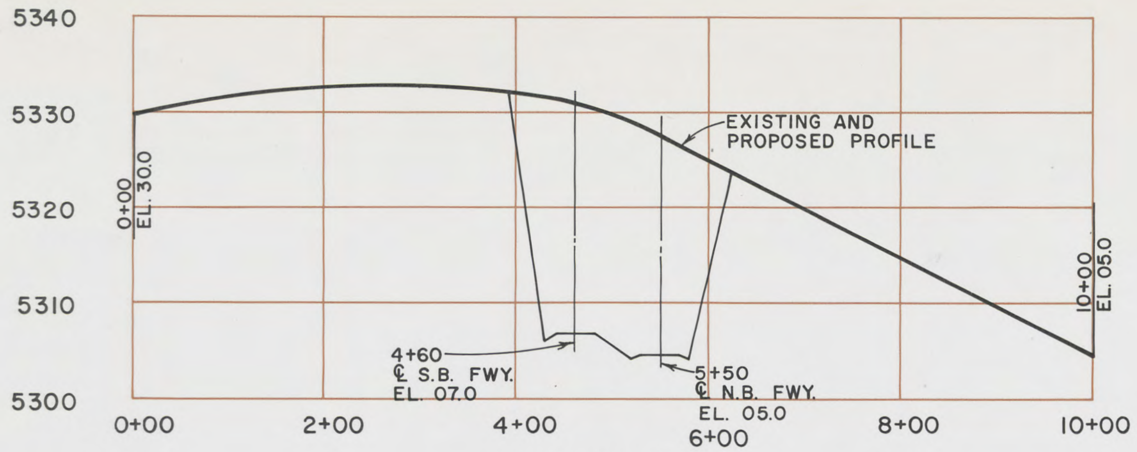


RAMP C

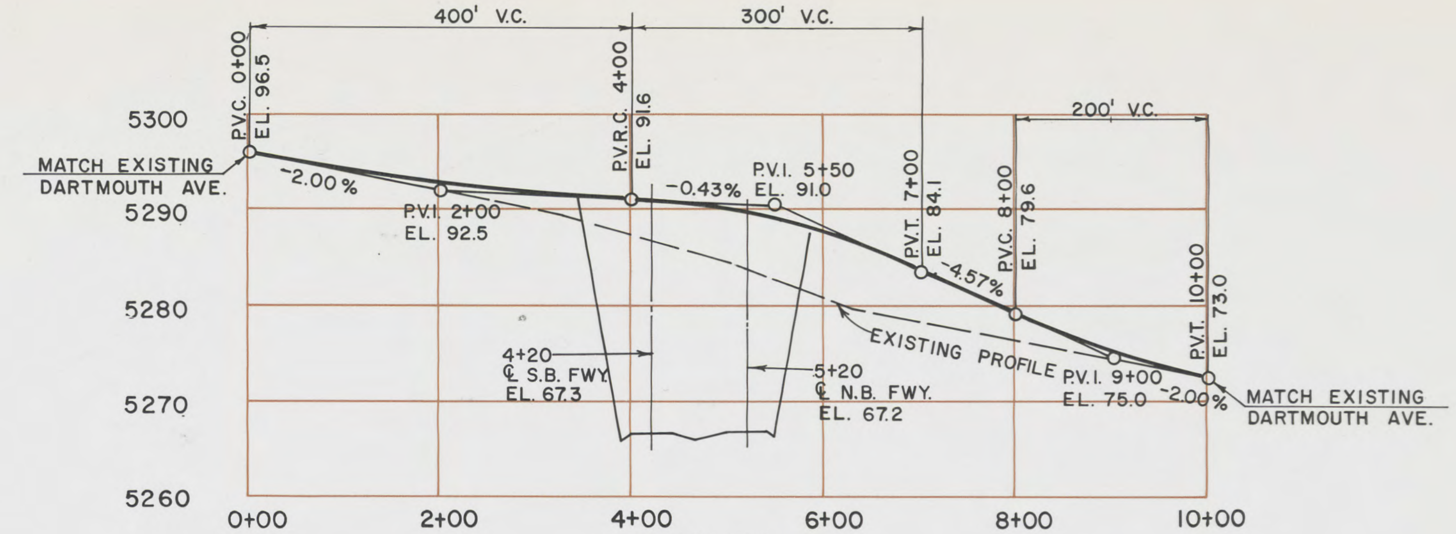


RAMP D

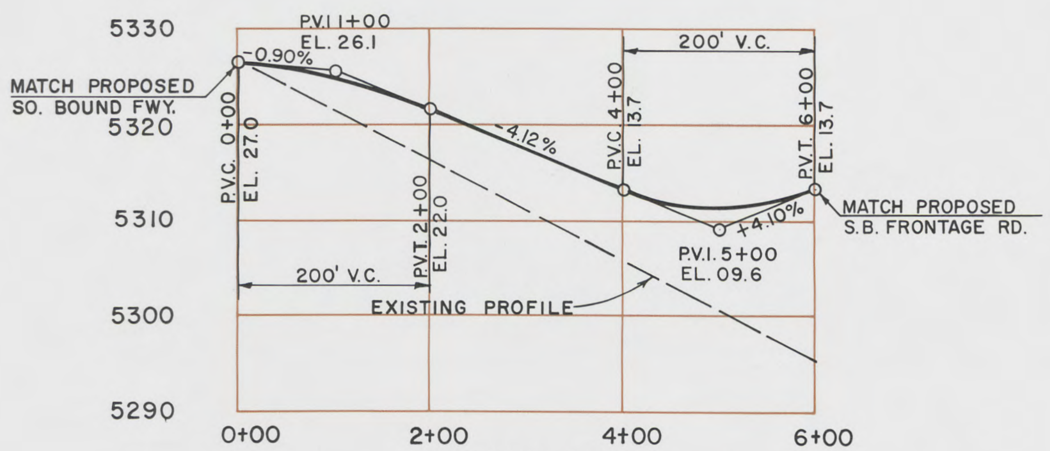
DRWG—77 / YALE—DARTMOUTH RAMP GRADES



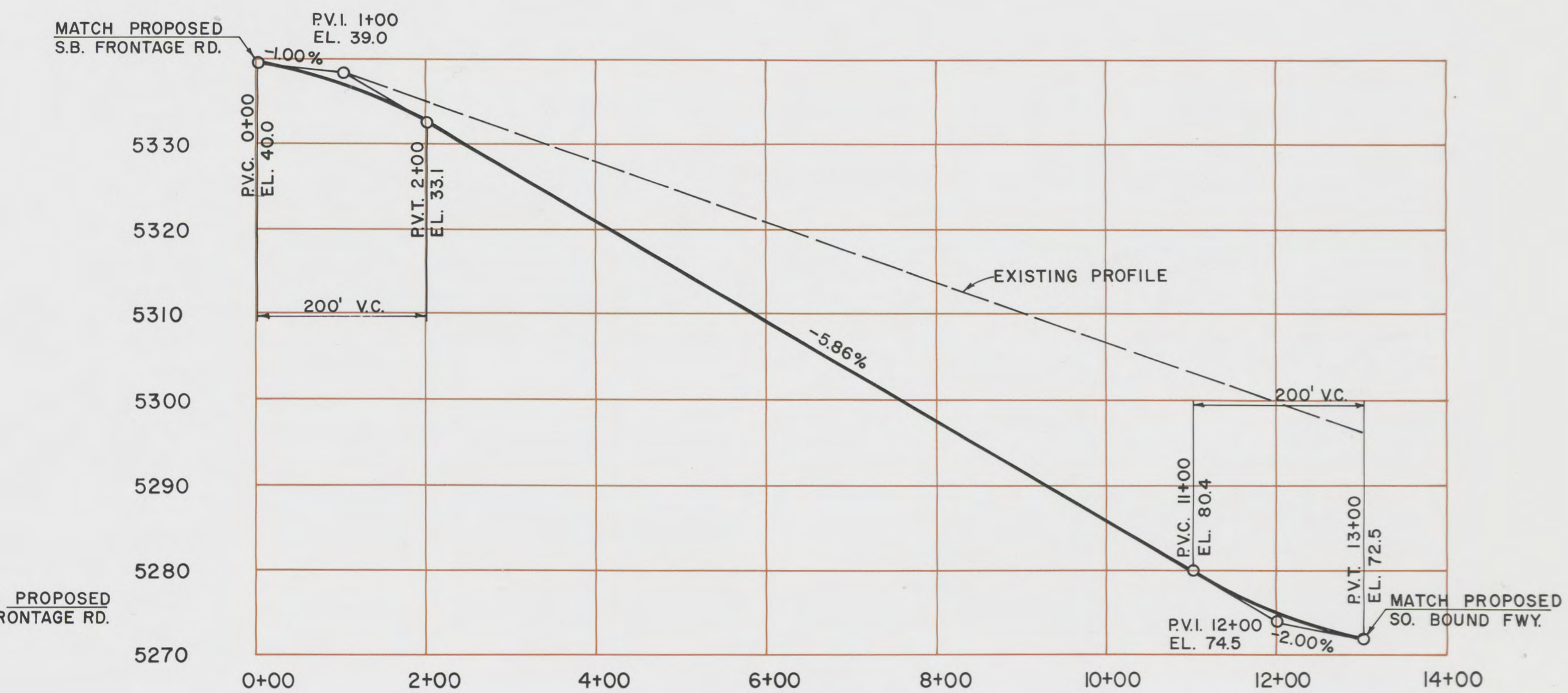
YALE AVE.
(DRAWING 65)



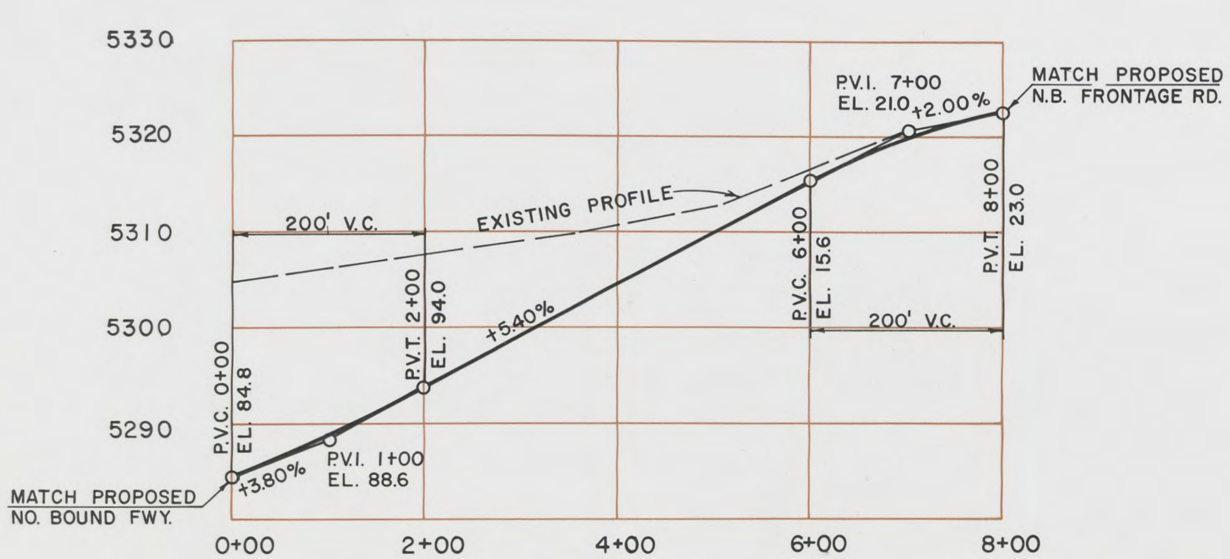
DARTMOUTH AVE.
(DRAWING 66)



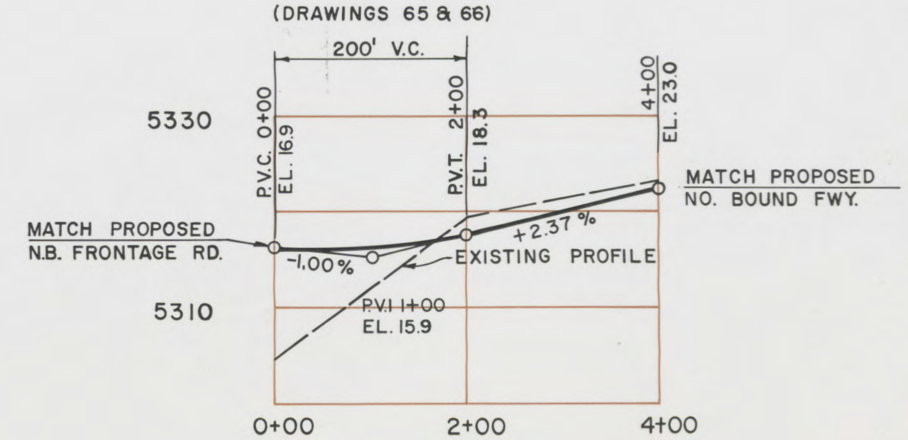
RAMP A
(DRAWING 65)



RAMP B
(DRAWINGS 65 & 66)

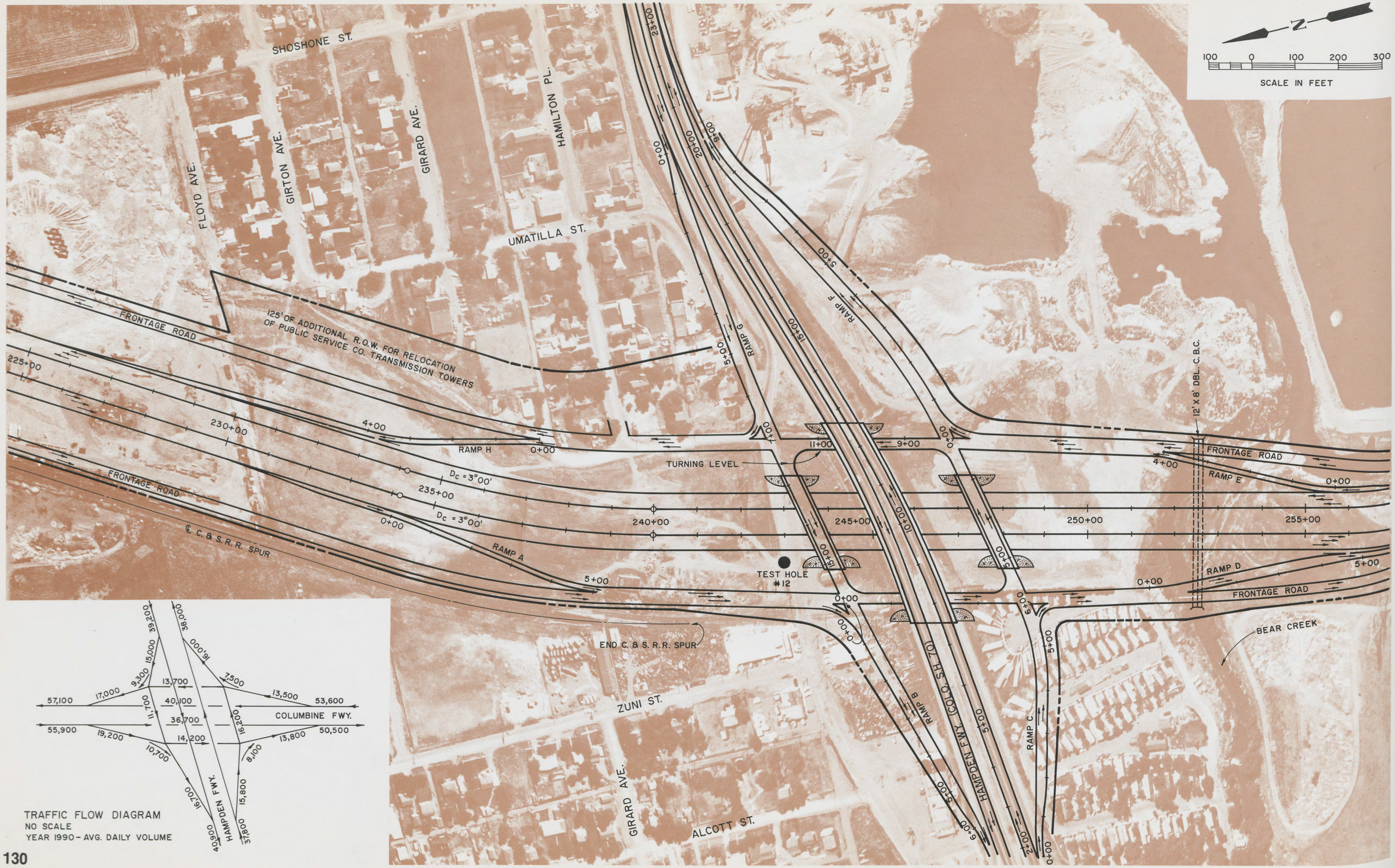


RAMP C
(DRAWINGS 65 & 66)

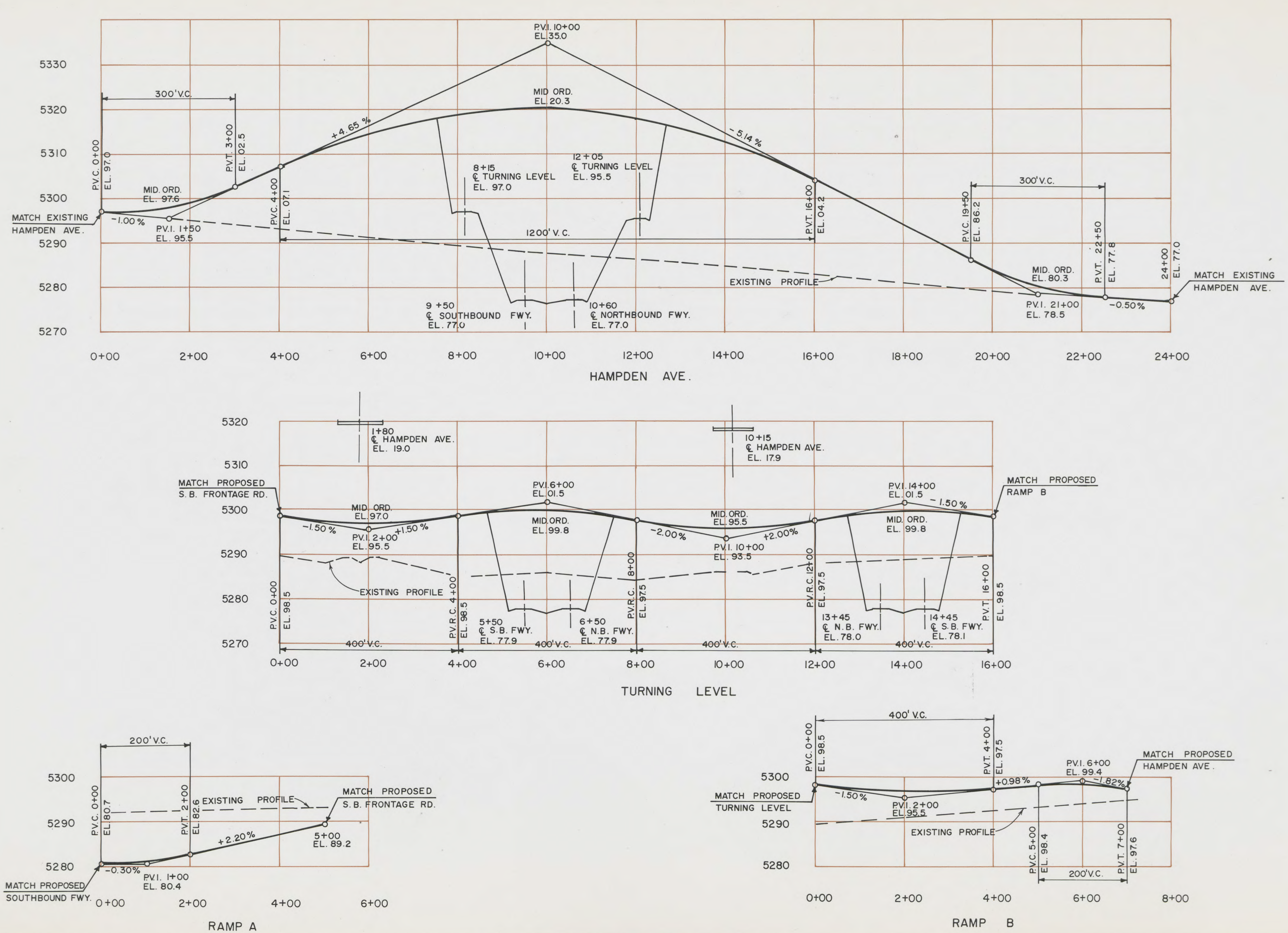


RAMP D
(DRAWING 65)

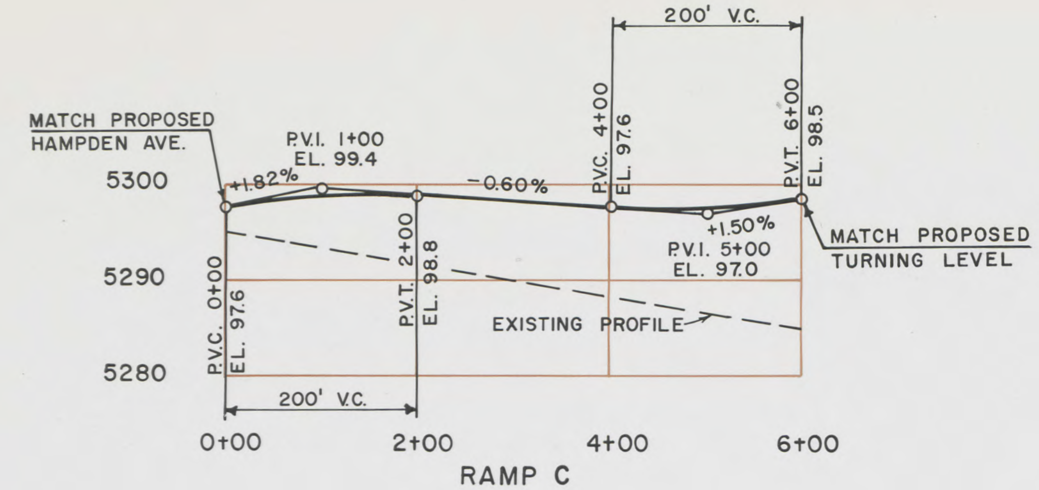
DRWG—78 / HAMPDEN INTERCHANGE

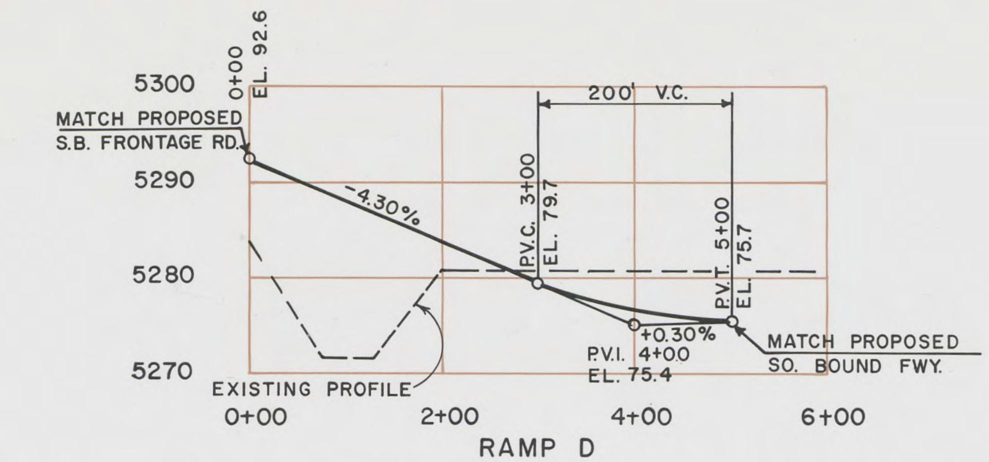


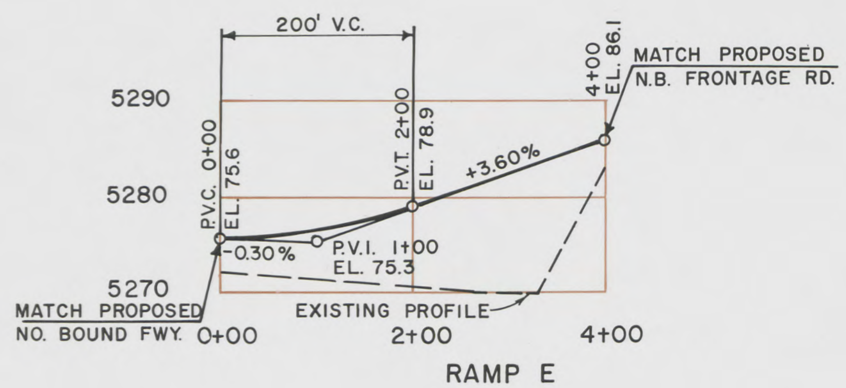
DRWG— 79 / HAMPDEN INTERCHANGE GRADES

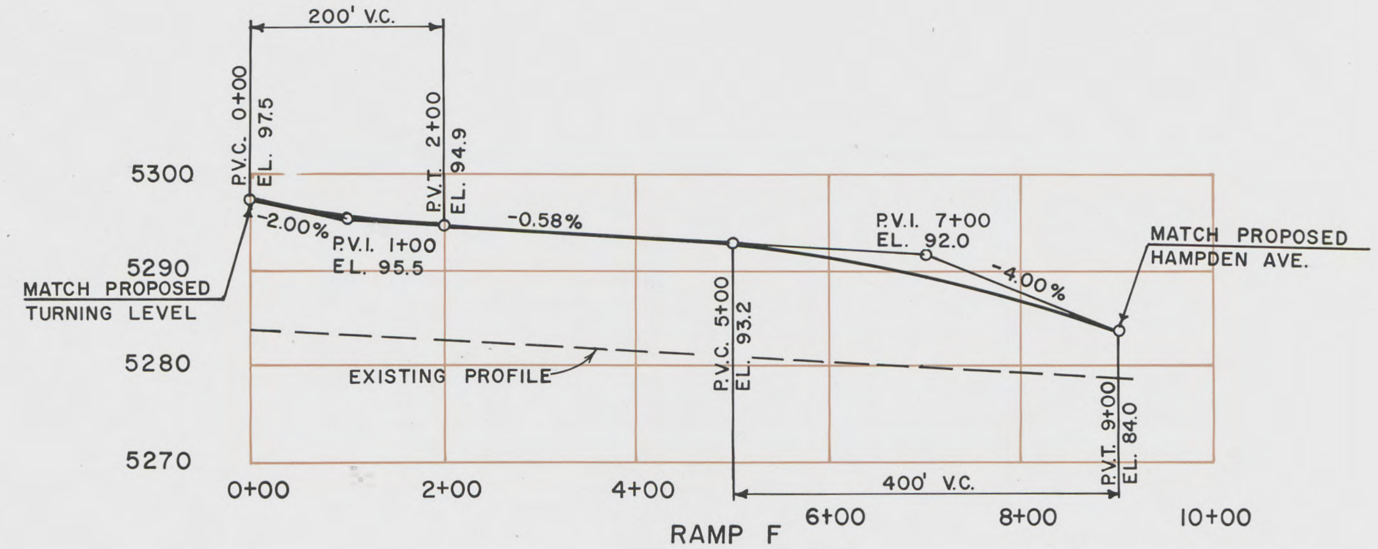


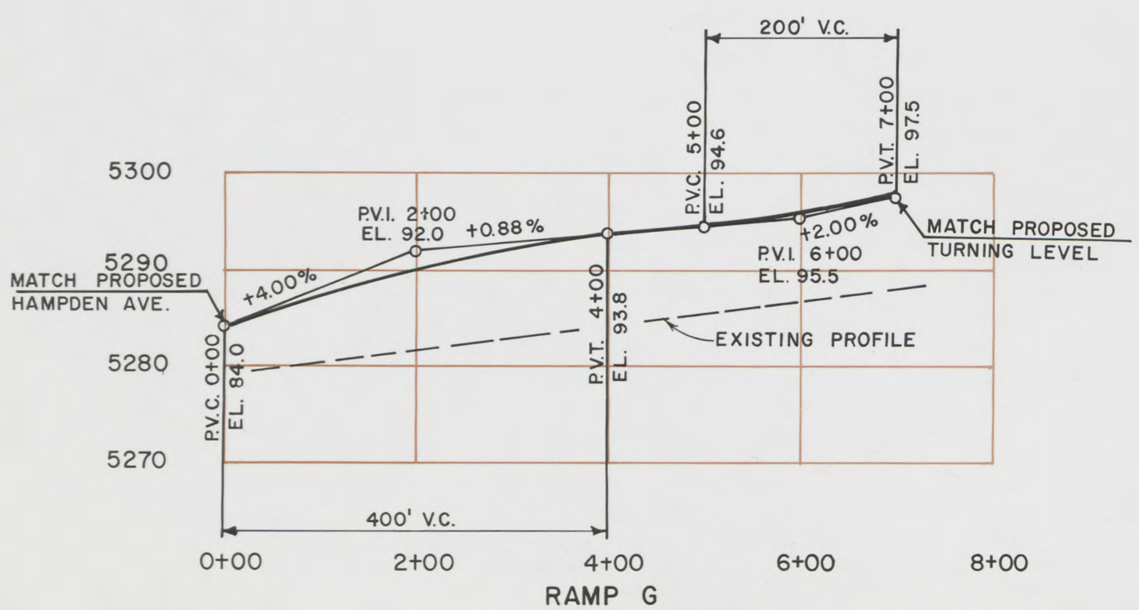
DRWG—80 / HAMPDEN INTERCHANGE GRADES

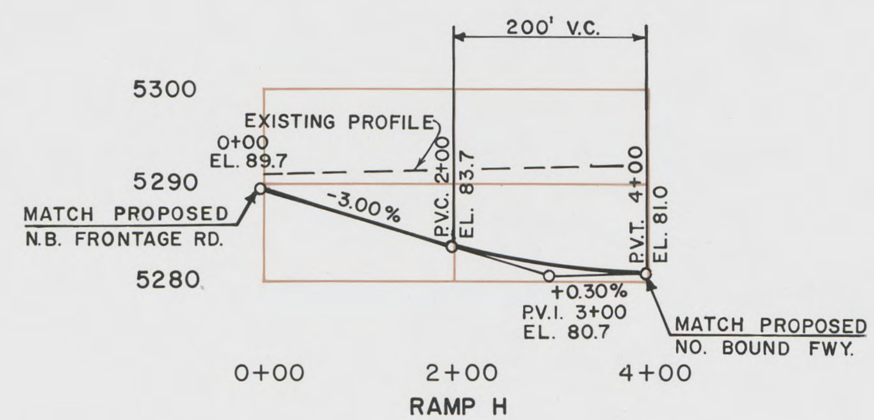




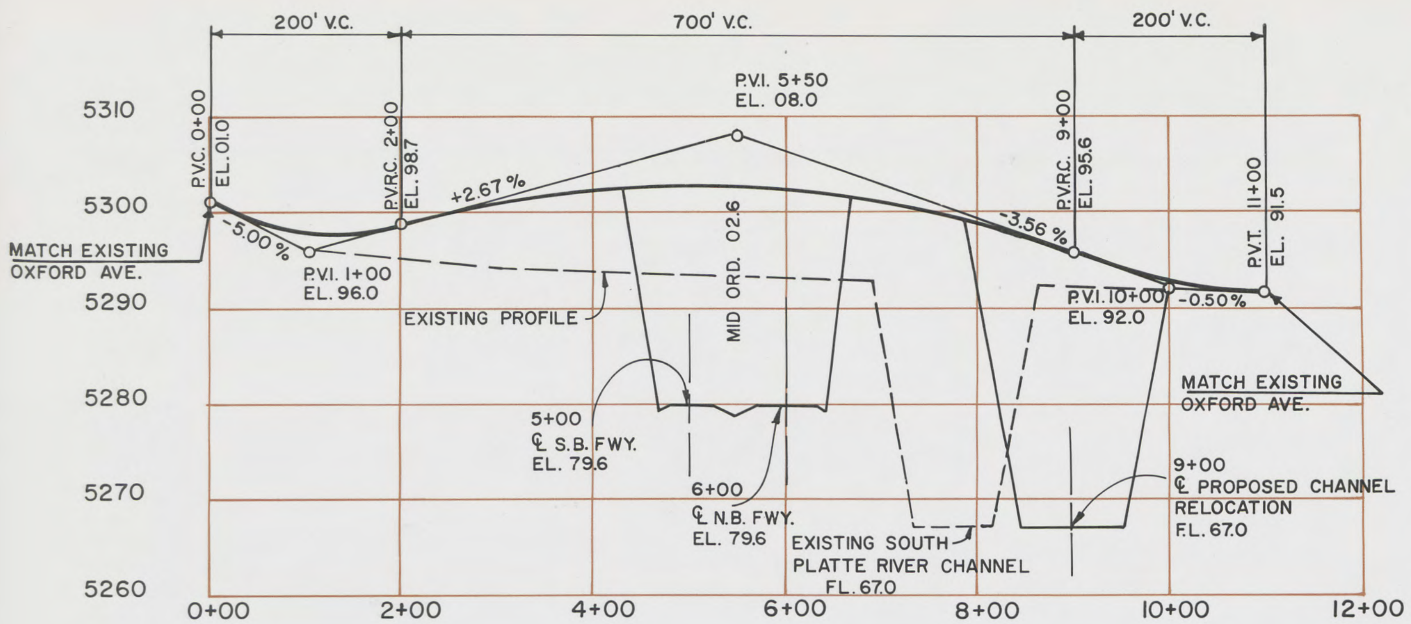




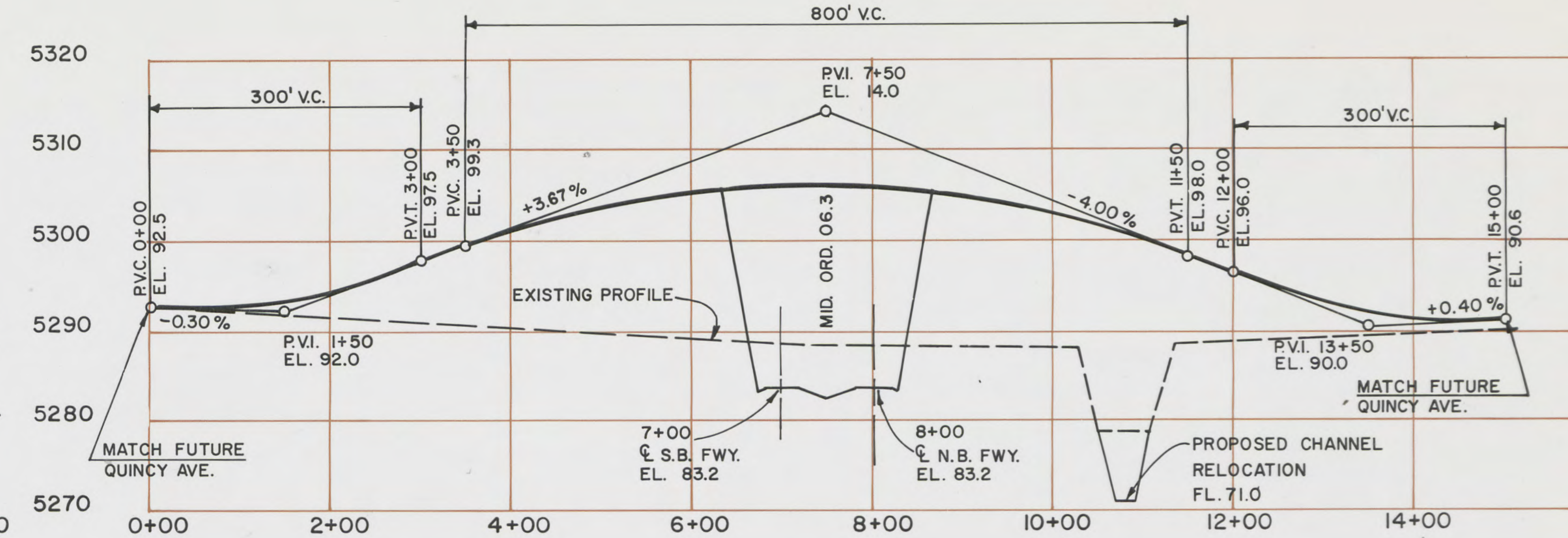




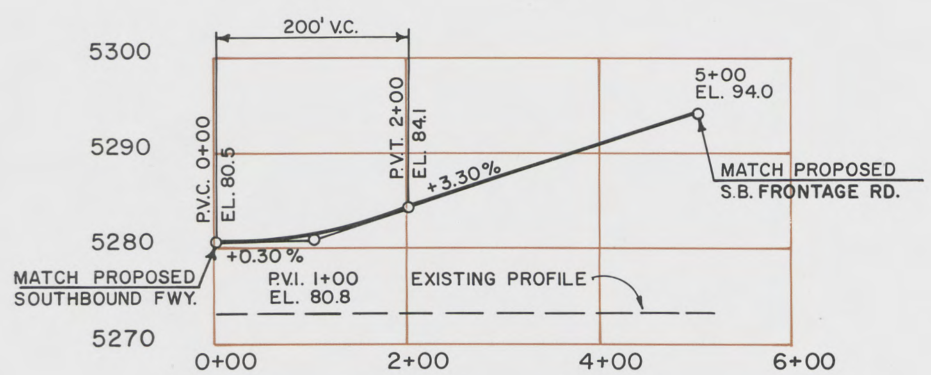
DRWG—81 / QUINCY—OXFORD RAMP GRADES



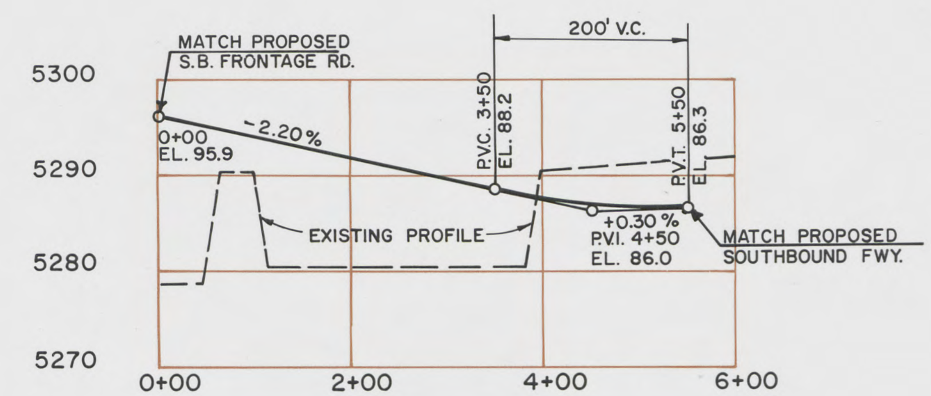
OXFORD AVE.
(DRAWING 68)



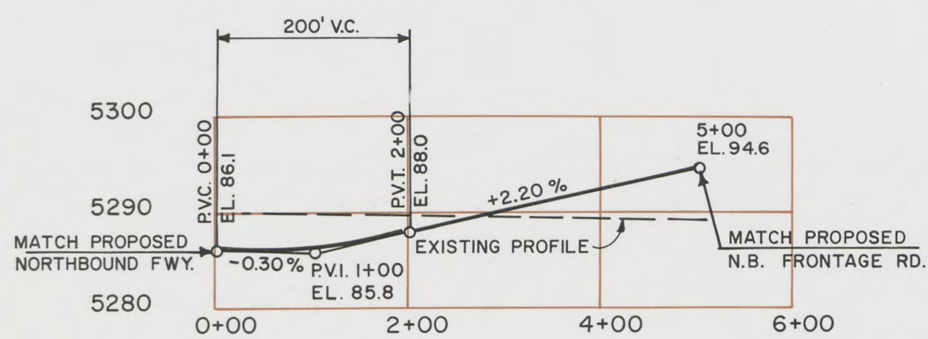
QUINCY AVE.
(DRAWING 69)



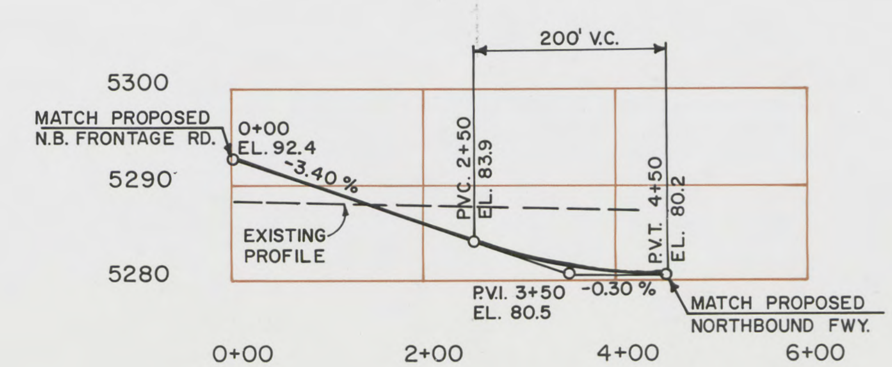
RAMP A
(DRAWING 69)



RAMP B
(DRAWING 69)

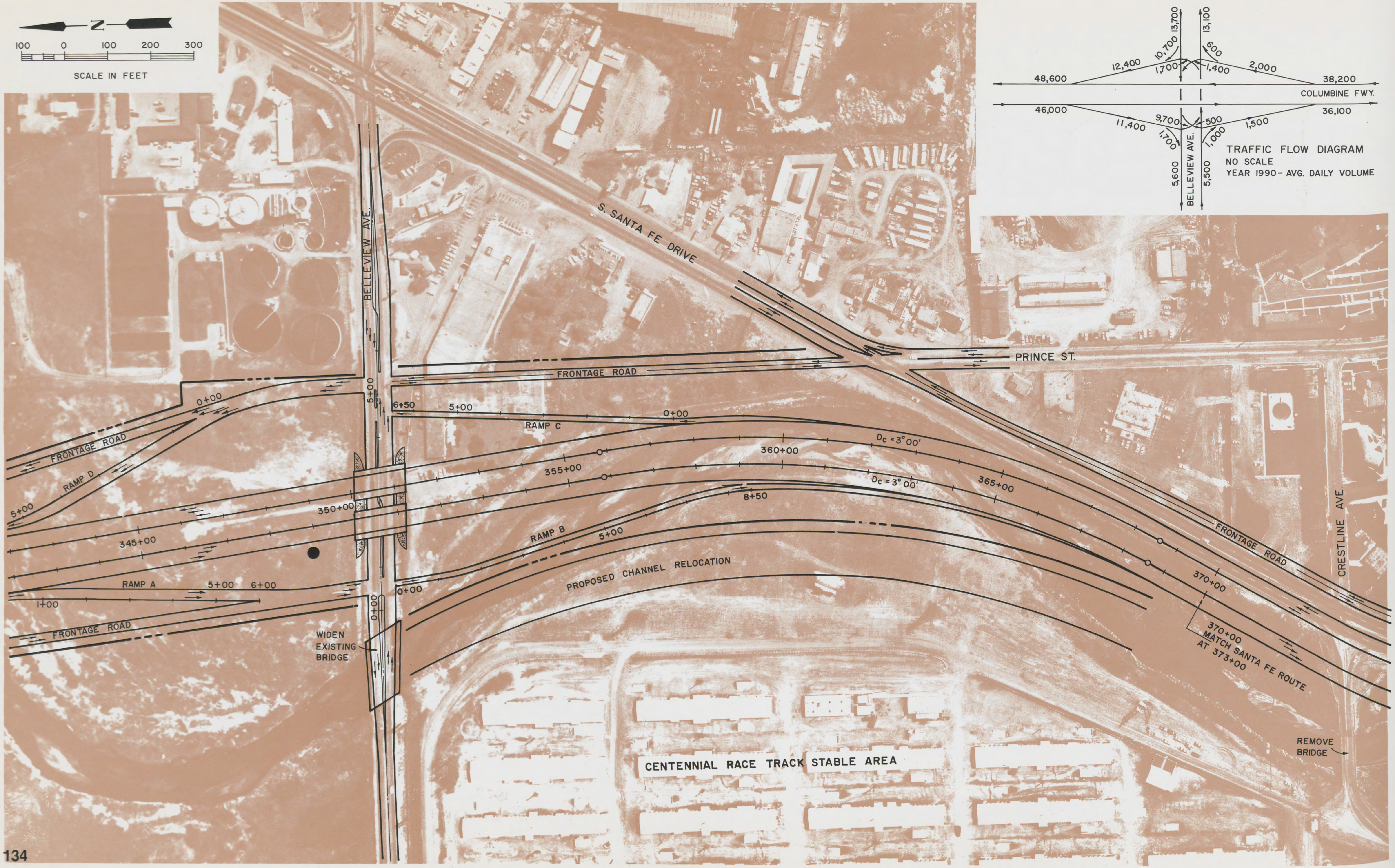


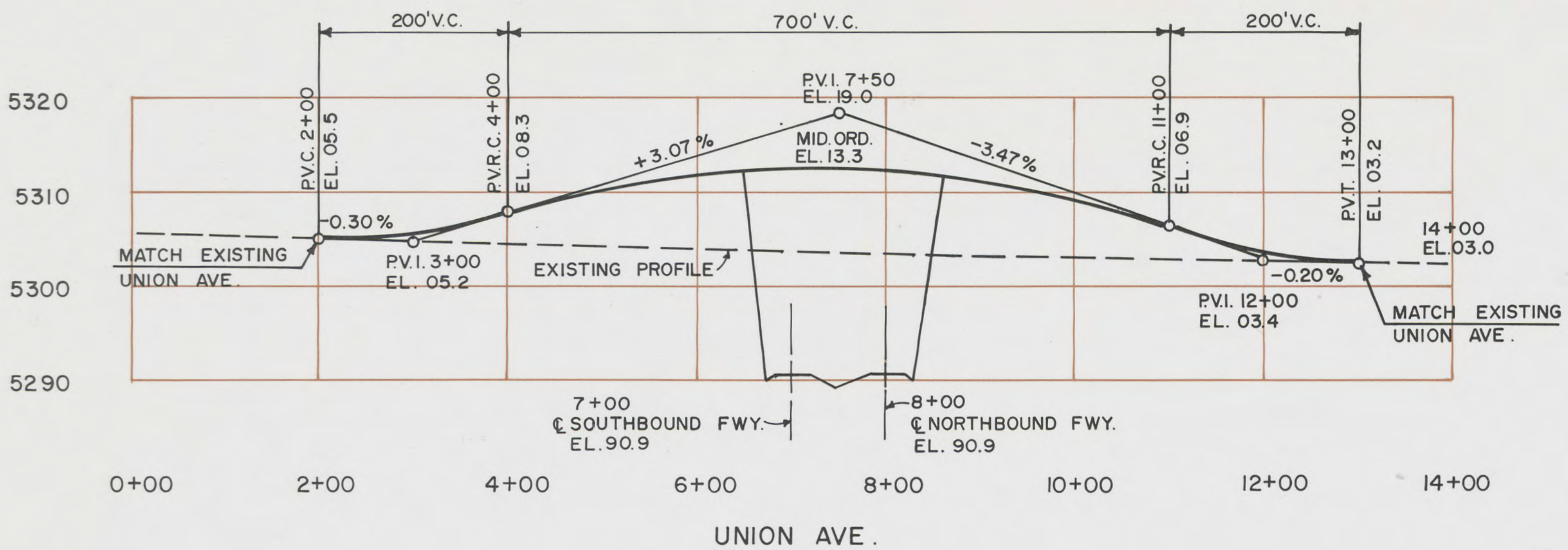
RAMP C
(DRAWING 69)

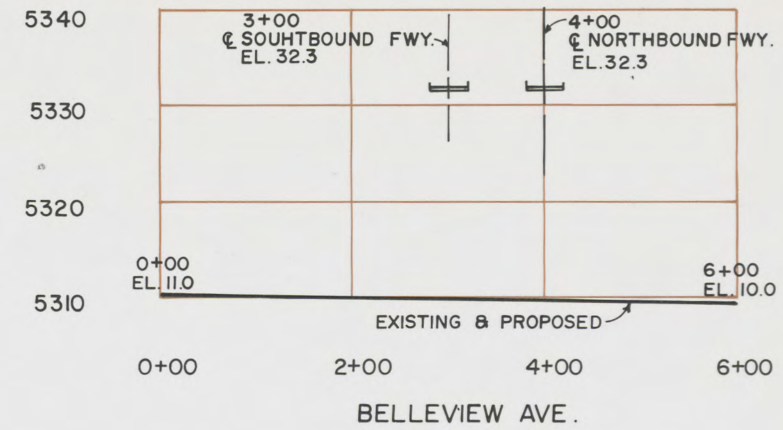


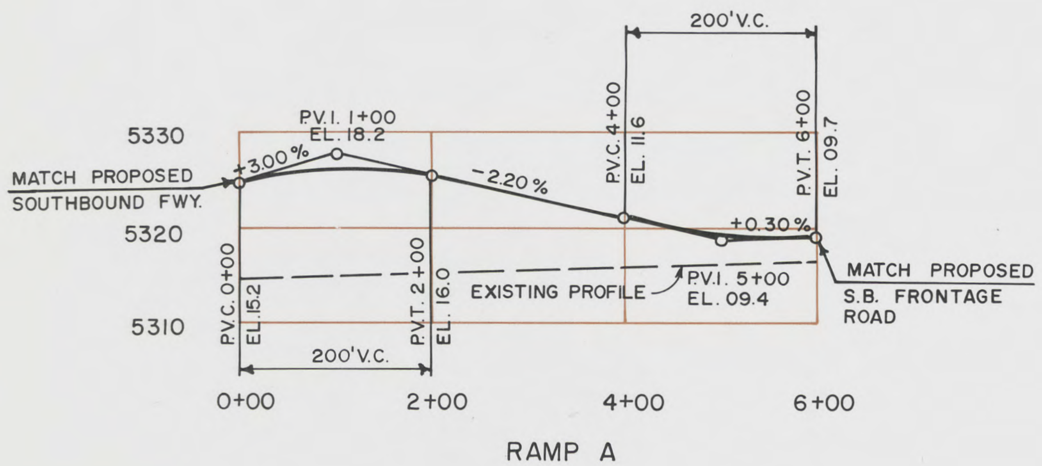
RAMP D
(DRAWING 69)

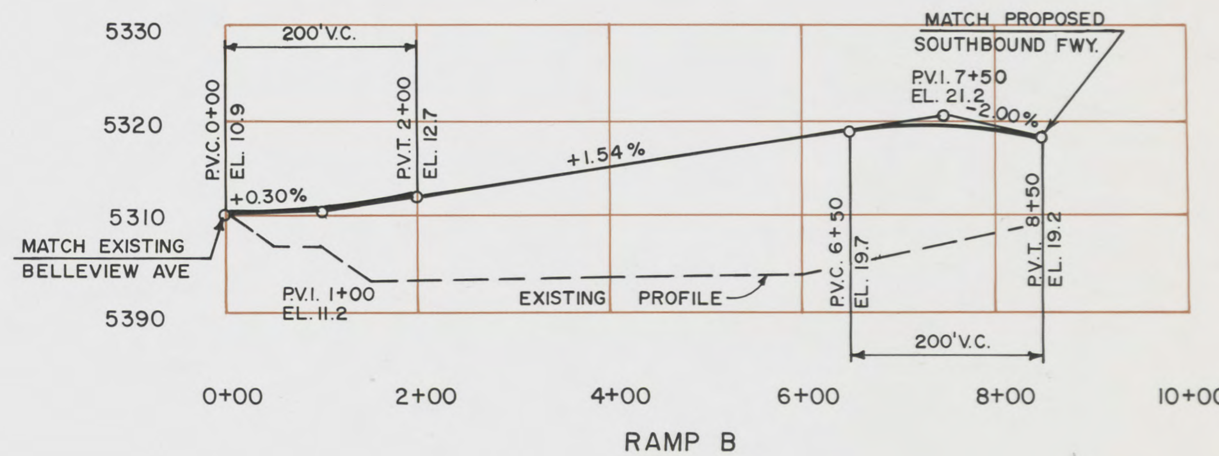
DRWG—82 / BELLEVIEW INTERCHANGE

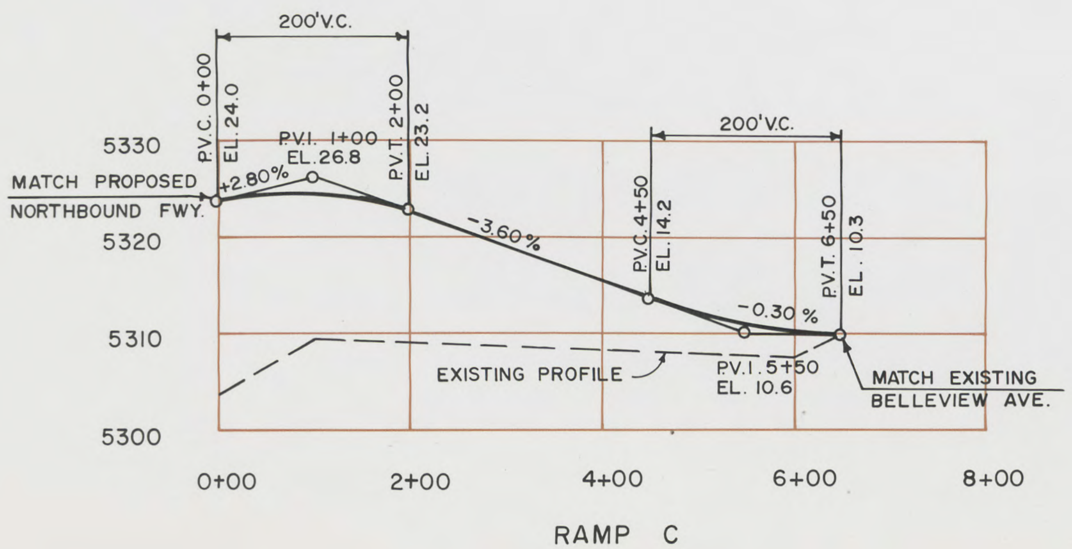


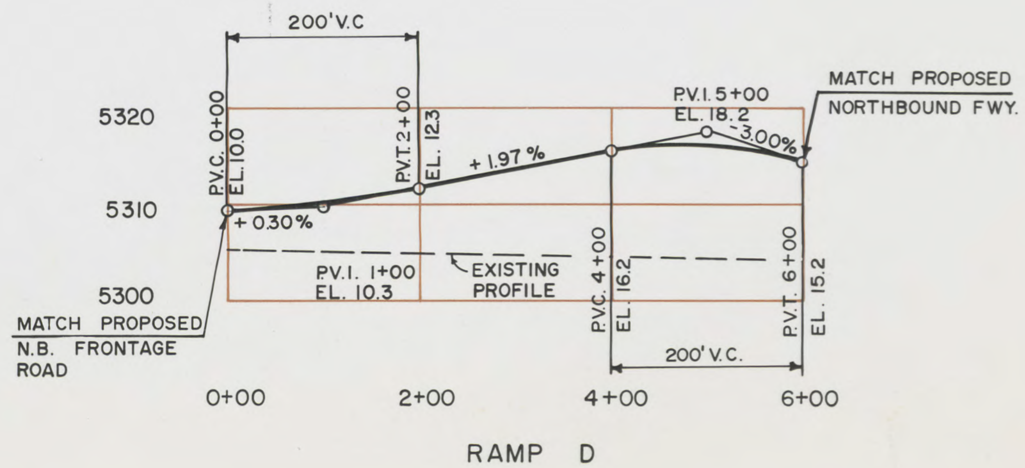












DRWG—83 / BELLEVIEW—UNION RAMP GRADES

DRWG—84 / PLAN—STORM DRAINAGE

DRWG—85 / UTILITIES—VIRGINIA TO FLORIDA

DRWG—86 / UTILITIES—FLORIDA TO ILIFF

DRWG—87 / UTILITIES—ILIFF TO DARTMOUTH

DRWG—88 / UTILITIES—DARTMOUTH TO OXFORD

DRWG—89 / UTILITIES—OXFORD TO UNION

OTHER ROUTE INVESTIGATIONS

RAILROAD ROUTE INVESTIGATIONS

By visual inspection along Santa Fe Dr., there appears to be a large amount of unused railroad right of way which is owned by the AT & SF Railroad on the east and the D & RGW Railroad on the west. These railroads jointly own approximately 200 feet of right of way from Louisiana Ave. south. Considering this right of way, it would appear possible to locate a freeway with the northbound lanes between the two railroad tracks and the southbound lanes on Santa Fe Dr. Another apparent option would be to relocate the D & RGW railroad east to obtain enough right of way combined with the Santa Fe Dr. right of way to provide for freeway construction. Both of these two alternatives were investigated and a summary of each follows.

Freeway Lanes Separated by Railroad

With the northbound freeway lanes between the existing AT & SF and D & RGW tracks, a minimum of 82 feet would be required for these lanes. This would include four 12 foot lanes plus the shoulders, and a minimum side distance of 10 feet to the right of way lines each side of the lanes. For the area investigated between Jewell Ave. on the north and Belleview Ave. on the south, there is a minimum of approximately 135 feet between the existing tracks to accommodate such a freeway design. With 25 feet allowed from each freeway right of way line to the centerline of the tracks, the minimum horizontal clearance appears to be available. This option would not allow for a frontage road adjacent to the northbound lanes.

Under this option, long, expensive crossing structures would be required at each end of the railroad route. In addition, the interchange design would be very difficult because there would be practically no room available for construction of off and on ramps at the side of the freeway lanes. These ramps would have a very limited turning radius where they entered the overcrossing or undercrossing street, and the turning movements at the undercrossing intersections would be practically blind in both directions.

Under this plan, the D & RGW Railroad would be penalized in that its service to existing industry presently located between the two railroads would be lost, the existing railroad service road in this area would be lost, and potential for future service to industry would be eliminated. In addition, a railroad located in the median of the freeway would be very difficult to maintain. If an accident were to occur on the railroad, the railroad and the freeway could be tied up for an indefinite period. In the winter, snow removal from the freeway or the railroad could be a serious problem for both.

For the freeway lanes southbound, a minimum of 152 feet would be required to provide for the freeway and a two lane, two way frontage road. North of Bates Ave. where there is only 74 feet of existing right of way and south of Bates Ave. where there is 100 feet of existing right of way, it is apparent that substantial right of way costs would be involved to obtain 152 feet of right of way. To obtain this additional right of way would involve complete purchase or major damage payments to many businesses along Santa Fe Dr. If the major portion of the existing structures were to be saved south of Bates Ave., the freeway would be of a substandard design.

Because of the inherent problems of trying to combine a railroad with a freeway and because the characteristics of this type of freeway would be very undesirable, expensive and substandard, this option was eliminated from further study.

Acquisition of D & RGW Railroad Right of Way

The second option of obtaining the D & RGW railroad right of way and relocating that railroad was investigated. To evaluate the possibility of obtaining approximately 110 feet of existing right of way from the D & RGW Railroad for freeway construction, meetings were held with representatives of both the AT & SF and D & RGW Railroads. In the first meeting held June 19, 1968, in the offices of the D & RGW Railroad in Denver, the question was asked as to whether the D & RGW Railroad would sell their entire right of way and combine to jointly use the AT & SF tracks through this area. The Chief Engineer for the D & RGW Railroad indicated that both railroads had recently made a study to determine if they could combine their trackage from Denver south. The result of this study indicated that both railroads should keep their present right of way and trackage.

The second possibility of whether the D & RGW Railroad would sell their right of way and relocate their main line to the AT & SF right of way was then explored. In order that the D & RGW Railroad could move to the AT & SF right of way, the Chief Engineer posed several questions that would have to be answered. Those questions were: (1) Could the railroad acquire replacement land for right of way land which was acquired in lieu of cash payment? (2) Could the industries presently located on the right of way be relocated satisfactorily so the railroad could still serve them? (3) Could the D & RGW Railroad acquire a permanent easement or right of way from the AT & SF Railroad?

Because the D & RGW relocation hinged on availability of AT & SF right of way, it was decided to resolve the possibility of right of way sharing with the AT & SF railroad management. In a subsequent letter of June 19, 1968, this question was asked of the AT & SF Railroad Chief Engineer. In the AT & SF Railroad's reply of August 9, 1968, the conditions for sale of right of way, subject to executive approval, were set forth as follows: (1) The AT & SF Railroad should be paid for the right of way acquired by the D & RGW Railroad; (2) An access road with gravel surface should be provided on the property east of the AT & SF tracks for use of both railroads as a maintenance road because the present maintenance road for both railroad tracks lies between the two main lines; (3) The AT & SF Railroad would not be required to pay for any part of the proposed grade separation crossings planned for the freeway.

Based on the requirements of the August 9, 1968, letter, questions were posed to the Chief Engineer of the D & RGW Railroad in a letter dated August 30, 1968, as to whether the D & RGW Railroad would consider selling all of its 110 feet of right of way and relocating onto the AT & SF right of way. The D & RGW Railroad was also asked what the minimum right of way requirement for their facilities on the AT & SF right of way would be. A reply was forthcoming in a letter dated October 23, 1968, which established criteria for relocating the D & RGW Railroad main line onto the AT & SF right of way as follows: (1) The joint use communication line which now exists on the right of way line between the AT & SF Railroad and the D & RGW Railroad would need to be relocated somewhere between the final location of the two concerned railroads. To accomplish this would require a track centerline minimum clearance distance of approximately 32 feet; (2) A joint use maintenance road on the east side of the AT & SF tracks would not be satisfactory because moving of equipment and men across these tracks to service the D & RGW tracks would be a cumbersome and hazardous practice; (3) The D & RGW Railroad would require 25 feet as an absolute minimum from the centerline of their tracks to their westerly right of way line, exclusive of any right of way necessary for fill slopes; (4) With respect to the existing industries on the land leased from and presently served by the D & RGW Railroad, each industry would have to be relocated to an area satisfactory to that industry and to a location where the D & RGW Railroad could continue to serve them; (5) All of the contemplated freeway work would be at the convenience of the highway traffic, and therefore the cost should be borne by highway projects.

It is obvious from the foregoing requirements that the D & RGW Railroad could not release all of its 110 feet of right of way. It is felt that because restricted access from the highway would be a part of the freeway plan and because no frontage road is planned on the east side of the Santa Fe Route, a maintenance road would be necessary for the D & RGW Railroad. This maintenance road should be located between the two track locations and would increase the minimum required distance between the tracks from 32 feet to approximately 54 feet. Based on the foregoing investigation, it was determined that an average of approximately 70 feet of right of way could be acquired from the D & RGW Railroad if all of the requirements as outlined by that Railroad were properly considered. On this basis, a cost analysis was undertaken to determine the cost of acquiring the railroad right of way, moving the railroad onto the AT & SF right of way, constructing a new common service road for both railroads, relocating the joint use communication lines where required, and relocating all railroad signaling equipment. The cost of these and other associated items of construction, together with the cost for relocating the industry presently located between the tracks, was estimated as shown in Table 4. It was assumed throughout this cost study that the freeway plan would be essentially the same as for the Santa Fe Route except for a 70 foot easterly shift throughout the strip of relocated railroad. Practically no change in utility adjustment costs would occur since the main utilities are located along Santa Fe Dr. and would still require relocation. It was assumed that no railroad service road bridges would be constructed because at-grade crossings from the east would be provided at crossing streets.

The small reduction in cost of right of way from the west side of Santa Fe Dr. occurred because only a few parcels could be eliminated or reduced. All other parcels were either still predominantly required or were damaged so much that full acquisition costs could reasonably be expected. In addition, the most valuable property along the west side of Santa Fe Dr. is that which fronts it. The 70 foot strip from the railroad made no reduction possible in the number of these front parcels which would be acquired and only the less expensive back parcels were affected.

TABLE 4 / RAILROAD RIGHT OF WAY COST COMPARISONS

1.	Railroad right of way	$1,400,000
2.	Relocation of industry presently between tracks	700,000
3.	Utility line relocation	16,000
4.	Earthwork	71,000
5.	Rail relocation	335,000
6.	New bridges	225,000
7.	Service road	58,000
8.	Miscellaneous	10,000
	Total cost of railroad right of way	$2,815,000
	Reduction in cost of right of way to be acquired west of Santa Fe Dr.	$ -370,000
	Resultant net expense of utilizing railroad right of way	$2,445,000

The cost figures show this concept to be unfeasible, as it would cost $2.8 million to acquire a 70 foot wide strip of land from the D & RGW Railroad while only $370,000 in right of way savings could be realized on the west side of the freeway.

SPLIT ALIGNMENT INVESTIGATIONS

Because of the existing barrier and development pattern which has been created along Santa Fe Dr. and the railroad tracks, the Santa Fe Dr. alignment is a logical place for the southbound freeway lanes of a split alignment. Two locations for an alignment of the northbound freeway lanes were considered, one along East Platte River Dr. and the other on the Western Route alignment. Both of these split alignment possibilities are discussed in the following paragraphs.

Santa Fe Dr.—East Platte River Dr.

In the early stages of this study, a preliminary investigation was made to determine the feasibility of using existing South Santa Fe Dr. and East Platte River Dr. as locations for a split Freeway alignment to eliminate the need for taking expensive, developed property along Santa Fe Dr. It was noted that from the Valley Highway to Bates Ave., Santa Fe Dr. has a 74 foot right of way and south of Bates Ave. it has a 100 foot right of way. Along East Platte River Dr., there is an existing 100 foot right of way from the Valley Highway to Dartmouth Ave. To construct a four lane one direction Freeway with a two lane one way frontage road placed as close to the Freeway as possible would require approximately 110 feet as an absolute minimum between interchanges and grade separation crossings.

On the preceding basis, an investigation was made using Santa Fe Dr. between the Valley Highway and Belleview Ave. as a one way freeway southbound, with an ultimate design of four lanes and a two lane one way frontage road on the right to serve the existing businesses. This Freeway design would be non-conventional in that the opposite direction of travel would be on the driver's right instead of the left. A design of this type would be required to provide a frontage road on the right. With the northbound freeway lanes located on the east bank of the South Platte River, utilizing the existing 100 foot right of way, several of the problems involved in the construction of a conventional freeway on the Santa Fe alignment would be solved. On an absolute minimum basis, only a small amount of additional right of way would have to be obtained on the Santa Fe alignment with the major portion being north of Bates Ave. Additional right of way necessary for the East Platte River Dr. would not be expensive as much of the land is not developed. For the northbound lanes located east of the Platte River between Belleview Ave. and Hampden Ave., right of way acquisition could be coordinated with the Corps of Engineers' channel relocation work.

To obtain a suitable alignment for this freeway design, a considerable amount of channel realignment would have to be made. North of Hampden Ave., two notable locations of channel realignment are required to accommodate the Freeway alignment. These two locations are between Floyd Ave. and Vassar Ave. In addition, some smaller channel changes would have to be made in the area of Overland Park Golf Course. These channel changes would provide a finished channel alignment which would be considerably straightened compared with the present alignment of the Platte River.

Considering the fact that a high speed freeway along the River would preclude further river-oriented development from occurring, which would be in conflict with present plans for the Platte River Valley, it was anticipated that this alignment would not be acceptable. Because of conflicts of plans for the Platte River and other problems, such as the large distance between northbound and southbound lanes in some locations, the non-conventional design of the Freeway and the major crossover structures required at Louisiana Ave. and at Belleview Ave., this plan was eliminated from further study.

Santa Fe Dr.—Western Route

Another investigation of a split alignment was considered which would also utilize existing Santa Fe Dr. for one way southbound. The complementary one way northbound alignment for this plan would utilize the Western Route with crossover structures required at Louisiana Ave. and Belleview Ave. Some of the problems involved with this split alignment plan are: (1) a double set of frontage roads should be provided along the Western Route one way freeway alignment. Because of this requirement, the right of way required would approach that required for a full freeway; (2) the alignment for directions of traffic would be separated by approximately two-thirds of a mile; (3) a non-conventional traffic arrangement for locating southbound traffic lanes on Santa Fe Dr. as previously described would be required.

The location of the Western Route would be an excellent location for the other set of the divided lanes because of the potential for development afforded between the lanes of this split alignment. There has been expressed some concern that the split in the freeway lanes may be too wide from a traffic-carrying point of view. However, from the point of view of the impact on the corridor and upon the provision of access to and through the corridor, it is felt that this division would not be excessive. This study does indicate that there are no substantial disadvantages in dividing the freeway lanes between Santa Fe Dr. and the Western Route, and it is considered feasible to construct a freeway in this manner. Because there are no significant benefits or cost savings which would indicate that this approach should be followed, this investigation was not pursued further.

Depending on the problems involved in reaching an agreement on a freeway route suitable to all communities in the corridor, it is felt that the split alignments, whether for freeway or additional surface streets, may someday be worthy of reconsideration.

COST ESTIMATES, RIGHT OF WAY CONSIDERATIONS AND SOURCES OF FINANCING

BASIS OF COST ESTIMATES

Estimated construction costs of the Columbine Freeway Study are based on the following sources:

1. Colorado Division of Highways' publication "1967 Cost Data, January 1, 1968." These data were projected for 1969 costs.

2. Project bid files of Meurer, Serafini and Meurer, Inc., projected for 1969 costs.

3. Material prices of 1968 projected to 1969 as provided by suppliers in the Denver area.

Highway bridge structures were estimated on a cost per square foot basis. Items such as utility relocations, walls, fencing, paving, etc., were estimated on the basis of quantity of material utilized, which was then related to a cost per linear foot. Some items, such as light standards and traffic control signals, were estimated on the basis of total quantity required.

The utility adjustment costs include adjustment of all water and sewer lines affected by the Freeway construction and alterations or improvements made on arterial streets as a part of the Freeway construction. Costs not included in utility adjustments are those costs for private utilities which would be relocated at the expense of the utility company. Such utilities include local service electric power lines, natural gas lines, and telephone lines. These utilities are presently located within an existing dedicated right of way and thus are the responsibility of the owner. The Public Service Co. power transmission towers are an exception and are included in the costs since they are located on private right of way.

This estimate does not include the cost of required River relocation for either route between Belleview Ave. and Bowles Ave. This work, with proper coordination, can be made a part of the Corps of Engineers "Chatfield Dam and Reservoir Downstream Channel Improvements."

RIGHT OF WAY COSTS

Right of way cost estimates were furnished by the Colorado Division of Highways based on minimum right of way required for construction of the Freeway on either route as established by Meurer, Serafini and Meurer, Inc. In preparing these estimates, the following assumptions were made:

1. No allowance has been made for moving existing tracks on property owned by various railroads. It is assumed that all properties now being served by railroad trackage, not in the proposed acquisition, will have the same type of railroad service to their places of business in an after condition. Physical improvements and land value, exclusive of trackage, have been included on the parcels owned by the railroads. No damages incurred by the railroads by reason of curtailed services or reduced trackage have been considered in this estimate.

2. Reliance has been placed on the assessment records of the City of Denver and Arapahoe County. Adjustments have been made in these valuations because of the following:

   a. A base was used for estimated market valuation from 1963 through 1966. This period reflects a relatively slack period in market activity in the Denver and Arapahoe County areas.

   b. Denver and Arapahoe County do not include trade fixtures in their estimates of market value. This is included in their personal property section. These trade fixtures are included in any appraisal for right of way purposes.

3. The large acquisitions of industrially and commercially zoned land will probably upset the relatively stable land values in these areas. This condition could materially affect the acquisition costs of such land.

4. In estimating right of way costs, only the land actually required for highway construction is included as shown on the plan and profile drawings for both routes.

All construction costs are based on early 1969 conditions and all right of way costs are based on present conditions. Accordingly, an adjustment must be made in these figures to reflect real estate and construction costs at the time of acquisition and construction.

An urban construction and traffic control cost factor of 15% of construction costs was used for the Santa Fe Route to discount the following:

1. The Colorado Division of Highways' unit costs used reflect little urban work as they represent the average costs of statewide work.

2. The use of existing right of way along Santa Fe Dr. creates the problem of maintaining at least four lanes of traffic along the route during construction. This incurs additional cost to cover such items as widening of bridges, detour construction and removal, signing and re-signing, striping, special lighting, special signaling, special safety provisions, etc.

3. Unknowns associated with the project, such as mislocated or unknown utilities can create extra construction costs through scheduling delays.

4. The contractor, because of the nature of the project, will have to actually "run through" most of the project twice as only half of the roadway can be constructed at one time if four lanes of traffic are maintained during construction along Santa Fe.

For both routes studied, no utility relocations were assumed for the viaduct connection from the Valley Highway to the Broadway—Lincoln one way pair because of the overhead structure. Construction and right of way costs for these viaducts are included in Table 5 as separate items.

An urban construction and traffic control cost factor of 5% of construction costs was used for the Western Route because a large reduction in problems of maintaining traffic is anticipated for this route, and a double run through will not be required.

A summary of the estimated costs of construction of a complete Freeway for each route considered is given in Table 5.

TABLE 5 / COLUMBINE FREEWAY SUMMARY OF COSTS

Work Classification	COST PER ITEM Santa Fe Route	Western Route
1. Right of way (Valley Highway to Chatfield Rd.)	$27,555,000	$16,415,000
2. Right of way (Valley Highway to (Broadway—Lincoln)	$ 3,825,000	$ 2,660,000
3. Clear & grub; demolition	$ 775,000	$ 492,000
4. Utility adjustments	$ 1,500,000	$ 860,000
5. Earthwork	$ 1,931,000	$ 2,370,000
6. Drainage	$ 1,247,000	$ 1,200,000
7. Base, surfacing, shoulders, curbing, striping	$ 3,124,000	$ 3,234,000
8. R.R. grade separation bridges	$ 968,000	$ 313,000
9. Bridges	$ 4,115,000	$ 7,088,000
10. Viaduct connection to Broadway	$ 6,106,000	$ 4,997,000
11. Walls	$ 901,000	$ -0-
12. Guardrail, fencing, lighting, traffic control devices, signing	$ 1,116,000	$ 1,002,000
13. Landscaping	$ 1,100,000	$ 1,100,000
14. Rebuilding Golf Course	$ 110,000	$ 110,000
15. SUBTOTAL Lines 3 through 14	$22,993,000	$22,766,000
16. Urban construction and traffic control costs 15% of Line 15 for Santa Fe Route; 5% of Line 15 for Western Route	$ 3,449,000	$ 1,138,000
17. Engineering and contingencies 20% of Line 15 plus Line 16	$ 5,288,000	$ 4,781,000
18. TOTAL ESTIMATED COST	$63,110,000	$47,760,000

Length of Both Routes — 10.8 miles, including connection to Broadway—Lincoln

Total Cost of Project, including Broadway—Lincoln connection

Santa Fe Route	$5.84 million/mile
Western Route	$4.42 million/mile

Total Cost of Project, exclusive of Broadway—Lincoln connection (Length 10.0 miles)

Santa Fe Route	$50,859,000 or $5.09 million/mile
Western Route	$38,804,000 or $3.88 million/mile

RIGHT OF WAY CONSIDERATIONS

As explained previously in this chapter, all right of way costs are predicated on present land values and are the major cost item for either route. As can be seen by driving through the South Platte River Valley, construction is occurring daily in areas where the Freeway would be planned on either the Santa Fe Route or the Western Route. As shown in the summary of costs, the cost of the Western Route is considerably less due to the estimated lower right of way costs. This is because of the larger amount of undeveloped land available for right of way on the Western Route. To assure these lower right of way costs will require the concerted effort of all municipalities and planning agencies involved along the selected route corridor. If the public agencies involved desire that the Freeway be constructed in the foreseeable future, it is imperative that a Freeway agreement be signed by the municipalities for a route and, at that point, the steps should be taken by the municipalities involved and the Colorado Division of Highways to preclude construction from the right of way corridor.

While the cities and counties have a number of measures which can aid in reserving future rights of way, such as the "mapped streets act," zoning, subdivision platting, and building permits, none of these measures can be applied in lieu of purchasing the property. These tools can be helpful in suggesting the coordinated and cooperative reservation of vacant land, providing all parties are willing. In those cases where the owners of the land are not willing to voluntarily reserve the property, acquisition must be made. The application of these measures to reserve right of way can be construed in the courts to be an illegal taking of land without payment or damages. In essence, the only truly effective measure that the cities have at their disposal is the actual purchase of properties.

Advance acquisition undertaken jointly by the municipalities and the Division of Highways could be very effective and need not be expensive if applied only to properties actually about to be developed. That is, if the cities and counties review development proposals and coordinate their work, they will be able to acquire only those properties, at a fair market price, which are actually about to be developed. Vacant land can remain the property of private owners. Cities and counties could take advantage of appreciating property values even though they leave their properties undeveloped and sell them in the future to the Division of Highways. Advance acquisition should be encouraged wherever possible. Additionally, throughout the alignment various land traits may be considered. For example, the city of Denver might trade Robinson Brick and Tile Co. some city land along the Platte River Drive for vacant land owned by Robinson along the Colorado & Southern railroad spur.

In summary, reserving of right of way is the one most important aspect of the Freeway construction, and it will require the combined effort of all public agencies involved to accomplish the construction of the Columbine Freeway.

CONCLUSIONS

RECOMMENDED ROUTE

The recommendation of this study is that the Freeway be located on the Western Route. The Freeway south of Bowles Ave. is not required at this time and will only be required as the development south of Bowles Ave. occurs.

ADVANTAGES OF THE WESTERN ROUTE

The Western Route provides a better connection with the Valley Highway than the Santa Fe Route in that the Western Route turning movements would be much simpler and easier to sign. The restriction between Gates Rubber Co. and the Platte River is completely avoided. This area is very restricted, would require extensive retaining walls, and could possibly require a slight westerly relocation of the South Platte River north of Mississippi Ave.

For the Western Route, a large amount of the right of way can be taken from open ground which now exists in that corridor; and much of the existing street system can serve for one way frontage roads. In utilizing open land for the Western Route, the existing businesses along Santa Fe Dr. are preserved.

Right of way cost estimates for both alignments utilized city and county assessment records as a reference to current acquisition costs. It is felt that the right of way cost estimates along the Western Route could be more accurate than those along the Santa Fe Route because the open ground and newer buildings that must be taken on the Western Route can be more accurately evaluated than the older buildings on the Santa Fe Route. With the more numerous and older buildings along the Santa Fe Route, it is possible that those right of way costs could be more substantial than have been estimated.

On the Western Route, with more right of way available at a lower cost, a double frontage road was planned. With a one way two lane frontage road either side of the Freeway in all areas possible, the potential for development of adjacent land and potential for added traffic carrying capacity is insured. For the Western Route, with the use of one way frontage roads either side of the Freeway, the alignment of the Freeway at interchanges is considerably simplified over that of the Santa Fe Route.

The Western Route has the advantage that it can be depressed in certain areas to reduce noise and disruption to the nearby properties. One such area where a depressed Freeway is quite compatible with the terrain is from Yale Ave. south of Hampden Ave. near Bear Creek through the town of Sheridan.

The alignment for the Western Route is superior to that of the Santa Fe Route in that it does not have the three distinct turning movements at each interchange which would be encountered along the Santa Fe Route. These turning movements are caused when the Freeway is looped away from the railroad tracks to provide for off and on ramps to the crossing street. An example of these three turning movements can be observed on Santa Fe Dr. at the existing Hampden interchange.

For the Western Route, the Freeway located west of the Platte River north of Belleview Ave. would open a large area for development on both sides of the route. In this area, with Santa Fe Dr. as a major arterial retained on one side of the valley and the Freeway on the Western Route, the development advantages of a split alignment could be realized. With some industries presently located between the two roadways, a corridor would be created to separate industry from residential areas. This resultant corridor would do much to eliminate the strip development which presently dominates Santa Fe Dr.

The D & RGW Railroad's interests are better served by the Western Route because of the restrictions placed on a railroad by an adjacent freeway. The D & RGW Railroad would be isolated by a freeway immediately west of its trackage and future customer service would be practically eliminated.

Traffic carrying capacity provided by the Western Route compared with the Santa Fe Route shows a substantial difference. A freeway of the type proposed in this study would carry approximately 104,000 vehicles per day at a "C" design level. Santa Fe Dr. now carries approximately 35,000 vehicles per day. A two lane frontage road, one way, could carry approximately 10,000 vehicles per day. On this basis, the traffic carrying capacity available with the Western Route would be 104,000 for the Freeway, 35,000 for Santa Fe Dr., 10,000 for each one way frontage road, totaling 159,000 vehicles per day. If the Freeway were located on Santa Fe Dr. with discontinuous frontage roads, the carrying capacity would be approximately 104,000 vehicles per day.

A major advantage of locating the Freeway on the Western Route is the elimination of the need to construct over the top of an existing major arterial roadway which is already carrying more traffic than it was designed to carry. One such project was recently completed in the Denver area, that being the construction of I–70 over East 46th Ave. through the stockyards area.

Depending on the financing of this Freeway, its construction could feasibly take some time to complete. If the Santa Fe Route were selected, many highway users along the corridor would be inconvenienced by construction for the duration of the project.

DISADVANTAGES OF WESTERN ROUTE

If the freeway were constructed today, a substantial right of way saving could be incurred compared with the Santa Fe Route because of vacant land available for the Western Route. If the land is intensively developed and improved in the future, this savings will be lost. It is extremely important that the public and private entities involved in this area cooperate in the reservation and/or advanced acquisition of this right of way.

The Western Route would not provide the urban renewal for the properties from the Overland Park Golf Course to Belleview Ave. along Santa Fe Dr. This type of renewal would take everything in the path of the Freeway, including good and poor businesses. It is felt that many business owners along Santa Fe Dr. would object strongly to being displaced by a freeway. By the use of building permits, condemnation of property that does not meet building codes, and application of zoning regulations, much can be done to improve the appearance of Santa Fe Dr. properties.

The Western Route will not provide immediate traffic relief for Santa Fe Dr. until it is completed to at least the vicinity of Evans Ave. Once the Freeway is constructed from the Valley Highway to Evans Ave., the traffic problems on South Santa Fe Dr. could be expected to diminish. Not until the Freeway is completed from the Valley Highway to Belleview Ave. would the total impact of traffic relief for Santa Fe Dr. be fully realized.

FUTURE OF SANTA FE DR.

It is recommended that if funds cannot be obtained for construction of the Columbine Freeway, Santa Fe Dr. be upgraded after the initial construction project recommended in Chapter VII to include a 6 lane divided major arterial roadway from Louisiana Ave. south to Belleview Ave. This construction could be accomplished from Bates Ave. to Belleview Ave. within the existing 100 foot right of way, but between Bates Ave. and Florida Ave. additional right of way would have to be acquired. If such a project is undertaken, an investigation should be made to determine if the additional right of way between Bates Ave. and Jewell Ave. could be obtained by moving the D & RGW railroad to the east 25 feet.

As the Santa Fe Route is planned between Jewell Ave. and Belleview Ave., grade separation crossings would be constructed at Evans Ave., Yale Ave., Dartmouth Ave., and Quincy Ave. If the Freeway is located on the Western Route, Santa Fe Dr. along the existing railroads would be left in its present condition and the existing street crossings of the railroad tracks would continue to be a problem, with the exception of Yale Ave., which does not now cross the tracks. Even with the proposed Columbine Freeway located on Santa Fe Dr., the grade separation crossings would not be provided at Mississippi Ave., Louisiana Ave., Oxford Ave. (it is planned that Kenyon Ave. and Tufts Ave. would be blockaded), Belleview Ave., Main St., and Alamo St. in Littleton, Prince St., Ridge Rd. and County Line Rd.

FIG. 45 / TYPICAL SANTA FE DR. GRADE SEPARATION CROSSING

Because of the importance, as stressed by many individuals, of obtaining grade separation crossings for certain east-west streets in conjunction with Freeway construction, an investigation and evaluation of the actual hazards of the grade crossings along Santa Fe Dr. was made to help evaluate the selected route. Police departments of the City and County of Denver, Englewood, Littleton and Sheridan were contacted. In addition, the D & RGW Railroad and the traffic departments of both the City and County of Denver and the Division of Highways were visited to obtain accident information for this corridor. It was found that out of approximately 70,000 reported accidents since January 1, 1966, approximately 60 of these accidents had been of the car—train variety. This is a ratio of less than 1 per 1,000. Of the 60 accidents reported, only one accident involved a fatality, that being the Evans Ave. March, 1968, fatality in which three persons were killed. These three deaths accounted for 1% of the auto fatalities in these municipalities in the last three years. The Evans Ave. grade crossing is equipped with only flashing warning signals and does not have the advantage of the gated crossings. In the last four year period there was one additional fatality at Tufts Ave. which has only a stop sign and a fixed railroad crossarm warning.

It was found that of the present 14 grade crossings between Mississippi Ave. and Ken Caryl Rd. south of Littleton, only three of these crossings have gates. These three crossings are Main St., Alamo St., and Ridge Rd., all in Littleton. Since these three gated systems have been installed, no car—train accidents have been reported at these locations. The three gated structures in the City of Littleton were financed by Littleton with 90% State and Federal funds and 10% City funds. Payment for maintenance of these signals is the responsibility of the City of Littleton.

By investigation, it appears that from a safety standpoint, the advantage of the four proposed grade separation crossings on the Santa Fe Route compared with none on the Western Route is more for the sake of convenience than for actual safety. If safety were actually the major concern, it would seem that more gated crossings would have been installed at the problem crossings.

Because only three existing grade crossings would be eliminated by locating the Freeway on the Santa Fe Route, with grade crossings remaining at Mississippi Ave., Louisiana Ave., Oxford Ave., Belleview Ave., Main St., Alamo Ave., Prince St., and Ridge Rd. no matter which alignment is finally decided upon, the advantage of the grade separation crossings of the Santa Fe Route is not significant. This crossing problem should not dominate the decision to locate the Freeway on either route.

A possible layout for a typical grade separation crossing has been made at Evans Ave. with Santa Fe Dr. as a 6 lane major arterial roadway crossing Evans Ave., as shown on Figure 45. The estimated cost of such a crossing is $700,000. Three such structures would cost approximately $2,100,000. Even if these three grade separation structures were to be included as a part of the Western Route Freeway construction, a major cost differential would still remain favoring the Western Route.

Because either route location does not solve the majority of the railroad grade crossings, it is recommended that the interested communities do all possible to install gated safety structures for all railroad crossings along the existing route. In addition, the minor crossing streets of Kenyon Ave. and Tufts Ave. should be closed to traffic.

LIST OF SELECTED REFERENCES

Denver Metropolitan Area Transportation Study—4B Surface Street System Analysis; prepared by DMATS Technical Steering Committee

Traffic Volumes on Urban Freeways in Colorado; Prepared by Division of Highways, State of Colorado

Highway Capacity Manual 1965--Highway Research Board Special Report 87; Prepared by Division of Engineering and Industrial Research, National Academy of Sciences, National Research Council

Instructional Memorandum 21-13-67 40-01 Subject: Reserved Bus Lanes; dated August 18, 1967, prepared by U. S. Department of Transportation, Federal Highway Administration

Design Manual; Colorado Division of Highways

Current issues of the **Policies and Procedures Memoranda** of the U. S. Bureau of Public Roads, which included:

A. PPM21-3, Preliminary Engineering
B. PPM40-2, Design Standards for Federal Aid Projects
C. PPM40-3.1, Plans and Specifications for Federal Aid Projects Standards for Preparation

Standard Drawings; Colorado Division of Highways

Colorado Department of Highways 1966 Cost Data; dated January 1, 1967

Instructional Memorandum 40-1-67, Subject: Guidelines for Lateral Clearance and Use of Guard Rails at Bridge Piers and Abutments Adjacent to High Speed Travelways; Bureau of Public Roads

Instructional Memorandum 40-2-67, Subject: Bridge Widths—Safety Provisions; Bureau of Public Roads

The Policy on Arterial Highways in Urban Areas; American Association of State Highway Officials

A Policy on Geometric Design of Rural Highways; American Association of State Highway Officials

Standard Specifications for Highways and Bridges; American Association of State Highway Officials

A Study of Mass Transit in the Denver Metropolitan Area; The Denver Planning Office, December, 1963

Transportation Plan; Denver Planning Office

A Summary of Urban Transportation Demonstration Projects; U. S. Department of Housing and Urban Development, November, 1967

Transportation—A New Dimension of Traffic Engineering; Nathan Cherniack, The Port of New York Authority

Miscellaneous information from the California Division of Highways, Los Angeles, California, regarding bus transit

Land Use Report, 1961; Origin and Destination Report, 1962; Interim Report to the Executive Committee, 1966; Denver Metropolitan Area Transportation Study

Urban Freeway Development in Twenty Major Cities; Automotive Safety Foundation, August 1964

Landscape Design Guide; American Association of State Highway Officials, 1965

Freeways in the Urban Setting; Conference held in Hershey, Pennsylvania, June, 1962

The Freeway in The City; The Urban Advisors to the Federal Highway Administrator, May, 1968

Man-Made America—Chaos or Control?; Christopher Tunnard & Boris Pushkarev, 1963

In Response to a Flood .... Denver, Colorado; Mayor's Platte River Development Study of The City and County of Denver, June, 1965

Freeways; Halprin; Reinhold, 1966

Metro Growth Plan, 1970—1980—1990—2000; Inter-County Regional Planning Commission

Master Plan, Arapahoe Junior College; Eugene D. Sternberg & Associates

Land Use Study; City of Englewood, Colorado, Planning Department, 1964

Littleton Central Area Plan; Small, Cooley & Associates, 1967

40001