Report on railroad grade crossing elimination and passenger and freight terminals in Los Angeles / California Railroad Commission, Engineering Department, Richard Sachse, chief engineer.

California Public Utilities Commission.
[Sacramento : Railroad Commission, c1920]

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REPORT

on

Railroad Grade Crossing Elimination

and

Passenger and Freight Terminals

in

Los Angeles

California Railroad Commission
Engineering Department

RICHARD SACHSE, Chief Engineer

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PART IV—FREIGHT

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PART V—REAL ESTATE, FRANCHISES, FINANCIAL MATTERS AND ESTIMATES

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ADDRESS ALL COMMUNICATIONS TO
RAILROAD COMMISSION OF THE STATE OF CALIFORNIA

LETTER OF TRANSMITTAL

Subject: Los Angeles Railroad Grade Crossing and Terminal Investigation, Cases 970 et seq.

California Railroad Commission,
San Francisco, California.

Gentlemen:

In December, 1917, the Commission instructed me to arrange for a complete engineering investigation into the Los Angeles railroad grade crossing and freight and passenger terminal situation and to report to the Commission on all of the matters above referred to. This work has now been completed and I am submitting with this letter this department's "Report on Railroad Grade Crossing Elimination and Passenger and Freight Terminals in Los Angeles."

You will find preceding the first chapter a summary and in the body of the report a full discussion of the Los Angeles grade crossing and terminal problem. The report has grown to be larger than was expected. It was necessary, nevertheless, to limit the scope of the investigation and to leave out of consideration a number of matters that were brought before us in the course of our work. Among such matters were the relation of the Los Angeles railroad development to the municipal harbor at San Pedro, more comprehensive plans for the elimination of grade crossings on electric rapid transit lines, the electrification of the steam roads in the Los Angeles district and in Southern California, the location and the plan for a civic center, and other problems of a city planning character. Aside from the fact that each one of these subjects is large enough for a separate and independent investigation and that we had neither the means nor the time to deal adequately with these matters, it was apparent that in their essential features they were outside the jurisdiction of this Commission.

Within the limits it was necessary to recognize, we believe that our report is complete. This statement is made with the fact in mind that there is available in the engineering department a very large amount of detail data that it was impracticable to include in a printed report. The magnitude of the subject can, perhaps, best be illustrated by the fact that estimates were

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made for various purposes and plans (many of which had to be rejected) totalling in excess of one hundred million dollars, and that the total estimate for all of our ultimate recommendations amounts to approximately thirty-two million dollars.

It will be convenient to give to the Commission in this letter our conclusions in the three main branches of the investigation (possibility of grade crossing elimination; desirability, location and plan for a union passenger terminal; possibility for improvement in the freight situation) and in the matters related to these three main branches.

Grade Crossing Elimination

This is the most important of the three subjects and is the one that is of most vital importance to the public and to the railroads. It is also the controlling engineering element in the entire report and, to a large extent, governs the solution of the union terminal and freight problems. We believe that all complaints against the unsatisfactory grade crossing conditions in Los Angeles, within the scope of this report, can be satisfied and that a permanent solution of the problem can be had by the adoption of our recommendations. These are:

1. Eliminate all important grade crossings on both banks of the Los Angeles River through the depression of the railroad tracks and the elevation of the streets by means of the improvement of existing, and the construction of new, viaducts across the river and across the tracks adjacent to the river. The streets to be so treated are North Main, Macy, Aliso, East First, East Fourth, East Seventh and East Ninth Streets. The North Spring Street crossing is to be entirely eliminated and Alhambra Avenue crossing is to be protected by an improved interlocking plant. The recommendations should be carried out substantially in the order and according to the plans given in this report.

2. Allow tracks to remain on Alameda Street but eliminate all (except approximately 3 per cent) of the present railroad traffic by diverting to better channels. The remaining traffic (consisting of switching service) is to be handled at night between Macy and Ninth Streets. Eliminate all main line traffic from Alameda Street.

3. Bring about the elimination of 61 streets, 8 electric railway and 2 steam railroad crossings by the adoption of the Santa Fe plan for an improved line between Los Angeles and Pasadena. Bring about the elimination of an additional 28 grade crossings on the Salt Lake Railroad by requiring that road to join in the construction and the use of the proposed Santa Fe line and by the abandonment and removal of its present tracks between the termini of the proposed line.

   If, in addition to the existing rapid rtansit lines, a municipal electric line should be built between Los Angeles and Pasadena, this line should be located on the same right of way (additional width to be acquired) and should be combined for the Santa Fe and the Salt Lake between Los Angeles and Pasadena.

4. Depress Santa Fe Avenue and raise the Butte Street tracks to eliminate the grade crossing at Butte Street and Santa Fe Avenue.

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Union Passenger Terminal

After a most exhaustive consideration of all arguments for and against a union passenger station in Los Angeles, we have come to the conclusion that the establishment of such a station is desirable both from the standpoint of the public and from the standpoint of the railroads, that the cost is justified and that the project can be financed. The reasons for this conclusion are given in detail in the body of the report.

We have found three sites adapted to the location of such a station, viz., the Plaza site, the Santa Fe Station site and the Southern Pacific Station site. Detailed plans and estimates have been worked up by us for each of these locations, and the recommendations contained in the report have been fitted to each of the plans. Of the three plans, the Plaza plan is the best and it is our recommendation that the Commission order the establishment of a union passenger station at this site substantially in accordance with the plan we have developed.

Freight

We believe that the matter of proper freight facilities is of even greater importance to the City of Los Angeles than the matter of steam railroad passenger facilities. It is our conclusion that freight traffic conditions are not unsatisfactory and that no far reaching recommendations are necessary to bring about such further improvements as appear to us desirable. Our recommendations in this connection are:

1. Tracks should not be removed from Alameda Street at this time, but all possible traffic should be removed from that street (see recommendation No. 2 above).
2. The so-called "Santa Fe Alley Spur" should be removed north of Butte Street.
3. Dealing with switching service and spur tracks for the future, we recommend that:
   (a) New permits be not granted for industry tracks longitudinally in the streets.
   (b) All tracks now longitudinally in the streets be confined to industrial purposes only and be removed as soon as better access to the industries served can be obtained.
   (c) All spur tracks to be built in general easterly and westerly direction from the river banks and not across east and west streets unless, by such construction, the crossing of important north and south streets is avoided.
4. The establishment of a union freight station for less than carload freight at the Santa Fe freight yard site on Santa Fe Avenue from First to Seventh Streets is recommended. The present Santa Fe freight station is to become a part of this union freight station. This we consider a very important recommendation and one that will be of great and permanent benefit to the railroads and to the shippers in Los Angeles.
5. The establishment of team yards along the east side of Alameda Street is recommended, as outlined in the report.
6. We recommend the construction of new freight yards farther away from the industrial district. A new yard is recommended for the Southern

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Pacific, following the plans of this road, along the San Fernando Road, and a new yard for the Santa Fe is recommended on the Fullerton line just east of Hobart, on land already acquired.

Related Recommendations

Related to the foregoing recommendations are certain other matters that are either before the Commission in various applications consolidated with this proceeding or that are important factors in the terminal problem and that fall within the scope of this report.

1. **Union Passenger Station and Electric Interurban Service:** If our recommendation for the establishment of a union passenger station at the Plaza is adopted by the Commission, we recommend also the construction of a subway from the present Pacific Electric station at Sixth and Main Streets northerly along Main Street to and under the passenger station, changing to an elevated railroad along Ramirez Street and meeting the present line at the Aliso Street bridge. This line from here would continue as an elevated railway to Brooklyn Avenue where the present tracks and grade would be met. This subway construction along Main Street should be undertaken within the next five years.

   The present elevated Pacific Electric structure in the rear of the Main Street Station should be extended to Alameda Street and thence south to Fourteenth Street.

   We realize that this is a far-reaching recommendation but believe it justified and essential in the interest of transportation and city development in Los Angeles, for reasons given in the report.
2. **Continuation of Consolidated Uptown Ticket Office:** This matter is related to our recommendation for a union passenger station. We urge that the existing consolidated uptown ticket office be continued, pending the establishment of a union passenger station, after the railroads return to private control. This recommendation is made because the present arrangement instituted by the United States Railroad Administration has proved satisfactory in every respect to the public and to the railroads.
3. **Application 3346** (Southern Pacific Company and Salt Lake Railroad for approval of agreement covering joint terminal facilities). It follows as a result of the recommendations contained in this report that this application should be dismissed.
4. **Application 2962** (Industrial Terminal Railway to issue stock for the construction of a switching and terminal railway): This application should be dismissed for the same reasons, although it will probably appear that with the adoption of our recommendations, another application of this nature will likely be filed later on in a modified form.
5. **Application 3037** (Los Angeles and Salt Lake Railroad Company for authority to establish 14 grade crossings in order to enable the construction of a freight terminal on Alameda Street): We recommend that this application be denied since our recommendation for a less than carload union freight station at the Santa Fe site will take care of all such freight requirements.
6. **Case 938** (Interlocking at Aliso Street and the Los Angeles River): In this case the Commission made its order directing the installation of an interlocking plant to control the Pacific Electric Railway, the Santa Fe and the Los Angeles and Salt Lake roads at this point. A supplemental order was later issued holding the matter in abeyance pending

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the completion of this report. Since our recommendations for the separation of grades and for a union passenger station will eliminate this crossing, the construction of this interlocker will not be necessary. An order should be issued to this effect after the adoption of our recommendations.

7. **Pairing of Southern Pacific and Salt Lake Tracks between Los Angeles and Colton:** The recommendation for such pairing of tracks was made to the Director General jointly by the engineers representing the Federally controlled railroads and by the Commission. Although this recommendation is very clearly to the benefit of the interested railroads and although the improvement can be made with very small expenditure and although an annual saving in the cost of operation was estimated at $173,025 (and this estimate has in the meantime increased), nothing has been done to carry out this recommendation. We can see no reason and have no explanation for the inaction on the part of the United States Railroad Administration. The recommended plan will work perfectly with our recommendations and we again urge that the proposed pairing of tracks as outlined in the report be put into effect by the action of this Commission as soon as the operating control of the roads is released by the Federal Government.

Cost Estimates

Detailed cost estimates will be found in the summary, in the body of the report and in Chapter XX.—Estimates. I shall here give only our totals for the ultimate plans worked out by us for the foregoing recommendations:

ESTIMATED CAPITAL EXPENDITURES FOR ALL RECOMMENDATIONS
(Ultimate Plan)

Grade Crossing Elimination		$11,488,933
Along Los Angeles River	$4,596,042	
Between Los Angeles and Pasadena	6,700,000	
Butte Street Trackage	192,891	
Union Passenger Terminal and Coach Yard		10,933,202
Union Freight Station		2,575,942
New Freight Yards		2,835,187
Double Track Operation of Southern Pacific and Salt Lake Tracks between Los Angeles and Colton—Pairing of Single Tracks		136,812
Team Yards		629,021
Additional Trackage, Various Locations		710,818
Subway and Elevated Construction—Pacific Electric		5,741,566
Total		$35,051,481
Release Southern Pacific Station and Coach Yard Sites		2,818,036
Net Total		$32,233,445

While a capital expenditure of over $32,000,000 seems large, it should be remembered that this money is to be expended over a term of years. In any event, whether the foregoing recommendations are adopted or not, very large capital expenditures aggregating probably in the neighborhood of the sum estimated by us will become necessary in the near future if the transportation of Los Angeles is to keep pace with the growth and the industrial and business

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development of the City. The choice is not between a large expenditure if these recommendations are adopted and a small one if they are not adopted: it is rather between an adequate and carefully planned development without wasteful expenditures and a haphazard growth dictated, in the main, by private interests from the standpoint of each individual road. In either case the burden of capital and operating costs must, in the end, be borne by the public.

It is impossible to estimate in dollars the direct and indirect savings and benefits through the carrying out of these plans that will accrue to the railroads, to the passengers and to the shippers and also to the people and enterprises affected by transportation conditions. We have no hesitation in saying, however, that from the financial standpoint alone, the proposed expenditure is justified. In the larger aspect of city planning, there is no doubt that the City of Los Angeles should use every effort to assist in the carrying out of these recommendations.

It is a pleasure to acknowledge the whole-hearted co-operation of our permanent and temporary engineering staff and of all other Commission employees assigned to this work. I have attached to this letter a statement of personnel, listing all engineers assigned to the investigation, in order that the Commission may know to whom credit and responsibility belong. Much credit and thanks are due to the engineers and representatives of the City and County of Los Angeles and of all the railroads, steam and electric, who were always ready to furnish us with the necessary information and to assist us in every possible way. It would have been impossible, without the assistance of these gentlemen, to complete this report within the time and means at our disposal.

Respectfully,

Richard Sachse

July 31, 1919.

Chief Engineer.

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H. G. Weeks, Assistant Engineer, in charge of office and field work in Los Angeles.

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E. A. Bender, Draftsman,
*T. F. Chace, "
*H. E. Findlay, "
*G. A. Raab, "
H. Schmidt, Draftsman,
*O. A. Schyl, "
*H. Y. Smith, "
*L. Millsaps, "
*Earl Frary, Architectural Draftsman,

Land Appraisal—V. C. Dickinson, Assistant Engineer.

R. L. Davis, Assistant Engineer,
Ward Hall, " "
F. H. Smith, Assistant Engineer,
R. W. Ure, Clerk,

Historical and Traffic Studies—A. C. Wells, Assistant Engineer.

*C. Fiske, Jr., Assistant Engineer,
*R. N. Taplin, Assistant Engineer,

Trackage Estimates and Industrial Survey—A. A. Anderson, Assistant Engineer.

J. F. Beaman, Assistant Engineer,
A. N. Johns, Assistant Engineer,

Building Estimates—*H. D. Johnson, Assistant Engineer.

General—

B. W. Campbell Assistant Engineer,
G. H. Sisson, Assistant Engineer.

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SUMMARY OF REPORT AND OF RECOMMENDATIONS

History of Proceedings

A short review of the formal proceedings which led to the Los Angeles grade crossing and terminal investigation is necessary to an understanding of the purpose of this report. In July, 1915, several civic organizations of Los Angeles filed complaints asking the Commission to ameliorate the grade crossing situation within the city limits of Los Angeles, to consolidate and unify the tracks of the various roads, to provide for a union passenger station and for better freight facilities and to investigate thoroughly the entire transportation situation.

These complainants were joined in their general and more specific petitions by a number of other civic and commercial organizations and by several municipalities in the immediate neighborhood of Los Angeles, until, in August, 1916, there were before the Commission seven formal proceedings and at least ten informal complaints. Under the provisions of the Public Utilities Law, the Commission began the hearing of these cases and consolidated them into one proceeding.

The question of the Commission's jurisdiction was raised by the railroads and by the City of Los Angeles and the issue was taken before the Supreme Court of the State of California. After the Court had confirmed the Commission's jurisdiction in all essential aspects and had placed the Commission under mandate to proceed with the various cases, the City of Los Angeles, the County of Los Angeles and other interests were made parties to the proceeding and the Commission continued with the investigation.

There are now included in this proceeding all of the steam railroads and electric railways entering into and operating in the City of Los Angeles (the Southern Pacific, the Santa Fe, the Los Angeles and Salt Lake, the Pacific Electric and the Los Angeles Railway); the City of Los Angeles, as represented by the city authorities and by a number of commercial and civic organizations; the Cities of Pasadena, Alhambra, San Gabriel, South Pasadena, San Dimas, El Monte, Pomona, Ontario, Sierra Madre, Colton, San Marino, San Pedro, Whittier, Santa Monica and Venice; and the County of Los Angeles through its county authorities.

Subsequent to the filing of the various proceedings just referred to, applications were made to the Commission by the Los Angeles and Salt Lake Railroad, by the Industrial Terminal Railway Company of Los Angeles, by the Southern Pacific and by the Southern Pacific, the Salt Lake and the Pacific Electric jointly, for permission to undertake certain operating agreements affecting the Los Angeles grade crossing and terminal situation.

With all of these applications the Commission took the position that large capital expenditures and important re-arrangement of existing conditions were unjustified until the larger matters had been thoroughly considered. For this reason all of the applications were held in abeyance.

In December, 1917, public hearings by the Commission were continued until further notice pending the completion of the engineering investigation

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which had been undertaken by the Commission and for the purpose of which the City Council of Los Angeles had appropriated $20,000 to defray part of the cost of the work.

Active work in this investigation began about January, 1918, shortly after the control of the three steam railroads in Los Angeles had been taken over by the United States Railroad Administration, and this work has been pursued ever since, resulting in this report.

With the assumption of the operating control of the railroads by the Federal Government, Hon. Wm. G. McAdoo, the Director General of Railroads, announced as one of his policies the unification of terminal facilities. Los Angeles was one of the cities whose terminals he wished to unify. He made request on this Commission to give him the benefit of its investigation and of its views in the Los Angeles grade crossing and terminal situation. As a result of this request the Commission's Engineering Department made two reports, the first in September, 1918, and the second in January, 1919. Both of these reports contained recommendations which were to be put into effect immediately and during Federal control, which were calculated to improve certain unsatisfactory traffic and grade crossing conditions and which (and this was the main point) were to effect considerable immediate savings in operating costs. While the recommendations in the first report were urged upon the Director General by the Commission alone, the proposals in the second report were the joint recommendations of the Railroad Administration's own engineers and the engineers of this Commission.

It might be stated here that none of the recommendations have at this time been carried into effect by the United States Railroad Adminisration.

It is the Commission's intention that this report in its present form shall be submitted to all of the interested parties for criticism and suggestions, that thereafter further public hearings shall be held, that after the conclusion of these hearings the recommendations contained in the report shall be revised on the basis of such additional facts as may be established during the hearings, and that finally the Commission shall make its decision and order.

Scope of Work

The scope of the investigation is broad and includes the entire steam and electric railroad situation in Los Angeles and vicinity. Of necessity, however, the report deals particularly with the steam railroads, although the interurban electric transportation problem (Pacific Electric Railway) and the street railway question (Los Angeles Railway) have been given consideration in their relation to the steam carriers.

The engineering inquiry involved the following subjects:

(a) Grade crossing elimination,
(b) Union passnger terminal,
(c) Joint main line and industrial trackage,
(d) Improvement and possible re-arrangement of freight facilities,
(e) Electric interurban, street railway and automobile traffic,
(f) City streets, viaducts and bridges and the relation of the transportation problem to the general subject of city planning.

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Again, the engineering investigation distinguishes between:

(a) Work to be done within the city limits of Los Angeles,

(b) Work to be done outside the city limits of Los Angeles.

And again, the report recognizes that any comprehensive plan can be carried out only under the "unit system" and that a program must be laid down for:

(a) Work to be commenced and carried out immediately after a plan has been adopted,

(b) Work to be carried out later,

(c) Work for the more distant future,

Recommendations

The recommendations may be considered under three heads, in the order of their importance:

(a) Elimination of grade crossings,

(b) Establishment of a union passenger terminal,

(c) Improvement in the handling of freight.

These three phases of the investigation are interdependent, and a determination of one question cannot be reached without a study of the other two. On the basis of such a study, the following conclusions are reached:

ELIMINATION OF GRADE CROSSINGS

Crossings Adjacent to Los Angeles River

Traffic studies indicate that every year about 65,000,000 people cross the Los Angeles River and the tracks of the Santa Fe and the Salt Lake roads adjacent to the River, divided as follows:

	People per Annum
Over present five grade crossings	33,000,000
Over present four viaducts and bridges	32,000,000
Total	65,000,000

If we estimate the population of Los Angeles in 1918 at 600,000, this movement would be equivalent to a going back and forth of the River every day of approximately one-third of the population.

The railroad traffic amounts to about 560 train movements each day from 6 A. M. to 8 P. M., or at least 600 movements per twenty-four hours for the five existing grade crossings mentioned above.

Numerous accidents have occurred and the delay to vehicular traffic and, especially, interurban cars, is also serious. On Seventh Street, the crossing gates have been found to be down as much as 19 per cent of the daylight

We recommend that the grade crossings formed by the following streets and the Santa Fe on the west bank and the Salt Lake on the east bank of the River, be eliminated by depression of tracks and elevation of the streets: hours—the period of main traffic.

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RECOMMENDED DEPRESSION OF TRACKS AND ELEVATION OF STREETS FOR ELIMINATION OF GRADE CROSSINGS ALONG LOS ANGELES RIVER

Street	Which Work Order in Should Be Done	Santa Fe or West Side		Salt Lake or East Side	
		Depression of Tracks	Raise of Streets	Depression of Tracks	Raise of Streets
North Spring	2nd	1.2 ft.	‡	3.4*ft.	‡
North Main	2nd	2.5 "	22.5 ft.	4.5 "	20.5 ft.
Alhambra	2nd	7.9 "	0.0† "	8.0 "	0.0† "
Macy	1st	7.9 "	17.1 "	11.3 "	13.7 "
Aliso	1st	8.3 "	16.7† "	8.0 "	17.0† "
East First	3rd	8.7 "	16.3 "	3.8 "	21.2 "
East Fourth	3rd	3.6 "	21.4 "	6.4 "	18.6 "
East Seventh	3rd	7.0 "	18.0 "	7.3 "	17.7 "
East Ninth	3rd	2.7 "	22.3 "	5.7 "	19.9 "

*Raise. †Tracks only, no highway. ‡Remove existing bridge.

The above mentioned Santa Fe tracks at Macy and Aliso Streets are those along the River. We intend to eliminate the crossings of the present main line at these streets by removing the track.

The recommendation above stated as to the order in which the work should be undertaken is here based on the assumption that this grade crossing elimination work **only** is done. If our recommendation for a union passenger station and for certain changes in freight handling are adopted, the order of these grade separations will be changed as will appear later.

At the locations marked "1st" the crossings should be eliminated at once; at those marked "2nd" the crossings should be eliminated within five years; the crossings at the others should be eliminated shortly thereafter, the time depending, to a large extent, upon future development. The cost of the whole work is estimated as follows:

ESTIMATED COST OF GRADE CROSSING ELIMINATION ALONG LOS ANGELES RIVER, NORTH BROADWAY TO BUTTE STREET

(CONSRUCTION IN ONE STEP)

Construction of Viaducts and New Approaches to North Broadway Viaducts		$3,658,132
Depression of Existing Tracks (Grading for Double Track)		629,412
Santa Fe	$309,898	
Salt Lake	244,966	
Southern Pacific	74,548*	
*Includes all interlocking at Mission Tower.		$4,287,544

These estimates, like all the others, include the costs of additional lands, compensation for existing private structures and damages and include allowance for contingencies, interest during construction, engineering, and legal and general administrative expense. Estimates for the viaducts are based on three-span reinforced concrete arch bridges across the river, on steel construction over the tracks and on filled approaches with concrete retaining walls. Roadways are uniformly 48 feet between curbs, and grades of the street approaches are 4 per cent.

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The cost, as estimated, is predicated on the depression of the existing Salt Lake tracks, only such changes being made as are occasioned by the depression. The grading, however, is for a double track road-bed all the way from near North Broadway to south of Ninth Street. On the Santa Fe side, double tracks are estimated all the way, the ends of the freight yard being "planed off" to fit the new grade of the river tracks. Otherwise the yard between First and Sixth Streets is not disturbed.

If a union passenger station is built or if certain changes in the handling of freight are made, these estimates will be increased as shown hereafter. They are here given only for "simple depression" of the existing river tracks.

If the work is done by steps, the cost will again be increased for the reason that, because of temporary grades, the work between certain points will have to be done twice. The estimate for the 1st step is as follows:

FIRST STEP IN GRADE CROSSING ELIMINATION ALONG LOS ANGELES RIVER, ELIMINATION OF GRADE CROSSINGS AT MACY AND ALISO STREETS (WITH SIMPLE DEPRESSION OF SANTA FE AND SALT LAKE TRACKS)

Viaducts (Macy and Aliso Streets)		$774,493
Tracks (Alhambra Ave. to 1st St.)		196,993
Santa Fe	$103,812	
Salt Lake	93,181	
Total		$971,486

No estimates have been made for the second and third steps.

Alameda Street Grade Crossings

Traffic studies indicate that every year approximately 78,000,000 people cross Alameda Street in its most congested part (Spring Street to Ninth Street), divided as follows:

Location	Important Streets	Electric Railways	People per Annum Crossing Tracks
North of Arcade Station	9	6	59,000,000
South of Arcade Station	4	1	19,000,000
Total	13	7	78,000,000

The railroad traffic is very heavy: the average street north of the Arcade Station is crossed by 157 train movements each day, and the average street south of the station is crossed by 98 train movements. This means that 13 principal streets have an aggregate of 3,315 train movements daily.

Accidents have occurred (though they have not been very numerous on account of the reduced speed of the trains) and there is an important delay to both railroad, vehicular and electric railway traffic. At both Sixth and Seventh Streets the crossing gates are down over 15 per cent of the daylight hours. Both danger and delay will increase as time goes on.

We recommend that the tracks be allowed to remain in Alameda Street but that all except approximately 3 per cent of the present railroad traffic be diverted from this street and that this remaining traffic (switching service) be handled after midnight between 1 and 6 A. M. between Macy and Ninth

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Streets. Thus all mainline traffic will be eliminated. This will do away with practically all the grade crossings and will, at the same time, disturb the existing investment in buildings and business as little as possible. It will mean little or no increase in railroad operating costs.

Through Southern Pacific freight trains (about ten daily) between the Southern Pacific yard and Los Angeles Harbor should be rerouted to avoid Alameda Street. They should be handled along the river bank tracks and should reach Alameda Street via Butte Street.

There is at present a traffic of some 45,000 fuel oil (tank) cars per annum on Alameda Street. This movement results in a serious disturbance to both the public and the railroads because of the long, heavy trains running at slow speed. These cars, which comprising about 32 per cent of all freight cars moved on Alameda Street, run between El Segundo and Los Angeles via the Pacific Electric. We recommend that they be rerouted through the city and that they be handled over Salt Lake or Santa Fe tracks along the river between the Southern Pacific yard and near Butte Street, at which point they be transferred to and from the Pacific Electric.

The Southern Pacific now hauls cars for the Pacific Electric between Macy Street and Eighth Street on Alameda Street in order to avoid haul over Pacific Electric tracks further uptown. These cars also should be handled on the tracks along the river, reaching the Salt Lake tracks at Aliso Street and the Pacific Electric tracks at the transfer tracks at Santa Fe Avenue and Butte Street. Nearly 31,000 cars per annum—22 per cent of all freight cars switched on Alameda Street—are involved. Cars transferred between the Southern Pacific and the Pacific Electric amount to 36,000 cars per annum—26 per cent of all freight cars handled along Alameda Street.

These cars, too, should be diverted from Alameda Street to the banks of the Los Angeles River.

This rerouting and diversion is very important in reducing the traffic on Alameda Street, the switching so rerouted amounting to 85 per cent of all freight cars switched along this important thoroughfare.

Grade Crossings between Los Angeles and Pasadena

The Santa Fe has under consideration plans which will eliminate 61 street, 8 electric railway and 2 steam railroad crossings. The railway grade will be reduced, with a shortening of line and a reduction of curvature. There will result a large saving in operation. This work is estimated to cost $6,700,000. The Santa Fe plans are in a preliminary stage at this time, and we have agreed to hold as confidential the information given us. The plans fit perfectly into all other recommendations made in this report and in all respects meet our views as to the phase of the problem dealing with the main line situation between Los Angeles and Pasadena.

This construction could be divided into two steps: The first step should begin at Los Angeles and extend about 5½ miles. In this distance all of the street crossings (2 in number), all of the electric railway crossings (2 in

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number) and all of the steam railway crossings (2 in number) would be eliminated. It is estimated that this work, based on 1916 prices, would cost approximately $2,083,000, but at the present time the cost would probably be $3,000,000. It should be pointed out that this first step, while accomplishing the complete elimination of grade crossings, would not reduce the present maximum grade or the amount of curvature. The saving in operation, therefore, would not be proportionate to the expenditure.

We draw attention to the fact that piecemeal elimination of these crossings would probably average $100,000 per crossing, which is approximately the figure obtained by dividing the estimated costs above by the number of crossings, and that for this expenditure a practically new double track roadbed is gained in addition to the separation of grades. Also, that the history of railroads in the larger cities proves the wisdom of a comprehensive plan of track elevation (or, in some cases, depression) as compared with temporizing and separating the grades of crossings one by one.

There would remain about 28 grade crossings on the **Salt Lake,** the elimination of which is also desirable.

We recommend that the first step in the elimination of grade crossings on the Santa Fe between Los Angeles and Pasadena be undertaken at once, taking into consideration the early completion of the whole project and consequent saving in the cost of operation as well as the public benefits resulting from the elimination of crossings at grade.

We further recommend that the Salt Lake join in the construction, use and operation of these new tracks and abadon and remove its present tracks between the termini of the proposed new line.

The **City of Pasadena** has taken steps toward the construction of its own **rapid transit line between Los Angeles and Pasadena** but the matter seems to be in abeyance at this time. If the project should be revived, it **should be combined with the elimination of grade crossings on the Santa Fe and the Salt Lake by constructing the tracks on the same, but somewhat wider right of way and roadbed.** This would reduce the cost of construction and operation of such a rapid transit line and also reduce the number of bridges and subways in the Cities of Pasadena, South Pasadena and Los Angeles.

We would not recommend the construction of such a rapid transit line through private capital because the revenue from the traffic is apparently insufficient to justify the investment. If the line is a municipal and public enterprise, however, and is partially supported by general taxes, consideration of earnings, expenses and return are no longer of first importance. In any event, and provided that construction of the line is seriously considered, the plan should be carried out in accordance with the above recommendation.

Santa Fe Avenue and Butte Street

If freight switching, through freight and certain transfer freight, is diverted and rerouted according to the plans herein presented, the tracks on Butte Street will become so busy that it will be desirable to avoid a grade crossing at Butte Street and Santa Fe Avenue. The increase of vehicular

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traffic along Santa Fe Avenue is another reason for the elimination of a grade crossing at this point.

It is recommended that within five years Santa Fe Avenue be depressed five feet and that Butte Street track be raised to cross over the street. We are satisfied that under any plan this grade crossing elimination should be made.

This improvement would cost, it is estimated, $47,652 for the subway and bridge and $50,630 for the elevation and rebuilding of the Butte Street tracks (including a double track line); a total of $98,282.

ESTABLISHMENT OF UNION PASSENGER TERMINAL

The establishment of a union passenger station is largely a question of its desirability and cost. It is not entirely a railroad matter but is also one of public policy and it may be resolved into a question of whether or not public convenience and necessity, present and future, demand the expenditure.

A union passenger station is desirable for the following reasons:—

(1) As a gateway to the city, Los Angeles prefers one adequate, convenient and beautiful entrance to several separate gateways, onen of which can by themselves have all the advantages of a single union depot. This is a matter of civic pride and of city planning for the future. Los Angeles, by reason of its wonderful advantages as a tourist center and as a center of travel, is justified and sound, in our opinion, in making this consideration one of the first importance.

(2) There will be increased convenience to passengers. Since mail, express and baggage is carried on passenger trains, it is more economical to handle this business at one station. $10,000 per annum would be saved in the handling of mail if a terminal post office were established. The express business amounts, in tonnage, to about one-fourth of the less than carload freight business of Los Angeles and much would be saved by elimination of the wagon haul between the various depots. This saving cannot readily be estimated in terms of money and is dependent on the location of the main depot. The more central the location, the greater the saving. Baggage is also transferred between the stations and—while of lesser importance in cost—increased convenience would result.

(3) Grade crossing elimination would be simplified. When it is maintained that there is no necessity for a union station, it must be remembered that the retention of more than one station will necessitate greater expenditure for the elimination of grade crossings, and, pending complete separation, will result in more vehicular movement across tracks at grade.

(4) Present passenger facilities of the Santa Fe and the Salt Lake stations are inadequate. Large capital expenditures must soon be incurred in any event to satisfy present and future needs. This is true to a lesser extent of the Southern Pacific station also. A union depot will fill these needs better, permanently and at a relatively smaller cost than piecemeal construction by individual roads rgardless of the problem as a whole. If the three steam roads now had satisfactory facilities, this argument would be less important. Under existing conditions, it is of prime importance.

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(5) The topographical conditions and location of the railroads in Los Angeles are almost ideal and point definitely towards a union station. These natural conditions are such that a union station can be created with comparatively inexpensive connections between the roads at a relatively small capital expenditure. Long and costly approaches are eliminated and there is no doubt that the first cost will be relatively much smaller than for a similar undertaking in other communities of equal importance in the United States.

(6) Centralization and consolidation would be particularly desirable from the point of view of unified operation of the railroads, whether under private or government ownership and control.

The pricipal arguments against the establishment of a union station are:

(1) Los Angeles is not a through station. Practicaly all trains entering the city terminate there, and it is there that the majority of the passengers reach their destination. Only approximately 15 per cent of the total number of passengers transfer from one station to another.

(2) The first cost of any adequate union passenger terminal will be high and the saving in operating expenses will not alone warrant the resulting increase in fixed charge.

These are the principal arguments for and against a union station. Other and more detailed reasons are given in the report.

Taking all arguments into consideration, we are convinced that a union station is desirable, provided it may be suitably located.

After a very complete study of the various sites and plans presented and suggested, we have come to the conclusion that there are but three locations worthy of serious consideration and detailed analysis:—

First: The Plaza site.

Second: The Santa Fe site.

Third: The Southern Pacific depot site.

The Hawgood and Storrow plans (submitted at hearings before the Commission) are located on sites which are too short for the construction of the necessary trackage and, locating the station as they do, too great a climb is required by the passengers between the station platforms and the concourse. The distance from Alameda Street to the Los Angeles River and between Macy and Aliso Streets is such that the throat of a properly designed yard would come so close to the River that the approaches would necessarily be by means of curved approaches north and south and crossing the River. This is very undesirable, viewed from the standpoint of train operation. This land should not be used for this purpose. The Storrow Plan also contemplates removal of the tracks from Alhambra Avenue and the construction of new tracks on private right of way adjacent thereto, with the elimination of a grade crossing at Mission Road by depressing the tracks. This would result, in order to obtain a satisfactory grade, in such a large expenditure, that we do not think it commensurate with the results to be obtained.

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We recommend that the Commission order the establishment of a union passenger station at the Plaza site, substantially in accordance with the plan we have developed. This site and plan were selected for the following principal reasons, listed in the order of their importance with brief comparisons:

(1) **Size and shape of site.** The Plaza site is much wider and longer than the Southern Pacific Station site and is equal to the Santa Fe site, which is too large.

(2) **Greater architectural and aesthetic possibilities.** Civic pride and the advertising value of this feature is of particular significance in a tourist center. At the Plaza, a suitable park to set off the station is possible with least damage to business, and at least cost, and at the intersection of important streets. The Santa Fe freight station interferes at the Santa Fe site, which has the least possibilities in this respect.

(3) **Ultimate rapid transit.** The Plaza site is on a more probable axis of the ultimate rapid transit system, which would be nearer and more convenient to the station than with either the Southern Pacific or the Santa Fe plans. More interurban passengers would pass the Southern Pacific site than the Santa Fe site.

(4) Because of the separation of passenger tracks from the future main switching leads along the west bank of the river, there would be less **interference with switching** with the Plaza plan than with the Santa Fe plan, which presents bad operating conditions because of too much traffic in one place. The Plaza plan is nearly equal to the Southern Pacific plan in this respect.

(5) **Least train, coach equipment and light engine mileage.** The Plaza site is very superior to the other sites largely due to the location at a more northerly point. The Southern Pacific plan is worst in this respect.

(6) **Union freight station.** The Santa Fe site is partaicularly suitable for a union freight station, which is possible either with the Plaza or the Southern Pacific plans. The Plaza plan is equal to the Southern Pacific plan and both are better than the Santa Fe plan.

(7) **Grade crossing separation.** With the Plaza plan, no elevated railway structures are necessary in uptown district or awkward subway and crossings in a very important thoroughfare, as with the Southern Pacific plan. The Plaza plan is nearly equal to the Santa Fe plan.

(8) **Accessibility by street car lines.** Sixty per cent of the passengers use the street cars. With the Plaza plan more are accommodated without transfer than at the Southern Pacific or the Santa Fe sites. In this respect the Southern Pacific site is more convenient than the Santa Fe site.

(9) **Distribution and collection of mail and express.** The Plaza site is nearly as good as the Southern Pacific site. The Santa Fe site is further and less accessible than either.

(10) **Operation of yard and coach yard.** The Plaza site is better than the Santa Fe site because of the proximity of the coach yard, notwithstanding the fact that a through station is possible at the latter site. The Southern Pacific site is worst as the coach yard is distant, a stub station is necessary and the approach is on a steep grade.

(11) **Property values.** Considering ultimate appreciation and neglecting immediate disturbances, the Plaza plan is far superior and the Southern

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Pacific plan is far better than the Santa Fe plan. The ultimate appreciation with the station at the Plaza site and a union freight station at the Santa Fe site is estimated at over $8,000,000. This is of advantage to the City in the restoration of depreciated property values.

(12) **Convenient to hotel, business and shopping districts.** The Plaza site is slightly less convenient than the Southern Pacific site, which is much superior to the Santa Fe site.

(13) **Accessibility by automobiles.** The Plaza site is superior to the Southern Pacific site from all points except the business district, where the inferiority is slight. Both are better than the Santa Fe site.

(14) **Locomotive service and repair facilities.** This is partly covered in No. 5. Otherwise the Plaza site is first, the Santa Fe second and the Southern Pacific third with respect to use of present facilities and construction of new facilities.

(15) **Freight draying.** The Plaza site is best inasmuch as passenger and freight vehicle traffic is separated. The Santa Fe site is worst since both classes would be in the same district.

(16) **Confinement of transportation facilities to natural channel—the banks of the Los Angeles River.** The departure at the Plaza site is not of great importance because of location and improvements. The Santa Fe site is slightly better than the Plaza site and much better than the Southern Pacific site.

(17) **Release of lands in industrial district.** Arranged in order of benefit, the three plans compare as follows:

Plaza: Release Southern Pacific station and coach yard sites.

Santa Fe: Release Southern Pacific station site; use coach yard for team stracks.

Southern Pacific: Release coach yard site.

(18) **Segregation of freight and passenger routes.** This is best accomplished by the Southern Pacific plan, but the Plaza plan is not much inferior. The Santa Fe puts both passenger traffic and freight switching along the west bank and is in this way far inferior in this respect.

These arguments are more fully discussed and other arguments are given in other parts of this report.

Attention is drawn to the fact that construction of a union passenger station requires more than the expenditure covering the station iself and more than the addition of a coach yard, not only ultimately, but through the different steps of construction. Committed, as we are, to the separation of grades by the depression of the river tracks, the union passenger station plans hinge upon such separation and certain of this track depression and viaduct construction should be undertaken along with the building of a union station. The Plaza plan will close Alameda Street from Aliso Street to North Main Street and use part of the Southern Pacific freight station site. Therefore the re-location of this facility is imperative and of great importance, as approximately 50 per cent of all Los Angeles less-than-carload freight is handled at this station. Gathering the passenger traffic on the west bank of the river and using the Southern Pacific freight yard for a coach yard, forces extension of the new freight yard of the Southern Pacific along the east bank of the river north of Dayton Avenue. Having in mind

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the influence of one factor on another we have, in the following table, presented our estimate of the total new money required for the necessary construction undr the proposed plan:

ESTIMATED NEW MONEY REQUIRED FOR UNION PASSENGER STATION AT PLAZA AND OTHER PROPOSED IMPROVEMENTS (IMMEDIATE AND ULTIMATE PLANS)

Item No.	Item		Immediate	Ultimate*
Steam Roads				
1.	Passenger Terminal, Approaches, etc.		$8,942,992	$10,303,492
2.	Union Coach Yard		516,264	629,710
3.	Subtotal, Station Facilities	(1+2)	($9,459,256)	($10,933,202)
4.	Union L. C. L. Freight Station		772,333	2,575,942
5.	Viaducts over Los Angeles River		774,493	3,658,132
6.	Depression of, and New, Tracks along River		290,357	937,910
7.	Main Line Track and Connections, not depressed		71,042	.....
8.	New Tracks for Southern Pacific, East Bank of Los Angeles River, North of Humboldt St.		.....	305,238
9.	Butte Street Trackage and Santa Fe Ave. Subway		.....	192,891
10.	New Trackage, River to Hobart and Connections		111,570	401,144
11.	New Freight Yards, Southern Pacific and Santa Fe		1,198,127	2,835,187
12.	New Freight Terminal, Salt Lake, Alameda St.		†	†
13.	New Connections, Relief Alameda St. Switching		67,209	4,436
14.	Team Yards		148,271	629,021
15.	Total	(1 to 14)	$12,892,658	$22,473,103
16.	Release Southern Pacific Station Site		1,243,654	1,243,654
17.	Release Southern Pacific Coach Yard Site		1,574,382	1,574,382
18.	Total Credits	(16+17)	$2,818,036	$2,818,036
19.	Net Total—Steam Roads	(15-18)	10,074,622	19,655,067
Electric Roads				
20.	New Line, Pacific Electric Station to Brooklyn Avenue and to 14th Street		5,591,480	5,591,480
21.	New Surface Line to Union Station at Santa Fe		†	†
22.	Freight Tracks		.....	150,086
23.	Total Electric Roads	(20 to 23)	$5,591,480	$5,741,566
24.	Grand Total—Steam and Electric	(19+23)	15,666,102	25,396,633

*"Ultimate" includes "Immediate." †Not included in this plan.

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The largest single item in these totals is land. Of privately owned land, it is necessary to acquire approximately 65 acres, estimated to cost $3,905,122. Of this, 41 acres are to be used for the union station and would cost $2,822,831. The other parcels of land are required for connections, widening of existing right of way, new trackage along the east bank of the river north of Humboldt Street, etc.

These latter figures include two blocks bounded by Commercial, Arcadia-Aliso, San Pedro and North Main Streets, which go to make up the largest part of a proposed new plaza in front of the station and which, it is estimated, would cost $678,186, or 24 per cent of the total cost of the land required for the terminal and immediate approaches, and $195,010 for land for one end of a viaduct to carry Macy Street over the station yard. They do not include $99,641 estimated to be the present market value of City of Los Angeles real estate included in the terminal area, or Southern Pacific property also so located and estimated to have a present market value of $272,679.

These figures indicate the magnitude of the land question.

In this matter of the acquisition of land and other property, and of damages, account should be taken of the litigation that is almost certain to result in connection with certain pracels. The Commission, under Section 43 of the Public Utilities Act, has power to condemn all necessary real estate and other property and to fix the just compensation for such property and for damages. We quote what to us appear the determining portions of this section:

> " (c) 1. The commission shall have power in accordance with the procedure provided in this subsection to fix the just compensation to be paid for property or any interest in or to property to be taken or damaged in the separation of grades at any crossing specified in subsection (b) hereof, or for property or any interest in or to property to be taken or damaged in the construction, alteration or relocation, under the order or with the approval of the commission, of elevated tracks or subways for any railroad or street railroad over or under any public road, street, highway or private right of way, or of any public road, street or highway over or under the tracks of any railroad corporation or street railroad corporation; and upon the payment of the just compensation so fixed to make a final oder of condemnation as hereinafter provided.
>
> 2. Proceedings under subsection (c) hereof may be commenced by order on the commission's own motion or by a petition filed by the state, county, city and county, incorporated city or town, other political subdivision, railroad corporation, or street railroad corporation affected.
>
> . . . . . .
>
> 6. The finding of the commission on the question of the necessity for the taking and the finding, fixing the just compensation to be paid for any property or interest in or to property under the provisions of this subsection shall be final and shall not be subject to modification, alteration, reversal or review by any court of this state.
>
> . . . . . .
>
> 8. The legislature hereby declares that subsection (c) hereof is enacted as a germane and cognate part of and as an aid to the jurisdiction of the railroad commission in the supervision and regulation of railroad and street railroad corporations."

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In our estimates of land costs we have assumed that such parcels as cannot be acquired in any other way would be secured through just compensation proceedings. The methods of valuation used in such cases by the engineering department are made the basis of such cost estimates.

While we have reached the conclusion that a union passenger depot at the Plaza is superior to any other possible plan, we have also made estimates for union stations at the Santa Fe and Southern Pacific sites. Both of these plans have the advantage of lower first cost over the Plaza plan. A full discussion of these two plans will be found in the body of the report in Chapters XII and XIII.

Continuation of Consolidated Uptown Ticket Office

The establishment of a consolidated uptown ticket office by the United States Railroad Administration in 1918 has evidently proved entirely satisfactory. **We recommend, therefore, that this facility be continued, irrespective of whether or not the railroads return to private control.**

Application of Southern Pacific Co. and Salt Lake For Approval of Agreement Covering Joint Terminal Facilities—Application No. 3346

In this application, filed November 22, 1917, and consolidated with the seven other formal cases, applicants ask approval of agreement dated July 18, 1917. This agreement covers construction and operation in connection with the joint use, by these two roads, of the Southern Pacific passenger station. Approval of this agreement would give these roads permission to go ahead with their plans to the exclusion of other plans herein recommended.

In recommending a union passenger station at the Plaza we are, in effect, rejecting the Southern Pacific-Salt Lake plan, but final disposition should be made of this application by the Commission.

We recommend, therefore, that Application No. 3346 be dismissed.

Union Passenger Station and Electric Interurban Service, Pacific Electric Railway

As noted before, this report will not deal with the general problem of the elimination of grade crossings in Los Angeles on the lines of the Pacific Electric Railway. We have, however, considered this electric road in the light of its relation to a union passenger station and have given attention to the elimination of grade crossings on Main, San Pedro, Aliso and Seventh Streets, which are the most congested with interurban cars.

If the Commission decides to adopt our recommendations for a union passenger station at the Plaza, **we recommend also the construction of a subway from the present Pacific Electric station at Sixth and Main Streets northerly along Main Street to, and under, the union passenger station, changing to an elevated railway along Ramirez Street and meeting the present line at the Aliso Street Bridge. From here this line would continue as an elevated railway to Brooklyn Avenue, where the present tracks and grade would be met. We also recommend that the Pacific Electric continue the**

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present elevated structure in the rear of its station, elevating the Long Beach line to Fourteenth Street. The subway work along Main Street should be undertaken within the next five years.

This recommendation is made with full knowledge that the proposed improvements cannot, for a number of years to come, earn a return on the estimated cost of this work. It is clear, however, from the testimony given by the Pacific Electric Company in these cases, that the Pacific Electric realizes the necessity and advantages of making radical and permanent changes in its downtown lines in the near future and at a large first cost. We are in agreement with Mr. Paul Shoup that present conditions will not be tolerable much longer. We are also satisfied that if capital expenditures for such purposes are made in excess of, say, $1,000,000, then the money should be expended in accordance with the recommendation above.

This subway and elevated will eliminate the most important grade crossing of the Pacific Electric in Los Angeles, relieve the present congestion on the streets mentioned, reduce the running time and provide not only a good connection between the steam and electric roads, but also a start on the ultimate rapid system.

Main Street, being centrally located between the hilly section west of Hill Street and the business section between Alameda Street and Main Street, is the most logical location for the main north and south line of the future subway system. The street is also wide and straight and is, we are informed, the most free from sub-surface obstructions of any of the principal north and south streets. These facts lead toward the most economical construction. It is proposed that the immediate permanent construction would commence at Seventh Street and run north to the union passenger station and to Brooklyn Avenue. A single-track subway loop could be constructed in Seventh and Los Angeles Streets and under the Pacific Electric Station, using the latter for a station. Another station should be located midway between the Plaza and Sixth Street.

The construction of a subway in Main Street or an elevated construction in Ramirez or Aliso Streets is apparently impossible under the present charter, Article I, Section 43, which reads in part as follows:

> ". . . No franchise for an elevated structure or subway shall be granted in or along any street or way in a longitudinal direction, either above or below the surface thereof. . . ."

The charter would, therefore, have to be amended.

The elevated construction in the rear of the Pacific Electric station would also be permanent. It is probable that Sixth Street will be the route of the principal east and west subway, and it is entirely feasible to make the change from this elevated construction to a subway between San Pedro and Wall Streets. San Julian Street only would have to be closed, and since this is not a through street, the objections to closing it should be outweighed by the benefits. One of the principal advantages is the fact that an elevated railway is cheaper, by far, than a subway, and if the change

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between the two can be made and, at the same time, can combine immediate construction with the ultimate plan, a large saving can be effected.

The plan proposed by the Pacific Electric provides for elevated construction from the rear of the Pacific Electric station across the Los Angeles River and north along the Salt Lake right of way to Aliso Street, where the present line will be met. Also, it is proposed that elevated construction shall be installed south from the above line on the Long Beach line as far as Fourteenth Street. This locates two main routes of the interurban roads comparatively near the union passenger station, providing for transfer (which is, however, not very convenient) between the two steam and electric roads. The estimated cost is $2,574,013 against $1,200,000 as estimated by the Pacific Electric Railway on earlier and lesser unit costs and on a somewhat shorter distance. This is the best and most logical solution if joint use is made of the Southern Pacific Station site.

Under the third possible plan, using the Santa Fe site, we recommend the elevated construction, as under the Southern Pacific plan, except that instead of using the Salt Lake right of way between Sixth and Aliso Streets, the new line would be built on the west side of the river on the Santa Fe right of way, passing the proposed union station and reached by a subway from it. The estimated cost is $2,557,223. Under this plan, the Pacific Electric would not have access to the station by surface tracks. This is undesirable, not only because this road would undoubtedly wish a direct line and because the public would be best served thereby, but also because the handling of mail and express demands a surface connection. We would, therefore, recommend an extension of the present Pacific Electric line from Sixth Street and Ceres Avenue to the station.

IMPROVEMENT IN THE HANDLING OF FREIGHT

There can be no doubt that the matter of proper freight facilities is of even greater importance to the City of Los Angeles than the matter of steam railroad passenger facilities. It is our conclusion, however, that freight traffic conditions are not by any means unsatisfactory and no far-reaching recommendations will be necessary to bring about such further improvements as appear to us desirable.

Industry Tracks and Switching

Present conditions relative to the handling of carload freight within the City of Los Angeles have generally been found satisfactory. Mr. F. P. Gregson, the representative of the Associated Jobbers of Los Angeles, representing, as he stated, approximately 75 per cent of the shippers, is on record to the effect that conditions in Los Angeles, with respect to carload freight destined to industrial spurs, are almost ideal. With the thought, therefore, that such an almost unique situation should not be disturbed, we see no reasons for making radical recommendations with regard to this class of freight movement. The underlying reason is that in Los Angeles a car entering the city via one road is set on an industry track belonging to

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another road without any charge, and vice versa, so that there is already practically consolidation of all industry tracks within the city.

There are about 820 industries located on about 382 industrial spur tracks within the free switching limits, which extend outside the city boundary. The total length of these tracks is 60 miles, with a car capacitay of over 4,000 freight cars. We are particularly concerned with the more conjested industrial district between Alhambra Avenue and Butte Street because of street and railroad traffic conditions and the large percentage of the shipping. Four hundred and fifty-five industries are located in this district, and to these in 1917 there were set 48,000 loaded freight cars, or 70 per cent of the total number set on industrial tracks. In addition, 20,600 empty cars were set for loading, making a total of 69,200 cars per year, or an average of 230 cars per working day.

From these figures it must be evident that the large investment in buildings, tracks and commercial business connected with spur tracks, and the present large amount of spur trackage, make it inexpedient to make any radical change in the present location of these industrial tracks. At present these spurs branch off from two main stems, the Southern Pacific tracks in Alameda Street and the Santa Fe tracks along the river. Those off the Santa Fe tracks run in a general easterly and westerly direction between the important east and west streets and in this way may be considered as built in conformity with the so-called herring-bone system.

There are 42 spurs branching off from the Southern Pacific main line tracks in Alameda Street between Alhambra Avenue and Butte Street. These tracks have a total length of 24 miles, a car spot capacity of 922 cars, and serve 278 industries, exclusive of 36 industries on the Santa Monica Air line. There were set to these industries in 1917 about 34,000 cars, and to team tracks 14,000 cars.

A few of these industries may be served without the use of the Alameda Street tracks, but the importance of the commercial business and railroad investment is so great that **we do not believe it would be proper or wise to recommend the removal of the tracks from Alameda Street at this time.**

All but 3 per cent of the present traffic in Alameda Street can be removed. In addition, we recommend that the duplication of switching service to industrial spurs be discontinued. This will reduce the number of train movements and the number of grade crossing movements, and benefit both the public and the railroads. We also recommend that the Santa Fe Alley spur be removed north of Butte Street. This track was built in 1907, apparently for competitive reasons, and these reasons no longer exist. It is a spur over a mile long and is located in an alley 15 feet wide. This is insufficient width for safe operation, and as time goes on and business develops, it will undoubtedly be found too long to switch economically. We believe, therefore, that it should be discontinued now, when the resulting disturbance will be relatively small.

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For the future we recommend that:

(1) New permits should not be granted for industrial tracks longitudinally in streets.

(2) All tracks now longitudinally in streets be confined to use for industrial purposes only and be removed as soon as access to the industries served is otherwise obtained.

(3) All spur tracks shall be built in a general easterly and westerly direction from the river banks and not across east and west streets, unless, by such construction, the crossing of more important north and south streets is avoided.

Union Freight Station

We have recommended a union passenger station at the Plaza. Recognizing the resulting isolation of the present Southern Pacific freight station by cutting off Alameda Street north of Aliso Street, and further bearing in mind the fundamental principle that freight conditions should be equaled or bettered and certainly not made worse, we propose to take care of the Southern Pacific and in addition to make a general improvement in the less-than-carload freight situation.

We recommend the establishment of a union less-than-carload freight station at the Santa Fe freight yard site on Santa Fe Avenue, from First to Seventh Streets, the present Santa Fe freight station on the west side of Santa Fe Avenue to become a part of this union freight station.

This would locate the station on a very suitable site in a very convenient location. The site is of sufficient area for development to over 125 per cent of present facilities, is of good shape and is centrally located. A union station once established, there would result a desirable stabilization of business and increase of property values. Draying should be cheaper and more satisfactory, and this is a large item.

This recommendation will also hold good if the Southern Pacific station site is chosen for a union passenger station. This proposed freight station is estimated to cost, ultimately, $2,576,000 in new money for buildings, trackage and driveways, including removal of the present yard and facilities. Not all of this is necessary at present. Sufficient shed space (119,480 sq. ft.) for the Southern Pacific could be constructed (based on Class "A" construction) for approximately $680,000, including trackage, and the present Santa Fe sheds are ample to take care of the Salt Lake less-than-carload freight business.

This recommendation is in opposition to the arguments before the Commission for several sub-freight stations. Sub-freight stations in the industrial district are, in our opinion, unnecessary and are a detriment in a city like Los Angeles where the district in which the less-than-carload freight is important is confined to a comparatively small area. They cost more to operate and are too much of a source of delay. Shipments are delayed by not reaching a central station in time to catch the train, and by the draymen having too many places to go to, which means light loads and delay.

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If branch receiving stations for freight appear desirable in the future, from changed conditions, the haul of L. C. L. freight between these branch stations and the central station, may possibly be made in railroad owned motor trucks, rather than in cars. Up to a certain volume of traffic and excepting certain classes of freight this is entirely feasible and cheaper.

If a union freight station at the Santa Fe site cannot be had and it appears that this contingency would arise only if the cost of a union passenger station was considered too great for the advantages accruing—we must be guided by the same principles of least expenditures. Under these conditions we should recommend the retention of the present Southern Pacific and Santa Fe freight stations, and in justice to the Salt Lake, we should recommend that it be allowed to proceed with its present plans for a freight terminal on its newly acquired site on the east side of Alameda Street between Eighth and Hunter Streets.

Additional Team Tracks

Convenient team tracks tend to restrict the construction of industrial spurs and grade crossings. Small shippers especially, if able to handle their shipments from a convenient team track, will not go to the expense of providing themselves with spur track facilities. We believe this to be true in spite of the fact that the advantage of an industrial track is that it obviates draying and two handlings of the freight.

The more expensive use of team yards, if it results in less demand for private spurs, is a distinct advantage from the standpoint of the grade crossing problem since it cuts down the number of crossings. It should, therefore, be encouraged.

Traffic studies show that in 1917 the movement of loaded cars to and from team tracks was as follows:

Road	Cars Set	Cars Loaded	Total Cars
Southern Pacific	8,732	5,426	14,158
Santa Fe	5,154	683	5,837
Salt Lake	3,651	240	3,891
Pacific Electric	137	1,888	2,025
Total	17,674	8,237	25,911

With this in mind, **we are recommending the establishment of team yards along the east side of Alameda Street.** They will be located differently, depending upon the location of the union passenger and freight stations on account of the different use proposed for different parcels of land. Team yards should be located as follows:

With Plaza Plan	With S. P. Plan	With Santa Fe Plan
At College and Alameda	At College and Alameda	At College and Alameda
At Macy and Alameda	At Macy and Alameda	At Macy and Alameda
Los Angeles Market	Los Angeles Market	Los Angeles Market
.....	.....	S. P. Coach Yard
Proposed Salt Lake Terminal	Proposed Salt Lake Terminal	.....

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With the union passenger station at the Plaza, as before noted, the Southern Pacific freight station at College and Alameda would be abandoned and consolidated with the other two roads in a union freight station at the Santa Fe site. The land at College and Alameda now occupied by the freight station team tracks should be devoted to team track use. This also holds under the Southern Pacific plan. In the Santa Fe plan the freight station would remain and the present team yard would also remain but would not be enlarged.

Under the Southern Pacific and Santa Fe plans, the present Southern Pacific team yard at Macy Street would be unchanged. Under the Plaza plan, the team yard would be shortened somewhat, but with the addition of more team tracks at College and Alameda Streets we believe that what remains will be sufficient.

The recommendation for a team yard at the Los Angeles Market property at Sixth and Alameda Streets should be qualified. We are of the opinion that this site is valuable for railroad purposes and should either be used for a team yard or should be developed by the construction of warehouses, which would be provided with spur tracks. It may be noted that this property is owned by the Los Angeles Market Company, which is, in turn, controlled by the Pacific Electric Land Company, the Pacific Electric Railway Company and, finally by the Southern Pacific Company.

ASSOCIATED MATTERS HELD IN ABEYANCE

Industrial Terminal Railway—Application 2962

In this application the Industrial Terminal Railway Company asks permission to issue stock for the purposes of acquisition of rights of way for a switching and terminal railroad approximately 2 miles in length, commencing on Alameda Street north of Aliso Street and running in an easterly and northwesterly direction across Ramirez Street, Macy Street, Lyon Street and crossing the tracks of the Santa Fe, across the Los Angeles River and across the tracks of the Salt Lake, terminating on the south side of Alhambra Avenue east of the Los Angeles River.

In Decision No. 4553, the Commission held that this application should neither be granted nor denied until the Commission's investigation into the larger cases had progressed sufficiently to determine whether or not it would be possible to allow applicant to proceed with its plan, and it was ordered that a supplemental order be issued at such time as the Commission was in possession of the necessary information to enable it to determine whether or not, under the circumstances set forth in the accompanying opinion, it was proper for this capital stock to be authorized.

We now believe that it would be unwise for the Commission to allow the construction of the railroad along the route proposed because of the grade crossings involved, and **we recommend that a supplemental order be entered in which this application be dismissed.** When the Commission has made its order in Cases 970 et seq., applicant can then file another application based upon the Commission's decision in the larger problem.

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Los Angeles and Salt Lake Railroad Company—Application 3037

In this application the Los Angeles and Salt Lake Railroad Company asks the Commission's authority to cross at grade 9 public streets, 4 railway tracks and 1 double track street railway, as follows:

(a) **Street Crossings at Grade:**

1. Sixteenth Street, to be crossed with 2 tracks.
2. Fourteenth Street, to be crossed with 2 tracks.
3. Eleventh Street, to be crossed with 2 tracks.
4. Tenth Street, to be crossed with 2 tracks.
5. Ninth Street, to be crossed with 2 tracks.
6. Alley between Hunter and Ninth Streets, to be crossed with 2 tracks.
7. Hunter Street, to be crossed with 2 tracks.
8. Lawrence Street, to be crossed with 2 tracks.

(b) **Steam Railroad Crossings:**

1. One track at grade across a one-track spur of the Santa Fe, south of Sixteenth Street.
2. Two tracks at grade across one spur track of the Southern Pacific Company, north of Sixteenth Street.
3. Two tracks at grade across two spur tracks of the Santa Fe, south of Fourteenth Street.
4. Seven tracks at grade, with two additional tracks proposed across spur tracks of the Santa Fe on Lawrence Street.

(c) **Street Railroad Crossings:**

1. Two tracks at grade across the double track line of the Los Angeles Railway on Eleventh Street. (**Note:** The Los Angeles Railway tracks have since been removed.)

As further set forth in the application, the Salt Lake contemplates the construction of a freight terminal in a newly acquired site bounded, roughly, by Alameda Street on the west, Hunter Street on the south, Lemon Street on the east and the Alley south of Hunter Street on the north, and the necessary grade crossings will occur principally on the connection between this proposed terminal and the existing Butte Street track of the Salt Lake between Santa Fe Avenue and Butte Street.

In Decision No. 4552, the Commission held that a decision should be postponed until the investigation into the general transportation situation in Los Angeles (Cases 970 et seq.) had progressed sufficiently to enable a determination to be reached as to whether or not the application should be granted and it was ordered that a supplemental order be issued at such time as the Commission was in possession of the necessary information.

We have already recommended a union freight station at the Santa Fe site. This would accommodate the Salt Lake and would avoid the construction of a freight terminal on the site above mentioned. Under these circumstances, the necessity for the construction of the connecting tracks having been eliminated, **we recommend that a supplemental order be issued in which the authority** to cross at grade **the streets mentioned be denied.**

As we also recommend that team tracks be established on this Salt Lake terminal site, provision must be made for reaching them. This we propose

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to do either by connection with the Alameda Street tracks of the Southern Pacific or by the Lawrence Street spur track of the Santa Fe. This will not introduce any additional grade crossings and, at the same time, will not prevent the use of the site.

Interlocking at Aliso Street and Los Angeles River—Case 938

Following a serious collision, on May 7, 1915, at the crossing of the Pacific Electric Railway and the Atchison, Topeka and Santa Fe Railway tracks at Aliso Street, Los Angeles, these two roads applied, on January 10, 1916, to the Commission for permission to install an interlocking device. From the plans submitted with this application (No. 2043) it developed that certain of the Commission's requirements regarding interlocking plants were not met, and that the scheme of protection would be incomplete unless the Los Angeles and Salt Lake road was included. Shortly thereafter the Commission instituted Case 938 upon its own motion and a hearing was held in both matters.

In Decision No. 3290, dated April 27, 1916, the Commission made its order directing the installation of a standard interlocking plant, the three parties at interest having, prior to the hearing, agreed between themselves to do this. According to the order, plans were to be submitted within three months and the plant placed in operation within nine months. On July 28, 1916, the Commission issued an "order extending effective date" in Case 938, in which the time within which the plans were to be submitted were extended until further order.

Thus the matter has been held in abeyance. Since we recommend a separation of grades for the crossings of the Pacific Electric and the main line of the Salt Lake and the river tracks of the Santa Fe, and the removal of the crossing of the present main line Santa Fe tracks, **the matter of installing an interlocking plant is, if the recommendation be adopted, automatically removed from further consideration. We recommend an order in Case 938 to this effect.**

Pairing of Southern Pacific and Salt Lake Tracks Between Los Angeles and Colton

In our two reports dealing with temporary unification of terminal facilities at Los Angeles, we recommended that the Southern Pacific and Salt Lake tracks should be paired between Los Angeles and Colton. This recommendation was also made by the engineers representing the federally controlled railroads at Los Angeles and urged for adoption upon the Director General of Railroads by the Commission. This means that trains would be run in one direction only over each of the two roads, making, in effect, a double track road of these two single track roads. Due to grades, operation was not to consist of routing trains in one direction only over each track between the termini, but to change between the two roads at Ontario. The scheme of operation is then as follows:

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Limits	Operate for Westbound Trains	Eastbound Trains
Between Colton & Ontario	Salt Lake track	Southern Pacific track
" Los Angeles & Ontario	Southern Pacific track	Salt Lake track

The estimated cost of the necessary changes, consisting of new connections and additional ballasting on the Salt Lake tracks, was estimated at $136,812. The annual saving in the cost of operation was estimated at $173,028 due principally to the larger tonnage ratings of freight locomotives because of more favorable ruling gradients. While this matter is not so intimately connected with grade crossing elimination and terminal unification at Los Angeles, it comes properly within the scope of this report. The financial results are large—for an expenditure of $136,812, a saving of $173,028 each year is possible.

We again recommend that the Southern Pacific and Salt Lake tracks between Los Angeles and Colton be paired for double track operation, as given above.

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PART I—HISTORICAL MATTERS AND PRESENT CONDITIONS

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CHAPTER I.

OUTLINE

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- Application for Joint Terminal Facilities by Southern Pacific Company and Los Angeles and Salt Lake Railroad Company (Application 3346)

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Attitude of United States Railroad Administration

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CHAPTER I

HISTORY OF PROCEEDINGS BEFORE COMMISSION (CASES 970 ET SEQ.) AND OF ENGINEERING DEPARTMENT INVESTIGATION

INTRODUCTION

For many years the question of grade grossing elimination has been more or less acute in the City of Los Angeles. The matter has been before the City Council and before the people in general in numerous cases such as when the railroads were seeking to build new tracks, when streets crossing railway tracks were opened or closed, or when street grades were established and the handling of passenger and freight traffic along or across streets had to be considered. At various times, also, the City had reports made by its own engineers as well as by engineers engaged for the purpose. In later years, certain associations and individuals began advocating union passenger and freight depots within the city.

With the jurisdiction over common carriers by the Railroad Commission, as defined in the Public Utilities Act, it became apparent that a comprehensive and permanent solution could not be had without action by the Commission.

On July 3, 1916, on the invitation of the City Council of Los Angeles, all the members of the Railroad Commission went to Los Angeles for an informal conference with the City Council with reference to the railroad grade crossing situation and the freight and passenger terminal conditions in Los Angeles. At the conclusion of the conference, the City Council unanimously voted to contribute $20,000 toward the expense of a complete and thorough investigation to be made by the Railroad Commission.

FORMAL COMPLAINTS

On the same day, complaints were filed by the Municipal League, the Central Development Association and the Civic Center Association. Shortly thereafter, complaints were filed by the cities of Pasadena, Alhambra, San Gabriel and South Pasadena.

The complaint of the Municipal League asks the Commission to eliminate railroad grade crossings, to prevent a further use of streets longitudinally by the railroads, and to compel the erection of a union passenger depot and appropriate freight terminals. The complaints of the Central Development Association and the Civic Center Association present the same issues as the complaint of the Municipal League, except that no relief is asked with reference to a union passenger depot or a freight terminal. The complaints of the cities of Pasadena, South Pasadena, Alhambra and San Gabriel ask relief with reference to the railroad grade crossing situation in Los Angeles and also the elimination of the grade crossing of Mission Road by the Pacific Electric Railway Company. These cities also ask that the Commission's order in Case 938, ordering the installation of an interlocking plant at Aliso Street and the Los Angeles River, be rescinded.

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The following table presents briefly the dates of filing, the complainants and the defendants of the seven formal complaints:

Case Number	Date Filed	Complainants	Defendants
970	7-6-16	Municipal League	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co.
971	7-6-17	Central Development Association	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co.
*971	7-24-17	Central Development Association	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co.
972	7-6-16	Civic Center Association	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co.
974	7-15-16	City of Pasadena	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co. 4. Pacific Electric Railway Co. 5. City of Los Angeles.
980	7-26-16	City of Alhambra	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co. 4. Pacific Electric Railway Co. 5. City of Los Angeles.
981	7-27-16	City of San Gabriel	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co. 4. Pacific Electric Railway Co. 5. City of Los Angeles.

*Amendment to Complaint.

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983	7-28-16	City of South Pasadena	1. Southern Pacific Company. 2. Atchison, Topeka and Santa Fe Railway Co. 3. Los Angeles and Salt Lake Railroad Co. 4. Pacific Electric Railway Co. 5. City of Los Angeles.

Following the filing of the above complaint by the City of Pasadena, several smaller cities, i. e., San Dimas, Pomona, Ontario, El Monte and Sierra Madre, filed with the Commission, by letter, their concurrence with all claims contained therein. At some of the hearings petitions circulated by various Los Angeles organizations were submitted to the Commission, as also were numerous letters from individuals. These were all accepted by the Commission with the understanding that they would be filed without being read into the record and that they would be held subject to inspection by any of the interested parties.

Other interested organizations and cities entered representatives as appearances at the hearings. They were:

1. **Cities:** Alhambra, San Gabriel, Santa Monica, Venice and Whittier.
2. **Organizations:** Associated Jobbers of Los Angeles, Business Men's Co-operative Association, Business Stability Association, Los Angeles Chamber of Commerce, Los Angeles City and County Viaduct Committee, Los Angeles Realty Board and the Northwest Association.

Jurisdiction of Commission

The defendants in these proceedings filed answers denying the Railroad Commission's jurisdiction. A public hearing on the question of jurisdiction was thereupon held in Los Angeles on September 15, 1916, and all of the cases were consolidated. At this hearing, all of the parties except the City of Los Angeles urged that the Railroad Commission had exclusive jurisdiction over the issues presented. The City of Los Angeles took the position that jurisdiction over all railroad grade crossings in Los Angeles was in the City and not in the Railroad Commission.

On October 21, 1916, the Railroad Commission rendered its order (Decision No. 3805), dismissing all proceedings. In the opinion preceding the order, the Commission gave its reason for this action. This was, in brief, as follows: While the Commission was of the opinion that it had jurisdiction, the investigation prayed for required the expenditure of so much public money and was of such great importance to the communities and the carriers involved, that, in agreement with all parties, no action should be taken until it was definitely established where jurisdiction rested in the premises.

The question of jurisdiction was then taken to the Supreme Court of the State of California by two writs of mandamus. In the first, the applicants were the same as in Cases 970, 971 and 972, and in the second, the same as in Cases 974, 980, 981 and 983. Taking up the first proceeding (L. A. No. 5028),

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the applicants asked, in brief, that the Court order the Commission to proceed with the investigation. The City of Los Angeles conceded that the Railroad Commission had exclusive jurisdiction insofar as a union passenger depot and freight terminals were concerned, but argued to the Supreme Court that, as to grade crossings and all other uses of streets by railroads in Los Angeles, the City had exclusive jurisdiction.

California Supreme Court Decision Ordering Investigation

On June 11, 1917, the Supreme Court made its decision in the first proceedings, upholding the position of the complainants and the Railroad Commission, and decided that the Railroad Commission had exclusive jurisdiction over the construction and operation of railroads on streets in Los Angeles.

We quote from the Supreme Court's decision:

> "The effect upon the present case may be stated as follows:
>
> "The City of Los Angeles has the power to open, widen, extend and improve streets and to regulate the ordinary uses thereof. The Railroad Commission, under Section 43 of the Public Utilities Act, has the power to make orders, which are binding upon the railroad companies under its supervision, to abolish grade crossings of the public streets of a city and to order a separation of grades so that the railroad and street shall not be upon the same level and generally to exercise the powers specified in that section. It cannot vacate the street or direct a cessation of the public use thereof. Its orders are to be directed to the railroad company and not to the city, except so far as may be necessary to apportion the expense of construction and maintenance of the particular mode of crossing which shall be required. The city has the power to alter the construction of its streets at such crossings, or any of them, by elevating them upon a viaduct so as to pass over the railroad or by making a subway passing under the railroad. In either case, if the change in the street does not interfere with the operation and use of the railroad at time, the Commission cannot prevent the change and it may be made without the consent of the Commission. But if it does interfere, either at the time or afterward, whether by natural causes or lack of repair of the street as changed, or by reason of changes in the construction or use of the railroad subsequently directed or approved by the Commission, the city must conform to the orders of the Commission so as to avoid such interference.
>
> "It is ordered that the Railroad Commission proceed to consider and determine, upon the merits, the complaints made to it by the plaintiffs herein, and that a writ of mandate be issued to it in accordance herewith."

On the same day, June 11, 1917, the Court made substantially the same decision in the second proceeding (L. A. No. 5029).

The City of Los Angeles thereupon filed a petition for rehearing. On July 10, 1917, the Supreme Court made its order dismissing the petition and the matter of jurisdiction was considered as settled.

Closely associated with these cases were three applications which were filed with the Commission previous to the decision by the Supreme Court. These were applications by the Industrial Terminal Railway Company, by the Los Angeles and Salt Lake Railroad Company and by the Southern Pacific Company and Los Angeles and Salt Lake Railroad Company jointly.

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ASSOCIATED FORMAL APPLICATIONS

Application of Industrial Terminal Railway Company. (Application No. 2962.)

The Industrial Terminal Railway Company has made two applications (Nos. 1803 and 2962), both for the issuance of capital stock. The details are given in Decisions Nos. 2832 and 4553, rendered on October 22, 1915, and August 18, 1917, respectively. Only Application No. 2962 and Decision No. 4553 are concerned with these proceedings.

In this application, applicant asks permission to issue stock to acquire, in effect, a right of way for an industrial railroad in Los Angeles and (quoting from Decision No. 4553):

> ". . . proposes to construct in the city of Los Angeles a switching and terminal railroad approximately two miles in length. If the plans of the company are carried out, the line will start at Alameda Street at a point about 200 feet north of Aliso Street, run in an easterly and northeasterly direction across Ramirez Street, Macy Street and Lyon Street, and across the tracks of the Atchison, Topeka and Santa Fe Railway Company; then across the Los Angeles River and across the tracks of the Los Angeles and Salt Lake Railroad, ending on the south side of Alhambra Avenue east of the Los Angeles River. The maps filed with the earlier application (Application No. 1803) do not show the proposed location of tracks and other facilities, but they do show the right of way as the company is securing it.
>
> "In addition to the right of way needed for the main line, these maps show right of way for a short spur, 40 feet wide, at right angles to the main line about 250 feet east of Macy Street."

In its opinion preceding the order, in the same decision, the Commission states:

> ". . . that this application should not be granted nor should it be denied until the Commission's investigation in the larger cases has progressed sufficiently to determine whether or not it will be possible to let applicant proceed with his plan. . . ."

It was ordered by the Commission that:

> ". . . a supplemental order will be issued at such time as the Commission may be in possession of the necessary information to enable it to determine whether or not, under the circumstances set forth in the foregoing opinion, it is proper for this capital stock to be authorized."

Application of Los Angeles and Salt Lake Railroad Company. (Application No. 3037.)

This condition also prevails with reference to Application No. 3037 of the Los Angeles and Salt Lake Railroad Company, which applied on July 16, 1917, for permission to construct, in Los Angeles, certain crossings in connection with a proposed new freight terminal at Eighth and Alameda Streets, which would give the Salt Lake Company a freight terminal on the west side of the river and would improve conditions of that carrier in regard to its freight business.

In Decision No. 4552, dated August 18, 1917, the Commission says:

> "We recommend that at this time the Commission neither deny nor grant this application but that a decision be postponed until the investigation into the general transportation situation in Los Angeles has progressed

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sufficiently to enable the Commission to determine whether or not the application should be granted."

It was ordered that:

". . . a supplemental order will be issued at such time as the Commission may be in possession of the necessary information to determine whether or not this application should be granted, and the location, construction, installation and protection of the crossings involved in this application."

Application for Joint Terminal Facilities by Southern Pacific and Salt Lake Railroad Company. (Application No. 3346.)

At the hearing held before the Commission on November 22, 1917, the Southern Pacific Company and the Los Angeles and Salt Lake Railroad Company filed an application asking approval of an agreement dated July 18, 1917. This agreement covered the joint use of the existing Southern Pacific Station at Fifth Street and Central Avenue by these two roads and entered fully into the cost and maintenance of existing and additional facilities.

The plan proposed was the same as that submitted to the Commission at the previous hearings. The most important features, in addition to the joint use of the Southern Pacific passenger station, were the joint construction and use of elevated tracks south of Sixth Street between Alameda Street and the east bank of the Los Angeles River, with additional tracks along the river. The Company claimed that the joint use of track would obviate the necessity for operation of passenger and freight traffic over Alameda and certain other streets and would also eliminate many grade crossing movements. The agreement further provided for the possible joint use of certain station facilities by the Pacific Electric Railway and for the construction and use by that company of a double track elevated structure alongside the steam railroad structure.

The application was consolidated with the seven other formal cases for determination and decision.

HEARINGS BEFORE THE COMMISSION

Immediately after the order by the Supreme Court dismissing the petition for rehearing, the Railroad Commission set Cases 970 et seq. for hearing in Los Angeles, and made arrangements for the necessary engineering investigation.

The hearings in these cases were held on the following dates:

September 15, 1916,	November 20, 1917,
July 24, 1917,	November 21, 1917,
July 26, 1917,	November 22, 1917,
August 22, 1917,	December 11, 1917,
August 23, 1917,	December 12, 1917.

At the hearings held on July 24, 1917, the Railroad Commission made the following announcement regarding the conduct of these proceedings:

"As is usual in formal complaints, the complainants will be permitted to introduce their evidence and then the defendants will present their testimony.

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"The Railroad Commission proposes to conduct a thorough, comprehensive and impartial investigation into the entire situation. The Commission will instruct its engineering department to make an exhaustive investigation and to prepare a report which will thereafter be introduced as evidence in these proceedings. Until this report has been prepared and introduced, and all the parties have had a fair opportunity to present their evidence and to cross-examine witnesses, no conclusion will be reached."

"One of the matters which will be determined as soon as possible is the time of payment by the City of Los Angeles of the sum of $20,000.00, which was voted by the City Council to help defray the expense of the investigation which is to be made by the Commission's engineering department. The sooner can the Commission employ the necessary engineers and other assistants.

"I assume that it will be entirely unnecessary to say that the Railroad Commission approaches this case, as every other case, with an absolutely open mind and with an earnest desire to ascertain all the facts, so that a just and constructive solution of the problem may be reached. It is our intention to view this problem in the largest possible aspect and to reach a conclusion which will serve the needs not merely of today, but also of the future. The people of the City of Los Angeles and the surrounding communities and railroads are entitled to an exhaustive and thorough consideration of the problems here presented and such consideration they will receive from the Railroad Commission.

"In this work, which will mean so much to the people of this community and the surrounding communities, as well as the railroads, the Railroad Commission, of course, expects the fullest consideration and cooperation from all parties—the complainants, the railroad companies and the public authorities."

The Commission also ruled that all of the formal complaints, seven in number (Cases 970, 971, 972, 974, 980, 981 and 983), be consolidated for hearing and decision.

At the same hearing, one of the principal complainants, the Central Development Association, filed an amendment to its original complaint to include the requirement of freight and passenger union terminals, in addition to reclaiming Alameda Street, reorganizing the trackage and eliminating grade crossings.

At all of the hearings, beginning July 24, 1917, and subsequent thereto, the complainants and defendants submitted data and evidence in general supporting or refuting the several proposed schemes for a union passenger and freight terminal and the elimination of grade crossings within the City of Los Angeles.

The testimony thus far covers 1477 pages and is supplemented by 53 exhibits filed and assigned numbers as follows:

Business Stability Association	No.	1		
Central Development Association	"	1	to 20	inclusive
City of Los Angeles	"	1	" 3	"
City Planning Association	"	1	" 3	"
Southern Pacific Company and Salt Lake Company	"	1	" 25	"

Since the hearings, the Business Stability Association has filed with the Commission a new drawing of its exhibit. This includes a larger area than

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the original map. The Central Development Association also filed a drawing supplementing the track plan shown by its original exhibit No. 5. Copies of these supplementary drawings have not been furnished to all parties but are reproduced in this report.

In December, 1917, the Commission opened an engineering department office in Los Angeles and assigned its Chief Engineer and a staff of assistants to study the entire situation. Further hearings were continued until after the completion of the report by the engineering department.

REPORTS UPON TEMPORARY AND IMMEDIATE MEASURES

Report of August, 1918

Shortly after the control of the railroads had been taken over by the United States Government on January 1, 1918, the United States Railroad Administration issued its general order for the unification, as far as possible, of all railroad facilities, including terminals in cities. At the same time, investigations were started and in some cities the terminal facilities were consolidated. In Los Angeles, due to the fact that the California Railroad Commission was at that time making a study of that question, Mr. McAdoo, as Director General of Railroads, on July 22, 1918, addressed the Commission, asking that it make a report giving the Administration the benefit of its knowledge in the investigation under way and to make recommendations for immediate unification. Mr. McAdoo's telegraphic request was as follows:

> "Am having investigation made of terminals at Los Angeles with a view of unifying them in line with similar policy through country with view to increasing the public convenience and economizing in cost of operation. I also desire, if possible, to reduce existing traffic on Alameda Street. Shall be glad if the California Commission will look into this situation and give me the benefit of its views on proposed changes. Mr. Sproule will gladly co-operate with you and supply all available information."

The Engineering Department of the Commission on September 7, 1918, submitted to the Commission its report on "Immediate Unification and More Economical Operation of Railroads with Resulting Betterment of Grade Crossing Conditions in Los Angeles and Vicinity." This report was concurred in by the Commission and was submitted on September 16th to Mr. McAdoo.

The seven recommendations made in this report follow:

1. Operate as double track the Salt Lake and Southern Pacific lines as east and westbound tracks between Colton and Los Angeles.
2. Discontinue Salt Lake passenger and freight service to Pasadena.
3. Discontinue Salt Lake passenger and freight service between Los Angeles and Glendale.
4. Discontinue Southern Pacific passenger service between Los Angeles and Anaheim.
5. Santa Fe take over Salt Lake freight business in Los Angeles.
6. Reroute certain freight switching in Los Angeles, relieving Alameda Street and providing for additional transfer facilities at Butte and Alameda Streets.
7. Unify all passenger facilities at the Santa Fe Station.

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Copies of the report were furnished to all interested parties: the carriers, the civic organizations, the City of Los Angeles and individuals.

A similar report had been asked by Mr. McAdoo from the engineers of the United States Railroad Administration, and the engineers of the three interested railroad companies submitted to their superior officers a joint report containing certain recommendations for the immediate unification of railroad facilities in Los Angeles. These recommendations varied considerably from the report submitted by the Commission, and, in consequence, the Federal Managers of the Santa Fe, the Southern Pacific and the Salt Lake applied to the Railroad Commission requesting a conference between the engineers of the Commission and of the roads for the purpose of reconciling the differences between the two reports.

Report of January 15, 1919

In consequence, three conferences were held, the first in Los Angeles on November 12 to 14, 1918, and the second and third in San Francisco on December 30 and 31, 1918, and January 14 and 15, 1919, respectively. Through these conferences the differences in the estimates were practically eliminated. The result of the conferences was, on January 15, 1919, submitted to Mr. Walker D. Hines, who had succeeded Mr. McAdoo as Director General of Railroads, by supplemental reports, one by the Engineering Department of the Commission dated January 15, 1919, and the other by the engineers of the carriers of the same date. These reports were combined and they included the estimates as revised and agreed upon, together with an explanation of the recommendations and methods in dispute.

Agreement was reached on the majority of the recommendations made by the Commission in the original report. This is true of original recommendations Nos. 1, 2, 3 and 6, and, with qualifications on the part of the railroad engineers, of recommendation No. 5. It was not possible to reach agreement with respect to recommendation No. 7—Unification of Passenger Facilities.

The Railroad Engineers' report still maintained the advisability of partial unification at the present Southern Pacific station. This plan contemplated the use of this station by the Salt Lake as well as the Southern Pacific, with the resultant increase of railroad traffic on Alameda Street.

In the first report to Mr. McAdoo, the Commission recommended **temporary unification of all passenger facilities** at the Santa Fe station site. In the supplemental report to Mr. Hines, the Commission recommended **temporary partial unification** by the joint use of the Santa Fe passenger station by the Salt Lake and the Santa Fe. This change in recommendations was caused by the changed general conditions that occurred between the dates of the two reports. At the time the supplemental report was made, the period of continued federal control was one of great uncertainty. The curtailment of all expenditures to an absolute minimum, as a war measure,

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was no longer imperative. With the cessation of hostilities, it was not considered:

> ". . . necessary, nor in the interest of the railroads, or the City of Los Angeles, to press at this time the matter of **complete temporary unification** of terminal facilities in Los Angeles."

The Commission decided that partial temporary unification at the Santa Fe site, with its minimum cost, was most desirable. Another factor leading to this conclusion was the fact that the investigation of the entire Los Angeles terminal situation was nearing completion and it was possible to consider seriously a permanent solution, which was thought superior to any temporary arrangement.

ATTITUDE OF UNITED STATES RAILROAD ADMINISTRATION

Since this report was submitted, Mr. Hines, during a visit to Los Angeles, expressed himself as being desirous of giving the support of the United States Railroad Administration to the investigation of the Los Angeles terminal situation. At a conference held on April 25, 1919, Mr. Hines stated:

> "I shall be glad to facilitate in every way in the power of the Railroad Administration the completion of the Railroad Commission's investigation of the Los Angeles terminal situation and shall give prompt consideration to the method by which I can most effectively aid in this direction."

No action has thus far been taken, however, by the United States Railroad Administration towards the carrying out of any of the Commission's and of the Administration's own engineers' recommendations. This is in spite of the fact that an annual saving of over $350,000 could have been accomplished with the expenditure of a very small amount of new money (less than $150,000) and with great benefits to the City of Los Angeles and to the railroads.

On June 3, 1919, the Director General issued instructions to the Regional Director setting forth the policy of the United States Railroad Administration with regard to public improvements and capital and operating expenditures. These instructions will be of importance in this proceeding and we quote in full:

> "June 3, 1919.
>
> **"Public Improvements**
>
> "To the Regional Directors.
>
> "Gentlemen:
>
> "The Railroad Administration is disposed in favor of the resumption or development of public works and improvements. In cases where the only objection thereto is to the present comparative cost of labor and material, no protest will be made on behalf of the Railroad Administration. Even where the burden upon the Railroad Administration in a particular district would be relatively a larger part of the total cost, the mere difference between the cost of work being done now and being done somewhat later is not sufficient to justify an attitude of opposition by the Railroad Administration to a policy of resumption or prosecution of public works.
>
> "The Railroad Administration should not identify itself with opposition to proposals looking to such development or resumption of public works

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unless the case is exceptional, and it is clear that the expenditure will be improvident, or that the project is actually in a private interest and involves the public interest only to a slight degree and the private interest involved will not assume the expense of the work. Nothing herein shall be construed to relate to facilities covered by General Order No. 15.

"Representatives of the Railroad Administration should at all times make it clear to the public authorities that responsibility for Capital Expenditures rests upon the Railroad Corporations and not upon the Railroad Administration, and unless specifically authorized by the Division of Law, shall speak only for the Railroad Administration in proceedings before Public Service or State Railroad Commissions, or officials or cities, counties or municipalities.

"The Railroad Administration may use its moral suasion to get the Railroad Corporations to consent to go ahead with public improvements and to finance improvements. However, no Federal Administration officer should take any action or make any commital, the effect of which would be to deprive a corporation of an opportunity to present its objection to the expenditure.

"In view of the fact that the amount of money available for capital expenditures is always limited, if a project will not be beneficial to the public in proportion to the expense, or can better be postponed pending the completion of more important Capital Expenditures, the Railroad Corporation, which will have to supply the capital, should present the conditions to the proper authorities.

"Bond Issues or Special Assessments

"Railroad Administration officials will not take any action for or against any proceeding, the purpose of which is to authorize a bond issue or special assessment, but will as fully as practicable keep the Corporate officer of each interested railroad advised so that if the Corporation desires to take any action, it may do so.

"In cases involving a special assessment chargeable to Capital Account in which the Corporation does not make financial arrangements to pay the assessment, there is no obligation upon the Director General to furnish the money. In such case, the question is one between the public authorities and the Railroad Corporation.

"Projects which Involve Charges to Capital Account That the Corporation Agrees to Assume, but which also Involve Charges to Operation

"If such a project is agreed to between the Corporation and the public body and the financial arrangements have been satisfactorily disposed of, the Railroad Administration will assume, as to Operating Expenses, the amount properly chargeable to it, but this policy should not prevent the Federal officer from presenting the objections, if any, which may develop to the project from an operating standpoint, nor from designating, wherever possible, the most economical method of carrying out any such project whenever there is more than one way of providing the proposed facility, or improving the existing facility, or from designating a better method of reaching the result if there is one available.

"Discussion with, or Proceedings Before, Public Service or State Railroad Commission, or Officials of States, Counties or Municipalities

"The general practices in connection with negotiations with, or before such public authorities preceding the issuance of an order, either formal or informal, should be along the following lines:

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"(a) Immediately upon receiving notice that any question affecting Capital Expenditures is to be taken up, notice should be given as information, to the proper officer of the Corporation so that the Corporation may participate in the consideration or hearing before the public authority, and where such projects involve the consideration of existing franchises or charters, unusual care in protecting the rights of the Corporation, to notice should be exercised.

"The United States Railroad Administration representatives should assure themselves that the public authorities have given the Corporation the notice required by law.

"(b) The representatives of the United States Railroad Administration will in such proceedings handle to the best advantage all matters involving maintenance, transportation and other items included under operation, and may be called as witnesses for the public, or the Corporation, as well as for the Railroad Administration.

"(c) It will be entirely proper to respond to any requests from a Municipality, County or State for information in regard to material and labor costs, and to volunteer such data so that all concerned may get the benefit for the information in the hands of the Railroad Administration officials.

"(d) Single complete items involving a charge to Capital Expenditures of $1,000 or less should be promptly reported to the Corporation to give the Corporation the opportunity of handling the matter with the public authority, but in the discretion of the Federal Manager the work should not be delayed if, and when, in his opinion, a prompt disposition of the matter will be the proper action under all circumstances.

"Compliance with Orders Issued by Public Authorities

"If and when a proceeding before the public authority has resulted in a definite order involving a charge to Capital Expense, the matter should be promptly reported to the Division of Capital Expenditures, with the position of the Corporation officer clearly expressed, together with the recommendation of the Federal Manager and Regional Director.

"Sincerely yours,

"(Signed) Walker D. Hines."

Since the date of this letter, Director General Hines has designated District Director William Sproule as the representative of the Administration. Mr. Sproule in a letter to the Commission of June 18, 1919, states that:

". . . the Director General, while not a party to these hearings, will co-operate in arriving at the facts and their bearing and desires to be represented at the hearing."

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CHAPTER II.

OUTLINE

Influences Affecting Terminal Problem

The Steam Railroad Problem

Relation of Electric Interurban Lines to the Problem

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CHAPTER II

GENERAL SURVEY OF PROBLEM

INFLUENCES AFFECTING TERMINAL PROBLEM

Mr. Bion J. Arnold has well summarized the influences affecting the Chicago terminal problem. Since the problem at Los Angeles is different only in degree, we shall take the liberty to quote from his report:*

"Influences Affecting Terminal Problem:

"A broad and unbiased study of this problem calls for consideration of the rights and viewpoints of the many interests concerned, which are briefly set forth here in order to emphasize the impossibility of reaching conclusive decisions until the full facts are available.

"1. **The Railroad Corporation**—viewing its properties, realty holdings, terminal advantages, operating rights and investment from an individual rather than a community point of view, thus reflecting the attitude of a foreign directorate.

"2. **The Municipality**—vitally interested in the proper physical and aesthetic development of the industrial properties within its borders as well as in the convenience of its citizens.

"3. **The Local Taxpayer**—who questions the justice of enormous railroad holdings within his city being assessed at merely a fraction of his own assessment rate while he is required to contribute a proportionally greater share to the support of the municipal government.

"4. **The Real Estate Owner**—generally in favor of any plan that benefits his property without considering the best interests of the city as a whole and who as loudly protests against the depreciation of his property values by contiguous railroad properties, and whose views are equally divergent upon the desirability of a railroad or loop terminal location depending upon whether his property is inside the "loop" or outside.

"5. **The Commuter**—satisfied with moderate terminal facilities if low fares and reasonable conveniences are available with quick access to the business district.

"6. **The Traveler**—favoring that road with the shortest running time, the best equipment, the most imposing terminal architecture and maximum terminal conveniences without so much regard to location, as his lack of knowledge of the city forces the use of taxicabs. Here the advertising value of the expensive terminal is evident.

"7. **The Stockholder**—often interested only in a maximum return upon his investment without much regard to methods of operation and often with none at all in the welfare of the community.

"8. **The Bondholder**—retaining through the trustees the absolute ownership and control of present property which cannot be disposed of outright without his consent except through long term leases and operating agreements.

"9. **The Management**—under continual pressure for maximum dividends, adherence to schedules, better equipment and the demands of the suburbanites for more and faster equipment in the face of increasing operating expenses and competition from long-haul rapid transit lines.

*Report on the Rearrangement and Development of the Steam Railroad Terminals of the City of Chicago—1913.

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"10. **The Financier**—gauging the amount and discount of his loan largely by the record of annual surplus shown on the road's balance sheet.

"11. **City Shipping**—Desiring freight terminal facilities located as close to point of originating tonnage as possible in order to avoid delay and expense in extra cartage. Obviously too close concentration within congested district defeats the purpose in view.

"12. **Through Shipper**—interested only in prompt transfer through the Chicago District with the least rehauling, which practically dictates the clearing system now being installed.

"13. **Lake Shipping**—the success of which practically depends upon cheap and convenient trans-shipment facilities that can only be brought about by the most intimate contact between rail and water, supplemented by interchange clearing and union freight station.

"Analysis of all these extremely conflicting viewpoints reveals the fact that in the main the decision of all parties interested as to the merits or demerits of any terminal plan proposed is practically guided by individual interest and in this respect the municipality is no exception. How, then, may a just balance of interests and equities be found? The method followed in this report is that of disinterested technical analysis.

"1. Analysis and classification of each proposal.

"2. Balancing of advantages and disadvantages from the viewpoint of the greatest good to the greatest number.

"3. Determination of capacity and commercial feasibility.

"4. Assumption of reasonable co-operation between all interested parties, especially the railroads and the city.

"In the present situation the property values and equities involved are so large and the interests so complicated as the result of long years of development, rearrangement, reorganization, acute competition and lack of adequate municipal supervision, that the question immediately arises:

"Shall expendiency and minimum cost govern, or shall permanent development based upon the lessons of the past and the unquestioned needs of the future prevail?

"Here there are the two extremes: the Corporation hesitates to plunge into a large investment for the distant future, especially during a close money market, and, therefore, follows the line of least resistance and uncertainty in providing only for the immediate future. On the other hand, enthusiastic supporters of the comprehensive City Plan are convinced that piecemeal and disorganized development for the present only will simply intensify the problems of the future. Both are right to a degree and in the analysis the problem is to find the middle ground, if possible, upon which these conflicting interests may unite upon a constructive program of necessity and moderation."

The problems involved at Chicago were very much the same as those presented in this investigation, more particularly the various interests involved. The most important exception lies in the fact that here in California the Railroad Commission has very large powers to make orders affecting service and operation of common carriers. These orders, if reasonable, are binding upon the carriers, and in a measure also upon municipalities and other political subdivisions of the state. The necessity of bringing the various conflicting interests upon the "middle ground" by means of

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argument and persuasion, that is, the necessity to compromise, is present, therefore, only if, in the interests of the greatest good to the greatest number, a compromise seems best.

However, a "disinterested technical analysis" is necessary in any case. The conclusions reached in this report are the result altogether of such disinterested analysis as we have been able to give to the problem.

THE STEAM RAILROAD PROBLEM

The main subject of this report is the study of the railroads in the City of Los Angeles and particularly the railroads in the industrial district. Plans have been formulated and recommendations have been made in the main with three objects in view:

1. The elimination of grade crossings,
2. The question of the desirability and location of a union passenger station, and,
3. The possible improvements in the handling of freight.

These three problems are interdependent: the plans of one item have an effect on the other two. It is obvious, for instance, that the matter of crossings is very largely dependent upon the location of a union passenger station. It is necessary, therefore, to determine first which one of the three problems shall be considered as of greatest importance. It has frequently appeared during the hearings in these cases and subsequently that the establishment and the location of a union passenger station is of paramount importance. Even a superficial examination of the factors involved will lead to the conclusion, however, that this is not the case. The matter of first importance, in our opinion, is the elimination of grade crossings. This is true not only because we are dealing with the question of danger to life and limb and property, but also because the continued existence of certain grade crossings in the City of Los Angeles is one of the main handicaps to a healthy and unhindered development of the city. The comparative importance of the grade crossings can be established from another angle:

About 2,750,000 people per year—approximately 7,500 per day—are now using the depots of the three steam railroads in Los Angeles. A union passenger station will probably accommodate for years to come not in excess of 10,000 people per day. Over the various grade crossings adjacent to the Los Angeles River and between North Broadway and East Ninth Street (the crossings chiefly under consideration in this report) there pass about 33,000,000 people per year—90,000 per day. And this number is steadily increasing and will, within another year, average at least 100,000 per day. These facts, in our opinion, demonstrate clearly the overshadowing importance of the grade crossing problem in the City of Los Angeles.

In addition to the three main factors affecting steam railroads, as enumerated above, we have considered only such other steam railroad matters as were clearly included in the cases officially before the Commission (the recommendations, for instance, that were made by the Commission in the

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reports to the Director General of Railroads on immediate unification possibilities) and in various other applications awaiting decision by the Commission.

RELATION OF ELECTRIC INTERURBAN LINES TO THE PROBLEM

It is an important fact that the Pacific Electric Railway in 1917 carried about 35,000,000 passengers in and out of Los Angeles—exclusive of five-cent fare passengers—while on the three steam roads combined the passengers numbered only 2,750,000. In other words, the electric interurban passengers are over thirteen times as numerous as the passengers on the steam roads. There were, on December 31, 1917, over 1,400 scheduled passenger trains daily on the Pacific Electric in and out of Los Angeles, exclusive of street or local service, while on the steam roads there were but 94. The proportion of thirteen to one, therefore, holds here also. The routes traversed by these 35,000,000 passengers are shown in Fig. 17 on page 107.

The grade crossings within the city on electric interurban lines also exceed the crossings on steam roads, but an exact ratio is difficult to establish because of the relative importance of the various crossings. Recently the City erected advance grade crossing warning signs in compliance with a state law, and there were about as many steam road crossings designated for signs as there were Pacific Electric crossings, the ratio being 159 to 163. These figures give a very good approximation of the number of crossings of both kinds considered dangerous by the City.

Electric interurban traffic in a city is more dangerous than steam road traffic for the main reason that electric trains accelerate much faster and, in general, operate at much greater speed. With these facts before us, it is necessary to take up the question of the elimination of grade crossings of the electric interurban tracks and its relation to the whole problem.

It should be stated at the outset that from the practical point of view, all matters dealing with electric interurban service within the City of Los Angeles resolve themselves first into questions of jurisdiction. To the extent that the scope of this report includes electric interurban service, we are considering the problem regardless of the power of the Commission to enforce recommendations and from an engineering standpoint only. As matters now stand, jurisdiction is divided between the various municipalities served, the County and the Commission. The ideal condition would be to have these various jurisdictions work together and agree on the best possible plan for future electric railroad development and to permit thereafter nothing to be done that would seriously interfere with the ultimate accomplishment of the adopted plan.

Such a plan, insofar as electric interurban traffic within the City of Los Angeles is concerned should, in our opinion, take account of the main factors indicated.

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The so-called Hill Street subway line which was discussed at length at the hearing in these proceedings, is a case in point. As long as fourteen years ago the interests then controlling the Pacific Electric planned this line as a subway westerly from the present Pacific Electric Hill Street station to approximately Vermont Avenue and thence either on the surface or as an elevated line to Vineyard.

This plan as developed fourteen years ago remains sound today. There is no doubt that construction of the line and the abandonment of the Hill Street station and the Sixteenth Street line for all but street car traffic would result in far better transportation to the various beach towns and in the elimination of dangerous crossings. In this connection see Fig. 89 on page 246.

A somewhat similar situation exists with regard to the elimination of Pacific Electric grade crossings between Los Angeles and Pasadena. This matter will be further discussed in Chapters IV and IX.

The general problem of the elimination of grade crossings on Pacific Electric tracks in the City of Los Angeles resolves itself into the separation of street levels and railway levels not only where the tracks cross the streets but between these points. This is a problem of city planning rather than one to be taken within the scope of this report.

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CHAPTER III.

OUTLINE

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  - Growth of the City
    - Los Angeles Harbor
  - Municipal Railroad
  - Steam Railroads
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    - Southern Pacific Company
    - Atchison, Topeka and Santa Fe Railway Company
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CHAPTER III

HISTORY AND DEVELOPMENT OF CITY AND OF TRANSPORTATION FACILITIES

HISTORICAL REVIEW

Early History of City

The Pueblo of Los Angeles was founded under the protection of the Spanish Government on September 4, 1781, shortly before the original site of the city had been laid out in rectangular shape (200 feet by 275 feet) and, according to the records, was approximately a little north and west of that area now between Main, Los Angeles, Marchessault and Plaza Streets, and comprised slightly more territory than is included in the present circular park known as the Plaza. It was at this location that the Mexican colonists gathered and declared this to be the Town of Our Lady the Queen of the Angels ("Pueblo de Nuestra Senora la Reina de Los Angeles").

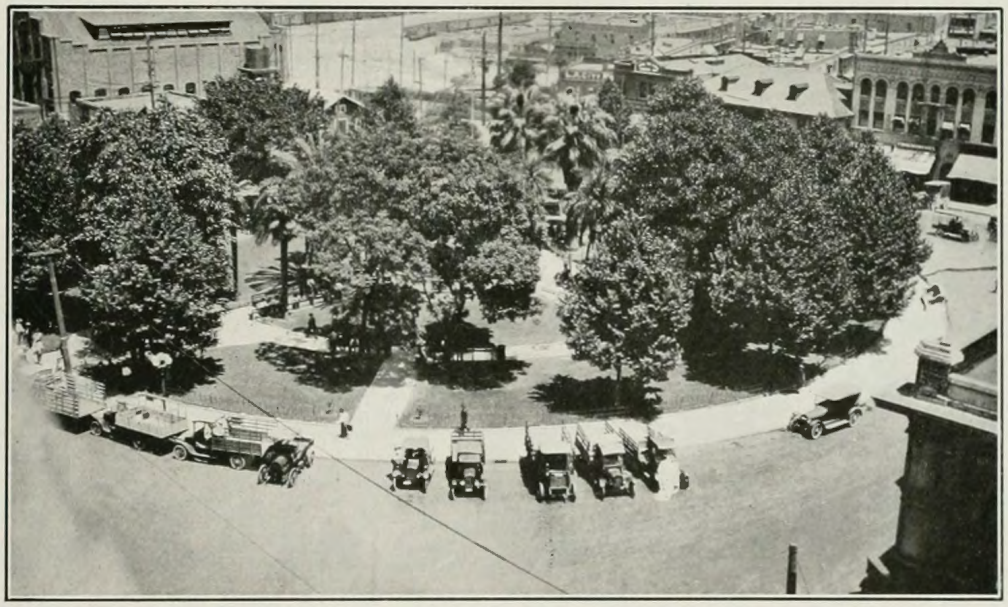

FIG. 2. THE PLAZA

This circular park marks the center of the original City of Los Angeles at the time of founding, in 1781. The area of the city was but slightly greater than the present plaza.

Los Angeles is, therefore, one of the oldest cities of the Pacific Coast. It was the first colony to be organized independently and separately from a Spanish Mission. Of these there were several and the largest was at San Gabriel, at that time the sponsor to the entire Southern California region.

The population at the time of founding is officially reported as forty-four. Since then, the growth of the city has not been regular, but has fluctuated during different periods. From the date of the foundation to the time of incorporation, in 1851, very little progress can be noted. About

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that time the population increased considerably because of the influx of prospectors into California attending the discovery of gold and the subsequent excitement. From about 1860 to about 1885, the growth of the town was fairly steady. In the latter year the last spike was driven in the Cajon Pass line of the Santa Fe, giving Los Angeles a direct and competing railway connection with the East. (The Southern Pacific, as will be discussed later, had come in, in 1873.) This event has been termed the turning point of Los Angeles from the old to the modern city.

Growth of the City

With the widespread advertising, and special railroad rates offered, traffic developed and there came a sudden flood of people to this part of the Pacific Coast. With this period the remarkable development of Los Angeles and Southern California began. In 1860 the population is reported to have been 3700; in 1870, 5728; in 1880, 11,090; in 1890, 50,395; in 1900, 102,479; in 1910, 310,198, and in 1918 it is estimated at over 600,000. The population of Los Angeles stands first in California, fifth in the United States, and about thirty-fifth among the cities of the world.

The actual growth in population may be more readily seen from the chart, Fig. 3, page 67.

The greatest rate of increase in any one decade was 350 per cent and occurred between 1880 and 1890 in the so-called "boom period." It has been stated this was caused, to a large extent, by the opening of the Santa Fe railroad from the East with ridiculously low rates. During the rate war between the Southern Pacific and the Santa Fe, in 1886, the fare from Missouri River points to Los Angeles reached as low as one dollar.

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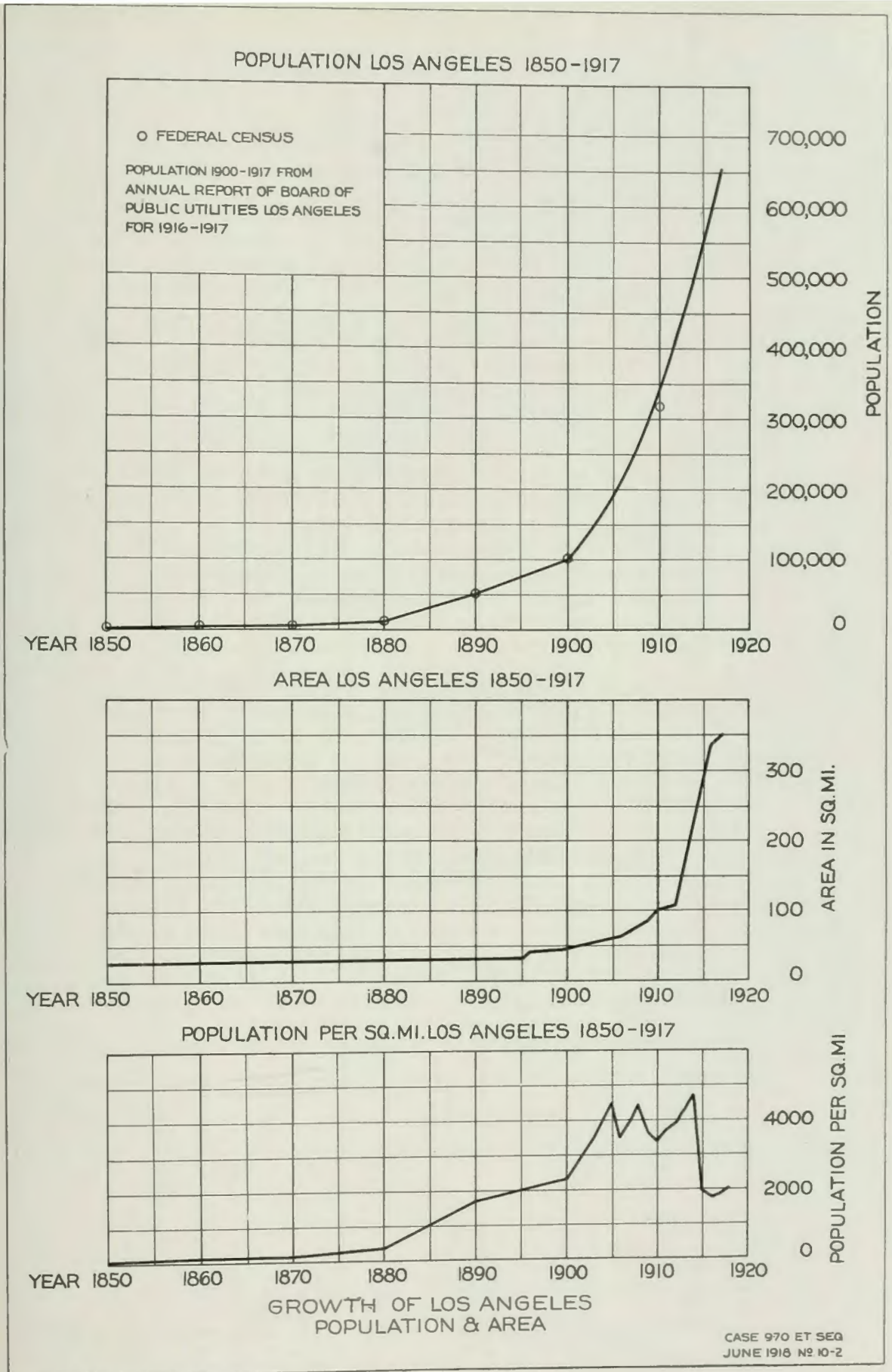

California Railroad Commission Engineering Dept.

FIG. 3. GROWTH OF LOS ANGELES IN POPULATION AND AREA

The upper diagram shows the growth in population from 1850 to the present time; the middle diagram shows the growth in area in the same period; and the lower one shows corresponding changes in average density of population. The drop in average density in 1915 is due to the annexation of the San Fernando Valley at that time.

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A chart, showing the territorial growth of Los Angeles from 1850 to the present time, is also shown in Fig. 5. In 1851, when the city was incorporated, the total area was 28.01 square miles. During the next fifty-five years the increase in area amounted to only 1.20 square miles. From 1900 to 1910 the area increased 133% and from 1910 to 1918, 261%. This last rate of increase was caused principally by the annexation of the San Fernando Valley. This annexation was made in order to irrigate this valley with water from the newly completed municipal aqueduct, the law providing that such water could not be sold outside the city.

The third graphic chart embraced in Fig. 3 shows the population per square mile of area and the corresponding changes in the density of population. This curve reflects the effect of the acquisition by the city of largely sparsely populated areas, nevertheless the population of the city is constantly growing. With two or three exceptions, the territories consolidating with, or annexing themselves to, the City of Los Angeles have been large in area, but small in population. The San Fernando District or Valley is an agricultural district and embraces approximately 170 square miles, with but 5000 or 6000 people.

The economic factors controlling the growth and prosperity of any community are directly reflected in such statistics as banking, building permits, and post office business. In the chart, Fig. 4, these statistics, for the years 1890 to 1918, together with curves for population and area, are shown as an indication of this growth in Los Angeles.

Fig. 5 shows the present shape and boundaries of the City of Los Angeles. The original townsite or city, as incorporated in 1851, and consisting of 17,924 acres or 28.01 square miles, is shown in black. The subsequent annexations are shown in decades by color, as explained on the drawing. The total length of the city, from the northern limits of the so-called San Fernando district to the most southerly point at San Pedro, is now approximately 45 miles. The present area is approximately 365 square miles. With this area, Los Angeles is the largest city, in point of territory, in the United States.

An idea of the distribution of the population may be obtained from Fig. 6.

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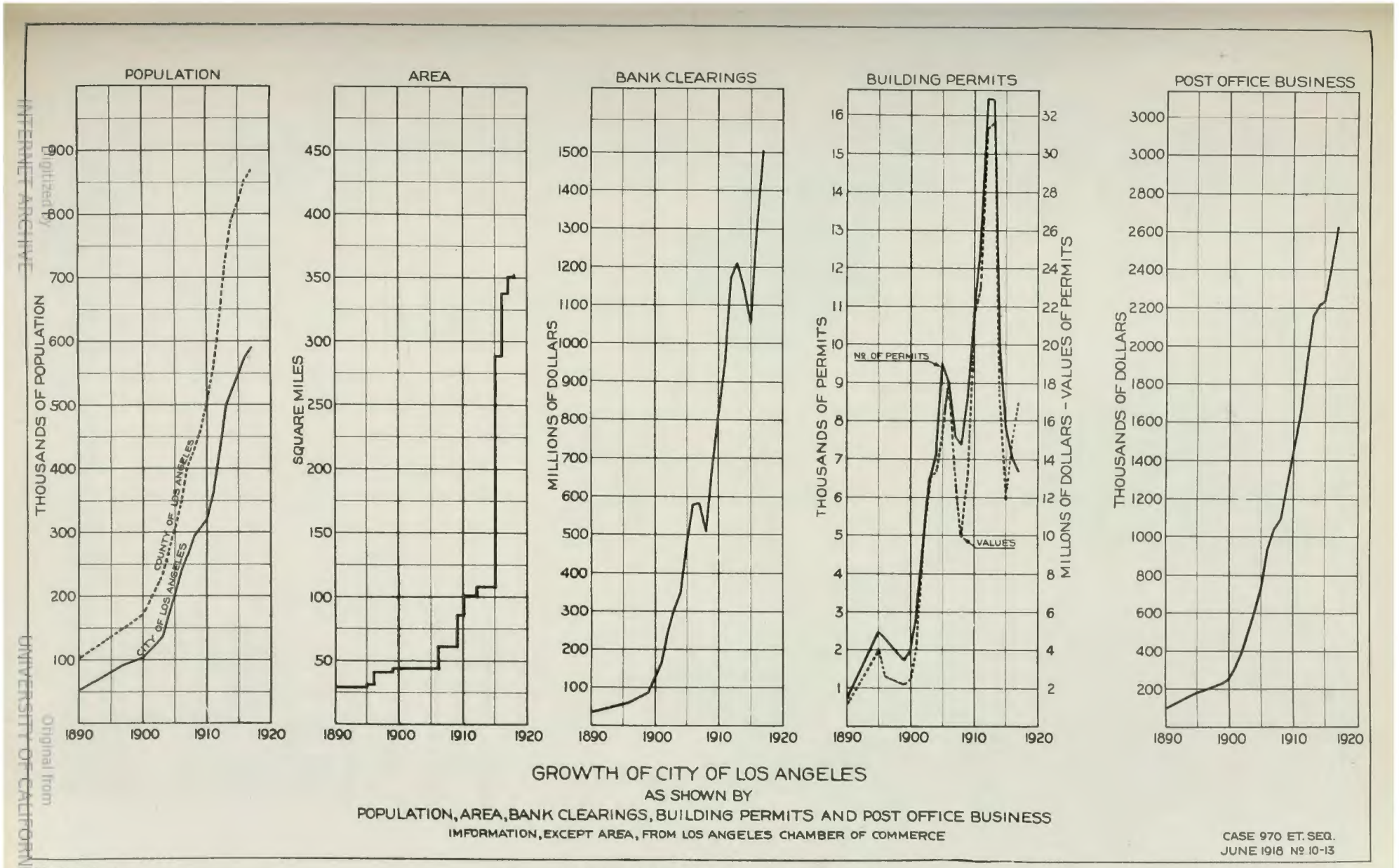

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FIG. 4. GROWTH OF THE CITY OF LOS ANGELES

A comparison of growth in population, area, bank clearings, building permits, and post office business from 1890 up to the present time, is shown. The drop in building permits is due to war conditions. The general upward tendency is very pronounced.

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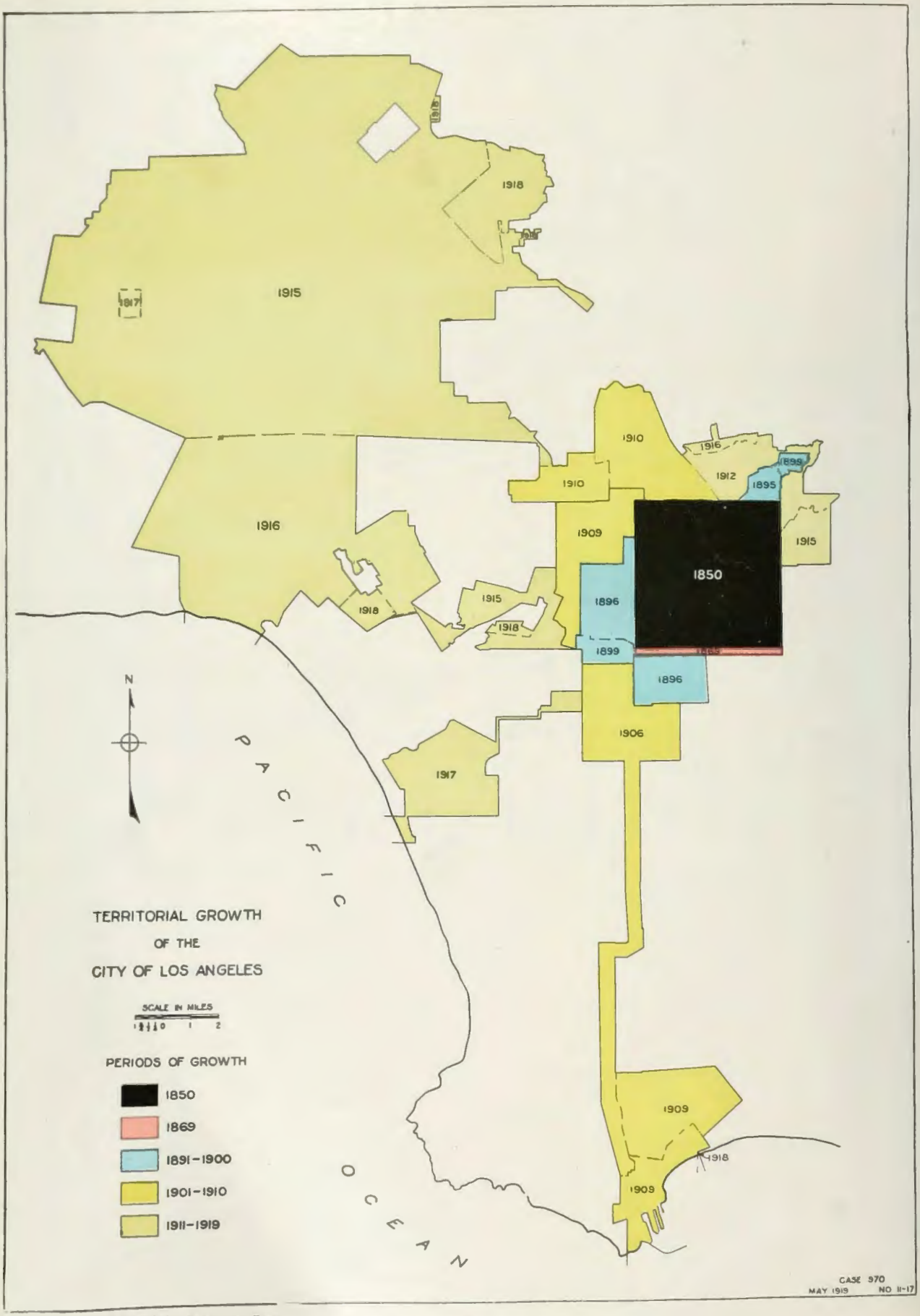

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FIG. 5. TERRITORIAL GROWTH OF LOS ANGELES

Except for slight early annexation, the periods of growth are by decades. In order that the density of population shall keep pace with the territorial growth, adequate rapid transit facilities are of prime importance.

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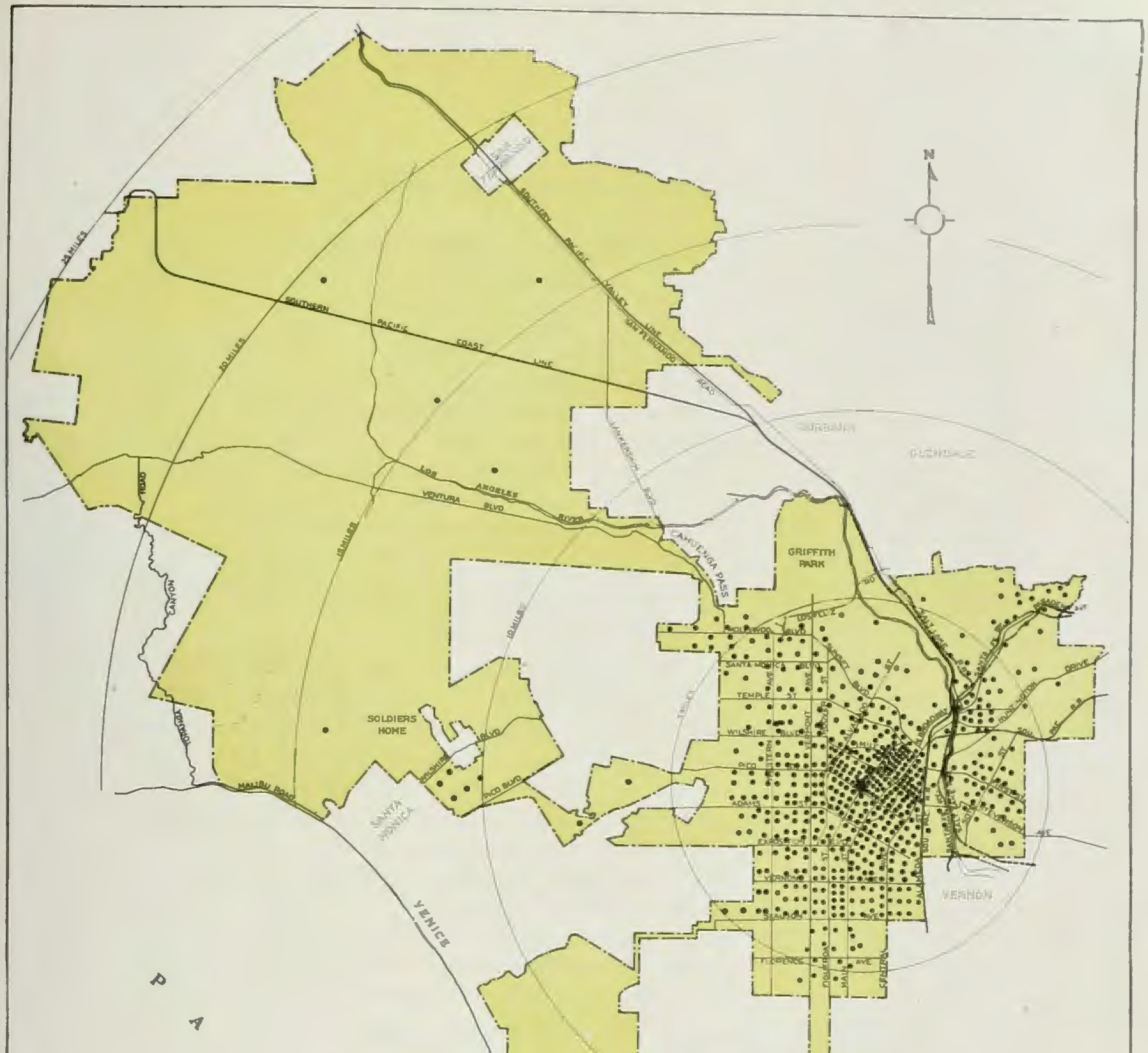

California Railroad Commission Engineering Dept.

FIG. 6. DISTRIBUTION OF POPULATION IN 1917

Each dot represents 1000 resident population. The star marks the point where a north and south and an east and west line divide the population into two equal parts. This map is based upon the registration of voters.

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Each dot on this chart represents 1000 inhabitants, with the center of population shown by the star, at approximately Eleventh and Georgia Streets. About 1911 this center was at Sixth and Main Streets. The star is located at the intersection of north and south and east and west lines equally dividing the resident population.

The first inhabitants located within the original plaza site but, as the town grew, the residential district was developed to the north and south of the Plaza, and occupied the area along Main, Spring, and Broadway (formerly Fort Street), as far south as Sixth and Seventh. From this district, the tendency seems to have been to the west and the south.

Along with the growth and increase in population, there were economic, industrial and manufacturing developments in the city and great agricultural growth and developments in the surrounding country.

Up to about 1880 the business of the city had been practically confined to the immediate vicinity of the old Plaza; then a few small business buildings were built south of First Street; and, ten years later, the center of the business district shifted from around the old Mission Church at the Plaza to First Street. Up to this time the predominating population lived north of the Plaza; but, as the number of inhabitants increased, the trend seemed to be westward. This movement also caused the shifting of the city's business center, which moved south from First Street to between Third and Fourth Streets on Broadway, Spring and Main Streets, where it seemed to hold for several years. Then, within the last few years, it has evidently been moving toward Seventh Street, west of Broadway and Hill Streets, which, thirty years ago, was the southern outskirts of the town, but which is now the acknowledged future business center. Thus, it will be seen that the modern Los Angeles has far outgrown, in every respect, the city before the "boom." It may be of interest here to note the time of the beginning in Los Angeles of a few of the modern conveniences. In 1850 the first United States census was taken and, in the same year, before the city was incorporated, the first post office was opened for business on April 9th. On July 1st, 1850, the first election was held. In 1853 the Wells-Fargo Express Company came in. It was not until October 8, 1860, however, that the first telegraph line was in operation between Los Angeles and San Francisco. The first locomotive operated in Los Angeles was shipped in by water in 1869. Street railway companies began the operation of horse or mule cars on the streets of Los Angeles in 1872. In 1873 the first bridges were built across the Los Angeles River at Downey Avenue, now North Broadway, and Aliso Street. In 1874 the first cable street railroad was built and known as the Sixth and Main Streets line. On December 31, 1882, the city celebrated the occasion of the first electric street lights. In the same year the telephone was introduced. Street paving was started in Los Angeles in 1887, when Main, Spring and Broadway were paved. Oil, which has been one of California's greatest products, was first pro-

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duced in Los Angeles in 1892, from a well dug by hand. The first shipment of oranges was made in 1877.

In due time Los Angeles decided that the city must be expanded to reach the coast. Accordingly, an annexation act was passed creating a "pan-handle" or "shoe string" reaching to and including San Pedro, which is now a portion of the corporation of Los Angeles. The city also began to reach out in other directions until, today, it has an area of approximately 365 square miles.

The Aqueduct, to which the present size of the city is largely due and of which Los Angeles is rightfully proud, was made possible by the issuance, in 1907, of a $25,000,000 bond issue. Actual construction began in 1908 and, in 1913, the waters of the Owens River were brought across 250 miles of desert to the City of Los Angeles at a total cost of $24,650,000.00. In addition to providing some 184,000,000 gallons, daily, of available water, the city is now building power plants at various points along the Aqueduct, and expects to develop electricity to the amount 185,000 horse power with plants already installed and to be installed.

Los Angeles Harbor

From 1871 to 1897 the question of constructing a breakwater at San Pedro was agitated, and for years there was a conflict between the railroads and certain factions of the citizens of Los Angeles to determine and secure from the government an appropriation for the construction of a harbor at either San Pedro or Santa Monica.

This contest, usually termed the "Los Angeles Harbor Fight," is a well known story in and around Los Angeles and will not be dealt with, in detail, in this report. The principal point is that the matter was one of railroad rivalry primarily; the Santa Fe (or its predecessor) developing a wharf at Redondo to compete with San Pedro, and the Southern Pacific Company, to checkmate this, extended its Santa Monica line three miles up the coast to Los Angeles and there building a wharf nearly a mile in length. Later, when the Southern Pacific Company transferred its plans from further extension of Santa Monica and Port Los Angeles to extensive improvements at San Pedro, the former wharves became practically abandoned. Not long after the transfer of the Southern Pacific interest, the government rendered its final decision in favor of San Pedro and, in 1897, the United States army engineers located Los Angeles Harbor. The present breakwater, 11,152 feet in length, was then built at a cost of $3,108,300.00. The construction of this breakwater marks the beginning of Los Angeles Harbor as a deep water port.

The first railroad facilities built on the old waterfront are shown in the following picture:

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FIG. 7. TERMINUS OF LOS ANGELES AND SAN PEDRO R. R. AT WILMINGTON
This picture was taken about 1869.

In 1906, the City of Los Angeles acquired a strip of land extending southerly from the then city limits to the northern boundaries of Wilmington and known as the "shoe-string" addition. Three years later, in 1909, San Pedro and Wilmington became a part of the City of Los Angeles.

Municipal Railroad

Shortly after the acquisition of this new territory along the waterfront, including Los Angeles Harbor, the city officials believed it to be to the best interests of the city to preserve to the people their rights to deep water frontage and to provide a means of access between the city and deep water for any transcontinental railroad which might build to Los Angeles. Accordingly, a plan was approved, and the road was to be known as the Municipal Railroad.

Shortly after a railway right of way from Los Angeles south to Wilmington and San Pedro was secured, through donations to the city, with no financial outlay whatever. These donations were obtained with the understanding that a railroad was to be constructed and, in many cases, the agreements called for the creation, by the city, of waiting stations, freight platforms, or the construction of a boulevard alongside the right of way, and also numerous other considerations. Later, when the building of the road did not materialize, the parties donating land demanded some action by the city, or the return of the land donated for railroad purposes. As fast

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as such applications are made, the city, without any objections whatever, is relinquishing all claims.

The only constructive work done by the City on the Municipal Railroad consisted of a double three-rail electric track from Aliso Street to Ninth Street on San Pedro Street; for this the City paid the following:

Pacific Electric Railway (paid by Harbor bonds)	$246,575.00
Engineers' fees	1,032.98
Installing intakes	327.00
Repaving street	421.00
Total expended	$248,355.98

The total appropriation by the City amounted to $250,575.00. After the completion of the track, it was leased to the Pacific Electric Railway Company for the consideration of the interest on the bonds, which amounts to $11,376.00 annually, or 4½% of the total expenditure. If, at any time, the City terminates the lease, the Pacific Electric Railway Company is to automatically receive the franchise for a track on Los Angeles Street. The franchise covering this was allowed by Ordinance No. 26,874 (N. S.) City Book 4, page 668.

The Los Angeles Railway has also obtained a franchise for the operation of cars over that portion of the municipal tracks between Ninth and Fourth Streets. Several years ago the City attacked the right of the Los Angeles Railway to operate on San Pedro Street and the case was carried through the Supreme Court, proving some of the Los Angeles Railway franchises void and others valid.

Steam Railroads

In the following short history no attempt is made to go into details, such as the corporate names or entities under which various sections of railroads and improvements were constructed or operated; the reorganizations that almost all roads underwent during their life; the changes in motive power and franchises, and other such matters. In all cases the matter has been considered in a general way, and with special attention to the more important developments. To attempt to list the names of all small companies which were organized, in most cases by the larger companies merely to build a certain section, small or large, of a particular road, and which, after completion, were absorbed by the operating company, would necessitate a great amount of searching of records and would not assist in any way our study of the case. This is intended to be merely a sketch of the railroad development of Los Angeles and its surrounding territory. The subject matter is taken from various publications dealing with the history of Southern California and Los Angeles, and from information furnished by old residents of the City. The accuracy of our statements is, therefore, limited to the accuracy of these historians.

There is no doubt in anyone's mind that progress and prosperity anywhere is dependent upon transportation to a greater extent than upon any

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other single factor. In the United States especially, as indeed in every "new country," the railroads have played a most important part in the growth of wealth, the increase of material comfort, and the spread of information and knowledge. While this is true of the country, as a whole, it is even more startlingly true in the later development of the Pacic Coast and of the State of California.

Los Angeles is now the first city in point of population in this State, and it is apparent that the railroad history of this city is intimately bound up with the progress of railroading in the entire State. A short review of that progress, in so far as it may be of interest in connection with this report, will, therefore, be in order. There are in California today 57 steam railroads, with a grand total of 12,000 miles of track, of which 8000 are main line. The first railroad in the State, and in fact on the Pacific Coast, was completed in 1855 between Sacramento and Folsom, a distance of 21 miles. The second was built in Oakland in 1862, 4 miles long and to facilitate the transbay traffic, then in a crude and undeveloped condition. The third was between San Francisco and Menlo Park, built in 1863 and extended early the next year to San Jose. The next railway achievement of importance was the construction of the Central Pacific from Sacramento to Ogden, commenced in January, 1863, and completed in May, 1869. During 1869 the Western Pacific Company was constructing a line between San Jose and Sacramento which was completed and merged with the Central Pacific in 1870. Soon after the Alameda and Oakland road, which meanwhile had crept along to Haywards, was purchased by the Central Pacific and extended to Niles. This completed the first great all-rail transcontinental system, with California as its western terminus.

Following this, railroads were built from San Francisco into the San Joaquin Valley and into the Salinas Valley, along the Coast. The high mountain ranges which separate Southern California from the central or San Joaquin Valley were encountered and surmounted, and with a tunnel 6966 feet in length the railroad from San Francisco to Los Angeles was completed.

The construction in 1877 of what is now known as the "Sunset Route," extending from Los Angeles to Yuma, and a few years later through the southern border territory to New Orleans, gave California another transcontinental route.

The railroads of next importance, whose operations were confined entirely to the southern part of the State, were the Atlantic and Pacific and the Southern California, in effect the Pacific ends of the Santa Fe. That portion of the Atlantic and Pacific route between Mojave and The Needles was originally constructed by the Southern Pacific Company in 1882-83 and transferred in 1884 to the Santa Fe, the present owner. At Needles it joined the main portion of the line, then nearly completed between that point and Albuquerque, adding a second transcontinental line to Southern California. Subsequently branches have been constructed into all of the

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important territory to the south and a great deal of enterprise displayed in the development of the country.

In 1895 a second railway was started from San Francisco to Los Angeles, practically paralleling the Valley line of the Southern Pacific Company; and in 1900 it had been completed and sold to the Santa Fe, which company has operated it ever since.

A third railroad which may be called a transcontinental line is the present Los Angeles and Salt Lake Railroad, formerly known as the San Pedro, Los Angeles and Salt Lake Railroad. This road has its western terminus at Los Angeles Harbor and its eastern terminus at Salt Lake City where connections with the Union Pacific are maintained. Though several schemes for such a road had been promoted and failed, the San Pedro Company, together with the Los Angeles Terminal Company which had already built from Los Angeles City to San Pedro or Los Angeles Harbor, finally, in 1905, completed its line to Salt Lake City.

The impetus to progress given by railroad construction in the southern part of California seems almost without an equal in the history of the nation. Within a comparatively short space of time Los Angeles had broken all records of growth. From a sleepy, indolent town of 12,000 inhabitants, few attractive features, and no evidence whatever of advancement, it has swelled to a metropolis of 600,000, and the railroad is the chief cause of the metamorphosis.

Los Angeles and San Pedro Railroad Company

The Los Angeles and San Pedro Railroad was the first railroad to be constructed in Los Angeles County or Southern California. Previous to the time when railroads began serving Los Angeles, the connecting link between Los Angeles and the outside world was the port or roadstead of San Pedro. All freight, with little exception, was transported that way, and, by the year 1869, business had grown to such proportions that a railroad from the port to the City was completed.

This road was first agitated in 1860. At that time money for railroad projects was hard to raise, and an appeal was made to the State. An enactment was passed by the legislature allowing counties and cities within the State of California the power to bond themselves and to loan the proceeds of the bonds as subsidies to railroads. The public, however, was more or less skeptical of the success of a railroad and consequently it was not until eight years later (1868) that the City and County approved the issuance of the bonds. By these bonds the County and City made available $225,000, $150,000 and $75,000, respectively, which made possible the building of the first railroad into Los Angeles.

It is a noteworthy fact, therefore, that the first railroad in Los Angeles was built with public and not alone with private funds.

On September 19, 1868, construction was started at Wilmington. By June, 1869, six miles of the road was completed. By August 1st, the road

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had been built to within 4 miles of Los Angeles or to about where the City of Compton is now located. By October the construction of eighteen miles was completed and the road brought well within the limits of the present city, but "far from town" as it appeared in 1869 and 1870. On October 26, 1869, the road was opened to the public although the regular schedule was not put into effect until November 1st.

The road into the City was built along what was then called the "Lane" (which in reality was an extension of Alameda Street) to its terminus at Alameda Street and what is now Commercial Street, where a depot and turntable, as shown below, had been constructed. Later this road was acquired by the Southern Pacific Company and is operated as its San Pedro Branch.

FIG. 8. FIRST LOS ANGELES RAILROAD STATION
This station was built in 1869 by the Los Angeles and San Pedro Railroad at Commercial and Alameda Streets.

In 1870 the Los Angeles and San Pedro Railroad Company extended its line from Wilmington to Timms Landing, at San Pedro. This was the real beginning of the city and the harbor of San Pedro.

Southern Pacific Company

The completion of the first continental railroad to San Francisco in 1869 gave an impetus to railroad building in California. To encourage railroad construction throughout the State, the legislature in 1870 enacted a law authorizing any county to bond itself to five per cent of the assessed

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value of all property in the county for the purpose of assisting railroads. Previous to this, the legislature had, in 1863, granted Los Angeles County and the City of Los Angeles permission to issue bonds as a subsidy to the Los Angeles and San Pedro Railroad Company.

About 1870 the Texas Pacific Railroad was building a road across Texas and had projected a line through California from Yuma to San Diego. This company had also proposed and offered to build a line extending along the coast to Los Angeles, providing suitable inducements or bonus were given by Los Angeles County and Los Angeles City.

The Southern Pacific, about this time, was building southward from Lathrop, through the San Joaquin Valley, and over the Tehachapi Mountains to Mojave. From this latter point, two separate surveys had been made to the Colorado River: one by way of Soledad Pass, via Los Angeles, through costly tunnels and over heavy grades; the other directly eastward to Needles, over an almost level plain and desert.

Rumors that the latter route would be chosen and Los Angeles sidetracked unless inducements were offered resulted in a committee being sent from Los Angeles in 1872 to San Francisco to confer with the Southern Pacific Company. Maps presented at this conference showed how the railroad could enter the city. When the road was finally built, it followed the lines indicated by those maps.

At the conference in San Francisco, the Southern Pacific Company offered to build fifty miles of its main trunk line through the County of Los Angeles and the City of Los Angeles, leading from San Francisco to Yuma, where connections were to be made with the Texas Pacific. Twenty-five miles of this fifty miles of road were to be built north of the City and a similar amount eastward. In consideration of this, the company demanded a bonus of 5% of the assessed valuation of all land and improvements in the county; sixty acres of land, ten acres suitable for a depot and fifty acres for shops at advantageous locations within the City, with the necessary rights of way for the main trunk lines. In addition, the company demanded the entire stock owned by the City in the Los Angeles and San Pedro Railroad Company.

According to the ordinance adopted in May, 1872, through which this matter was submitted to the vote of the people, the bonus to the railroad company was as follows: 5% of the assessed valuation of taxable property, which, in 1872, was $10,550,000, making a total of $527,000. $15,000 of this sum was to be paid by transfer of the capital stock held by Los Angeles County in the Los Angeles and San Pedro Railroad and $377,000 in 7% twenty year bonds. In addition, the City granted the lands and rights of way, as also the San Pedro Railroad stock as demanded by the Southern Pacific Company.

There then ensued a three-cornered fight between those who favored the Southern Pacific Company, those who favored the Texas Pacific, and

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those who were opposed to the expenditure of public money as a railroad bonus.

At this time, a committee from Anaheim, representing the southeastern portion of the County, which would receive little benefit from the railroad if constructed as indicated above, entered the discussion and to satisfy them and gain their vote the Southern Pacific Company offered to build, within two years, a branch road from Los Angeles City to Anaheim. This branch was constructed and the first train ran from Los Angeles to Anaheim on January 14, 1875.

The contest between the two railroad propositions was quite bitter and at the election held on November 5, 1872, the Southern Pacific won by a large majority.

The total donations to the Southern Pacific Company, exclusive of land and rights of way, amounted to $602,000. A number of citizens raised by subscription $75,000 and purchased a tract of land, consisting of fifteen acres, which was presented to the Southern Pacific Company for a passenger and freight depot. This was the southern portion of what was the River Station grounds and at present is part of the freight yards along North Spring Street. There was also deeded as a gift to the company fifty acres of land lying east of the Los Angeles River, to be utilized as shop yards, but the railroad, failing to comply with the conditions of the grant, the land reverted to the grantor. It was then donated to the City for a park and is now known as Eastlake Park.

The Southern Pacific Company immediately started construction from the City north to meet the so-called Valley line, and four years later, on September 6, 1876, when the work of building through the mountains and the Newhall tunnel, 6966 feet in length, had been completed, the first transcontinental railroad was connected with the City of Los Angeles. The first train was operated through the tunnel in June, 1876.

A line along what is now Alhambra Avenue was started in 1873-4, and by April, 1877, it had reached the Colorado River at Yuma. This line was continued to El Paso and completed in 1881. At El Paso it made connections with other eastern roads. Trains over this route began operation in 1883.

In ordinances and resolutions contained in the Revised Charter April 1, 1876, we find the following:

> "September 6, 1872, Southern Pacific Railroad Company granted right of way for tracks along Alameda Street. City reserves the right to cross same with new streets or pass under the railroad tracks such canals, ditches, etc., as it may desire.
>
> "September 6, 1872, Southern Pacific Railroad Company is granted right of way on Alameda Street, tracks to be located in center of street, residue of street to be used for vehicles, etc., crossings to be kept in repair.
>
> "July 26, 1873, Southern Pacific Railroad Company is granted right of way over San Fernando and Mission and Alameda Streets."

After the completion of the Southern Pacific Company's line through from San Francisco, the Company took over, as per agreement, the prop-

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erties of the Los Angeles and San Pedro Railroad Company, and, having made connections with their track on Alameda Street, operated trains to and from San Pedro. In the first year or two the Southern Pacific Company built repair shops near the newly acquired station of the Los Angeles and San Pedro Railroad, where, until the other shops were constructed at the present location, all the locomotive work was done.

In 1873 the branch line from Los Angeles to Anaheim was started as per agreement made at the time the City and County donated rights of way, land and money to the Southern Pacific Company. The construction of this line consumed practically two years, and the first passenger train from the City of Los Angeles to Anaheim was run on January 14, 1875.

In July, 1877, the holdings of the Los Angeles and Independence Railroad Company were purchased by the Southern Pacific Railroad Company. A few months later, after the City had granted a right of way over the Southern Pacific Railroad Company's land on September 27, 1877, the road was extended to First and Alameda, where connections were made with the Southern Pacific Company's main line and trains were run to the old station of the Los Angeles and San Pedro Railroad. A line was also constructed from Sixteenth and San Pedro to a connection with the Alameda Street line. Later, about 1892 or 1893, this line was removed and a connection made with the tracks at what is now Clement Junction.

After acquiring the Los Angeles and Independence Railroad, the Southern Pacific Company proceeded to remove the wharf at Santa Monica since it interfered with business at San Pedro, which threatened competition was in reality the cause of the purchase of the road.

The opening of the "Coast Line" by the Southern Pacific progressed very slowly. By 1887 the road was constructed to Santa Barbara, but not until 1901 was the road finally completed, and on March 31st of that year the first train passed over the entire length from San Francisco to Los Angeles.

After the Southern Pacific had built a connection from the so-called Santa Monica branch at Sixteenth and San Pedro to Alameda Street at about Fifteenth Street, that portion of the old Los Angeles and Independence Railroad from Sixteenth along San Pedro to Fifth and thence northeasterly to First and Alameda was removed. This was done in about 1889.

By the acquisition of the San Gabriel Valley Rapid Transit Company by the Southern Pacific Company in 1894, the latter company secured a right of way from approximately the station of Shorb, just east of Los Angeles, to Pasadena. The Southern Pacific Company immediately rebuilt the San Gabriel line and operated trains to and from Los Angeles to Pasadena.

Within the City of Los Angeles alone the Southern Pacific single track mileage is 75.07 miles of main line and 148.31 miles of other tracks.

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Atchison, Topeka and Santa Fe Railway Company

As a nucleus of the present Atchison, Topeka and Santa Fe Railway Company, a railroad was constructed in 1863 west from Kansas City practically along the old Santa Fe Trail. It was not until October, 1880, that a subsidiary organization of the Santa Fe made its appearance in California, when the California Southern Railroad Company was chartered.

The first actual construction began in January, 1881, when a line was constructed from San Diego Bay to Colton via Temecula. This line was placed in operation in 1882 and the following year was constructed to San Bernardino. That portion of this line running through the Temecula Canyon was washed out in the spring of 1884, and in order to reconstruct and also extend the road from San Bernardino to Barstow arrangements were made with the Santa Fe. In 1885 active construction of the extension from San Bernardino, its then terminal, to Barstow, was undertaken and completed on November 9, 1885, when the last spike was driven in Cajon Pass.

At Barstow connection was made with the Atlantic and Pacific road, then owned jointly by the Santa Fe and the St. Louis and San Francisco Railroad Company. Completion of this line, together with a traffic agreement with the Southern Pacific from Colton to Los Angeles, allowed the Santa Fe to inaugurate through train service from Kansas City to Los Angeles. We find that many historians state that this was the direct cause of the ensuing great development in California. The first Santa Fe train entered Los Angeles on November 29, 1885.

In 1886, through a subsidiary company, the Santa Fe started the construction of a railroad from Los Angeles to Santa Monica. This line was only partially built, its western terminus being between Inglewood and Bellona. In 1892 another company was organized and extended the line into Santa Monica. Part of this line was sold in 1892 to the Los Angeles Pacific Railroad Company, now merged into the present Pacific Electric Railway Company. In 1888 another line was constructed and connected with the Santa Monica road near Inglewood, extending to Redondo Beach. The present Santa Fe still maintains and operates this line from Los Angeles to Redondo Beach.

In order to have its own line into Los Angeles, the Santa Fe, in 1887, constructed a line west from San Bernardino to Lamanda Park, connecting there with the Los Angeles and San Gabriel Valley Railway Company. This company was taken over by the Santa Fe in 1887. This route constitutes the present Santa Fe line between San Bernardino and Los Angeles via Pasadena.

About this time, the Santa Fe, through a subsidiary company, the Riverside, Santa Ana and Los Angeles Railway Company, started the construction of a second line from San Bernardino to Los Angeles. This route ran in a westerly direction from San Bernardino through what is known as the Santa Ana Valley, and entered the City of Los Angeles from the

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south by crossing the Los Angeles River just south of Butte Street and paralleling the river on the west bank to First Street, where it connected with the tracks of the Los Angeles and San Gabriel Valley Railroad and where the La Grande station of the Santa Fe is now located.

In 1895 a few San Francisco merchants and capitalists organized a company and started the construction of a railroad from San Francisco Bay through the San Joaquin Valley. This road was built with the express purpose of competing with the line built by the Southern Pacific to Bakersfield. This line was purchased by the Santa Fe in 1900-1901. The road work was completed in 1900 and placed in operation as the Valley Division of the Coast lines of the Santa Fe.

The Atlantic and Pacific Railroad Company, which had built a road from Albuquerque, New Mexico, to Needles, California, and had acquired a lease on the Southern Pacific from Needles to Mojave, went into receivership in 1894. By 1897 the Santa Fe Company had purchased, at foreclosure sale, the properties of the Atlantic and Pacific Company and immediately began reconstruction. Through an exchange in 1911 of a branch line of the Santa Fe running from Nogales to Guaymas, Mexico, with the Southern Pacific, the Santa Fe became owner of the Southern Pacific line between Needles and Mojave, known as the Mojave Division, and at the same time entered into a new agreement with the Southern Pacific Company for joint use of the Southern Pacific Mojave-Bakersfield line over the Tehachapi Pass.

Practically all of the present Santa Fe main line mileage south of the Tehachapi was constructed during the years 1886 and 1887, aside from that of the California Southern, which ran from National City to Barstow. Since that time, however, the Santa Fe has been very active in the construction of service and industrial tracks in Los Angeles and other Southern California cities.

Within the City of Los Angeles alone, the Santa Fe single track mileage is now 14.27 miles of main line and 65.44 miles of other tracks.

Los Angeles and Salt Lake Railroad Company

This company, which at present operates a railroad from the City of Los Angeles to Salt Lake City, Utah, finished the last section of the road early in 1905, the first through train entering Los Angeles April 17, 1905.

This road had acquired the entire properties of the Los Angeles Terminal Railways Company, which had been incorporated in 1891, and which had as its nucleus the consolidation of the old Los Angeles & Glendale Railroad Company and the Los Angeles, Pasadena & Glendale Railroad Company.

These latter companies, as previously related, had constructed from Los Angeles to Glendale, a narrow gauge road, and from Los Angeles to Pasadena and Altadena a broad gauge road. As soon as the property of the Los Angeles & Glendale Railroad Company was acquired, the Terminal Company reconstructed that line as a broad gauge. These two branches are at present operated as branches of the present company.

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Soon after the incorporation of the Los Angeles Terminal Railway Company, application was made to the City for a concession of land to be devoted to yard uses and railroad terminal facilities. The City Council approved the application of the Terminal Company and granted them sixty (60) acres of land on the east side of Los Angeles River, being properly a right of way along the river bank through the city. In addition to this grant, the Company purchased some land within the city and along the east bank of the river at a cost of $60,000. Included in this purchase was 21 acres at First and Meyers Streets, which, with the land donated by the city, is at present occupied by the Salt Lake, where the Company's passenger station, yard, round house, and shops were constructed in 1891. Until the track was completed to the new station near First Street, the company used the old Los Angeles & Glendale Railroad Company's station at Downey Avenue. For some time after the trains began operating to the new station, the old depot was made a stop, but was finally abandoned. At that time trains to Pasadena were run almost hourly.

From First Street, or the new station, the Terminal Company continued building its road to Long Beach, being the first railroad to serve that city, and to East San Pedro, where the Company had acquired what was then called Rattlesnake Island (now known as Terminal Island), comprising approximately 2,000 acres. This branch line was 22 miles in length and connected directly with the Company's wharves and docks on the waterfront at East San Pedro. The value of these waterfront facilities was greatly increased after the United States Government undertook and improved the Los Angeles Harbor and constructed the breakwater.

In March, 1901, the San Pedro, Los Angeles and Salt Lake Railroad Company was incorporated and began the construction of a line from Salt Lake City to Los Angeles. Although such a line had been proposed and agitated many times, it was not until this company was organized that the work was finally carried to completion in 1905. The first passenger train from Salt Lake City via the Salt Lake Route arrived on April 17, 1905, and the road was opened for general railroad traffic May 1, 1905. On August 25, 1916, the San Pedro, Los Angeles and Salt Lake Railroad Company changed its name to the Los Angeles and Salt Lake Railroad Company, under which it is at present operating.

In 1905 and 1906, the Salt Lake constructed a track from a connection with the Southern Pacific Company's track on Alameda Street at Butte Street along the latter street across the Los Angeles River and easterly to the main line from Salt Lake City, a distance of about one and one-half miles. The following year a track was built along what is called "Santa Fe Alley." This is the alleyway one-half a block east of a parallel to Santa Fe Avenue from near Seventh Street to Thirty-seventh Street. Besides these two principal pieces of trackage, the company has constructed quite

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a number of spur and industry tracks to serve industries and handle freight and passenger business.

The present single-track mileage within the city limits of Los Angeles of this company amounts to approximately 17.85 miles of main line and 42.04 miles of other trackage.

San Gabriel Valley Rapid Transit Railway

Real estate possibilities were the cause of the promotion of the San Gabriel Valley Rapid Transit Railway, which was constructed from the City of Los Angeles eastward to Monrovia, with a branch line from near the present town of Alhambra to Pasadena. This was a narrow gauge road and was operated almost exclusively for passengers. The road entered the City of Los Angeles over a right of way practically the same as that used at present by the Pacific Electric for its Pasadena Short Line, except that it ran only as far as Anderson and Aliso Streets, on the east side of the Los Angeles River. Here the company constructed a small shed and platform, used as a passenger depot.

The San Gabriel Valley Rapid Transit Railway was leased by the Los Angeles Terminal Railway for the term of one year, beginning June 14, 1892. After the expiration of the lease, the San Gabriel Company operated the road during the following year, when it was sold to the Southern Pacific. That company immediately started the construction of a standard guage track on the right of way acquired from the San Gabriel Company as its Pasadena branch. The new branch connected with the company's main line at their present station of Shorb and is at present the Southern Pacific's only steam line into Pasadena. The other tracks of the San Gabriel Company were torn up and the remaining portions of the old right of way were later sold to the Pacific Electric, controlled, through stock ownership, by the Southern Pacific.

Los Angeles and Glendale Railroad Company

Shortly after the completion of the Santa Fe into Los Angeles and during the time of the so-called "boom," a railroad was promoted to run from Los Angeles to Glendale. This road was named the Los Angeles and Glendale Railroad and was constructed in 1887, as a narrow gauge line from near old Downey Avenue and the east side of the Los Angeles River to Glendale. At the terminus of the road near Downey Avenue, a frame building was constructed and served as a passenger station and ticket office. This company, about four years after completion of this line, was absorbed by the Los Angeles Terminal Railway Company, and the work of widening the roadbed and track was started immediately.

Los Angeles, Pasadena and Glendale Railroad Company

This company was organized, in 1890, for the purpose of constructing a railroad from Los Angeles to Pasadena. Being fostered by the same interests as the Los Angeles and Glendale Railroad Company, the road

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was constructed from the same terminus in the city, the Downey Avenue station to Pasadena and north to Altadena, a distance of about sixteen miles.

This company, with the Los Angeles and Glendale Railroad Company, was consolidated, in 1891, into the Los Angeles Terminal Company.

Los Angeles and Independence Railroad

Through the construction of a wharf at Santa Monica, in 1875, and the development of the city, it was thought Santa Monica would become part of Los Angeles and a great shipping point on the Pacific Coast. At about this time a supposedly great mining district in Inyo County, about 250 miles northeast of Los Angeles, was being developed and a few Los Angeles men decided to build a railroad from Santa Monica to this district. The company, known as the Los Angeles and Independence Railroad, was chartered January 4, 1875, and construction began immediately. By December, of the same year, the tracks had been laid as far as Los Angeles, a distance of approximately sixteen miles, and terminated at San Pedro and Fifth Streets. The line east from Los Angeles was never built.

For about two years this road did a thriving freight and passenger business and, to remove this competition, the Southern Pacific Company, on July 1, 1877, acquired and operated the road until 1880, when it was leased for operation to the Central Pacific Railroad Company for five years. After the purchase, the Southern Pacific Company, having established a terminus at Wilmington, transferred the freight business to that point and practicaliy dismantled the wharf at Santa Monica. In 1889 the Southern Pacific removed the tracks on San Pedro Street, from Fifth to Sixteenth Streets. A portion of the balance of this road is the present Sixteenth Street line of the Pacific Electric.

Passenger Stations in Los Angeles

The first railroad station to be constructed in the City of Los Angeles was built in 1869 by the Los Angeles and San Pedro Railroad Company. This structure, shown in Fig. 8 on page 78 of this report, was located on a lot fronting three hundred feet on Alameda Street and having a depth of one hundred and twenty feet, its situation being such that, after Commercial Street was extended to cross Alameda Street, the depot building occupied the southeast corner of the two streets. This station had very inadequate passenger facilities and was utilized principally for freight business. This depot was the city terminus of the first railroad in Los Angeles. Passenger trains between Los Angeles and San Pedro were at first scheduled for two round-trips a day. The freight train had no schedule, but was running according to business.

The second railroad depot in Los Angeles was built about 1876, by the Southern Pacific Company, on the west side of North Spring Street about opposite Sotello Street. In the following year the company built a com-

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bination building, part of which was used as a ticket office, the balance being devoted to hotel purposes. This building was located about a hundred yards south of the first station and was maintained for only a short time. The business of the Southern Pacific Company, after its completion to Los Angeles, increased very rapidly, and it was but a short time before the first small station and ticket office built was moved to the site of the present office building of the main freight house and a larger depot was constructed where the first had been located. This building contained considerably more space than the others, housing practically all offices of the company, and had adequate passenger facilities for that period. After the completion of this building, the so-called "Hotel" was torn down.

By the year 1876, the Southern Pacific Company had constructed its tracks as far south as the location of the Los Angeles and San Pedro Railroad Company's depot at Commercial and Alameda Streets and began using the latter company's station for both passenger and freight business. Even after the Southern Pacific Company had built the Arcade Depot, at Fifth Street and Central Avenue, and up to 1896, all trains stopped at the old Los Angeles and San Pedro depot and at River Station. After 1896, this old "San Pedro Depot" was considered a "flag stop."

The brick building situated on the northwest corner of Sotello and North Spring Streets was purchased by the Southern Pacific Company, in 1885, and given the name of River Station. Since its organization, the company has made two enlargements. The depot, as shown in Fig. 83 on page 241, was operated as the main passenger station in the City of Los Angeles up to the time the old Arcade Station was built, at Fifth Street and Central Avenue, in 1888. After that time all trains, both inbound and outbound, stopped at River Station, although, during the last few years and until 1915, the trains stopped for orders rather than for passengers. In 1895, the frame station, built opposite and across North Spring Street from River Station, was torn down and the main part of the building was rebuilt as a passenger station at Tustin, California.

For the purpose of furnishing adequate passenger facilities, the Southern Pacific Company, in 1888 or 1889, leased a small brick building, about 20 by 30 feet, on the east side of Alameda Street half way between First and Second Streets. This structure was used as a waiting room and ticket office for only a short time.

In acquiring the Los Angeles and Independence Railroad Company, the Southern Pacific Company also obtained possession of a second passenger station within the City of Los Angeles. This was the first station built by the former company and was located a little east of San Pedro Street, about half way between Fourth and Fifth Street, or about opposite Winston Street. This was practically nothing more than a platform and shed used only for passenger purposes. Although this building was maintained as a passenger depot for a comparatively short time after being taken

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over by the Southern Pacific Company, it remained in place until about four years ago (1915).

As previously stated, the Southern Pacific Company constructed a track, from the line of the old Los Angeles and Independence Railroad on San Pedro Street, connecting with its main line on Alameda Street near Fifteenth Street. After the completion of this new trackage, and in the year 1889, operation along San Pedro Street was eliminated and the old line, from Sixteenth Street to First and Alameda Streets, was removed and a new passenger station was built at Sixteenth Street and Central Avenue. This building was 18 feet by 40 feet and provided a ticket office, baggage and waiting room. Later, this building was removed to Glamis, on the Southern Pacific Company's line, where it is at present being used as a station. On the old line of the Los Angeles and Independence Railroad the Southern Pacific Company also maintained two other stations, one at Jefferson and Main Streets and the second at Vermont Avenue, known as University Station (built in 1888). The former was operated in a building leased by the company and a regular agent was turned over to the Pacific Electric Railway Company, after the latter began operating trains over this line.

In 1888 the Southern Pacific Company erected a frame building at the intersection of Main and Alameda Streets, where the Alhambra Avenue and Alameda Street lines connect and which is designated by that company as Naud Junction. This building was about 18 feet by 40 feet, and contained an open waiting room, a baggage room and ticket office. This building served as a passenger station for a number of years but was, in June, 1910, removed after the city complained of its occupying a portion of the public streets and declared it a menace and source of danger and accidents at this crossing.

When the site of the present Southern Pacific Company's passenger depot was donated to that company, it was part of the agreement that a passenger station should be erected. This station was to be a structure similar in all respects to the Arcade Depot previously built by the Southern Pacific Company at Sacramento. In 1888, the Southern Pacific Company, under this agreement, constructed the passenger station at Fifth Street and Central Avenue.

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FIG. 9. TRAIN SHED—OLD SOUTHERN PACIFIC ARCADE STATION

This station, known as the Arcade Station, was for about twenty-five years the main passenger depot of the Southern Pacific Company in Los Angeles and in addition to furnishing passenger facilities, contained practically all offices then maintained in the city.

After the plans for the two expositions held in California, in 1915, had been made, agitation for a union passenger station, or at least a new and respectable Southern Pacific station, commenced in Los Angeles. The old Arcade Depot, built of wood, was depreciating and, although it was considered a model station at the time of its construction, it lacked the facilities and appearance of a modern railroad station. In 1912, the Southern Pacific Company announced its plans for the construction of a new passenger station to be erected at Fifth Street and Central Avenue on the site of the old Arcade Depot, but with the main portion of the building fronting almost directly on Central Avenue.

The plans for the new depot, particularly the proposed construction of trackage across two of the principal streets of the city and also the arrangement for street car service, had been made without consultation with the city and, when announced, met with much opposition. After the plans had been shown to, and discussed with, the City Council and certain modifications made, an agreement was finally reached. The main contention of the city was the question of the right of the Southern Pacific to build on the stub end of Fifth Street and, also, the proposed scheme of construction of tracks in such a way as to make worse, rather than improve,

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the grade crossing conditions. An application was then filed, by the Southern Pacific, with the Railroad Commission, asking permission to abandon the old Arcade Depot and erect a new station. At the hearings held on this case, the opposition to the placing of additional tracks across Fourth and Sixth Streets was vigorously pressed and the Southern Pacific Company filed a stipulation that, if permitted to construct the new station, no objection based upon its construction, would ever be made to the abatement of grade crossings on Alameda Street by track elevation or depression. The present Southern Pacific passenger station, shown in Fig. 76 on page 234, built at a cost of $345,000 for the building and furnishings, was commenced March 28, 1914, and completed in 1915. The baggage room and ticket office was opened for business on May 2, 1915, and the official opening of the station was held on June 12th of the same year. This station and other passenger depots are discussed further in Chapter X of this report.

The first station, or depot, on the line of what is now the Santa Fe, was built about 1884, by the old Los Angeles and San Gabriel Valley Railroad Company at Downey Avenue, just west of the Los Angeles River. This depot was a small frame building and used almost exclusively for passenger business and accommodated travel between Los Angeles, Pasadena and Lamanda Park, the eastern terminus of this road. In 1887, a track was constructed, by another subsidiary company, connecting the most southerly point of the Los Angeles and San Gabriel Company's line at Alhambra Avenue and the River, and extending to First Street and Santa Fe Avenue. Also to this same point, where a considerable tract of land had been acquired, the Santa Fe had constructed a track along the west bank of the river from the south. Here, in 1887, was built a second depot, located on the east side of Santa Fe Avenue and about half way between First and Fourth Streets. This building was of wooden construction but contained much more space than the little old depot at Downey Avenue and, in addition to serving as a passenger station, it housed all the necessary offices.

In 1893, the Santa Fe built the brick building which, with several alterations and changes during subsequent years, at present serves that company as its Los Angeles passenger station. This is known as the Le Grande Station, shown in Fig. 84 on page 242, and located on the east side of Santa Fe Avenue just south of First Street.

When the Los Angeles and Glendale Railroad Company constructed its track connecting Glendale with the City of Los Angeles, the depot of this road was located on Downey Avenue on the east side of the Los Angeles River. This station, built in 1887, was of frame construction and served all purposes of a railroad station. This same depot building served as a passenger station for the Los Angeles, Pasadena and Glendale Railroad Company for travellers between Los Angeles and Pasadena. The city terminus of the San Gabriel road was on the east side of the Los Angeles

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River just north of Aliso Street and east of Anderson Street, and where the Pacific Electric at present maintains several team tracks. Here, the company built the small shed and platform which served the purpose of that company till 1894, when the Southern Pacific Company took over the property of the San Gabriel Company, when the tracks and old depot were removed.

After the Los Angeles Terminal Railway Company had been organized and secured its right of way along the east bank of the Los Angeles River, it constructed a passenger station at First Street, just east of the Los Angeles River. This structure is at present used for the same purpose by the Los Angeles and Salt Lake Railroad Company. Previous to the construction of this station, the business offices of the Los Angeles Terminal Railway Company were maintained in the Burdick Building but, upon completion of the depot, were moved to the new structure. It was not long after the new station was occupied that the old depot at Downey Avenue was abandoned.

In 1905, the Salt Lake erected an umbrella shed and platform at Seventh Street, on the east bank of the Los Angeles River. Only local trains operating between Los Angeles and San Pedro, stop at this point.

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FIG. 10. MAP OF RAIL ENTRANCES AND EXTENT OF FLAT LAND ALONG RIVER

No great change in the rail entrances is possible except at prohibitive cost. The shaded area represents rolling country and is largely residential. Observe that the principal streets are not parallel with the Los Angeles River, but that their general direction is toward Pasadena. Transportation and growth follow the lines of least resistance.

PRESENT CONDITIONS

Railroad Entrances

Fig. 10 shows the extent of the comparatively flat land adjacent to the Los Angeles River and suitable for railroad construction. From this drawing, it is evident that the main lines of the steam roads are obliged to enter the industrial and business district of the city from either the northeast or southeast.

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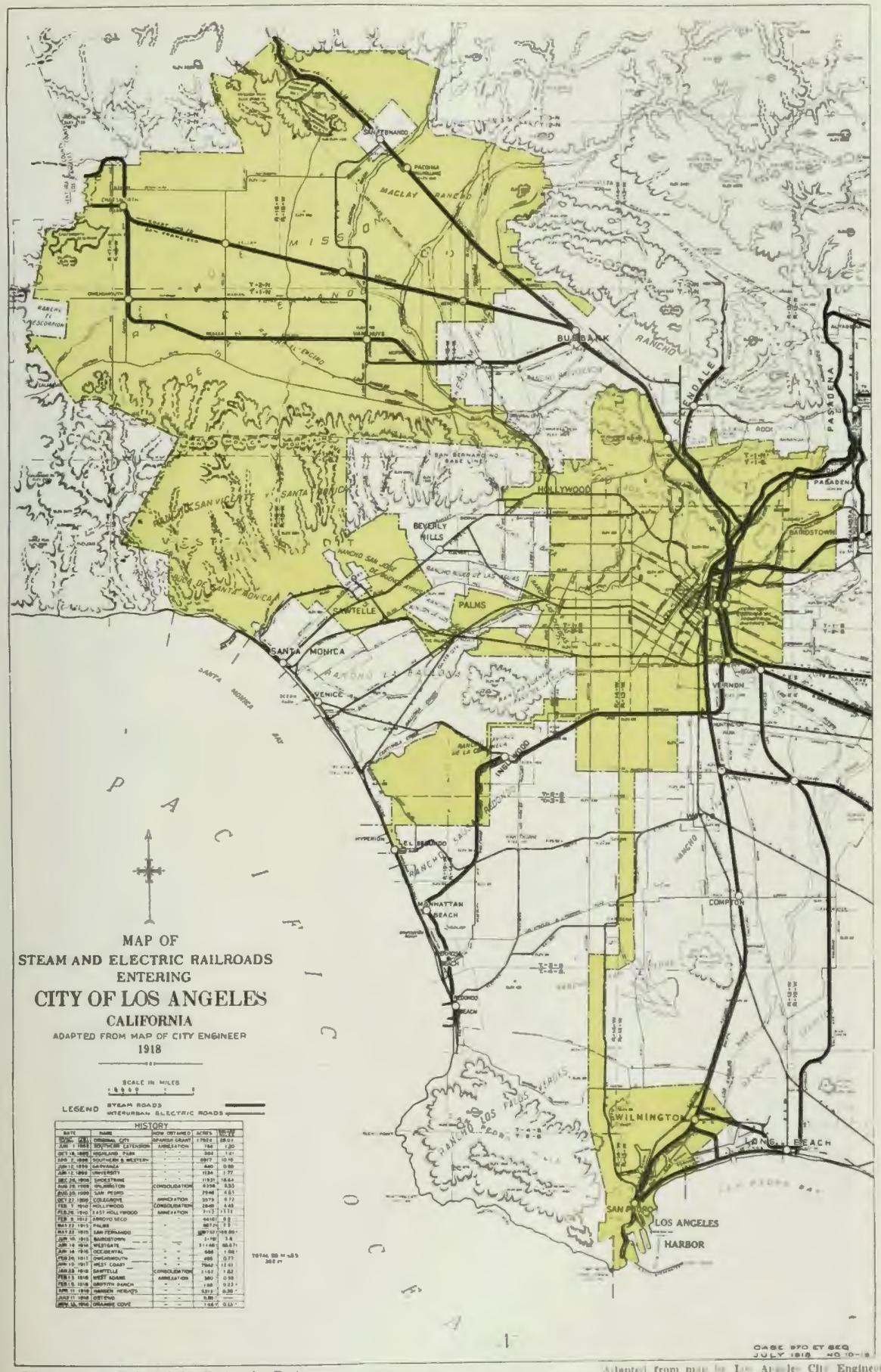

California Railroad Commission Engineering Dept

Adapted from map by Los Angeles City Engineer

FIG. 11. RAILROAD MAP OF LOS ANGELES DISTRICT

The steam roads enter the city from the north, northeast, and southeast. Notice how parallel they run to Pasadena, in the vicinity of Vernon, and to Los Angeles Harbor. Illustrating difficulties of grade crossing elimination

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Southern Pacific Routes

Fig. 11 shows the steam and electric roads in the Los Angeles district. The Coast and Valley Routes of the Southern Pacific connecting Los Angeles with San Francisco and the Sacramento and San Joaquin Valleys, unite at Burbank and follow the left bank of the Los Angeles River to the Arroyo Seco. Here, the line crosses to the right bank, branching out into the freight yards. The passenger line continues under North Broadway Bridge and, leaving the river, proceeds along Spring and Alameda Streets to the passenger station at Fifth Street. The "Sunset" or El Paso Route enters the city along Alhambra Avenue, joining the tracks on Alameda Street. Local lines run south from the station along Alameda Street, terminating, one at San Pedro, and the other at Santa Ana.

Santa Fe Routes

The main line of the Atchison, Topeka & Santa Fe Railway from the east, through Pasadena, follows the Arroyo Seco and reaches the west bank of the Los Angeles River just north of North Broadway Bridge. Passing under this bridge, it proceeds south partly adjacent to the river and then, at some distance away from it, to the Santa Fe station and yard between the river and Santa Fe Avenue and First and Fourth Streets. An alternative route from the east, used principally for freight, because of more favorable grades, from San Bernardino, through Riverside and Fullerton, enters the city from the southeast. The river is crossed near Butte Street and the line follows the west bank to the station. The line from San Diego joins this line at Fullerton. A local line runs to Redondo.

Salt Lake Routes

The main line of the Los Angeles and Salt Lake Railroad enters the city from the southeast, skirting the southerly high ground. It then proceeds up the east bank of the Los Angeles River to the Salt Lake station and yard adjacent to the river between First and Seventh Streets. One local line runs south to Long Beach and San Pedro; another, following the east bank of the river northerly from the station, passes under North Broadway Bridge and follows the Arroyo Seco to Pasadena. A branch of this line crosses the Arroyo Seco and terminates at Glendale.

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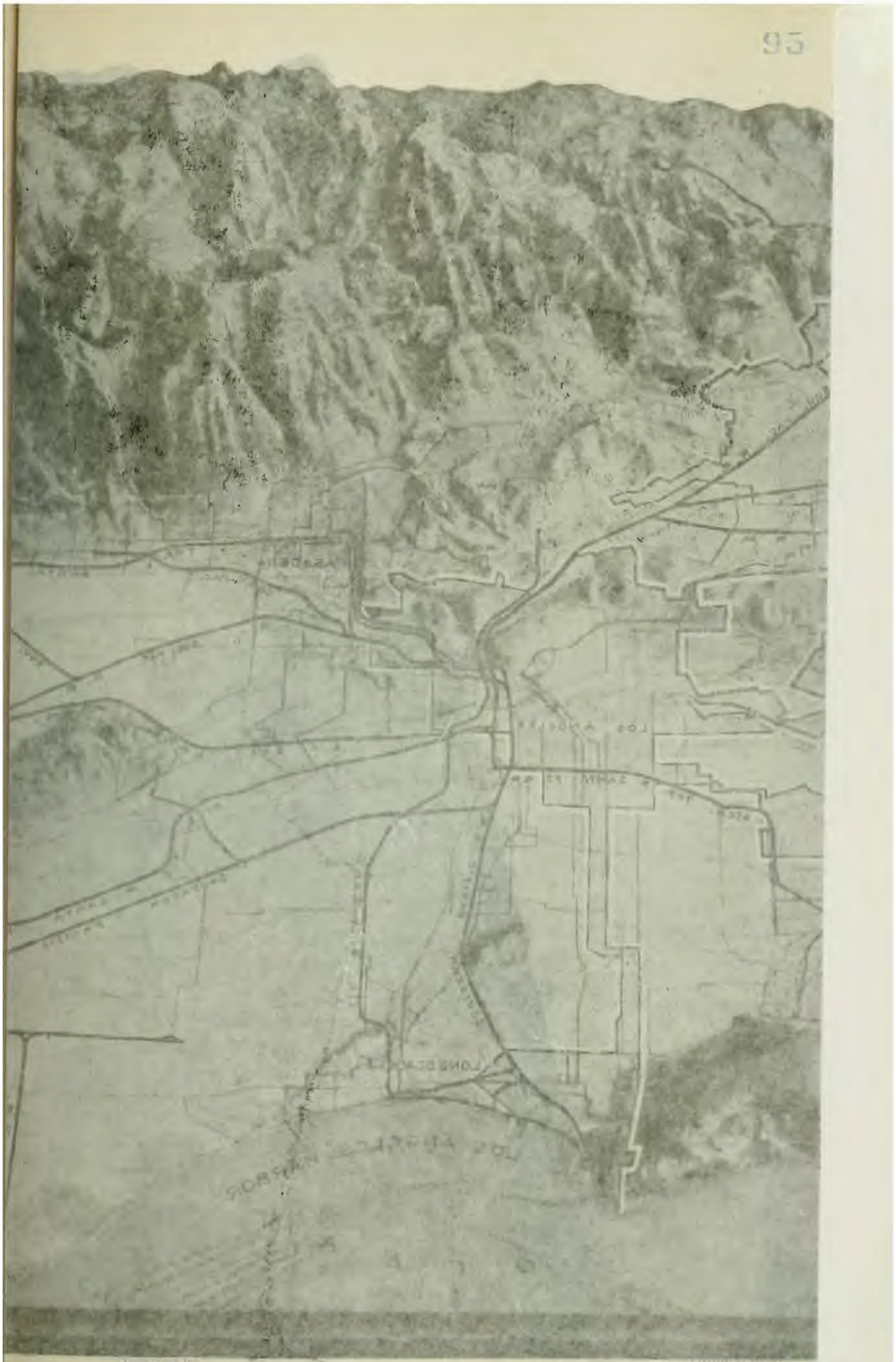

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FIG. 12. RELIEF MAP OF LOS ANGELES COUNTY

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Railroad Mileage in Los Angeles

The present equivalent single-track mileage of the railroads within the city limits of Los Angeles may be summarized as follows:

TRACK MILEAGE IN THE CITY OF LOS ANGELES

	Miles—Single Track		
Steam Roads	**Main Line**	**Other Tracks**	**All Tracks**
Southern Pacific	75.07	148.31	233.38
Santa Fe	14.27	65.44	79.71
Salt Lake	17.85	42.04	59.89
Total	107.19	255.79	362.98
Electric Roads			
Pacific Electric			
Owned	200.43	28.62	229.05
Leased from S. P.	14.62	9.43	24.05
Leased from City of Los Angeles	6.74	5.98	12.72
	221.79	44.03	265.82
Los Angeles Railway	318.95	17.56	336.51
Total	540.74	61.59	602.33
All Roads			
Grand Total	647.93	317.38	965.31

Valuation of Steam Railroad Property in Los Angeles

An appraisal of steam carrier properties definitely allocated within the wide boundaries of Los Angeles would be, in itself, a stupendous task. We will, however, attempt to make an estimate of the railroad investment.

In connection with the nation-wide valuation of carrier properties made by the Interstate Commerce Commission, both the companies and the Interstate Commerce Commission have made estimates of reproduction cost. The estimates are made up by sections, and it so happens that a combination of these sections on the three roads will cover about all carrier property in the industrial district. The total cost so estimated is, approximately, $40,000,000 for the operative properties, exclusive of rolling stock of the Southern Pacific, Santa Fe and Salt Lake. Pre-war unit costs of material and labor are used in the detail figures making up this total.

This figure of $40,000,000 is made up partly, of carrier estimates, partly of Interstate Commerce estimates and partly of our own estimate. The detail cannot be made public, as some of the underlying data was submitted confidentially, and all is tentative and subject to review and revision

Relation of the Business District to the Topography

The business and industrial district of Los Angeles lies in the broad valley of the Los Angeles River, between the bluffs called "Boyle Heights," along the east or left bank, and the ridge immediately west of Hill Street. The four main streets of Los Angeles—Main, Spring, Broadway and Hill—are parallel with this ridge from First Street to Sixth Street. North of First

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Street, as far as Sunset Boulevard, the high ground extends east as far as Main Street. Two tunnels have been built connecting Hill Street and Sunset Boulevard and there are traffic tunnels at Third Street and at Broadway. A new traffic tunnel is projected for Second Street. The center of the old town was at the Plaza, near the intersection of Main and Sunset Boulevard. From this point, Sunset Boulevard passes through a gap in the range of hills west of the river valley. From the Plaza, the streets radiate in all directions.

The present business center is at about Fifth and Spring Streets and the highest realty values are at Seventh Street and Broadway, the center of the shopping district. There has been a progressive movement of the business center southwestward. From Main Street, at the Plaza, it has followed the more level ground west of Hill Street to Seventh Street and now seems to be moving westerly, skirting the southerly end of the ridge west of Hill Street. This shifting of the business and shopping district is, however, by no means the result of topographical and other natural conditions alone; factors connected with real estate operations have had an equal or, perhaps, greater effect in determining the direction of the growth of the city.

Particular attention is called to the fact that the direction of the four main streets diverges more than 45° from the direction of the Los Angeles River, south of First Street. This results in the fact that the farther south the main streets are followed, the farther the location from the Los Angeles River and the natural channel of the steam railroads. Main Street, if it were continued straight, would be in line with the Arroyo Seco and would pass through Pasadena. The main travel is north and south. From First Street to Sixth Street, the cross streets are narrow, being only sixty feet wide. Seventh Street is the principal cross street of the city. West of Central Avenue and east of Los Angeles Street, the district is becoming less and less industrial. It has residential and small store occupancy. Alameda Street is the main artery of the industrial district and has replaced Los Angeles Street in this respect.

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CHAPTER IV.
OUTLINE

- Los Angeles Railway
  - Present Conditions
  - Rerouting
- Pacific Electric System and Rapid Transit Plans
  - Present Conditions
  - Recommendations in Arnold Report
  - Causes of Lack of Growth
  - The Ultimate Rapid Transit System
    - The First Subways
    - Subway West from Hill Street Station
      - Connection of Subway West of Hill Street with Main Street Station
    - Elevated Line Eastward from Main Street Station
    - Transportation Between Los Angeles and Pasadena
    - Legal Matters
    - Recommendations

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CHAPTER IV

ELECTRIC TRANSPORTATION

Of the two electric transportation systems operating within the geographical limits of this report, the Pacific Electric is by far the most important for the purposes of this investigation. The Los Angeles Railway operates principally within the city limits and is only slightly affected by our recommendations. For these reasons it will be considered first.

LOS ANGELES RAILWAY

The Los Angeles Railway is a narrow (3 ft. 6 in.) gauge street railway with approximately 390 miles of track and operating about 880 passenger cars. This road is strictly a passenger road and handles no freight. The railway operating revenue for 1918 was $6,577,638.52, and during that year 130,538,704 regular fare passengers were carried.

Present Conditions

An analysis of the local street railway system of Los Angeles is not within the scope of this report except as to the question of adequate street car service to the several sites proposed for a union station, or to the extent that the plans proposed will alter existing routes. It is obvious that, other things being equal, that site is most desirable which will serve the maximum number of people without a transfer, and that a location convenient to existing lines will not require the construction and maintenance of special or accommodation lines.

The Los Angeles Railway has put into effect the through route principle and universal transfers as applied to its own system but does not exchange transfers with the Pacific Electric Railway, although this would prove of advantage to the city.

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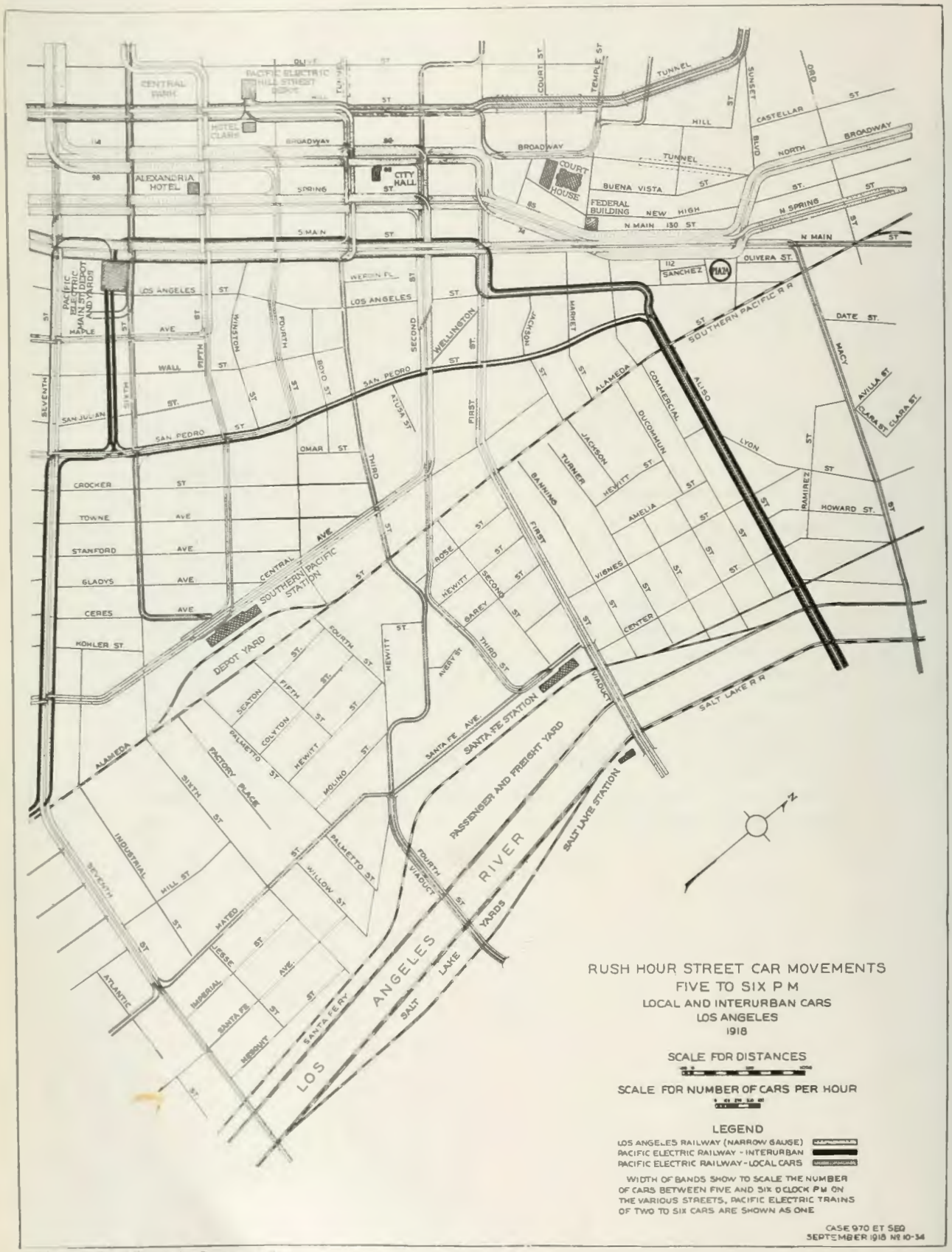

California Railroad Commission Engineering Dept

FIG. 13. STREET CAR FLOW IN BUSINESS DISTRICT DURING EVENING RUSH HOURS

The relative width of lines show the volume of street car traffic from five to six P. M. The numbers indicate the cars per hour. Notice that the main travel is north and south and that the limit of capacity is already reached at the North Main Street "throat" near the Plaza.

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Fig. 13 shows the local and interurban street car movements during the rush hour from 5:00 to 6:00 P. M. in the central district. It will be noted that here the main travel of Los Angeles is northeast and southwest, that is, lengthwise of the river valley. Attention is called to the large volume of traffic passing through the "throat" on North Main Street between Temple Street and Sunset Boulevard, and to the large amount which turns at Seventh Street and Broadway.

The use of a lesser headway than 30 seconds would result in such a low schedule speed as to be impracticable, so that 120 cars per hour per track is about the limit of capacity. The maximum number of cars of the Los Angeles Railway Company, per hour, operating on Hill, Broadway, Spring and Main Streets, is as follows:

NUMBER OF CARS IN RUSH HOUR LOS ANGELES RAILWAY

	Northbound	Southbound
Hill Street from Fifth to Seventh	34	36
Broadway, from Fourth to Seventh	98	114
Spring Street, from Fourth to Seventh	107	86
Main Street, from Fourth to Seventh	63	68
Main Street, from Temple to Sunset	112	131

It will be noted that the limit of 120 cars per hour is actually exceeded in one instance, and is nearly reached in three others. It is seen that the number of cars that can be operated upon the streets leading to the North Main Street throat is limited to the capacity of the throat itself.

Rerouting

In connection with plans for a union station at the Plaza, some rearrangement of the car lines is necessary, and it was thought best to extend the study to include a complete rearrangement of the lines at the north end of the business district.

In that part of the Arnold Report relating to local street railways, the following principles are enumerated, and, as far as possible, these have been applied in our plans for rerouting:

1. The chief problem is to do away with present and future congestion in the business district.
2. More cross-town and circuit lines should be built.
3. Congestion is due to loops and curves. A car passing around a cruve takes fully 50 per cent more time to clear the crossing than a car passing directly across the street at right angles.
4. The threading of the cars from the traffic of one street into that of another makes impracticable the running of cars in pairs at high speed at street intersections.
5. The interurban cars should be eliminated from Main Street. (This has since been accomplished to a large extent by rerouting to San Pedro Street.)

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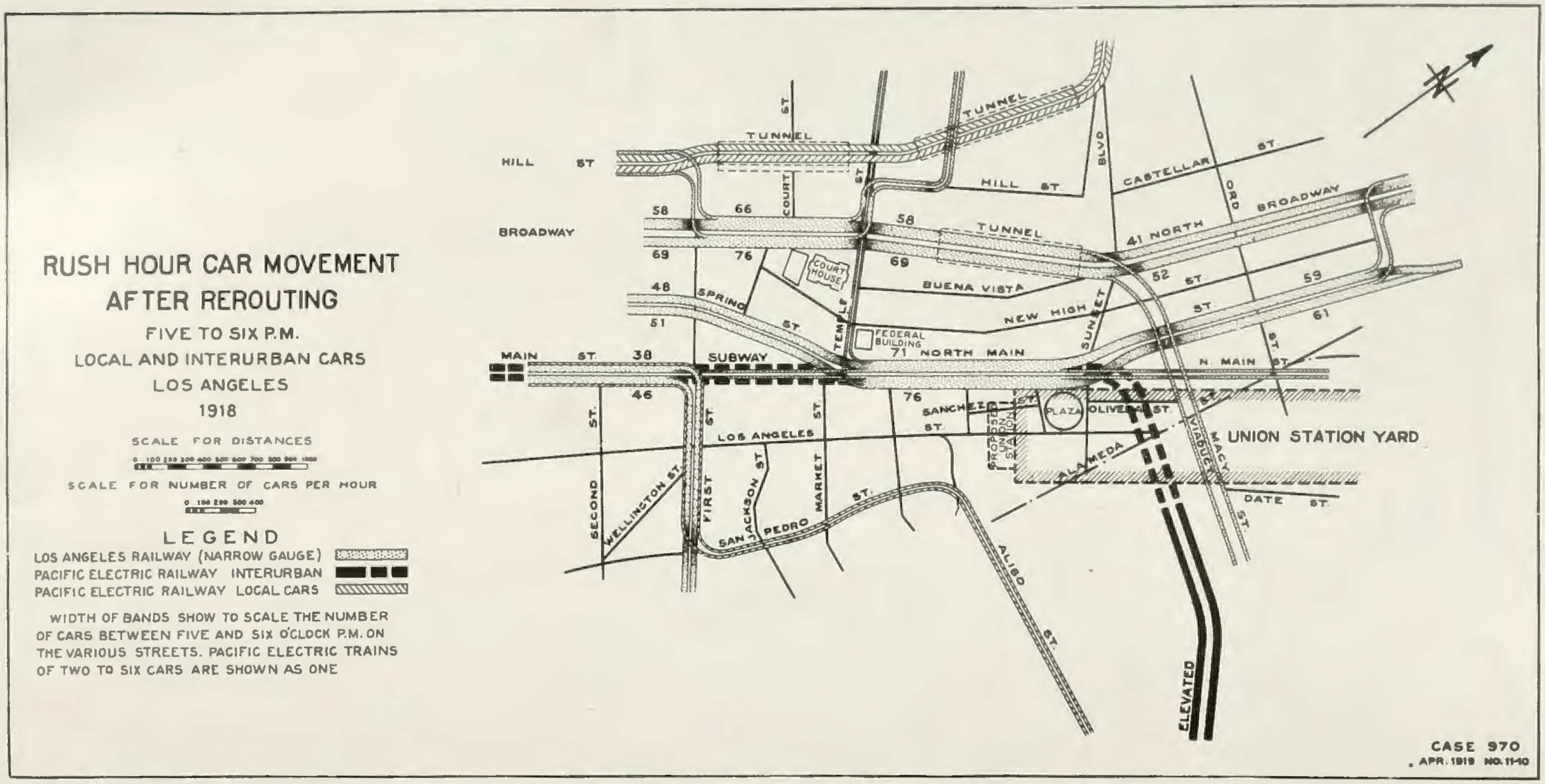

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FIG. 14. STREET CAR FLOW IN VICINITY OF PLAZA AFTER REROUTING

Notice the direct routing of the Broadway line and the reduction of turns on First Street. The value of an additional outlet to the north is apparent.

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Fig. 14 has been drawn out to show the advantage of building a street car subway below the present Broadway tunnel. This subway, a cross-section of which is shown on Fig 129, can be built at considerably less ost than a separate bore and will not disarrange the normal position of street traffic. It will provide two outlets—Broadway and Main Street—to the north instead of one—Main Street—and will permit direct routing of the Broadway cars to North Broadway. As Spring Street and Broadway combine with Main Street at Ninth Street and near Tenth Street respectively, it is relatively immaterial which streets are used between First and Tenth Streets. The volume of traffic on each will be maintained as at present. Incidentally it may be noted that additional outlets to the south will be as necessary as at the north end of the city. One will be provided by the proposed extension of Broadway. By this arrangement, it is seen that practically all of the curves at First Street will be eliminated.

Upon the completion of the projected Second Street tunnel, it is desirable that the car line operated through it should continue as a cross-town line.

Fig. 15 shows the individual routes now in use. Nearly one-half of the cars of the Grand Avenue line now operating on Broadway, return to North Broadway after passing through the North Main Street throat.

Fig. 16 shows how routes have been rearranged so as to give the least car interference and to provide as direct routing as possible. The number of cars at present operating through the throat at North Main Street have been divided equally between the two throats of the new plan. However, additional cars have been added to the North Main Street throat from Temple Street. The reduction in the number of cars on North Main Street makes it possible to extend the Temple Street line to a stub terminal on North Spring Street, thus giving the district served by that line and the Sunset Boulevard district of the Pacific Electric more direct service to the union station, if located at the Plaza. A part of the Grand Avenue line will continue to operate on North Spring and North Main Streets, as at present. The Griffith and Griffin line will remain unchanged, thus giving service from the station to North Broadway. All other lines at present operating on North Broadway will be rerouted to Broadway and through the proposed sub-tunnel. The diversion to Spring Street of those Grand Avenue cars which now operate on North Spring and North Main Street will reduce the number of cars turning at Seventh Street and Broadway.

The maximum number of Los Angeles Railway cars north of Second Street and the number resulting from the suggested changes in route are as follows:

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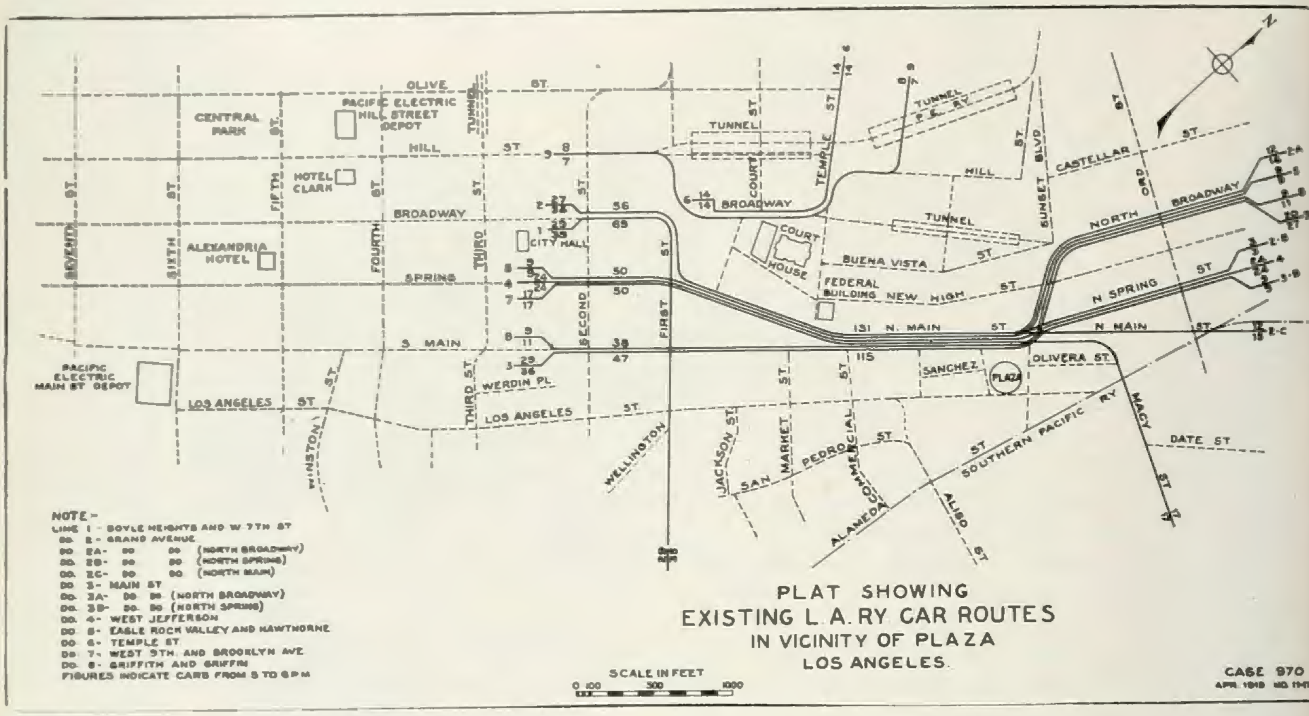

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FIG. 15. EXISTING STREET CAR ROUTES—PLAZA DISTRICT

Notice the turns at First Street and at Sunset Boulevard and how three of the main streets have but one outlet to the north.

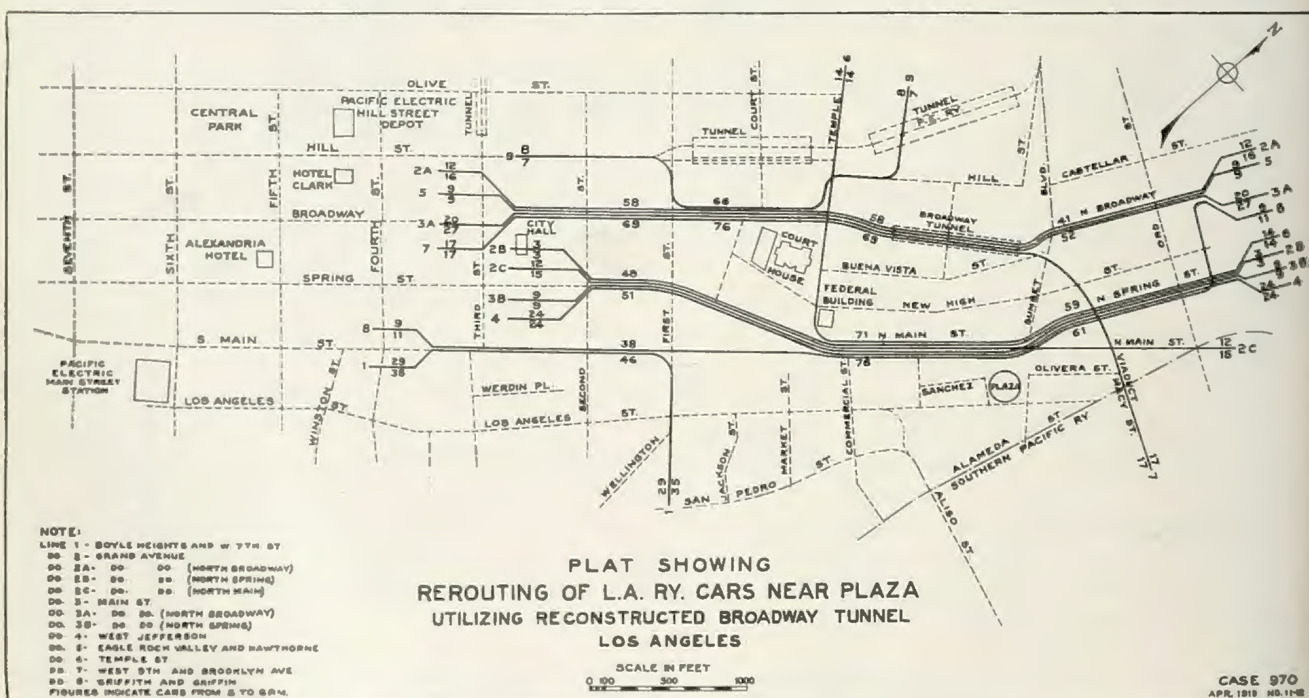

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FIG. 16. REROUTING OF STREET CARS—PLAZA DISTRICT

By means of a subway below the existing Broadway tunnel it will be possible to rearrange the routes as shown. Notice that the change in volume of traffic on Broadway, Spring and Main Streets, south of First Street, is slight, but that the routes have been simplified. The car interference has been greatly reduced by providing the additional "throat."

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PRESENT AND PROPOSED NUMBER OF LOS ANGELES RAILWAY CARS IN BROADWAY, SPRING AND MAIN STREETS NORTH OF SECOND ST.

	Broadway			Spring			Main		
	North	South	Total	North	South	Total	North	South	Total
Present ...	56	69	125	50	50	100	38	47	85
Proposed .	58	69	127	48	51	99	38	46	84

SUGGESTED ROUTES NORTH FOR LOS ANGELES RAILWAY LINES ON BROADWAY, SPRING AND MAIN STREETS

Mark on Plans	Line	No. of Cars Northbound	No. of Cars Southbound	Present Route	New Route
1	Boyle Heights and West Seventh St.	29	35	Broadway to First St.	Main St. to First St.
2A	Grand Avenue and North Broadway..	12	16	Broadway to First, to Spring, to Main, to Sunset, to North Broadway	Broadway via Subway to North Broadway
2B	Grand Avenue and North Spring St..	3	3	Broadway to First, to Spring, to Main, to Sunset, to North Spring terminus	Spring to Main, to Sunset, to North Spring terminus
2C	Grand Avenue and North Main St...	12	15	Broadway to First, to Spring, to North Main	Spring to North Main
3A	Main Street and North Broadway..	20	27	Main to Sunset, to North Broadway	Broadway via subway to North Broadway
3B	Main Street and North Spring St..	9	9	Main to Sunset, to North Spring terminus	Spring to Main, to Sunset, to North Spring terminus
4	West Jefferson St...	24	24	Spring to Main, to Sunset, to North Spring terminus	Unchanged
5	Eagle Rock Valley & Hawthorne	9	9	Spring to Main, to Sunset, to North Broadway	Broadway via subway to North Broadway
6	Temple Street	14	14	Temple to Broadway terminus	Temple to Main, to Sunset, to North Spring terminus
7	West Ninth and Brooklyn	17	17	Spring to Main, to Macy	Broadway via tunnel to Macy St. viaduct
8	Griffith and Griffin..	9	11	Main to Sunset, to North Broadway	Main to Sunset, to North Spring, to Alpine, to North Broadway

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It should be noted that the entire Los Angeles Railway operating and financial situation is at this time the subject of a special study by this department. Matters are there considered that have no immediate bearing on the subject of this report, but the recommendations here made will be kept in mind when suggestions are made in the other report on the Los Angeles Railway problem.

PACIFIC ELECTRIC SYSTEM AND RAPID TRANSIT PLANS

The Pacific Electric Railway is a standard gauge electric road giving both interurban and local passenger service and with a considerable freight traffic. This road operates about 1100 miles of track and is one of the largest—if not the largest—electric railway systems in the world from the point of view of mileage. The company serves a population of about one million in over fifty incorporated cities and towns located in four different counties.

In 1918, about 68,000,000 passengers were carried, divided about equally between interurban and local or five-cent fare passengers. The passenger revenue was $7,500,000, and the freight revenue $2,350,000, or roughly one-third of the passenger revenue. The figures are especially noteworthy as indicating the importance of the freight business, both as a source of revenue and as an unusually prominent part of an electric road's business.

The Southern Pacific Company controls, through stock ownership, the Pacific Electric Railway and directs its policies. The Pacific Electric has a considerable interest in the Los Angeles Union Terminal Company, as discussed in another chapter.

Present Conditions

The City of Los Angeles is fortunate in having this system of electric interurban lines which has contributed so largely to its growth and development. A due appreciation of the importance of the Pacific Electric system may be had when it is stated that in 1917 this road carried 65,000,000 passengers, while in the same year the steam roads of the entire State of California carried only 39,000,000.

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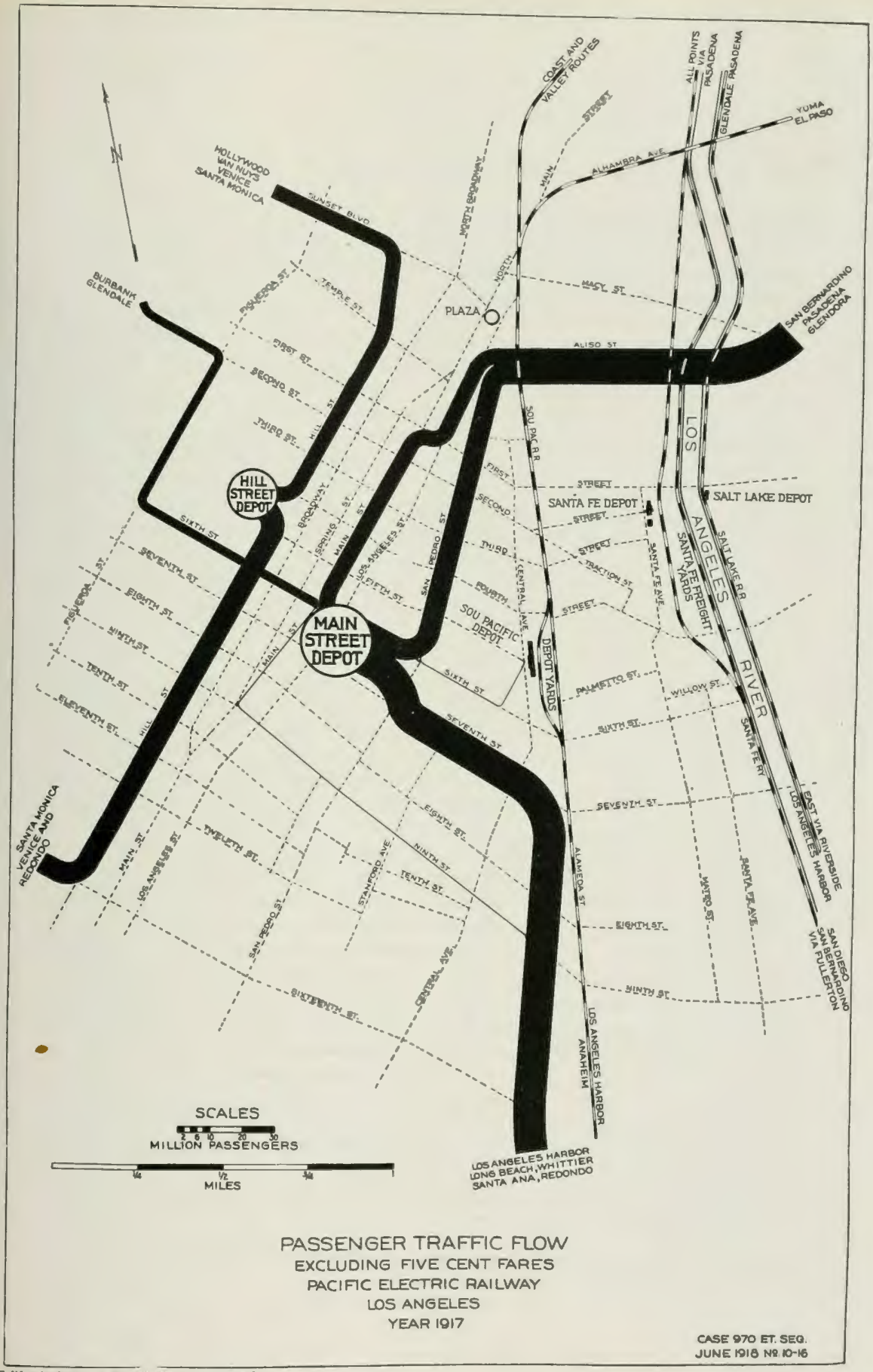

California Railroad Commission Engineering Dept.

FIG. 17. PASSENGER TRAFFIC FLOW DIAGRAM

The width of band represents the number of interurban passengers carried by the Pacific Electric Railway in both directions during the year 1917. Observe that the combined traffic from the Hill Street station is greater than that of the Long Beach Line, showing the practicability of through routing.

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Recommendations in Arnold Report

Mr. Arnold, in his report* to the City of Los Angeles on the local transportation problem, after drawing attention to the broad constructive policy followed by the management producing the network of electric lines which bind together the different communities of the district, draws attention to the important part played by the Pacific Electric in the prosperity of this entire section and advises that the continual growth of this interurban system should not be hampered.

He stated that there were promising possibilities in the use of an elevated structure or subway running from the rear of the present terminal building back to and across the river, with a connection in the vicinity of the Southern Pacific Arcade Depot to the four tracks of the southern division running to Long Beach, San Pedro, Santa Ana, etc., and, after crossing the river, the extension should connect with the northern division which serves Pasadena, Alhambra and other foothill communities. This is virtually the same plan as submitted by the Pacific Electric in conjunction with the Southern Pacific-Salt Lake plan for the use of the former's depot as a joint station for the two roads.

Mr. Arnold further advises that the Pacific Electric should be encouraged to work out plans to provide for this permanent way and, at the same time, to make public the plans for the tunnel connection running northwest from the Hill Street station more or less parallel to Sixth Street. He recommends the connection of the Hill Street station with the Main Street station by means of a subway which, however, should be carefully located so as not to interfere with a longitudinal subway which may eventually be located on Broadway, Spring or Main Streets. In this connection it should be noted that Mr. Arnold counseled very generous franchise grants by the City as at least a partial contribution on the City's part compared with the amount of money to be expended by the Pacific Electric. The franchise question is considered under a special heading in this report.

It is important to note that it was decided that ultimately there would be need of an elongated sub-surface terminal along the axis of natural growth with a number of stations for the distribution and collection of passengers. This plan, in general, is one whereby interurban passengers may be deposited or picked up at several points four or five blocks apart in the business district and is, we believe, superior in every respect to the one-station plan whereby passengers leave or board the trains at one point only. The advantage of the former plan over the latter is the fact that the people receive better service, since the station is nearer the point of destination whether it be a place of business, a hotel or more or less definite points in the retail or wholesale district. Congestion under such a plan is reduced if not entirely avoided.

*Preliminary Report upon the Transportation Problem in Los Angeles, by Bion J. Arnold, October, 1911.

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If the present cars or lines of the Pacific Electric doing only local business remain on the surface of the streets—and this is the proper place for them—we believe something could be accomplished in the way of through routing for interurban cars. This must go hand in hand with the discard of the terminal idea and the adoption of the "district stop" plan. It so happens that the number of passengers now carried along Main and San Pedro Streets when added to those now carried along Hill Street north of the Hill Street station approximately equals the number of passengers carried out Seventh Street plus those on Hill Street south of the Hill Street station. If the number of passengers is approximately the same, the number of cars should also be about the same, and this is the factor which has probably the greatest effect on the possibility of through routing.

Whether or not this possibility of through routing and the evident approximate balance of the traffic were known to Mr. Arnold, we are not advised, but in any event he has stated as follows:

> "Such a terminal (referring to an elongated sub-surface terminal) would collect the electric interurban lines of the west and northwest at a point near the original Plaza and the interurban lines entering the City from the south, the west and the southwest at a center located in the vicinity of Pico and Main Streets."

Causes of Lack of Growth

Normal development of the system has to some extent been retarded by several causes:

1. The increase in interference due to grade crossings.
2. The increase in interference due to street traffic.
3. The increase in automobile competition, public and private.
4. The reduction in capital expenditures and the increase in expenses on account of the war.

The subject of grade crossing elimination is taken up in Part II.

Interference due to street traffic can, of course, be prevented only by taking the high speed lines off the streets. The local, or street, cars can continue to use the present routes.

With improvement in equipment and speed **and especially in distribution,** the electric lines should not suffer in the future to the same extent as they have in the past from automobile competition.

The Ultimate Rapid Transit System

In the development of any plan, the ultimate system must be kept in mind (if it can be foreseen) in order that it will not be necessary to undo later on what is first attempted. The solution of the interurban terminal should come before the transcontinental. In other words, a union passenger terminal should be located to secure the most efficient distribution of passengers.

In the development of a rapid transit system, certain general principles must be applied.

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1. For rapid transit lines serving the commuter district, an elongated terminal is better than a stub terminal because passengers are not left at a single point but are distributed. Such a terminal would be especially valuable in Los Angeles because of the long and comparatively narrow business district. For hauls beyond the commuter zone, stub terminals are preferable but they should be adjacent to the distributing lines.

2. Through routes are better than loops for rapid transit lines because they require less time and less car mileage.

3. There should be at least four entrances or trunk lines to the city for the interurban system. The ones opposite should be connected so as to secure through routing.

4. There should be a transfer point where these lines cross.

5. The subway should be for interurban lines only. The subway stations are three or four blocks apart and at these points transfers can be issued to the local cars, which will continue to operate as at present.

6. From an operating standpoint, a balanced traffic is desirable.

7. Coach yards will be required for the long haul lines.

8. There should be no grade crossings in subways, not even at junctions.

9. A universal transfer system is desirable if it tends to bring about:
   a—elimination of duplicate service,
   b—better distribution of passengers,
   c—uniform fares,
   d—a better satisfied public.

10. Elevated lines are undesirable in commercial, hotel, retail and residence sections on account of noise, unsightliness, extra climb, detours and the shutting off of light. These factors are of less importance in an industrial or wholesale district.

11. The justification for a subway is sometimes based upon the density of population along the route, but there are other factors which are of importance:
    a. Greater safety.
    b. Greater speed.
    c. Greater regularity.
    d. Greater capacity.

12. Open cut construction is less objectionable than elevated through residential districts, is less expensive than subways and simplifies the separation of grades.

13. In developing plans for a rapid transit system, the possibility of ultimate electrification of the steam lines should be kept in mind. Some of the advantages of such electrification are conservation of fuel oil, reduction of noise and smoke and fire risk, and superior tractive qualities.

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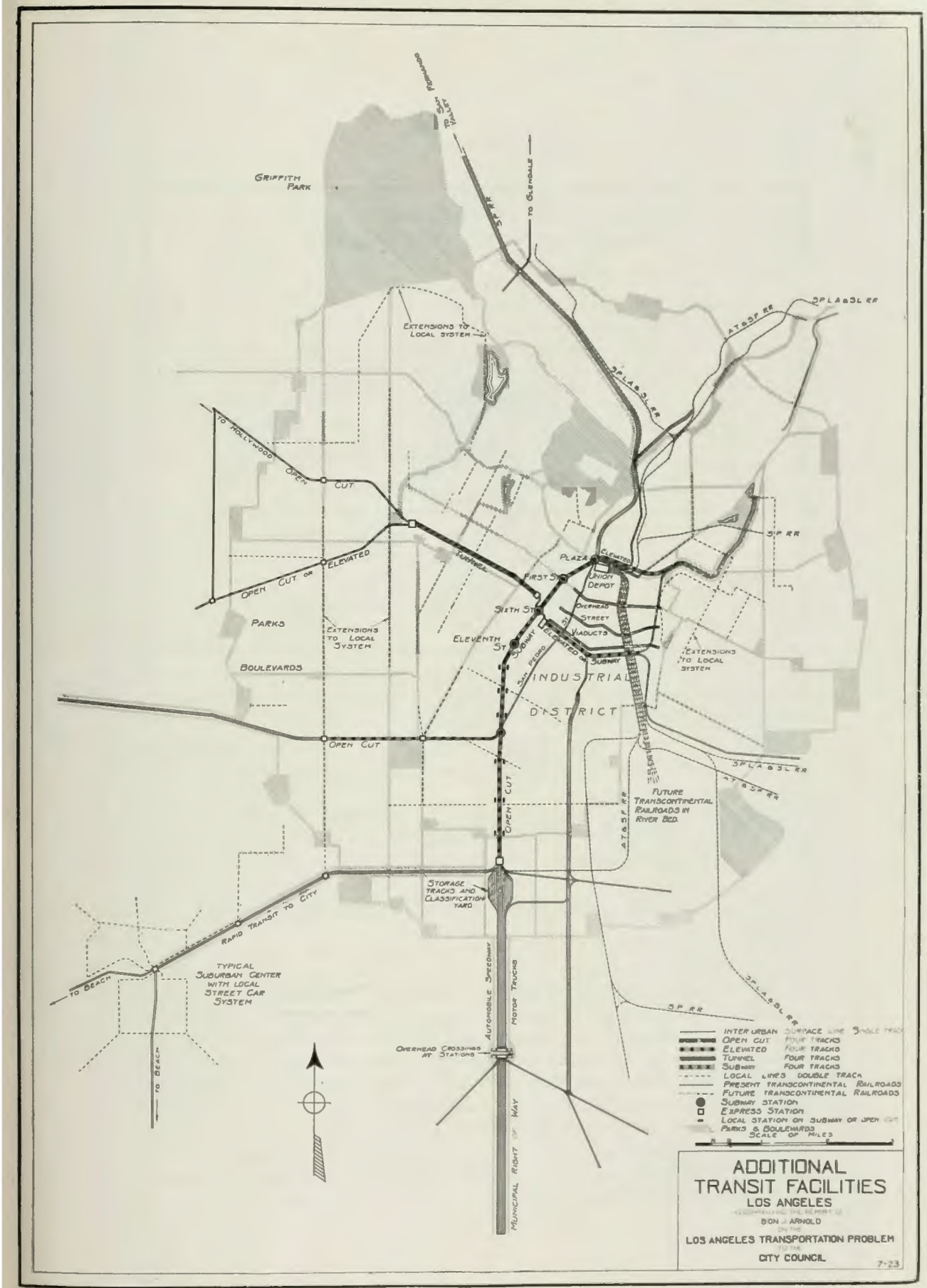

From Bion J. Arnold Report of 1911

FIG. 18. ADDITIONAL TRANSIT FACILITIES

This plan is reproduced from the Arnold report issued in 1911 and is the most important exhibit in it. It shows Mr. Arnold's suggestions for improvement in transportation and should be compared with Fig. 134.

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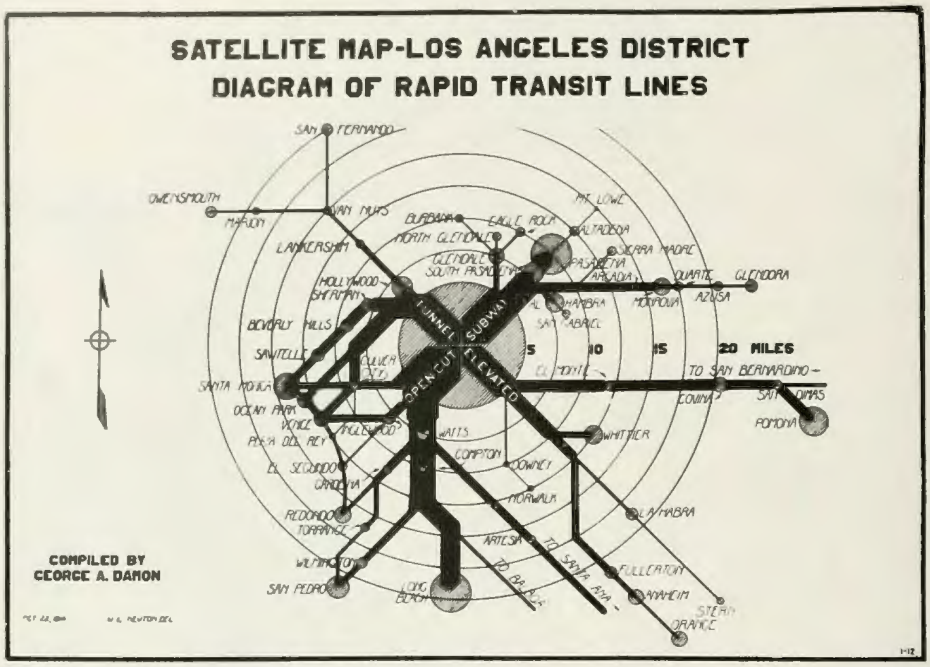

Exhibit No. 2 City Planning Association

FIG. 19. DIAGRAM OF RAPID TRANSIT LINES

This map was presented to show how all subcenters in the Metropolitan area would be reached from two main truck lines with a common transfer point at their intersection. Through routes with a balanced traffic are advocated

Fig. 18, in which these principles are applied, is reproduced from the Arnold report and is unquestionably the most important exhibit in that work. It merits careful study.

Fig. 19 is Exhibit No. 2 of the City Planning Association. It is diagrammatic and shows how the through route principle can be applied in Los Angeles. The four central rays, as interpreted and applied by us, are the Tunnel west of Hill Street, the Elevated east of Main Street, the Subway in Main Street, and the Open Cut in the territory south of the business center.

The First Subways

Main, Spring, Broadway and Hill Streets are the principal north and south streets in the present business district of Los Angeles. This district is a long and comparatively narrow belt of territory. Therefore, the first subway should be in one of these streets. The principal travel is along them. On the other hand, if the first subway were to be built on the other axis, there would be a tendency for the business district to elongate in that direction and there would be a consequent depreciation of values along the present axis of growth.

For the first subway, Main Street has several advantages over the streets parallel with it:

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1. It bisects a broader belt of business territory than would streets west of it, and the distance to Hill Street would be no greater than half the distance between stations.
2. Main Street is a through street.
3. There are fewer underground obstructions in Main Street than in either Spring Street or Broadway.
4. The present Pacific Electric terminal is at Sixth and Main Streets.

Ultimately, the Pacific Electric northern division lines might be continued south on Main Street to connect possibly with the Santa Monica Short Line and the Redondo line electrified. As a first step, however, it might be sufficient to terminate the northern lines at Sixth and Main Streets with a temporary loop.

Subway West from Hill Street Station

"Several years ago a tunnel enterprise was proposed to take care of the traffic to Santa Monica and vicinity, but the financial depression caused a delay in pushing the undertaking. The growth of the Hollywood district, the opening up of the San Fernando Valley and the extension of the electric lines into this district through the Cahuenga Pass would seem to be additional reasons for the construction of this double track outlet through the hills west of the business center." (Quoted from B. J. Arnold report.)

As noted before, the "Hill Street subway" was undertaken some five or six years before the date of the Arnold report. This is a local name for a proposed subway or tunnel west from the Pacific Electric Hill Street Station to Vermont Avenue and thence by elevated or surface railway to Vineyard. The sum of $1,590,000, exclusive of taxes, engineering and interest, was expended toward the acquisition of right of way and subsurface rights for this line.

This project is desirable as it will remove the express service from the streets and will result in a saving of both time and distance. Furthermore, it will pave the way for a connection with the station at Sixth and Main Streets.

Connection of Subway West of Hill Street with Main Street Station

This connection is very desirable, in order to secure through-routing. The stub terminals can still be used for the long haul business. It would be impracticable and undesirable to extend the present elevated west of its present terminus, but it could still be used for the stub terminal. As the north and south subway in Main Street would be built first, it would be nearest to the curface, while the east and west subway would be in Sixth Street and would pass beneath the other. There would be an underground transfer station at Sixth and Main Streets where the subway lines would cross.

The subway could continue west to Pershing Square and continue diagonally across the square to Olive Street, where it could enter the hill far enough below private property to entail nominal damages only, and

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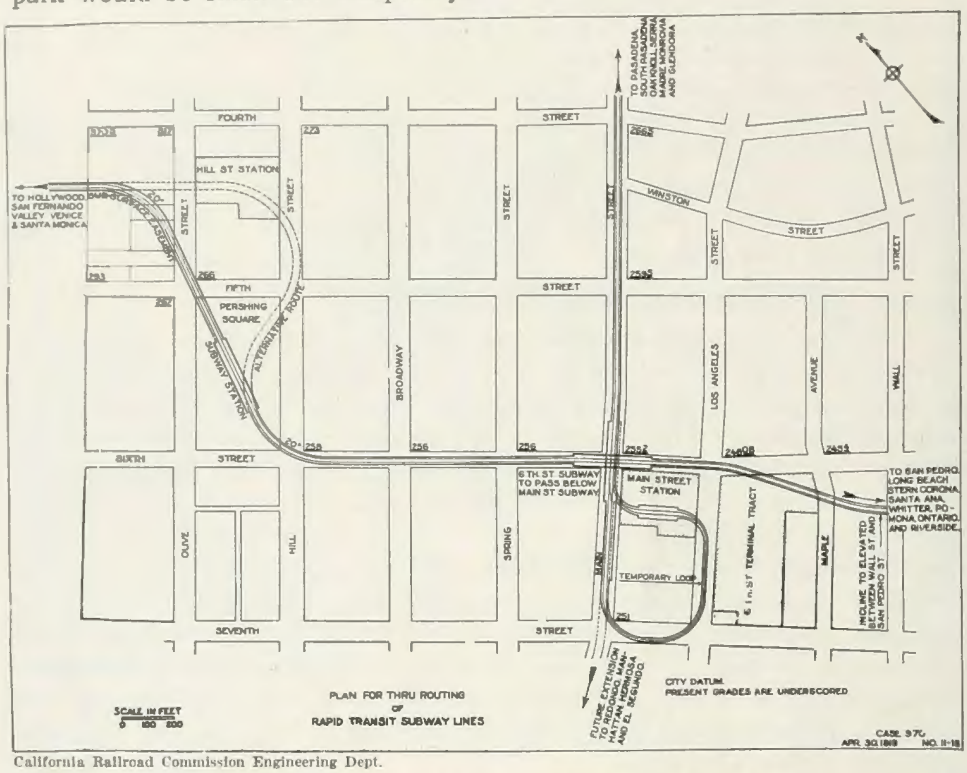
could join the proposed right of way west of the Hill Street station. The station would be used for the stub terminal business. The damage to the park would be small and temporary.



California Railroad Commission Engineering Dept.

FIG. 20. STUDY SHOWING RAPID TRANSIT SUBWAY ROUTES

The Main Street and Hill Street stations can be combined and through routing obtained by a subway beneath Pershing Square. Temporarily the Main Street line can terminate at the Sixth Street station using the "Loop."

Fig. 20 has been drawn to show the practicability of the alignment and grades. One of the advantages of the plan is that it would not necessitate the acquisition of expensive central property.

Eastward from Main Street station it will be possible to connect the subway with an elevated by means of an incline from under Wall Street up over San Pedro Street. It will be necessary to close San Julian Street and to regrade Wall Street between Sixth and Seventh treets. The resulting damage to property will doubtless be less than the extra cost of extending the subway east to Alameda Street—the first point where the transition to elevated could be made without closing streets. The grade of the incline would be 5 per cent, but this rate is equalled for short inclines in the Boston subways.

The possibility for a balanced traffic for through routes, or the use of "lap" system (in which cars run through the business district before turning back) is indicated on Fig. 17, page 107.

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Elevated Line Eastward from Main Street Station

The present Pacific Electric plan in the City of Los Angeles is the "one-station plan." The construction of an elevated roadway easterly from the present Main Street station connecting with the southbound tracks of its southern division and the tracks of its easterly division leading to Pasadena, Alhambra, San Bernardino, etc., is a further development of this plan.

Unfortunately, the construction of this elevated roadway would possibly, and probably, interfere with the development of a plan whereby interurban trains would be run north through the business district with stops approximately four blocks apart.

The northern and eastern divisions would furnish much better distribution by entering the business district at the north. The matter of distribution is of less moment for the long haul lines than for the lines serving the commuter district, but it is to the interest of the merchants of Los Angeles that the commuting radius be increased to the fullest extent. One hour is considered about the limit of commuting. Although the elevated route across the river would cost less than the route utilizing a subway in Main Street, the distance would be eight-tenths of a mile longer, and hence it would shorten the commuting radius by that distance.

The construction of the elevated would probably fill the need for rapid transit to such an extent as to delay the construction of the north and south subway.

Transportation between Los Angeles and Pasadena

Outside the City of Los Angeles the electric interurban traffic question affects this report particularly in relation to **rapid transit between Los Angeles and Pasadena**. A movement has recently assumed large proportions in the City of Pasadena looking towards the early development of a better rapid transit system between that City and Los Angeles. A municipal railway between the two cities was proposed by the Pasadena City Commission Years ago a bicycle pathway between Los Angeles and Pasadena was proposed, and a considerable portion of a private right of way was acquired. $5,000 was paid for an option on this right of way and an ordinance was passed calling for an election in Pasadena for the issuance of bonds to acquire all of the necessary right of way. An appraisal of all of the necessary right of way for the entire line with certain portions of the route in alternative shows an estimated cost of $700,000. Detailed estimates and surveys were not, as far as we know, ever made. But among the plans considered by the City Commission was one under which the City would provide the right of way and roadway complete with tracks and ready for operation and lease this property to an operating company under conditions somewhat similar to the contracts in effect on the later New York subway and elevated lines. During the period of the war and while the Capital

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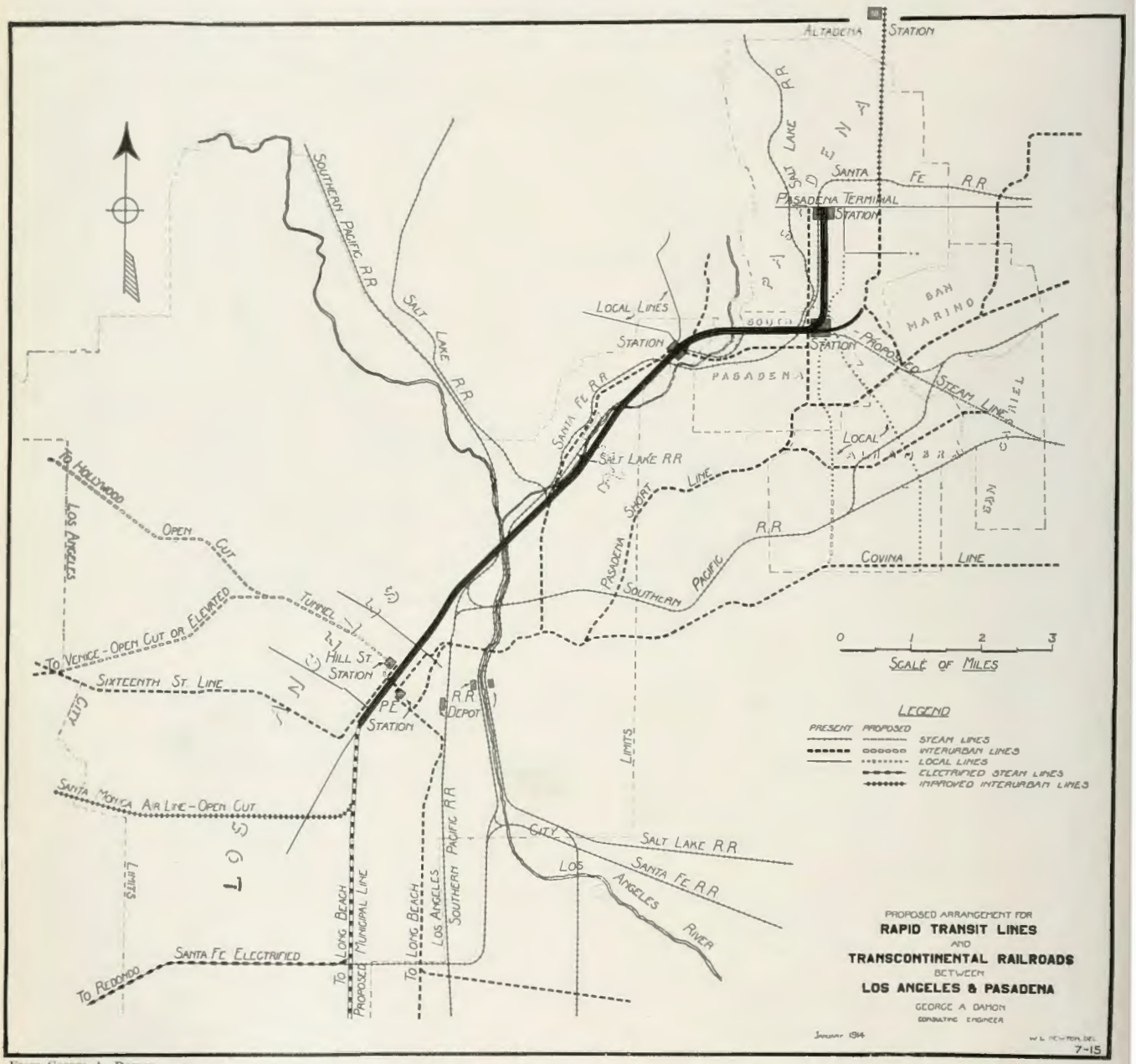

From George A. Damon

FIG. 21. PROPOSED RAPID TRANSIT LINE TO PASADENA

This is one of the plans for a direct route between Pasadena and Los Angeles by way of the Arroyo Seco. It is about one mile shorter than the Pasadena short line. We have recommended that the proposed right of way of the Santa Fe be used jointly for the steam and electric roads, (Chapter IX).

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Issues Committee looked with disfavor on any capital expenditures not absolutely necessary, this project was not advanced.

It was not necessary, in this report, to pass on the question of the necessity and desirability of the development of new electric interurban transportation facilities between Los Angeles and Pasadena along the lines suggested for the "Municipal Railway." But it is certain, in our opinion, that the very heavy expenditures for the new rights of way are unreasonable from every point of view if there can be made available existing rights of way giving the same results as far as rapid transit is in question. Such rights of way are now available. The project of the Municipal Railway, if it is revived, should be combined with the question of the elimination of grade crossings on the Santa Fe and the Salt Lake lines and the construction should be such that all tracks for both steam and electric lines are on one right of way and that the roadbed is of sufficient width.

There are at present four lines of railroad between Los Angeles and Pasadena:

1. The Santa Fe, over which no local trains are operated.
2. The Salt Lake, over which, at present, during the period of Federal control four trains are operated daily.
3. The Pasadena shortline of the Pacific Electric, over which ninety trains are operated daily, and
4. The Pasadena Avenue line of the Pacific Electric, over which local service is given.

We believe that the people of Los Angeles and Pasadena will best be served by one high-speed electric line with possibly four tracks (local cars on outside tracks; express trains in inner tracks). Express trains should be through trains and should not make more than, say, one stop between Los Angeles and Pasadena. This line should follow a shorter route than the present shortline on the Pasadena Avenue line and it should be altogether free from grade crossings. It should be constructed along the drainage of the Arroyo Seco since this line furnishes the most direct route over which it is feasible to build an economical road. Then, if it becomes necessary to maintain service between Pasadena and Los Angeles on the steam lines of the Salt Lake and the Santa Fe, even if the steam passenger trains are through trains, these two roads should occupy the same right of way as the electric lines, and there would then result a six-track line. The proposed re-location of the Santa Fe, which will be discussed hereafter (Chapter IX) will provide the possibility for such a right of way.

Legal Matters

It is stated in the charter that "no franchise for an elevated structure or subway shall be granted in or along any street or way in a longitudinal direction." It is not clear that the City could lease its own subways to an operating company as is done in New York. It would seem that the charter restrictions are rather severe in that they will tend to prevent or delay the building of adequate rapid transit terminal facilities and thus retard the

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natural growth of the City. For this reason, it is recommended that these restrictions should be modified by a charter amendment.

Recommendations

We recommend that the Los Angeles Railway cars be re-routed to avoid car congestion near the site of the Plaza terminal by the construction of a sub-tunnel under the present Broadway tunnel and the re-routing as suggested above in detail. This recommendation is made with the provision that it will be in harmony and correspond with more far-reaching recommendations that will be proposed in the recommendations in Los Angeles Railway Application (Appl. 4238) decision by the Commission.

With reference to the Pacific Electric, we recommend the construction of a subway from the present Pacific Electric station at Sixth and Main Streets northerly along Main Street to, and under, the Plaza union station, changing to an elevated railway along Ramirez Street and meeting the present line at the Aliso Street Bridge. From here, this line would continue as an elevated railway to Brooklyn where the present tracks would be met. We also recommend that the Pacific Electric continue the present elevated structure at the rear of its Main Street station, elevating the Long Beach line to Fourteenth Street. This elevated railway should be so designed that later connection can be made with a subway in Sixth Street. The transit from elevated to subway is to be made from San Pedro to Wall Street.

Further development of the electric interurban rapid transit in the more distant future should follow, generally, the lines laid down in the Arnold report and in this chapter.

Further recommendations for the Pacific Electric Railway in connection with rapid transit and the unification of railways between Los Angeles and Pasadena and the elimination of grade crossings in this district will be found in Chapter IX.

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PART II—THE ELIMINATION OF GRADE CROSSINGS

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CHAPTER V.

OUTLINE

Scope of Inquiry
Complaints

District in Which Grade Crossing Elimination Is To Be Considered

Plans Proposed for Grade Crossing Elimination

Necessity and Advisability of Elimination

Street Traffic in General

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CHAPTER V

GRADE CROSSING ELIMINATION IN GENERAL

SCOPE OF INQUIRY

Before taking up in detail the various plans presented for the amelioration of the grade crossing situation, it appears advisable to review the formal complaints to the Commission, which led to this investigation, and give consideration to the district in which special studies are necessary.

Complaints of Applicants

In Decision No. 3805, decided October 21, 1916, the Commission reviewed in brief the complaints in these consolidated Cases, Nos. 970, 971, 972, 974, 980, 981 and 983.

Referring to this decision, it will be noted that in Case 970 the Commission is asked:

> "....to order relief by reclaiming Alameda Street and other streets, by the improvement and abolition of grade crossings, by the installing of a union terminal and by reorganization of the traffic situation, so that, as far as possible, the operation of the lines of the defendants across the streets of the City of Los Angeles may be eliminated, locating said terminal station in as accessible a location as possible to the main lines of street and interurban electric railroads."

The defendants in this case were the Southern Pacific, the Santa Fe and the Salt Lake; the Pacific Electric was not included.

The complaint itself is general, but in Exhibits "A" and "B" we find specific mention of certain crossings. Exhibit "A" is a report to the Viaduct Committee of the City Council under date of May 12, 1916, by Messrs. Homer Hamlin, F. D. Howell and Samuel Storrow. Exhibit "B" is another report to the Executive Committee of the Municipal League of Los Angeles dated April 7, 1916, and is signed by Samuel Storrow. In Exhibit "A" (incorporated in this report on page 125), "the district" in which it is a "vital necessity to separate the grades of the railroads from those of the streets" is described as "adjacent to the Los Angeles River and extending from North Broadway, south to the south city limits." The streets within this district crossing the Los Angeles River or otherwise involved, are given as follows:

Main Street	First Street
Alhambra Road	Fourth Street
Macy Street	Seventh Street
Aliso Street	Ninth Street

Of these eight, the following six are considered as "necessary arteries for through traffic to be treated for the immediate separation of grades":

Main Street	Fourth Street
Macy Street	Seventh Street
First Street	Ninth Street

Exhibit "B" recommends a much broader course of action: This report, like Exhibit "A", does not mention a union terminal and concerns

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itself only with the elimination of grade crossings, except that the treatment suggested involves, to some extent, the relocation of certain tracks.

The recommendations in Exhibit "B" are these:

(a) All grade crossings now used by passenger trains in regular service must be eliminated.

(b) All grade crossings used by through freight trains (in distinction from freight cars being run on to a warehouse spur track) must be eliminated.

(c) The use of all grade crossings which are permitted to remain must be regulated and made as safe as possible.

(d) The requirement is a comprehensive design which can be available for continuous development so as to cover the grade crossings now to be improved and so as to be continued along similar lines for the improvement of grade crossings hereafter to be improved.

(e) The most important crossings calling for immediate improvement are those of Alameda Street, Macy Street, Aliso Street, Seventh Street and Ninth Street; all crossing the Santa Fe tracks, the river and the Salt Lake tracks.

(f) The right of the Southern Pacific to use Alameda Street must be withdrawn excepting insofar as it may prove necessary to use an Alameda Street track for delivering freight cars to adjacent spur tracks.

(g) It is advised that the Southern Pacific and the Santa Fe occupy an adjacent system of tracks on the west bank of the river bed and that the cars of through freight which are not to be opened and which are for delivery to consignees in Los Angeles, be handled in a system of freight yards outside the city limits.

(h) The trackage on the east and west banks of the Los Angeles River used for through freight or passenger trains shall be lowered from eight to ten feet below the present grade, and the streets crossing these tracks shall be built up to an increased grade until, reaching the railroad right of way, they enter a viaduct crossing the Southern Pacific, the Santa Fe, the River and the Salt Lake, and again reach an embankment at the east side of the right of way of the Salt Lake.

(i) The cost of readjusting the railroad grades and rights of way shall be borne by the railroads, and the cost of the remainder of the structures and the damages shall be borne, one-half to one-third by the railroads and the remainder by the City and County, or by an assessment area extending over as much frontage as possible.

In Case 971, the complainant does not mention any crossings specifically. The complaint is similar, in substance, to Case 970, with the exception that the petition for elimination of crossings is accompanied by a petition for a reorganization of railroad traffic. It is asked that as far as possible, the railroads of the defendants along or across the streets be eliminated to the extent that switching facilities would not be impaired.

The complaint in Case 972 is, in effect, similar to that in Case 971.

In Case 974, the City of Pasadena asks the Commission to rescind its order made in Case 938, which order provided for the construction of an interlocking plant at the crossing of the Santa Fe, the Salt Lake and the Pacific Electric Railway at Aliso Street and adjacent to the Los Angeles River. In addition, the City of Pasadena complains in particular of the

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crossings of the Pacific Electric Railway and Mission Road (or Huntington Drive).

In Case 980, the City of Alhambra makes complaint almost identical with the complaint in Case 974.

In Case 981, also, the City of San Gabriel makes complaint almost the same as that in Case 974.

In Case 983, the City of South Pasadena also makes a complaint nearly identical with that in Case 974.

DISTRICT IN WHICH GRADE CROSSING ELIMINATION IS TO BE CONSIDERED

It will be noted, therefore, that with the exception of the crossings of Mission Road and the Pacific Electric, all of the crossings referred to lie within the so-called Los Angeles railroad and industrial district. This investigation is confined, then, for reasons given heretofore, to the grade crossings within this district, which, roughly, is bounded on the north by North Broadway, on the south by the south city limits near Twenty-fifth Street, on the east by a line east of and adjacent to the east bank of the Los Angeles River, and on the west by a line west of and adjacent to Alameda Street.

In addition, the grade crossings between Los Angeles and Pasadena have also been studied.

PLANS PROPOSED FOR GRADE CROSSING ELIMINATION

There have, in general, been three remedies proposed for the amelioration of the present grade crossing condition of the steam railroad tracks: two remedies for crossings adjacent to the Los Angeles River and one for Alameda Street.

This subject was touched upon in the "Preliminary Report upon the Transportation of Los Angeles" by Bion J. Arnold, October, 1911. In this report it is stated that there are three kinds of grade crossings that are desirable to eliminate. Of these three kinds, those of the high-speed interurban electric trains are deemed the most dangerous; those of steam freight main lines and switching tracks, the most inconvenient; and transcontinental passenger traffic at grade, the least justifiable. The remedy proposed was, in brief, the construction of long viaducts carrying the streets over not only the Santa Fe and the Salt Lake tracks on both sides of the river, but also across a large portion of the industrial district as well. It was suggested that the first viaduct of this character be built on Fourth Street, commencing at Main Street, crossing the municipal railroad tracks on San Pedro Street, going over the present Southern Pacific tracks on and contiguous to Alameda Street, and connecting with the present viaduct over the Santa Fe yards. The existing viaduct crosses the river and is built over the Salt Lake railroad yards. Under this plan it was proposed to collect and deliver goods from the second story of buildings, thus increasing present facilities for

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handling the business of industries now located along the viaduct. Adding the advantage of switching carload freight to and from buildings on the lower or present street level, the double-decking of the street was considered a decided advantage which would add to, rather than detract from, the value of all industrial property.

Then, if the Fourth Street viaduct proved its usefulness, the First Street viaduct could be continued in a similar manner. Another connection between the business center and the east part of the city could be provided for by a similar viaduct on Sixth Street, from Main Street to Boyle Avenue.

It appears that Mr. Arnold's idea was to standardize the elimination of grade crossings along the river by carrying the streets over the tracks. In connection with such grade separation, the double-decking of Los Angeles Street, running north and south, parallel to the main line railroad track, was also advocated.

Under date of June 17, 1915, the Board of Public Utilities of the City of Los Angeles published a report of its Chief Engineer, Mr. F. D. Howell, on grade crossing elimination, transportation, congestion, and viaducts across the industrial district. This report advocated the construction of the following viaducts:

Street	From	To
North Main Street.	Clover Street.	Sunset Boulevard.
Macy Street.	Mission Road.	North Main Street.
First Street.	Boyle Avenue.	Near San Pedro Street.
Fourth Street.	Boyle Avenue.	Crocker Street.
Seventh Street.	Near Boyle Avenue.	Near Central Avenue.
Ninth Street.	Soto Street.	McGarry Street.

The cost, including three 100-foot spans across the river, where needed; the removal of the Los Angeles Railway tracks and the replacing of the same on viaducts; the widening of the streets for approaches; engineering; advertising; and 10 per cent additional for contingencies, was estimated at $4,260,000, or an average of $120 per foot of viaduct.

It is evident that this plan, in its general aspects, is similar to the Arnold plan.

In his testimony before the Commission, Mr. Howell stated that at the time this report was written, he had in mind the advantages of maintaining the tracks on Alameda Street. If Alameda Street tracks are to be maintained and grade crossings eliminated, a viaduct must be built to go over all territory between the river and Main Street. When the public realized what this meant, "storm was raised against any viaducts of such great length." Following the agitation for the removal of tracks on Alameda Street, a so-called "short viaduct" plan was then presented, this term being used in contra-distinction to the "long viaduct" plans above mentioned.

The City Council of Los Angeles then appointed a Viaduct and Grade Crossing Committee. This Committee on May 3, 1916, addressed Mr. Homer Hamlin, City Engineer, Mr. F. D. Howell, Chief Engineer, Board of Public

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Utilities, and Mr. Samuel Storrow, Consulting Engineer, Municipal League of the City of Los Angeles, as follows:

"At the meeting of the Viaduct Committee held at 2:00 P. M., this date, a Committee of Engineers, consisting of Messrs. Homer Hamlin, City Engineer, F. D. Howell, Chief Engineer, Board of Public Utilities, and Samuel Storrow, Consulting Engineer, representing the Municipal League, was appointed to report back to the Viaduct Committee at 2:00 P. M., Monday, May 8, 1916, giving their recommendations after considering the methods heretofore submitted to said Viaduct Committee as to the proper method for separation of grades within the City of Los Angeles and the names of the streets which should be considered in said separation.

Their reply was attached as Exhibit "A" to the Complaint in Case 970, and is here quoted in full:

"Los Angeles, Cal., May 13, 1916.

"To the Viaduct Committee of the City Council, Los Angeles, California.

"Gentlemen:

"The Committee of Engineers appointed by your Honorable Body on Wednesday, May 3, 1916, to report on the practicability of the several methods of eliminating grade crosisngs heretofore submitted, begs to report to you herewith, as follows:

"The District in which it is vitally necessary to separate the grades of the railroads from those of the streets is that adjacent to the Los Angeles River, and extending from North Broadway south to the south city limits.

"The Streets within the above district crossing the Los Angeles River, or susceptible of crossings, and calling for immediate study, are as follow:

Main Street, Macy Street, First Street, Seventh Street, Alhambra Road, Aliso Street, Fourth Street, Ninth Street.

"Of these, we are of the opinion that those requiring to be considered as necessary arteries for through traffic to be treated for the immediate separation of grades, are:

"Main Street, Macy Street, First Street, Fourth Street, Seventh Street, Ninth Street.

"Alhambra Road has no highway bridge across the River at present, and is occupied prnicipally by the tracks of the Southern Pacific Sunset Route as well as tracks to the shops. It is close enough to Main Street so that Main Street can act as a main artery, and there is no present necessity of considering Alhambra Road.

"Aliso Street is so close to Macy Street at its eastern terminus that Macy Street can care for all the through traffic now present in this territory. The future development of the Aliso Street crossing should, and can, be on the design proposed for Macy Street.

"The question of the separation of the grades of the Pacific Electric Railway tracks crossing the Salt Lake and the Santa Fe railroads at the river is not one of immediate necessity because the Santa Fe, the Salt Lake and the Pacific Electric Railways have entered into a contract to construct an interlocking plant on these crossings, which interlocking plant is subject to the approval of the Board of Public Utilities of the City of Los Angeles and the California Railroad Commission. This will render these tracks safe for the present, and while an interlocking plant is an obstruction to the free flow of traffic, it is believed that before the separation of grades could all be finished —and if constructed in the order of necessity, before Aliso Street would be reached the probabilities are that the Pacific Electric Railway tracks at grade

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on Aliso Street will have been removed and connected up by elevated railroad or other grade separation with the terminal.

"Any design, however, that is applied to Macy or First Streets should be applied in such a manner as not to interfere with the probable separation of grade at Aliso Street at such time as the same shall become necessary.

"Specifications for the Separation of Grades on the streets mentioned relative to railroad tracks, are as follows:

Specifications for the separation of grades on the streets mentioned relative to railroad tracks, are as follows:

1. (A) 1st—All grade crossings other than those of industrial spurs must be removed;
2. 2nd—No industrial tracks permits should hereafter be granted for the use of the streets at grade longitudinally;
3. 3rd—All tracks now longitudinally within any street, to be confined to use for industrial purposes only, and finally removed as soon as access to the industries served can be obtained otherwise;
4. 4th—That eventually all spur tracks shall herring-bone out east and west from leads along the river-bank, and these leads and all other trackage throughout the city be for joint use by all railroads;

NOTE: A. 1, 2, 3, include Alameda Street, which should be handled in the following manner:

5. 1st Step—Eliminate through-freight and restrict the use of these tracks to passenger service and local car deliveries and removals:
6. 2nd Step—Eliminate passenger service;
7. 3d Step—Finally remove tracks altogether.
8. 5th—These requirements of course are susceptible to but one interpretation, namely—that the elimination of grade crossings for other than industrial deliveries and the maintenance of the minimum number of such grade crossings, with joint use of trackage, means a Union Terminal for Los Angeles, both passenger and freight, and it is only on this basis that the congestion and danger of railroad crossings can be avoided and minimized, and the best interests of the City at large and the Railroads themselves can be conserved.

The considerations bearing on the City's use of the streets as affecting the design for the separation of grades, are as follows:

9. (B) 1st—The greatest use to the public;
10. 2nd—The lowest grade percent possible with a maximum grade not to exceed 4 percent.
11. 3d—The least obstruction to possible river floods, thereby avoiding possible damage to other parts of the City, by reason of acting as a dam, or other obstruction to the river, assuming 50,000 second feet as extreme flood condition; and
12. 4th—The least damage to adjacent property.

The consideration governing the readjustment of road grades and alignment, are:

13. 1st—New grades for railroad tracks shall not be such as to seriously interfere with the proper operation of the railroad;
14. 2nd—Grades as now established for yard purposes shall not be reversed unless the yard can be redesigned;

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15. 3d—Access to industry spurs shall not be rendered inoperative.
16. 4th—Through freight or passenger service may be readjusted but must not be crippled.

Predicated upon the above, **we find the following methods of separating the grades of streets and railroads:**

17. 1st—All tracks can be elevated to full clearance over present street grades. This does not appear to be feasible or practicable, from the fact that it would cut the railroads off absolutely from the industries they are now serving within this district, and force the abandonment of the same as industrial territory.
18. 2nd—All streets can be elevated to full clearance over present railroad grades. This is not justifiable, as it will elevate the streets too high above the present surroundings and make the approaches too long to be reasonable.
19. 3d—All tracks can be depressed to full clearance under present street grades. This is not feasible because it would put the railroad tracks under water in flood time, and would also cut them off from access to the industries in the same manner as if elevated to full clearance above the street.
20. 4th—All streets can be depressed to full clearance under present railroad grades. This is impossible as it places the bridges crossing the river well down below the flood line, and makes them act as a series of dams, which would cause irreparable damage.
21. 5th—All tracks can be elevated part way, and all streets can be depressed part way, yielding full clearance between. This we believe is not feasible in all cases.
22. 6th—All tracks can be depressed part way and all streets can be elevated part way, yielding full clearance between.

This we believe to be the best practicable solution. It will make the minimum approach to the bridges across the tracks and the river, and will fill all the general specifications heretofore mentioned.

The City Engineer in signing this report, reserves the right of reconsidering the design proposed for 7th and 9th Streets.

"The requirements for the establishment of a level to which the railroad tracks can be depressed, will be the gauge as to how high the streets will have to be raised. This will involve a study of the necessary channel of the Los Angeles River and the establishment of a standard cross-section to be based on the grade established for the river bed itself.

"We believe that it is safe to assume that the trackage along the river could be lowered to a line 20 feet above the grade established for the river bottom.

"We attach hereto a tentative profile* made up from such information as we had at hand, showing the present bed of the river, the elevation of the Santa Fe and Salt Lake Railroads on the west and east bank of the same ,together with a tentative grade line to which, we believe, the railroads can safely be depressed.

"The solid red grade line shows the grade line proposed to be reached finally and is 20 feet above the river bottom, while the dotted red line shows the proposed deviation from this grade line to meet conditions that cannot immediately be altered. It is not now feasible to lower the railroad bridges

*See Fig. 23, page 139.

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crossing the river for the same reason that it is not now feasible to lower the street bridges, so that for the present it is proposed to meet the present grades of the Santa Fe bridge at North Broadway, the Southern Pacific bridge at Aliso Street and the Salt Lake bridge at or near Sixteenth Street, and lower these later when the trackage conditions have been altered to suit the then conditions.

"This would mean that at the various streets under discussion, the railroads would be depressed below their present level, as follows:

Depress	Main	Macy	First	Fourth	Seventh	Ninth
Santa Fe	2.7	7:5	8.5	6.5	10.50	7.0
Salt Lake	3.5	8.5	4.25	9.50	11.25	8.5

Respectfully submitted,
(Signed) HOMER HAMLIN,
City Engineer.
F. D. HOWELL,
Chief Engineer, Board of Public Utilities.
SAMUEL STORROW,
Consulting Engineer, Municipal League of Los Angeles."

NECESSITY AND ADVISABILITY OF ELIMINATION

The necessity for eliminating crossings at grade may be measured by the amount of vehicular traffic, amount of railroad traffic, number of passengers carried over the crossings, the number of accidents and the liabilities therefor, the influence of the delays occurring at the crossing and the cost of elimination.

Once decided that a situation is intolerable, there are several possibilities for improvement: The track may be done away with, the highway may be abandoned, the railroad traffic may be diverted or the vehicles may be rerouted. If one of these schemes does not bring about the desired result, it becomes necessary to make a separation of grades. There are, in general, six methods of separating grades at crossings, as follows:

(1) All tracks can be elevated to full clearance over present street grades.
(2) All streets can be elevated to full clearance over present railroad grades.
(3) All tracks can be depressed to full clearance under present street grades.
(4) All streets can be depressed to full clearance under present railroad grades.
(5) All tracks can be elevated part way, and all street grades can be depressed part way to yield full clearance between.
(6) All tracks can be depressed part way and all streets can be elevated part way to yield full clearance between.

One of these methods must be used in any location, the method to be chosen depending on the topography, the amount of traffic, the relation of the railroad to improvements and the City plan and, lastly, cost.

For example, where a trunk line railroad cuts directly across an important part of a city it is usually found advisable to adopt the first method. This is particularly true in level cities, such as Chicago and, in a measure,

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Detroit. The principal disadvantage of this method is that there is a great inconvenience and expense to industries which find it essential to have spur track connections. This method was proposed for Alameda Street in Los Angeles, but, because of the industry track situation, it was not thought feasible.

It may be well to point out at this time that conditions in Los Angeles are peculiarly favorable to the elimination of main line grade crossings, in that two of the three steam railroads are now located on the east and west banks of the Los Angeles River through the industrial parts of the city, and are crossed by very few streets. In the northerly portion of the district, where the Los Angeles River Valley contracts to such an extent that all three railroads are brought together along the banks of the river, it is possible to pass over them with a single structure similar to the North Broadway or Buena Vista Bridge. The southern portion of the industrial district is practically level on the west side of the river, but on the east side, within a comparatively short distance, the ground rises abruptly and there is a well-defined line between the bluffs and the level ground adjacent to the river. These conditions will appear important in the study of the elimination of the grade crossings formed by the Salt Lake tracks on the east bank and the Santa Fe tracks on the west bank of the Los Angeles River.

STREET TRAFFIC IN GENERAL

In the past few years an epochal change has taken place in street traffic: the horse and bicycle have been very largely displaced by the automobile (pleasure cars and commercial vehicles) and the motorcycle. Liability of accident has been enormously increased, due to the greater speed at which the modern vehicle moves, and the accompanying increase in the minimum distance in which a stop can be made.

In Chicago, between 1907 and 1913, it has been recorded, teams increased 11.8 per cent in number, while motor vehicles increased 832 per cent, with an increase in the number of all vehicles of but 19.1 per cent (Report on the Rearrangement and Development of the Steam Railroad Terminals of the City of Chicago, by Bion J. Arnold, 1913). From other studies in Chicago, the following increases are shown (Journal W. S. E., February, 1918):

CHANGES IN CHARACTER OF VEHICLES—CHICAGO

	Kind of Vehicle					
	Self Propelled		Trucks		Horse Drawn	
Year	No.	%	No.	%	No.	%
1916	45 409		9 898		46 187	
1910	...		799		...	
1908	5 475				53 678	
Gain	39 934	729%	9 099	1 138%	* 7 491	14%

*Loss.

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In our state the number of automobiles has increased very rapidly, as will be seen from the following:

GROWTH IN NUMBER OF AUTOMOBILES

	Automobile Registrations			
	State		Los Angeles County	
Years.	No.	Increase	No.	Increase
1914	123,516	....	43,099	....
1915	163,795	33%	55,217	28%
1916	232,440	42%	74,709	35%
1917	306,916	24%	93,654	25%
1918	364,800	19%	107,232	14%

Of the 107,232 automobiles registered in Los Angeles County, approximately 63,000 are registered in the City of Los Angeles, and of these about 9,000 are trucks.

With reference to the present relative numbers of the different kinds of vehicles, we can, from our counts, including different locations of grade crossings of steam carriers, and covering over 500 hours' traffic and about 140,000 vehicles, show the following result:

Relative Numbers of Different Classes of Vehicles		
Automobiles	57%	
Trucks	31%	88%
Wagons		9%
Motorcycles		3%
		100%

Very comprehensive studies in Chicago (Jour. W. S. E., Feb., 1918) showed that two-thirds of the number of vehicles counted in and out of the central business district were used for business and that 85 per cent of all movements of vehicles were made by these business vehicles. This is inserted to draw attention to the fact that in Chicago the traffic problem is intimately associated with business progress—and in Los Angeles the same general relation must hold, although the percentage of business vehicles to total vehicles is probably somewhat less.

It seems of particular importance to note the large number of motor vehicles in Los Angeles County and the surrounding territory. Table I. Appendix, shows that 107,232 automobiles were registered from Los Angeles County in 1918. This is 29 per cent of all the automobiles registered in California, and shows the relatively large number as compared with other locations, particularly when combined with the three contiguous counties. In this territory, there is a total of 128,767 automobiles. In Southern California (as this term is commonly used), there are 159,528 cars, or nearly one-half the total number in the state.

This relatively high proportion of local automobiles and the large percentage of high speed vehicles, are important factors in connection with elimination of grade crossings. Our studies take account of this fact. Traffic studies dealing with the vehicular and railroad traffic in different

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localities are grouped with the discussion of the necessity and advisability of the elimination of grade crossings at these various places.

It is interesting to note a comparison of the vehicular traffic at Seventh Street and Broadway with some other points more particularly concerned in this report. At Seventh Street and Broadway most people are familiar with the congestion and are more or less impressed by it. While this is the most congested point in the city, the greatest vehicular movement is elsewhere. In the following table consideration should be given to the difference between an intersection where two streets are involved, such as at Seventh Street and Broadway, and a crossing, such as at the bridges over the Los Angeles River, where but one street is involved.

RUSH HOUR VEHICLE TRAFFIC AT SEVERAL OF THE MORE CONGESTED POINTS LOS ANGELES

			No. of Vehicles and Cars			
			East & West		North & South	
Location	Date	Hours	Vehicles	Cars	Vehicles	Cars
7th & Broadway	6-6-19	5-6 PM	669	87	692	107
N. Broadway Bridge..	4-9-18	5-6 PM	...	...	1174	104
Macy St. Bridge	1-9-18	5-6 PM	647	31*	...	...
7th St. Bridge	5-9-18	5-6 PM	499	29	...	...
6th & Alameda	2-4-18	7-8 AM	667	0	...	...
7th & Alameda	5-8-18	4-5 PM	523	64	...	...
Sunset Blvd. near Main St.	3-21-18	5-6 PM	861	181	...	...
Los Angeles St. at Plaza	3-21-18	5-6 PM	...	...	672	...
Marchessault St. at Plaza	3-21-18	5-6 PM	558	0	...	...
Alameda St. south of Macy	3-1-18	4-5 PM	...	....	640	...

*On separate bridge.

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CHAPTER VI.

OUTLINE

Los Angeles River Crossings

Traffic Studies
- Vehicular Traffic Over Crossings
- Railroad Traffic Across the Streets at the River
- Grade Crossings at Los Angeles River a Menace and Nuisance

Plans for Elimination of Crossings
- Short Viaduct Plan Preferable and Practical
- Tracks Adjacent to River Should Be Depressed
- Amount of Depression Recommended at Various Streets
- Difference in Depression from Hamlin-Howell-Storrow Report

Estimates on the Santa Fe or West Side of Los Angeles River
- Simple Depression of the Santa Fe Tracks
- Depression Based Upon Union Passenger Station at the Plaza, and Union Freight Station at the Santa Fe Site
- Depression Based Upon Union Passenger Station at the Santa Fe Site
- Depression Based Upon Union Passenger Station at Southern Pacific Site and Union Freight Station at Santa Fe Site

Estimates on the Salt Lake or East Side of Los Angeles River
- Simple Depression of Salt Lake Tracks
- Depression Based Upon Union Passenger Station at Either the Plaza Site or the Santa Fe Site
- Depression Based Upon Union Passenger Station at Southern Pacific Site
- Adaptability of Southern Pacific-Salt Lake Plan to Proposed River Track Depression

Excavation Quantities

Order in Which the Work Should Be Done
- Simple Depression—No Union Passenger or Freight Station
- Union Station at the Plaza
- Union Station at the Santa Fe Site
- Union Station at the Southern Pacific Site

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CHAPTER VI

DEPRESSION OF TRACKS AND ELIMINATION OF GRADE CROSSINGS AT THE LOS ANGELES RIVER

LOS ANGELES RIVER CROSSINGS

It is our belief that the crossings which should be first considered are those where the various streets cross the Los Angeles River. The tracks of the two carriers on the east and west banks of the river will probably remain there, since this seems to be the logical location for north and south trackage, and the railroads will probably retain this location for all time. The elimination of these crossings can be undertaken regardless of the proposed location of a union passenger terminal for the reason that the establishment of this facility has no effect upon them other than to modify certain of the crossings. Neither is the separation of these river crossings dependent upon the recommendations for the improvement in the handling of freight.

TRAFFIC STUDIES

Certain traffic studies have been made in order to have the facts regarding traffic at the crossings of various streets and the Los Angeles River and the tracks of the Atchison, Topeka and Santa Fe Railway and the Los Angeles and Salt Lake Railroad adjacent to the river. The resulting data indicate, to a large extent, whether public convenience and safety require the elimination of these crossings and also the relative importance of elimination at different points.

To determine certain characteristics of the traffic across the grade crossings adjacent to all the bridges across the Los Angeles River, we have counted the traffic for a day of fourteen hours (6 A.M. to 8 P.M.) at all the bridges. An average week day was chosen for the counts, and no check was made on holidays, Sundays, rainy days or on days on which showers or rain was predicted. Supplementing our efforts, several counts were made by the Board of Public Utilities of Los Angeles. Our counts were made principally in January, 1918, while those of the City were of November, 1916, and July, 1917. The difference in results lies principally in that in each case we found a more extensive use of the bridges by the public and a less extensive use of the adjacent tracks by the trains than was shown by the counts of the City.

The following segregations were made, all independent of direction, the figures including movement in both directions:

Motive Power Street Traffic	Railway Traffic	Human
Automobiles	Passenger Trains	Pedestrians
Trucks*	Freight Trains (separate or together, Switch Engines and cars counted as one)	Bicycles
Wagons	Light Engines	
Motorcycles		
Street Cars**		

*A truck is defined as a vehicle with body arranged for freight, packages, etc.

**At Aliso Street two or three car trains of the Pacfiic Electric were counted as one.

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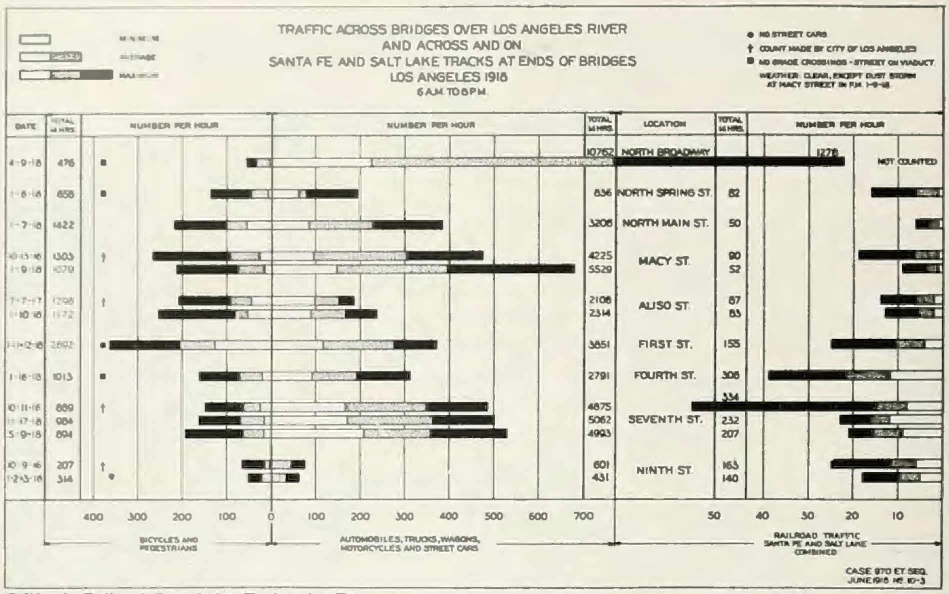

California Railroad Commission Engineering Dept.

FIG. 22. STREET AND RAILWAY TRAFFIC AT THE LOS ANGELES RIVER BRIDGES

This diagram shows the results of traffic counts at those bridges on the date given in the first column. The traffic is divided into three groups for each crossing: pedestrian, vehicle and railroad.

Fig. 22 shows some of the results of the counts of the traffic across bridges over the river and on the tracks on each side of the river. We have the average number of times the crossings are used and the maximum number per hour. The chart does not show, however, at what time of day these conditions occur at the various bridges. (This information may be obtained from other charts not reproduced in this report.) It appears that the maximum traffic is between 4 P. M. and 5 P. M., although the maximum automobile traffic is between 5 P. M. and 6 P. M. The observers report, however, that the maximum vehicular traffic is really between 4:30 P. M. and 5:30 P. M. The vehicular travel, at all bridges taken together, shows a fairly even distribution throughout the day, as will be noted in the following tabulation:

PERCENTAGE OF TRAVEL EACH HOUR—6 A. M. TO 8 P. M.

(Automobiles, Trucks, Wagons and Motorcycles)

A. M.		P. M.	
6 to 7	2.6%	12 to 1	7.2%
7 to 8	6.4%	1 to 2	7.3%
8 to 9	7.6%	2 to 3	8.2%
9 to 10	7.7%	3 to 4	8.2%
10 to 11	8.5%	4 to 5	10.1%
11 to 12	8.1%	5 to 6	9.9%
		6 to 7	4.5%
		7 to 8	3.7%
6 to 12	40.9%	12 to 8	59.1%

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This data is important in consideration of the facilities provided at the rush hours, or of the present crowding at certain bridges and the delays at certain crossings.

Figures giving average daily or yearly traffic movements are, as a rule, derived from one or more days count, which is assumed as an average day; yearly figures are simply 365 times as large. This method of computation can be made subject to refinement but is thought sufficiently accurate.

Vehicular Traffic over Crossings

It appeared necessary to make some study of the use of these crossings and with this in view, the number of people passing over the bridges across the river and over the Santa Fe and the Salt Lake tracks (which are on opposite sides of the river), was studied with the following result, which is found in more detail in Table II, Appendix.

	People Per Year
Over present five grade crossings	33,000,000
Over present four viaducts and bridges	32,000,000
Total	65,000,000
Average per day	178,000

This figure is equivalent to having the entire population of Los Angeles crossing the river approximately every third day.

The people passing over the present grade crossings were, with respect to mode of conveyance, as follows:

	Number Per Year	Ratio
People in vehicles	11,291,600	34%
Pedestrians and bicycles	2,222,100	7%
People in cars	19,744,300	59%
Total	33,258,000	100%

The vehicles, too, may be subdivided, the figures representing as above, the number per year using the present grade crossings:

	Average Day	Year	Ratio	
Automobiles	10,113	3,691,245	63%	
Trucks	3,612	1,318,380	22%	85%
Wagons	2,038	743,870		12%
Motorcycles	551	201,115		3%
Total	16,314	5,954,610		100%

It may be well to contrast some of our findings with the data in the testimony, in order that the latter may not stand unchallenged. Witnesses Koenig and James presented traffic counts at Fourth Street and the river which compare as follows with our findings:

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Item Number of	Date Hours—6 A. M.-8 P. M.	James 7-21-17	Engr. Dept. 1-16-18
Vehicles		2,940	2,679
Pedestrians		472	865
Street Cars		254	260
Passengers on Cars		5,757	6,601*

*4-1-18, for 24 hours.

It is seen that our figures are not very far from those of Mr. James and are within the limits of change between the dates.

Witness Koenig presented evidence covering traffic at East Seventh Street bridge, which compares with our data as follows:

Item Number of	Hours Dates	Koenig 6 A.M.-8 P.M. 7-21-17	1-17-18	Engineering Department 6 A.M.-8 P.M. ———	5-9-18
Vehicles		5,080	4,892	....	4,779
Passengers in Vehicles		30,480	....	*9,323	....
Pedestrians		870	....	749	....
Street Cars		361	383	....	361
Passengers in Street Cars		7,201	....	†10,203	....
Total Persons		38,551	....	†20,275	....

*Two dates averaged.
†24 hours, April 1, 1918

We believe that Mr. Koenig's total figure is about twice what it should be on account of an error in the number of passengers per vehicle.

Railroad Traffic across the Streets at the River.

The railroad traffic on the Santa Fe and the Salt Lake on both sides of the river and across the five east and west streets with grade crossings, may be briefly set forth as follows: (see Fig. 22, page 134).

Street	—6 A.M. to 8 P.M.— Santa Fe Trains Pass.	Frt.	Switching Pass.&Frt.	Salt Lake Trains Pass.	Frt.	Switching Pass.&Frt.
North Main	8	3	24	7	1	7
Macy	8	2	11	12	0	19
Aliso	10	2	34	7	1	29
Seventh—May, 1918*	18	4	105	14	2	64
Seventh—Jan., 1918	19	7	118	11	4	73
Ninth	19	10	91	12	2	6
Totals	64	24	278	49	8	134
Total movements per road..		366			191	
Total movements 14 hours..			557			

*Excluded in totals.

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The delays to traffic at Seventh Street on the west (Santa Fe) side were two hours and two minutes out of the fourteen hours counted, or, to put it differently, the gates were down 14 per cent of the time. On the east (Salt Lake) side, the gates were down one hour and thirty-nine minutes, or 12 per cent of the time. The Board of Public Utilities of the City of Los Angeles found, on October 11, 1916, that the percentage of time the gates were down was 18.5 per cent for the Salt Lake gates and 19 per cent for the Santa Fe gates.

Grade Crossings at Los Angeles River a Menace and Nuisance

With these 557 movements per day (6 A. M. to 8 P. M.) of trains across these five crossings, and with 16,314 vehicles and 2,042 street and interurban cars—a total of 18,356 vehicles moving across the tracks, practically all at four crossings—it will be obvious that there is a large menace in the form of liability of accident. With the gates down such a large per cent of the time (up to 19 per cent), the crossings are a prolific source of delay to traffic and those at grade should be eliminated.

PLANS FOR ELIMINATION OF CROSSINGS

Short Viaduct Plan Preferable and Practical

We have before us two general plans for the elimination of crossings at grade of the streets across the river: the "long viaduct" plan, as proposed by Mr. Arnold and later by Mr. Howell, and the "short viaduct" plan as proposed by Messrs. Hamlin, Howell and Storrow.

After considerable study, we have reached the conclusion that the "short viaduct" plan will, in general, give the best solution to the problem of elimination of crossings of various streets and of tracks adjacent to the river, for the following principal reasons:

(1) The industrial district adjacent to the river is at grade and is thus better served by short viaducts.
(2) Public opinion is against viaducts of great length in this industrial district.
(3) Lower cost and less property damage is incurred.
(4) Future extension of approaches, if advisable, is not prevented.
(5) Transition from subway to elevated railway is more easily accomplished.

This means that the tracks along the river should be depressed part way and that the streets should be elevated part way, so that the necessary clearance of twenty-two feet over the tracks is obtained.

The question of how high the streets would have to be raised depends upon the establishment of how far the railroad tracks can be depressed, and this latter involves a study of the channel of the Los Angeles River. The Hamlin-Howell-Storrow report states that the authors believe it safe to assume that the trackage along the river could be lowered to an elevation of twenty feet above the grade established for the river bottom. It is a demonstrable fact that the bottom of the river is now much lower than it

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was on account of the straightening of the river, which has increased the velocity and, consequently, the scouring power of the water, and also on account of the removal of the sand and gravel of the river bed for building operations within the city. Extensive studies dealing with this subject have been made by the Engineering Department of the City of Los Angeles.

We know that the authors of this report have made very comprehensive studies of flood conditions in the Los Angeles River and have also had a good deal of actual experience with this river. We believe, therefore, that their estimates of the lowest safe elevation to which the tracks along the river can be depressed are entirely sound.

We have discussed the tentative profile attached to the report of the three engineers, which shows the grade line to which the railroad tracks could be safely depressed, with the Chief Engineer of the Salt Lake Railroad and have ascertained that he does not entertain any serious engineering objection to this depression. We understand that he agrees that the depression of the Salt Lake tracks to the tentative grade line would be safe. We are advised by the Santa Fe that the depression to the proposed grade line is practicable but expensive.

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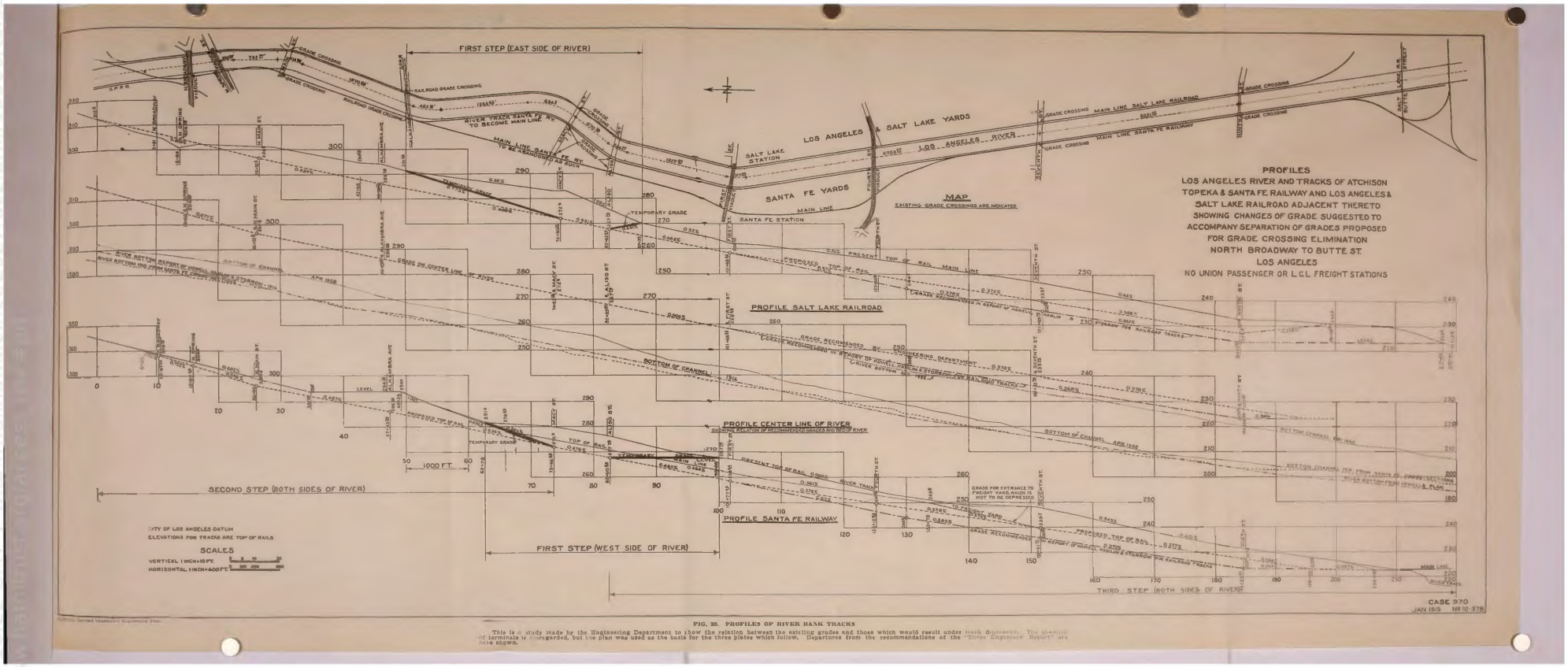

FIG. 33. PROFILES OF RIVER BANK TRACKS

This is a study made by the Engineering Department to show the relation between the existing grades and those which would result under track depression. The question of terminals is disregarded, but the plan was used as the basis for the three plates which follow. Departures from the recommendations of the "Olmsted Engineers' Report" are here shown.

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Tracks Adjacent to River Should be Depressed

With this information before us we are of the opinion that the Salt Lake and Santa Fe tracks along the river should be depressed to the grade line shown in the above profile, Fig. 23, which profile is substantially the same as that submitted to the Commission as Exhibit No. 1 by the City of Los Angeles. The difference between these two profiles arises in this way:

The profile submitted as an exhibit shows a final grade line for the tracks on both sides of the river, but the grade line and station shown are those on the center line of the official bed of the Los Angeles River. Our profile, (Fig. 23), shows three grade lines: one on the center of the river and one each for the Santa Fe and the Salt Lake tracks. It will be noted that these two latter grade lines show, at the points where various streets cross the river, the same elevations for the proposed final grade for the Salt Lake tracks, the center line of the river and the Santa Fe tracks. Between these streets, the rates of grade and elevations are slightly different, this difference being introduced by the difference in distance along the tracks on account of the curvature of the river and tracks.

Amount of Depression Recommended at Various Streets

The major difference, however, between the profile showing the grades recommended in the three engineers' report (City of Los Angeles Exhibit No. 1) is shown in the following tabulation which gives the amount to which the tracks of the Salt Lake and the Santa Fe are recommended to be depressed at the various streets now carried across the river by means of bridges and viaducts:

RECOMMENDED DEPRESSION OF TRACKS ALONG LOS ANGELES RIVER

	Street								
Santa Fe	**Spring Ft.	Main Ft.	**Alhambra Ft.	Macy Ft.	**Aliso Ft.	1st Ft.	4th Ft.	7th Ft.	9th Ft.
City Ex. 1	1.5	2.7	7.5	7.5	7.8	8.5	6.5	†10.2	7.0
Engr. Dept. ...	1.2	2.5	7.9	7.9	8.3	8.7	3.6	7.0	2.7
	0.3	0.2	0.4	0.4	0.5	0.2	2.9	3.2	4.3
Salt Lake									
City Ex. 1	3.0*	3.5	7.2	8.5	6.6	4.25	‡9.2	11.25	8.75
Engr. Dept. ...	3.4*	4.5	8.0	11.3	8.0	3.8	6.4	7.3	5.1
	0.4	1.0	0.8	2.8	1.4	0.45	2.8	3.95	3.65

* Raise (fill).

** Depression at Spring, Alhambra and Aliso Streets not listed in report of Messrs. Howell, Hamlin and Storrow, but shown on profile attached to Exhibit.

† 10.2 from the profile; 10.5 in above report.

‡ 9.2 from the profile; 9.5 in above report.

Difference in Depression from Hamlin-Howell-Storrow Report

The principal differences, it will be noted are at Fourth, Seventh and

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Ninth Streets, where the amount of depression we have recommended is considerably less than that recommended in the report of the three engineers. At the other streets the differences are probably due to the fact that our data is more accurate, for we have made no attempt to depart from the proposed elevations.

It was at first thought that the grades recommended by the three engineers would be entirely satisfactory, but a detailed study has led us to believe that the modifications as shown in the last tabulation should be made. The following line of reasoning was responsible for this change:

It was assumed that if a union passenger terminal is recommended or established in the vicinity of the Plaza or at the Arcade depot site, the Santa Fe should not be forced to regrade the entire area of about sixty acres covered by its freight yards between First and Seventh Streets; or if a union station, passenger or freight is recommended or established at the Santa Fe site, the grading should be reduced as far as possible. In short, this whole yard area should not be required to be depressed unless some advantage consistent with the cost obtains. The cost does not wholly lie in the excavation; removing and replacing tracks under operation is a large factor.

If the Santa Fe is to use this yard for freight alone, we would have a union passenger station elsewhere. If it be at the Plaza, then two main line passenger tracks would be required along the river and south of Fourth Street, and good practice would indicate that through freight trains and switching would require separate tracks. If the grade proposed by the three engineers' report at Seventh Street (elevation 235.7—City datum) be adopted, and also the plans for a viaduct similar to that shown in Fig. 56 on page 185 with four adjacent tracks along the river, the problem arises as to how to get the heavy freight trains into the yard on practicable gradients.

Any studies relative to grades between Seventh Street and the throat of the yard should take into consideration the ruling grades on the Santa Fe freight district over which Santa Fe trains entering this yard must run. The present ruling grade westward—San Bernardino to Los Angeles—on the Santa Fe, via Fullerton, is 0.7 per cent, and to introduce any grade heavier than this at this point would reduce the freight engine tonnage ratings. This is highly objectionable since it reduces the number of cars in every train which is filled up to the tonnage limit of the locomotive.

Opposite Willow Street, which is about the southerly throat of the present freight yard, the present main line tracks of the Santa Fe are at an elevation of 250 feet. It is proposed, by constructing two tracks which for convenience we will call M and N, parallel to the two tracks adjacent to the river the nearer nineteen feet west of them and descending southerly, to pass under a proposed viaduct on Seventh Street and then to connect both M and N with the tracks adjacent to the river, and also, by a single track ascending southerly to connect M and N with the coach yard tracks, etc., near the location of the present Pullman building. This situation we have attempted to show graphically in the accompanying drawing.

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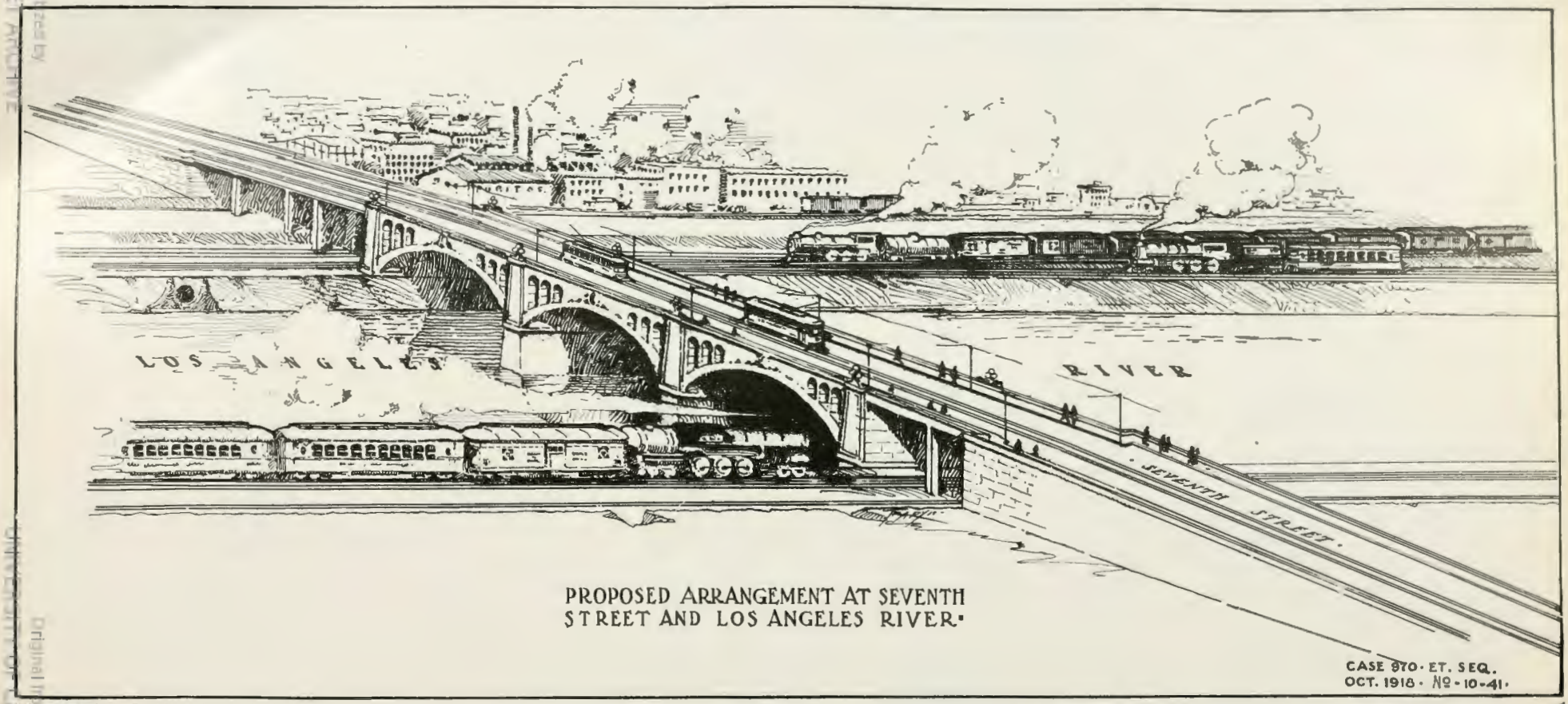

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FIG. 24. PERSPECTIVE OF BRIDGE OVER THE LOS ANGELES RIVER AT SEVENTH STREET

This sketch shows the general design of bridges proposed in this report. Bridge here shown is proposed for Seventh Street and contemplates simple depression of tracks on both banks of river.

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With the tracks at Seventh Street at elevation 235.7, as proposed in City's Exhibit No. 1, a grade in excess of 0.8 per cent on tracks M and N is necessary, and this is too steep. If this elevation is changed from 235.7 to 239.7, a 0.57 per cent grade can be obtained, which appears to be practicable since the grade at this point should be equal to somewhat less than the ruling grade on the district, on account of slow movement, virtual profile, etc. Raising the elevation of the proposed grade at this point 4.0 feet does not appear to introduce any objectionable features; the toes of slope of the viaduct approach are simply moved about 100 feet further away from the river, and on the west, to the east side of Santa Fe Avenue. It will also be possible—and this is important—to run the switching leads (which are about 160 feet from the river) under the viaduct, although the grades of these leads will not be the best.

On the north side of Seventh Street, at Santa Fe Avenue, the ground floor of an existing building is about three feet above present grade. Little damage, therefore, will result. A fire house is located on the opposite side of Seventh Street, at the corner of Santa Fe Avenue, and appears to be the only building affected by this change of grade. The effect on this structure is simply to raise the street at the doorway from five to seven inches. On the whole, there is little difference in property damage between having the depressed tracks at elevation 235.7 and 239.7.

At Ninth Street the grade recommended by the three engineers is at elevation 223.4. It seems that at this point, too, it would be highly desirable, from the viewpoint of facility of operation, to have the Santa Fe main switching leads, which are here also about 160 feet west of the river, carried across Ninth Street instead of cutting them off at the street line. This is just as desirable as at Seventh Street.

At Ninth Street the property is not well developed. Nor is it particularly expensive, and there is a long block from the river to Santa Fe Avenue. At present the main switching leads are at elevation 227.5, and upon examination and study we can see no good reason why they should not remain at this elevation and why the tracks along the river should not be depressed to the same elevation. This change does not increase the cost of the structures out of proportion to the reduction in excavation for the tracks and to the operating advantages gained.

It was found that a grade line connecting these new proposed elevations at Seventh and Ninth Streets would intersect the grade line proposed by the three engineers approximately at Station 101 plus 77, the point of change of grade at First Street, and we have, therefore, shown a grade line straight from Station 101 plus 77 to approvimately Station 184 plus 66, the center line of Ninth Street, as will be noted on the profile. The rate of grade is 0.377 per cent.

The cost of the depression of the Santa Fe and Salt Lake tracks depends upon the location of a union passenger depot and a union less than carload

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freight terminal, and also upon the location of various main line freight and passenger tracks running north and south through the City, since the quantities involved in excavation, track changes, etc., depend upon the number of tracks and their arrangement.

We have, however, made estimates of the cost of depressing the tracks under various conditions. The bases for these estimates follow, and, while there might be slight changes introduced, the figures would not be sensibly altered by the introduction of minor departures from the major plans.

ESTIMATES ON THE SANTA FE OR WEST SIDE OF LOS ANGELES RIVER

(a) Simple Depression of the Santa Fe Tracks

This estimate is based on depression to the proposed grades of the Santa Fe tracks as they now exist, except that certain changes are introduced which prevent literal adherance to this statement. The present main line between, approximately, First Street and Alhambra Avenue is to be abandoned as the main track and two new tracks, constructed adjacent to the river on the depressed grade, will become the main line. Between First Street and, approximately, Fourth Street, it is proposed to construct a double track line adjacent to the river, in addition to the present tracks. On the present main line, between First Street and Alhambra Avenue, it is proposed to remove entirely the tracks in Aliso and Macy Streets but not to interfere with the use of this track as a lead for the industry tracks branching off from it. Our estimate is then based upon a double track roadbed and tracks along the river all the way from North Broadway to Butte Street and the reconstruction of both ends of the yard between First and Fourth Streets to meet the proposed new tracks along the river. Estimates are made with Alhambra Avenue depressed and also with that Avenue not depressed. All grading for necessary changes in industry tracks is included.

(b) Depression based upon Union Passenger Station at the Plaza and Union Freight Station at the Santa Fe Site

This scheme is the same as in (a), except between Aliso Street and Seventh Streets, where the excavation is estimated as that necessary for a union freight station. The old main line tracks, approximately 160 feet from the river bank, are proposed to pass under the proposed Seventh Street viaduct at an elevation of four feet below that of the depressed river tracks, and the excavation includes the yardage necessary to make this depression. It is this arrangement that is embodied in our final recommendations.

(c) Depression Based Upon Union Passenger Station at the Santa Fe Site

This estimate is the same as in (b) except that the excavation between Aliso and Seventh Streets is that estimated as necessary for the passenger station yard. This scheme also contemplates depression of the old main line tracks to pass under the Seventh Street viaduct.

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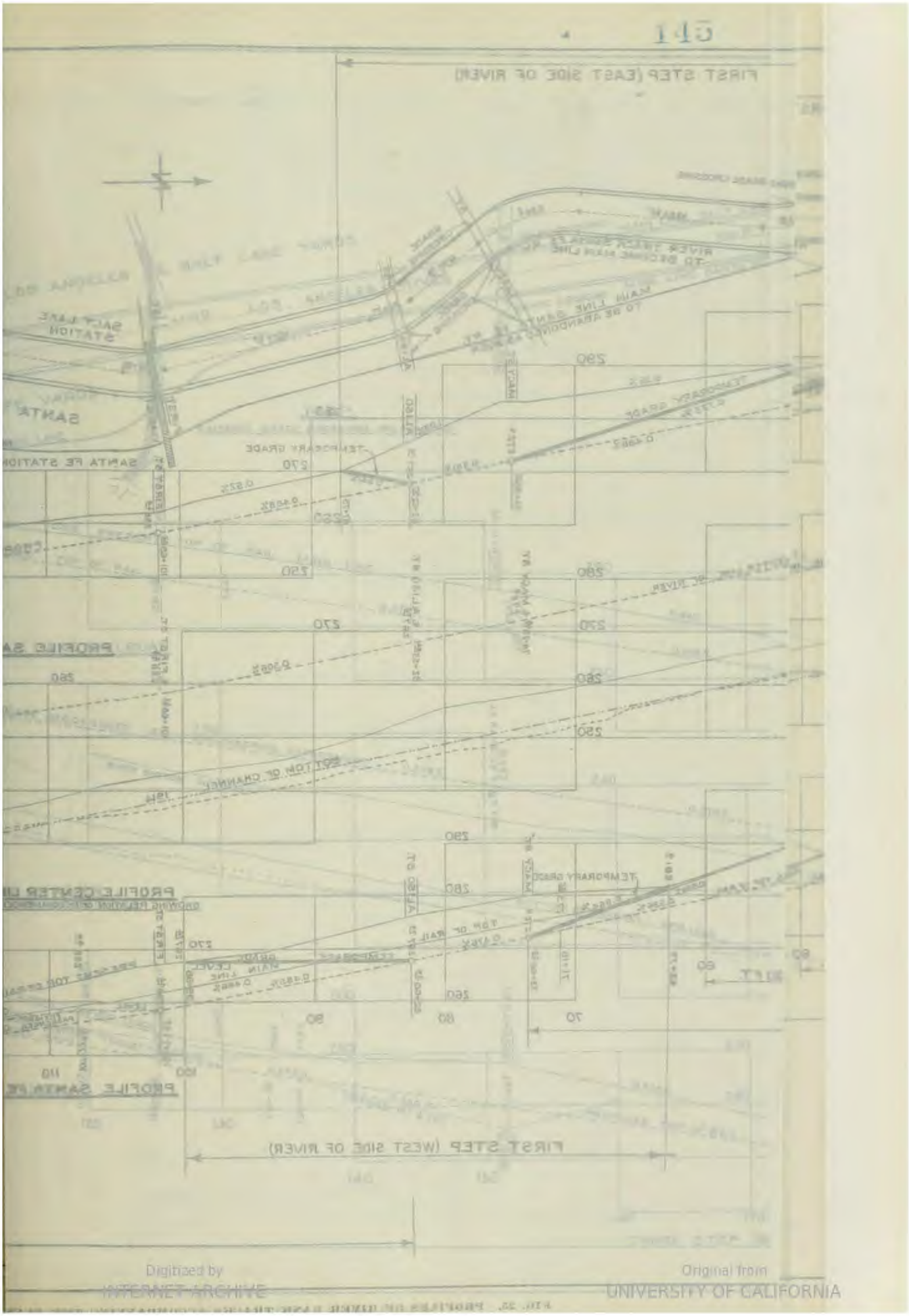

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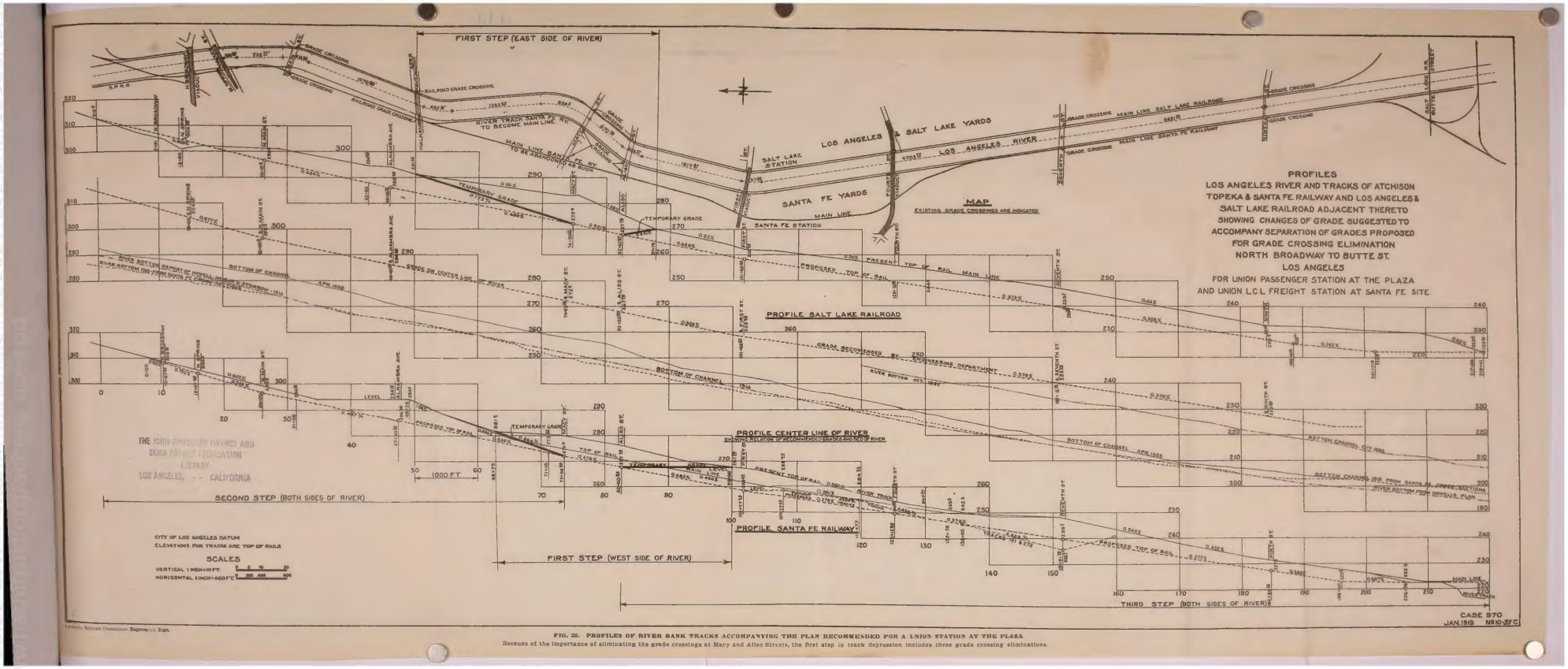

FIG. 25. PROFILES OF RIVER BANK TRACKS ACCOMPANYING THE PLAN RECOMMENDED FOR A UNION STATION AT THE PLAZA

Because of the importance of eliminating the grade crossings at Macy and Alisо Streets, the first step in track depression includes these grade crossing eliminations.

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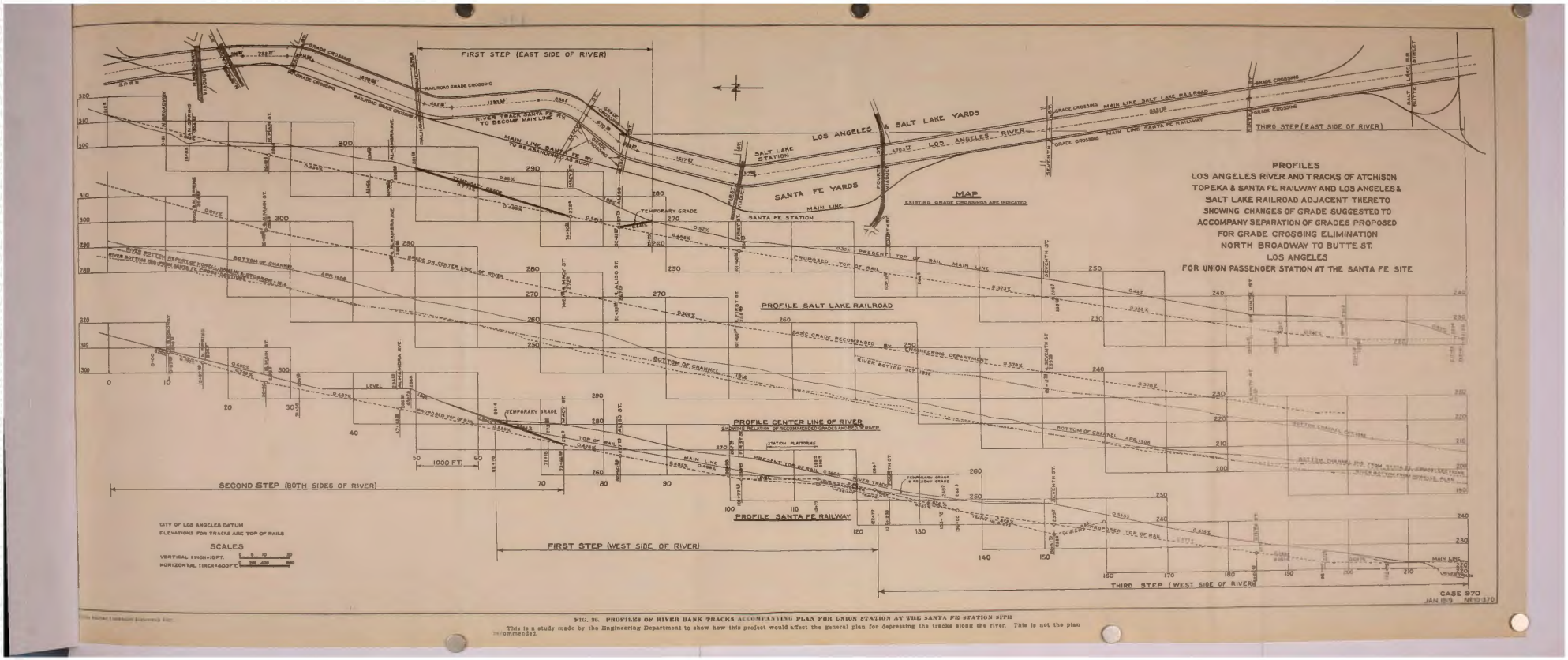

FIG. 30. PROFILES OF RIVER BANK TRACKS ACCOMPANYING PLAN FOR UNION STATION AT THE SANTA FE STATION SITE

This is a study made by the Engineering Department to show how this project would affect the general plan for depressing the tracks along the river. This is not the plan recommended.

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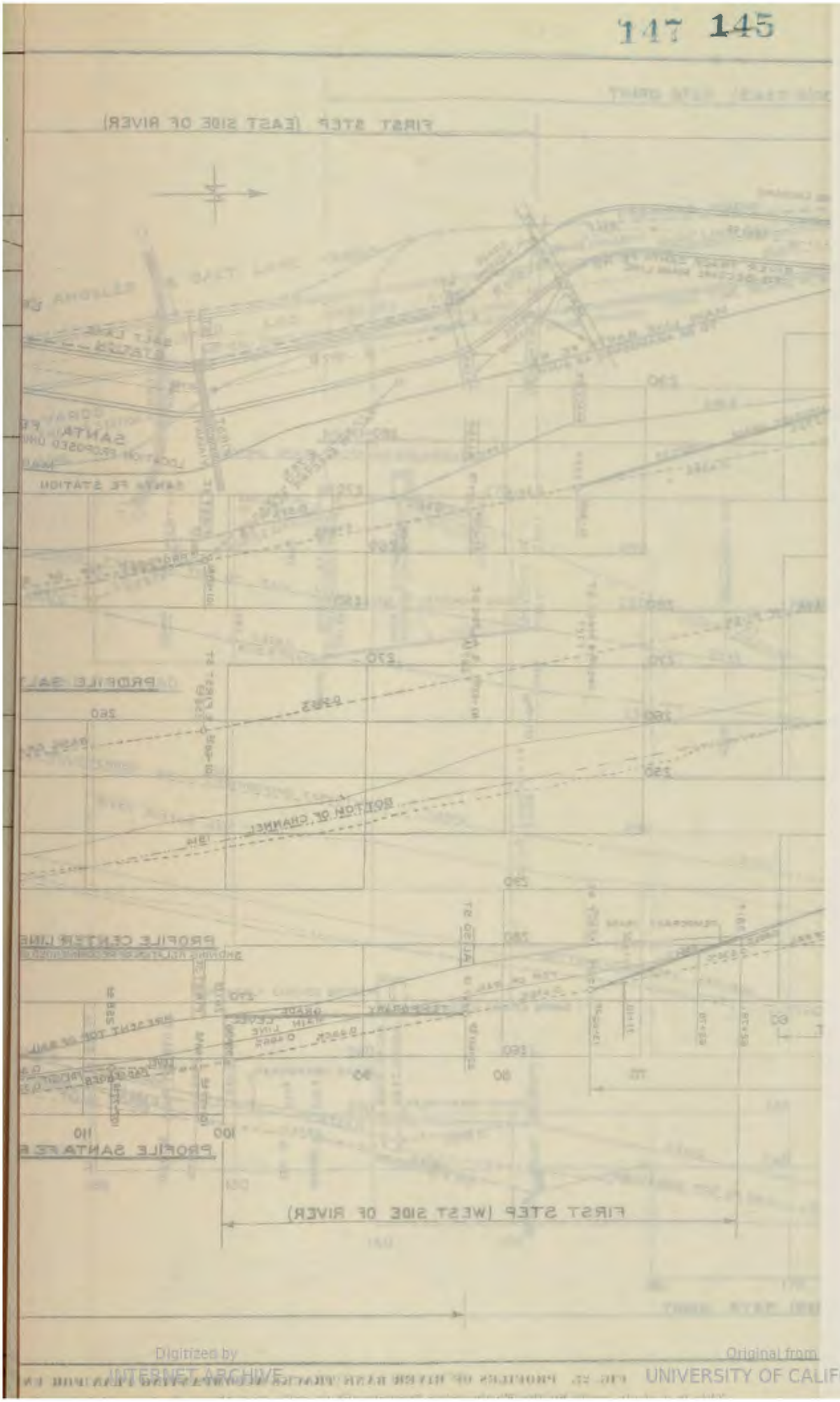

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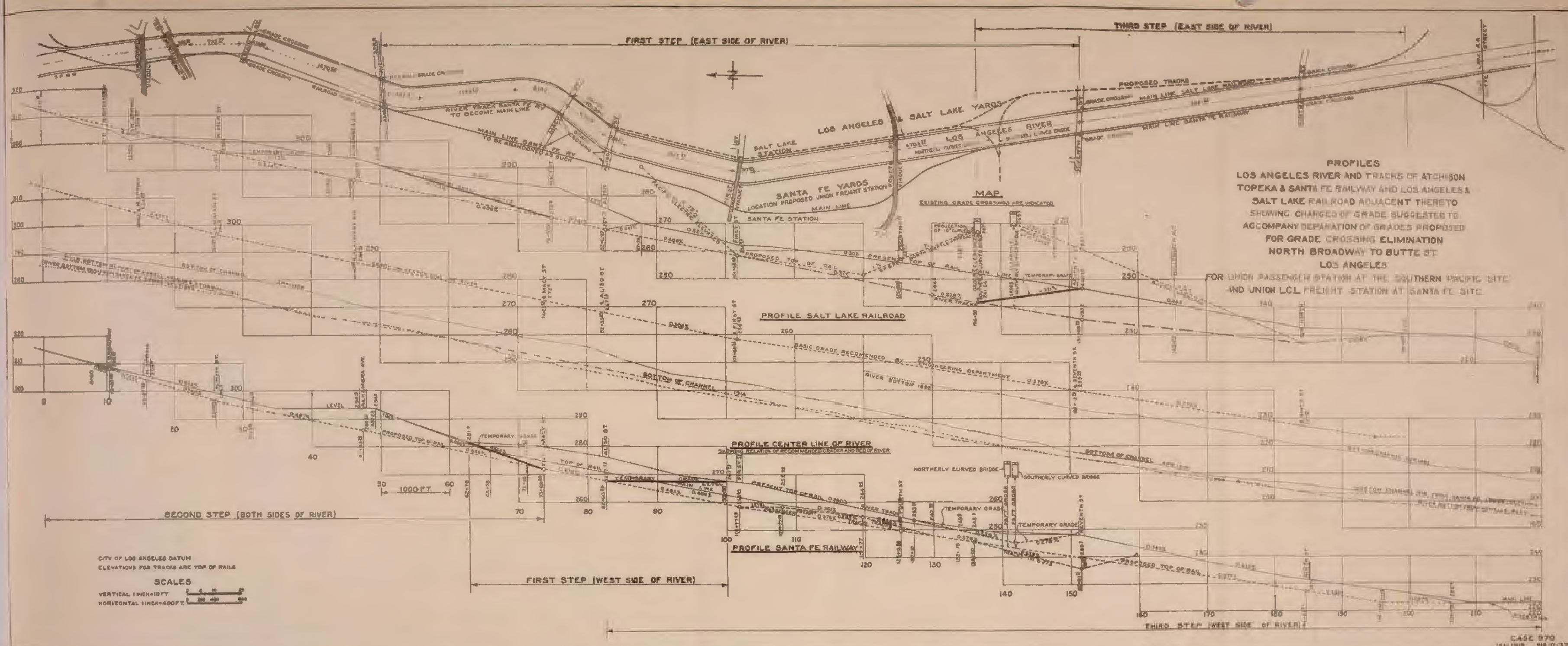

FIG. 27. PROFILES OF RIVER BANK TRACKS ACCOMPANYING PLAN FOR UNION STATION AT THE SOUTHERN PACIFIC STATION SITE

This is a study made by the Engineering Department to show how the project would fit into the general plan of track depression. The profile is based upon the revised alignment shown by the dotted lines in the map. The arrangement is not recommended.

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(d) Depression Based Upon Union Passenger Station at the Southern Pacific Site and a Union Freight Station at the Santa Fe Site

In this scheme the grading is the same as under (b) above.

ESTIMATES ON THE SALT LAKE OR EAST SIDE OF THE LOS ANGELES RIVER

(a) Simple Depression of the Salt Lake Tracks

This estimate is based upon the depression of the present Salt Lake tracks, which would not be altered in any other way, except where it is necessary to change connections of secondary tracks, such as yard tracks or industry spurs. The excavation for the roadbed, however, is predicated upon sufficient width for future double-track along the river. The alignment is changed at Macy Street to bring the tracks outside of the official bank of the river.

(b) Depression Based Upon Union Passenger Station at Either the Plaza Site or the Santa Fe Site

This estimate is the same as in (a) except that double-track with heavy rail is substituted for the present Salt Lake tracks, and that the depression, instead of stopping just south of Ninth Street, is continued around the long curve in order to provide a satisfactory grade on the proposed connections between the Salt Lake tracks and the Santa Fe tracks near Soto and Lugo Streets.

(c) Depression Based Upon Union Passenger Station at Southern Pacific Site

In the following notes, the proposed profile, Fig. 27, on page 147, for the depressed tracks along the river is for convenience referred to as "E. D. (Engineering Department) Profile". North of Aliso Street and south of Ninth Street, the excavation is the same as in A above. Between Aliso and First Street, additional excavation is required by the six tracks (two along the river, two Pacific Electric tracks—these are, however, on a trestle for part of the distance,—and two through steam passenger tracks). Between First and Seventh Streets the river tracks follow the proposed profile in City of Los Angeles Exhibit No. 1, as it is necessary to pass under Seventh Street about four feet lower than the grade proposed on "E. D. Profile", because of a lower approach for Seventh Street viaduct so that the passenger tracks may pass over the street near Anderson Street. From Seventh to Ninth Streets the river tracks are on a grade to meet the grade proposed on "E. D. Profile" at Ninth Street. Between First Street ond the foot of the approach to the northerly curved bridge, excavation is necessary for the steam passenger and Pacific Electric tracks, which are on the "E. D. Profile" grade. Between Seventh and Ninth Streets the approach to the southerly curved bridge is proposed as a fill and the grading included.

Adaptability of Southern Pacific-Salt Lake Plan to Proposed River Track Depression

The approaches and viaducts of the Southern Pacific-Salt Lake plan can be adapted to the plan of depression of the river tracks. It seems

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necessary, however, to discuss in some detail the grade adjustments necessary if this plan is given further consideration:

To explain in detail: At the point where the proposed northerly curved bridge crosses the Santa Fe present main line track, just south of Sixth Street, the proposed grade (after depression) of the Santa Fe top of rail is elev. 243.84. (All elevations herein are referred to City datum.) It is estimated that the gross headroom required would be twenty-six feet at this point—twenty-two feet for lawful clearance and four feet for the floor thickness of the structure. If this northerly curved bridge be on a ten degree curve and on a 1 per cent descending grade compensated 0.04 feet per degree of curve and since it is 700 feet from the Santa Fe tracks to the end of curve, the top of rail on the elevated structure at this point (end of curve) would be at elev. 265.6. From the end of curve to Fourth Street is approximately 850 feet and if the elevated structure descends to Fourth Street on a 1 per cent grade, the top of rail at Fourth Street would be at elev. 257.1. The present Salt Lake top of rail is elev. 256.0. The proposed elevation of the depressed tracks is 246.2, according to City Exhibit No. 1 and 249.6 as we have revised the grades shown in this exhibit. The bottom of the Los Angeles Railway bridge at this point is at elev. 276.8, and subtracting from this the proposed elevation for top of rail of 257.1, we note that the clearance would be 19.7 feet. Either this structure would have to be raised 2.3 feet or the clearance would be impaired by this amount. Though it does not appear to be very difficult to raise the frame trestles carrying the Los Angeles Railway and the highway, a "bump" of 2.3 feet in the bridge would be objectionable. The ultimate Fourth Street viaduct would give full clearance, and since the impairment is on a passenger line on a non-permanent structure, we have decided that the Southern Pacific-Salt Lake scheme can be adapted to the depressed grades along the river, as far as the northerly curved bridge and its approach are concerned.

If the tangent through the Los Angeles market property (and approaching the southerly curve across the river from the west) be extended, it will cross the Santa Fe tracks (after depression of the later) where the top of rail is at elev. 253.4. Adding on twenty-six feet for gross headroom, as before, gives the elevation of the top of rail on the elevated structure as 269.4. Also, if the south approach to the southerly curved bridge crosses Seventh Street approximately twenty-five feet west of the west line of Anderson Street, it will cross Seventh Street (as shown on Fig. — at elev. 252.3, this being the proposed grade. Seventeen feet gross headroom being required here, the top of rail on the elevated structure would have to be at least 269.3 or approximately the same as where the curved bridge southerly crosses the Santa Fe tracks. In other words, the southerly curved bridge and its approach, as far south as Seventh Street, would have to be level or approximately so. The proposed elevation of top of rail, if the tracks are depressed, at Ninth Street is 227.2 or there would be a drop of forty-two feet (269.3—227.2) between Seventh and Ninth Streets.

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As the distance is approximately 3300 feet, the rate of grade would consequently be 1.3 per cent. This rate of grade is too great, as it should not exceed 1 per cent, and, therefore, the Southern Pacific-Salt Lake plan cannot be adapted to the present plan of depression of the tracks along the river, that is, the plan which proposes the grade of depressed tracks at Seventh Street at elev. 239.7 with a 4 per cent approach grade, as shown on Fig. 56, page 185.

If, however, we depart from the adopted maximum of 4 per cent for the approach grades and use 5 per cent and commence the descent at this rate from the east abutment, neglect the plateau at Anderson Street and depress the Salt Lake tracks adjacent to the river about 5 feet more (that is to elev. 235), we would have an elevation on Seventh Street just west of Anderson Street of 244. Adding 17 feet for gross headroom would give the elevation of the top of rail on the elevated approach to the southern curved bridge of 261, which is 33.8 feet above the proposed grade at Ninth Street. As the distance is just over 3,300 feet, the rate of grade would very slightly exceed 1 per cent, and, therefore, this scheme appears to be practicable. If it were thought desirable not to exceed a 1 per cent grade, the proposed bridge at Ninth Street could be raised about 1 foot on the east side without detracting from its appearance.

The Southern Pacific-Salt Lake have proposed three schemes for getting around the difficulty of grades at Seventh and Fourth Streets, all shown on their Exhibit No. 15 (Fig. 28). The scheme shown in green, according to testimony, is the one which was best thought of. This scheme requires the east end of the Seventh Street bridge across the Los Angeles River to be about 6 feet lower than the west end, and the Salt Lake tracks to be depressed about 18 feet below the present level. We should say that a concrete bridge at this point, which is of more or less monumental construction and visible some distance in almost every direction, should be level as far as the channel spans are concerned. We think this is sufficient ground for the rejection of these plans.

EXCAVATION QUANTITIES

The excavation quantities for depression of the Santa Fe and Salt Lake tracks along the Los Angeles River, as estimated for the various combinations of stations and routes, are as follows:

EARTHWORK QUANTITIES—TRACK DEPRESSION ALONG LOS ANGELES RIVER

Depression of Trackage Along River as Influenced by Various Plans for Union Stations	Side of Los Angeles River: Santa Fe or West Side Cu. Yds.	Salt Lake or East Side Cu. Yds.	Total Cu. Yds.
Alhambra Avenue Depressed			
Depression of Existing* Trackage			
1. No Union Passenger or Freight Station	279,372	208,918	488,290

*Based on completion of double tracks on Santa Fe.

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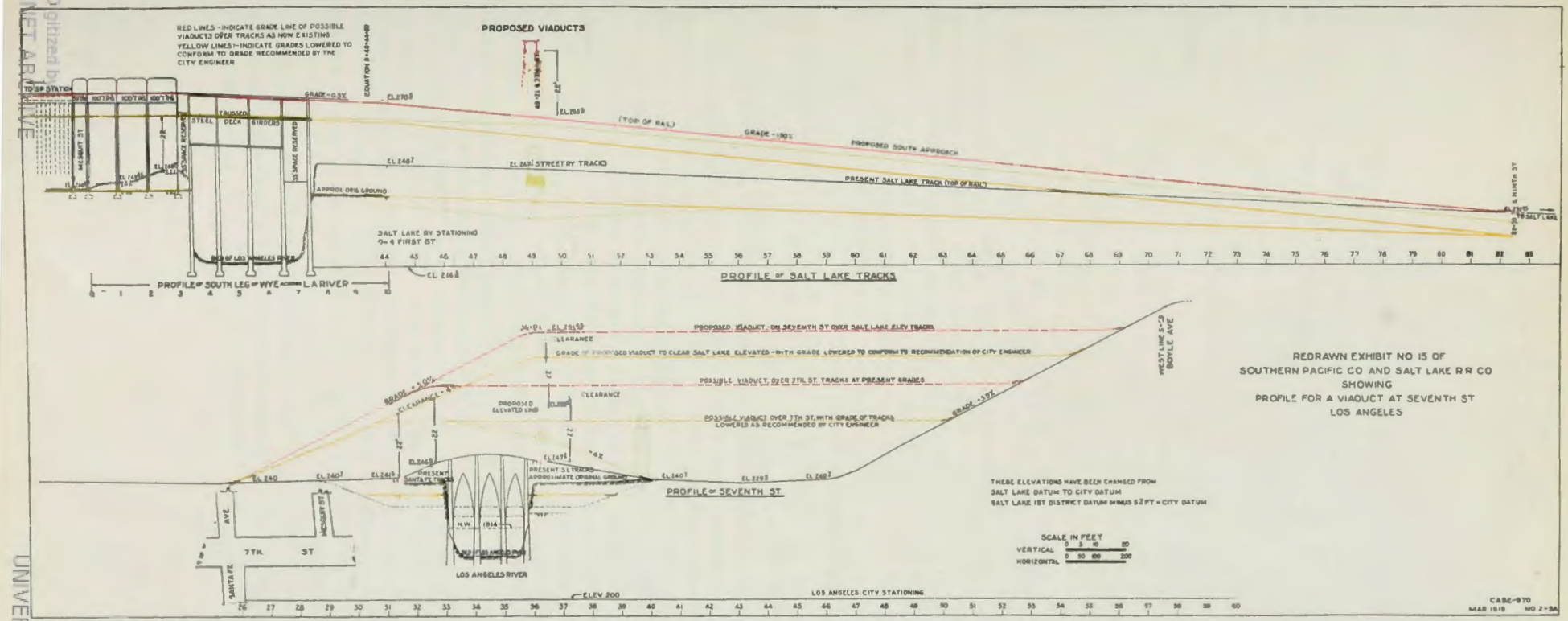

Exhibit No. 15 Southern Pacific-Salt Lake (Redrawn)

FIG. 28. PROFILE FOR A VIADUCT AT SEVENTH STREET

The first profile shows the grades for the tracks on the east side of the river and south of Sixth Street and includes also the curved railroad bridge and wye across the river, as in Fig. 120. The second profile shows the street grades which would result under various plans. To extend the east approach to the top of the bluff would involve an unnecessarily large initial expense and would entirely cut off the flat territory near the river unless an additional approach were provided.

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Depression and Double Tracking			
2. Union Passenger Station at Plaza. Union Freight Station at Santa Fe Site	544,926	235,561	790,487
3. Union Passenger Station at Santa Fe Site. No Union Freight Station	556,629	235,561	792,190
4. Union Passenger Station at Southern Pacific Site. Union Freight Station at Santa Fe Site	554,926	237,911	792,837
Alhambra Avenue not Depressed			
Depression of Existing* Trackage			
1. No Union Passenger or Freight Station	243,107	184,645	427,752

It will be noted that the excavation required for the depression of these tracks along both sides of the river is considerably increased (about 300,000 cu. yds. or over 60 per cent) by the grading necessary to establish either a union passenger or freight station at the Santa Fe site, and also that the total excavation is not materially different between the various plans for the union stations. It may be possible to somewhat reduce the yardage to be moved from the Santa Fe site.

The amount of earthwork is not large for the comprehensive changes which are involved.

ORDER IN WHICH THE WORK SHOULD BE DONE

Simple Depression—No Union Passenger or Freight Station: If no union passenger or freight station is built, but if the grade crossings along the Los Angeles River are eliminated and the tracks along the river are depressed, the first step should be construction of Macy Street and Aliso Street viaducts, which would require depression between Alhambra Avenue and First Street. These two streets are selected as the first on which the grade crossings should be eliminated because of the fact that at Macy Street the vehicular traffic is heavier than at any other existing crossing and because there are three steam railroad tracks involved. Depression of the tracks along the river at Macy Street will require depression at Aliso Street because of the short distance between them. Regardless of this, the heavy Pacific Electric traffic on Aliso Street justifies a separation of the grades. On the Salt Lake side of the river, the tracks would simply be depressed, although the roadbed would be made wide enough for two tracks at least. On the Santa Fe side, now practically all double-tracked, we have estimated complete double-tracking. The different steps in depression are shown in Fig. 23, page 139.

Depression at Macy and Aliso Streets requires two temporary grades. On the Salt Lake side one would be on a 0.441 per cent grade ascending southerly from Aliso Street to Station 87 plus 75, (Fig. 23 on page 139),

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near First Street and another on a grade of 0.773 per cent ascending northerly from Macy Street to Station 50, near Alhambra Avenue. On the Santa Fe side a temporary grade, level, would be installed south from Aliso Street to Station 99 plus 98, near First Street, and another temporary grade north from Station 71 plus 18, just north of Macy Street to Station 53 plus 00, near Alhambra Avenue, the rate of grade being 0.969 per cent ascending northerly.

Union Station at the Plaza: Under this plan, steps in the depression of the tracks along both sides of the river would be the same as in (a) above—depression of existing trackage. South of First Street double tracks would be constructed adjacent to the river on the present grade to the existing main line double tracks at Sixth Street.

Union Station at the Santa Fe Site: The depression of tracks along the river at Macy and Aliso Streets and the establishment of the terminal requires a complete regrade on the west side of the river from Macy Street to approximately Sixth Street. Temporary grades connecting the depressed and existing grades would extend from Macy Street to Alhambra Avenue and from Sixth to Seventh Streets. The existing First Street viaduct, being higher than the proposed new viaduct, need not be replaced because of the union station at the Santa Fe site.

On the west side of the river, the depression would be the same as for the union station at the Plaza.

Union Station at Southern Pacific Site: The second step would consist of depression of the tracks between Alhambra Avenue and North Broadway on both sides of the river, and the third step from Aliso Street to Station 199 plus 68 on the Salt Lake side of the river and Station 210 plus 00 on the Santa Fe side. A union station at the Southern Pacific site would affect the depression of the tracks along the Los Angeles River as follows:

In order that sufficient trackage be provided, the Salt Lake tracks should be double tracked north of Fourth Street before the union station is put into operation. Since the elevated approach to the Southern Pacific station from the Los Angeles River could only be built to a permanent grade, and as this permanent and ultimate grade requires depression of the Santa Fe and Salt Lake tracks in order to pass under the elevated tracks just south of Sixth Street, and further, in as much as the northerly approach should pass under the Fourth Street viaduct and the southerly approach over Seventh Street and under Ninth Street, the Salt Lake tracks should be depressed from Macy Street to the southerly curved bridge proposed over the Los Angeles River. Temporary grades would bring the tracks to the existing grade at Alhambra Avenue on the north, and Seventh Street on the south. The Santa Fe tracks would be depressed as in the heading (b) above. In addition, they would have to be depressed to pass under the proposed elevated approach to the Southern Pacific Station. This would occur just south of Sixth Street, the existing grades being regained at Seventh Street and about Willow Street.

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CHAPTER VII.

OUTLINE

General Elements of Design

- Bridge Roadway
- Approach Grades
- Cost Estimates

Present and Proposed Bridges

- Humboldt Street—Santa Fe Bridge
- North Broadway Bridge
- North Spring Street Bridge
- North Main Street Bridge
- Alhambra Avenue—Southern Pacific Bridge
- Macy Street Bridge
- Aliso Street Bridge
- First Street Bridge
- Fourth Street Bridge
- Seventh Street Bridge
- Ninth Street Bridge
- Butte Street—Salt Lake Bridge
- New Double Track Railroad Bridge South of Butte Street
- Santa Fe Railway Bridge—South of Butte Street
- Twenty-Sixth Street Bridge

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CHAPTER VII

PRESENT AND PROPOSED BRIDGES OVER THE LOS ANGELES RIVER

In a plan for the elimination of grade crossings adjacent to the Los Angeles River by the depression of the Santa Fe and the Salt Lake tracks along the river and by the elevation of the streets, the element of cost is one of the controlling factors.

We have, therefore, drawn plans and made estimates for structures to carry the following streets over the tracks and the river:

North Spring Street,
North Main Street,
Macy Street,
Aliso Street,
First Street,
Fourth Street,
Seventh Street,
Ninth Street,

At North Spring Street, it is proposed to remove the present structure, but at all of the other streets it is proposed that, ultimately, new bridges shall be built.

GENERAL ELEMENTS OF DESIGN

A survey of the plans we present will show that we have endeavored to maintain a general standard of construction and have adopted a type of bridge which, we believe, will make the best appearance at a low first cost and which will be the most economical to maintain.

Arch bridges are, without question, the most desirable from the aesthetic standpoint, and when constructed of reinforced concrete, there is practically no maintenance expense outside of that of maintaining the roadway. Our designs for all these bridges show reinforced concrete arch structures of three spans. It is well recognized architecturally that there should be an uneven number of arches for the most pleasing effect, and since it also appears more economical to use three spans across the 300 foot channel of the river, our designs for all these bridges show three spans of 100 feet each.

Bridge Roadway

The majority of the streets leading to the river are 80 feet wide, with a 56 foot roadway and 12 foot sidewalks. The most recent bridges, at North Broadway, North Main and Seventh Streets, adhere to this width of roadway, which provides for two lines of cars and four lines of vehicles, including operating clearances. As the number of pedestrians, as revealed by traffic counts, does not indicate that a sidewalk over 6 feet in width is necessary, two walks of this width have been used in the design. The sketch below shows the cross section of an 80 foot street where ample room is provided by a 56 foot roadway.

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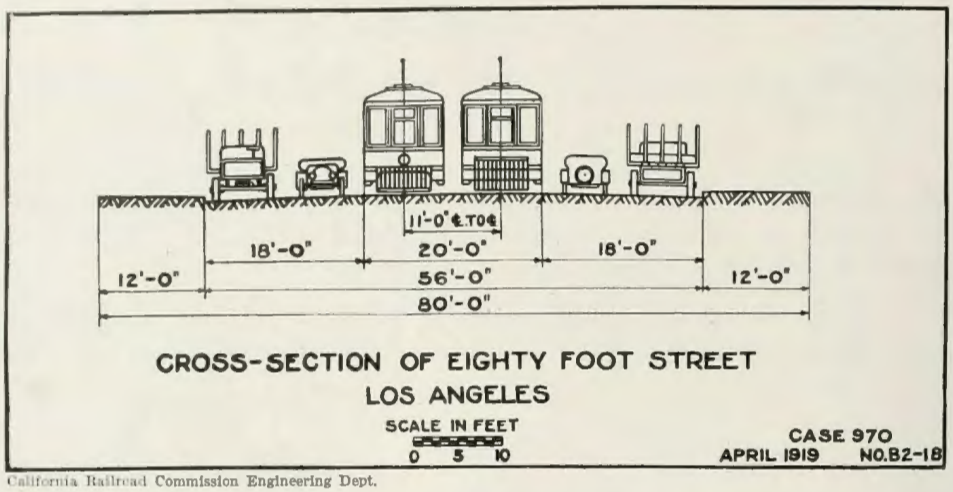

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FIG. 29. CROSS-SECTION OF EIGHTY FOOT STREET

North Main, Macy, First, Fourth, Seventh and Ninth Streets are 80 feet wide at the Los Angeles River. This section is drawn to show the space allotted to cars, vehicles and pedestrians in the normal arrangement. It is important that this arrangement be maintained at bridges and tunnel portals with the faster traffic toward the center. Nine feet is the standard width for one line of vehicles including clearance.

The approaches to the bridges really consist of two parts: The structure which carries the street over the tracks adjacent to the river, and the approaches descending from these spans to the street level. The spans over the tracks have been designed in steel in order to provide a minimum floor thickness, and therefore a minimum elevation for the roadway on the viaduct, and a minimum length of approach grade. While this form of construction is, ordinarily, undesirable on account of the corrosion resulting from the locomotive gases, this objectionable feature may be overcome by cement gun treatment and by a reinforced concrete suspended ceiling under the bridge. The girders would support reinforced concrete floor slabs on which the pavement would be laid.

Approach Grades

A study of the approach grades has led us to the conclusion that 4 per cent is the maximum which should be used. We believe it will be readily conceded that anything over 5 per cent is too steep, and as the difference in cost between 4 per cent and 5 per cent grades is not particularly large, we have endeavored to keep the approach grades down to 4 per cent. However, in one or two cases, this has been increased slightly on account of large property damages which would result from absolute adherence to this rate. The present grades of 7 per cent on North Spring Street and 7½ per cent on First Street are admittedly too steep.

For the sloping approaches, an earth fill, or retaining walls and fill, is the most economical form of construction. In some locations, the simple fill is possible; in others, on account of abutting property, it would be

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necessary to construct reinforced concrete retaining walls along the property lines.

In presenting these designs, it will be understood that they are but preliminary: they are necessary for a secure foundation upon which estimates can be made but do not preclude any changes which may prove desirable. In fact, it is expected that changes will be made, but the drawings are adapted for use as a basis for detailed working drawings.

In general we have shown spans over three tracks along both the river banks, and the estimates are based on this assumption. Union passenger station plans, or other plans, have considerable influence on the trackage, and as all plans could not be provided for in one drawing, we have used this basis of three tracks, subject to change for final plans.

Cost Estimates

The estimates of cost for the various viaducts, as given in connection with each bridge, cover the total cost of changing from the present structure and include, in addition to the structural costs, the estimates covering additional land where necessary, changes in pole and pipe lines, street railway tracks, building changes, temporary structures and damages for the full length of bridge, including approaches. The figures do not include any changes in the steam railroad tracks, these alterations having been covered in the estimates for the depression of these tracks.

PRESENT AND PROPOSED BRIDGES

Humboldt Street-Santa Fe Bridge

Humboldt Street-Santa Fe Bridge carries the main line of the Santa Fe between Los Angeles and San Bernardino, via Pasadena. This single track through skew truss steel structure, located north of North Broadway Bridge, is beyond (north of) those parts of the Los Angeles River banks which are involved in the elimination of grade crossings adjacent to the river, and in this report no reconstruction of this bridge is contemplated.

North Broadway Bridge

North Broadway Bridge (also known as Buena Vista Street Bridge) is a reinforced concrete structure of 7 spans, carrying North Broadway across one end of the Southern Pacific freight yard, Santa Fe tracks, the Los Angeles River, and the Salt Lake tracks. This bridge, approximately 900 feet long, was completed about 1913. On the west, North Broadway is cut into the hill, so that no filled approach is necessary. The east end branches into Pasadena Avenue and North Broadway, the approaches to these streets being on earth fill with a street grade of approximately 5 per cent. The erection of this structure is notable in that it is really the first satisfactory solution of the grade crossiing problem, the bridge crossing over 24 steam railroad tracks. It is a monumental structure and thoroughly modern, and no one interested in the problem of eliminating grade crossings on the Santa

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Fe and Salt Lake tracks along the river has considered it necessary to change this structure or to alter the present grades of the tracks which run beneath it. This bridge carries two tracks of the Los Angeles Railway and has a roadway 56 feet wide and two sidewalks of 8 feet.

We recommend an inclined approach to this viaduct from Baker Street, as will be noted later. This will serve the traffic now taken care of by the unsightly Spring Street Bridge, the ultimate removal of which is recommended.

FIG. 30. SANTA FE BRIDGE ACROSS THE LOS ANGELES RIVER

This single track steel structure carries the main line of the Santa Fe via Pasadena across the River. It is located near Humboldt Street. Nothing is contemplated in this report which would require changes in this bridge.

FIG. 31. NORTH BROADWAY BRIDGE

This reinforced concrete structure, built in 1913, carried North Broadway over the Southern Pacific and Santa Fe tracks, the Los Angeles River and the Salt Lake line to Pasadena, and marks the first comprehensive step of the City in the permanent elimination of grade crossings. About 17,000,000 people per year use this viaduct.

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FIG. 32. NORTH SPRING STREET BRIDGE CROSSING THE TRACKS OF THE SANTA FE, THE LOS ANGELES RIVER AND THE TRACKS OF THE SALT LAKE

This steel deck structure, built before 1890, is in fair condition and will undoubtedly be fit for some ten years. While the approach grades are approximately seven per cent, the traffic is not very heavy. A street car line which crossed this bridge was removed in 1918. As noted elsewhere, the floor on the right main span can be raised level with the top chord, and a new approach built to correspond therewith.

North Spring Street Bridge

North Spring Street is carried over the river on a steel deck truss bridge with approaches consisting of a plank floor supported by steel stringers on steel bents. The total length of the bridge is 742 feet; the width is 56 feet, which is used for a 30 foot roadway, and a sidewalk on either side. This 30 foot roadway was partly occupied by the tracks of the Los Angeles Railway, which were spaced 11 feet centers, but these tracks were removed in 1918. The grade of approach on the west side of the river is 7½ per cent and on the east side is 7 per cent. The clearance over the Santa Fe tracks is 20.45 feet or 1.55 feet less than lawful clearance, and on the Salt Lake side the clearance is 17 feet 8 inches on the main line and 19 feet 9 inches on the siding, or 4 feet 4 inches and 2 feet 3 inches respectively less than the lawful clearance of 22 feet. The river spans are 100 feet, three in number, and are supported on 50-inch steel cylinder piers.

This structure is a very old one and we have been able to derive very little information regarding its history. It might be interesting to note that the yokes used for a cable railway are still in view from beneath the bridge, which is, in itself, indicative of the use of this bridge as far back as 1890. At the present time, the bridge is well painted and is probably satisfactory for the small amount of traffic which it carries, except that

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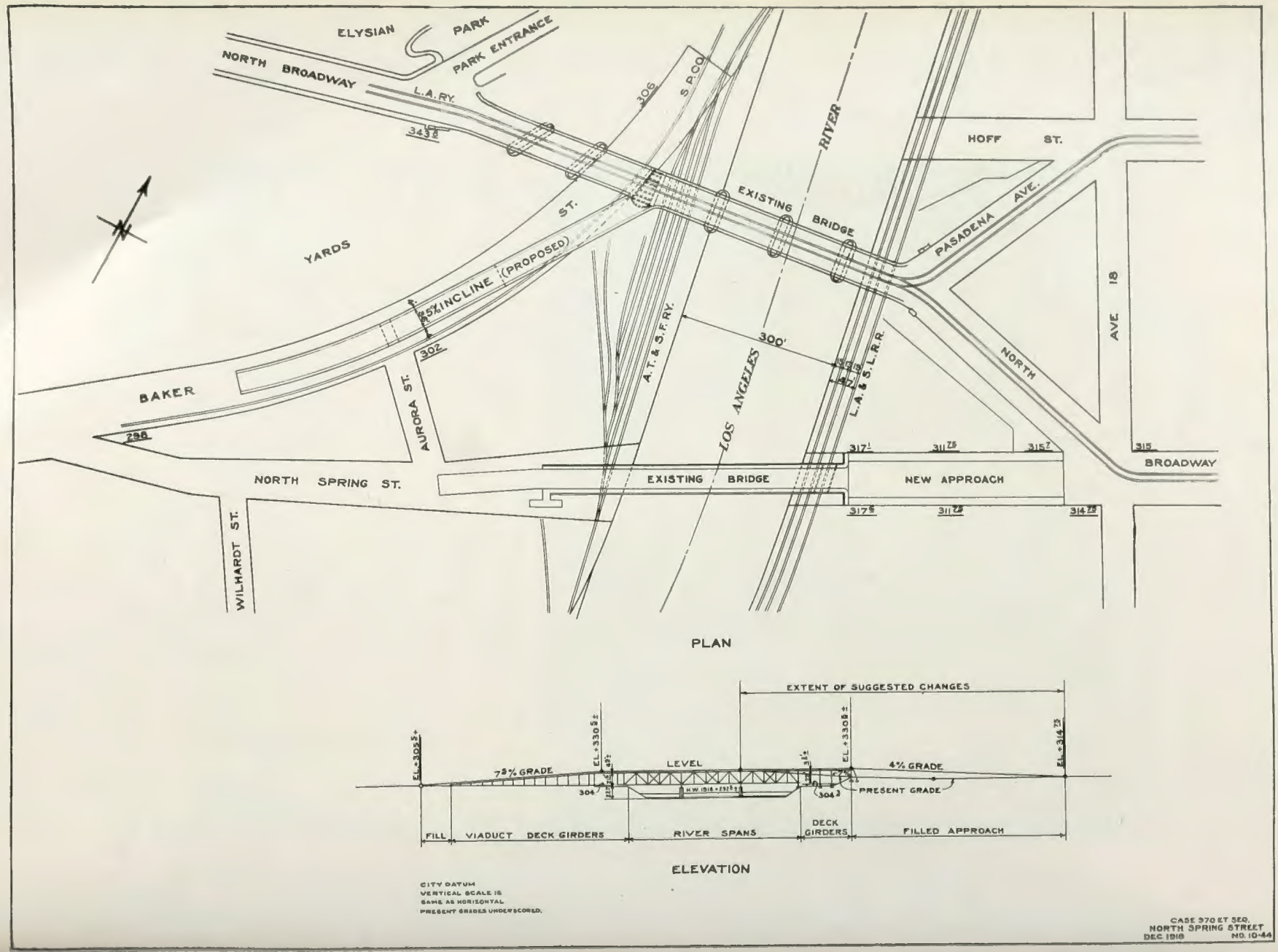

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FIG. 34. PLAN AND ELEVATION OF EXISTING BRIDGE AT NORTH SPRING STREET

bridges in order to improve the grade of the tracks along the east bank of the river, and to provide additional

Elimination of this bridge is recom-

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FIG. 33. NORTH END OF NORTH SPRING STREET BRIDGE

It is possible to raise the floor, which now slopes, so that it will be level and at the same elevation as the top chord of the truss, construct new steel approach spans over the Salt Lake tracks, and extend the filled approach toward Pasadena Avenue. The present clearance over the Salt Lake tracks, which are dipped under the bridge, is approximately 6 feet less than lawful clearance. It is recommended that this structure be removed entirely in the future, in accordance with plans.

there is excess vibration under heavy trucks. The use of this bridge was almost entirely discontinued after the construction of the so-called Buena Vista Viaduct, which carries North Broadway over the river.

The present grade of the Salt Lake track on the east bank of the river between the North Spring Street bridge and the North Broadway bridge is 1.4 per cent. The elevation of top of rail at North Spring Street is 300.89. By improving the grade, as shown in Fig. 23 on page 139, the elevation at North Spring Street will become 304.29.

This change, together with the addition of one or two tracks, would require reconstruction of the east approach to the North Spring Street bridge approximately as shown in Fig. 34. It would be necessary to raise the floor beams on the eastermost river span and to use new steel construction over the tracks. It is estimated that these alterations would cost $72,450.

An alternate plan is to buiid an incline from the wide pier of the present North Broadway bridge down to grade on Baker Street, as shown on Fig. 129. This plan has several advantages: As the North Spring Street bridge is about 30 years old, it would have to be rebuilt soon under the first scheme. As it is only about 400 feet from the North Broadway bridge and 1200 feet from the North Main Street bridge, the renewal would hardly seem justified. The west approach has a grade

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FIG. 35. LARGE PIER—NORTH BROADWAY BRIDGE

This view shows the large pier where the viaduct recommended in Baker Street would connect with North Broadway Bridge.

of 7½ per cent. The only excuse for its continued existence seems to be the fact that it serves the lower territory west of the river and south of North Broadway. This territory will be made accessible from North Broadway by this incline in Baker Street.

The Baker Street incline will cost more than the North Spring Street incline, our estimate being $111,051; and rather than expend $72,450 for a temporary approach to Spring Street viaduct, it is preferable to construct the Baker Street approach and to demolish the Spring Street bridge as soon as reconstruction of the Salt Lake tracks—which pass under it—makes this necessary.

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FIG. 36. NORTH MAIN STREET BRIDGE, CROSSING THE SANTA FE AND SALT LAKE TRACKS AND THE LOS ANGELES RIVER

This modern structure was built in 1908-1909, has a roadway 56 feet wide and two 6-foot sidewalks. The viaducts recommended in this report are similar to this structure, if it were at elevation great enough to cross over the tracks at both ends of it. It is proposed that this structure, except the piers, be raized, and a new viaduct built on the existing piers.

North Main Street Bridge

Main Street is carried across the river on a 3-hinged arch concrete structure of 87 feet clear spans supported on skewed concrete piers. This bridge was built in 1908-1909, part of the cost being contributed by the Los Angeles Railway. This bridge is 68 feet in clear width, 56 feet being used for the roadway and 12 feet for the two sidewalks. The approaches are slightly elevated above Main Street, the grade being 2 per cent on the west side and 4 per cent on the east side. This is a thoroughly modern structure in every respect and is in excellent condition.

The depression of the river tracks at Main Street being considerably less than at the other crossings, the approaches are necessarily much longer, the depression of the tracks recommended at this point being as follows:

Santa Fe Tracks.....2.5 feet
Salt Lake Tracks.....4.5 feet

For the west approach, enough property should be acquired to make an easy curve at the turn, and access to Chavez Street should be provided by a driveway at the present grade alongside the approach. The sidewalk on the side of the viaduct may extend over this driveway, supported by brackets from the retaining wall.

On the east side of the river, Darwin, Mozart and North Main Streets converge but do not intersect. Darwin Street, although 80 feet wide, stops at Douillard Street, and Mozart Street reaches within 40 feet of Main Street.

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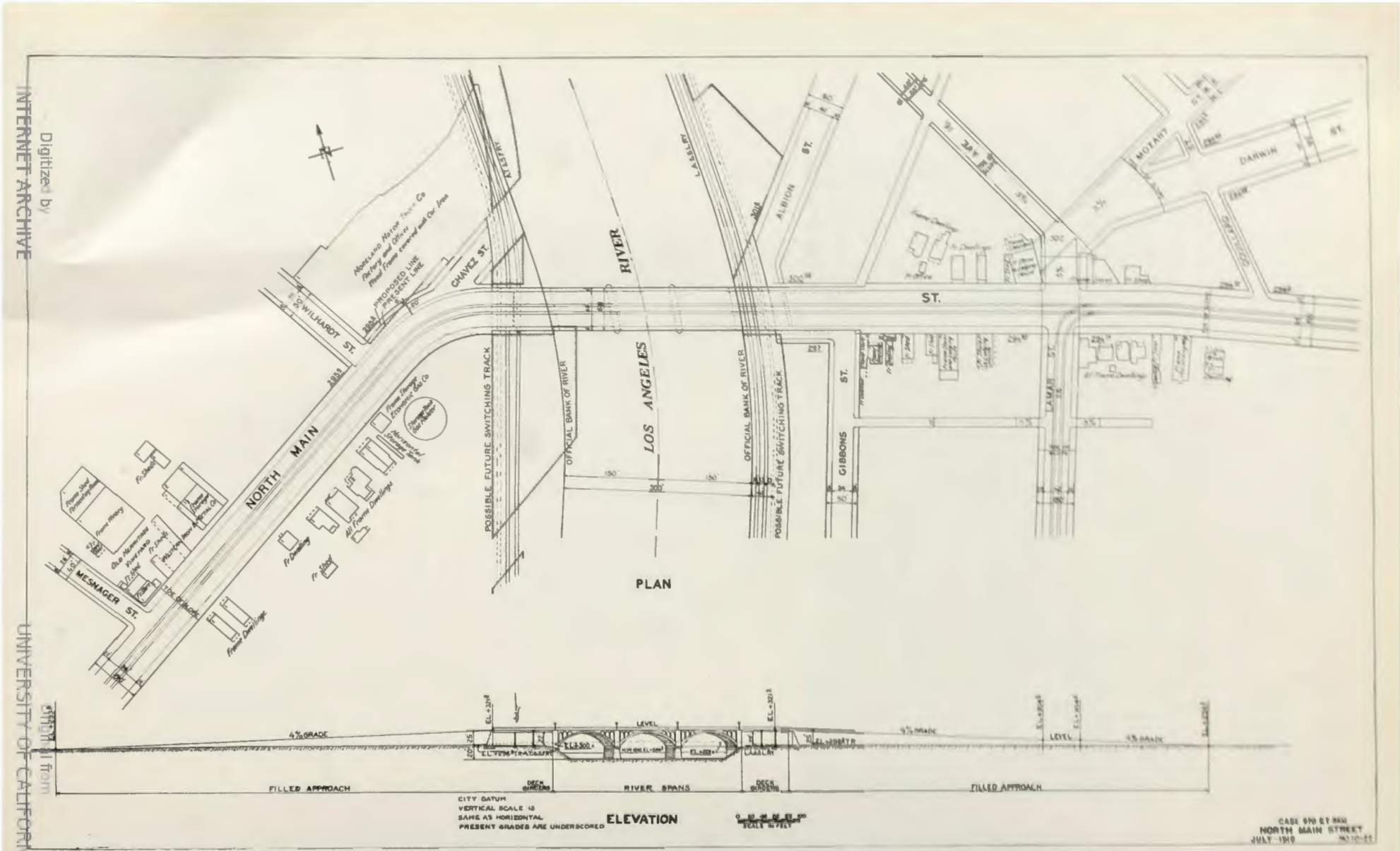

California Railroad Commission Engineering Dept.

FIG. 37. PLAN AND ELEVATION FOR A BRIDGE OVER THE LOS ANGELES RIVER AT NORTH MAIN STREET

This drawing has been made to conform to the general plan of depressing the tracks along the river. As at this point the depression is slight, the approaches are longer than at the other crossings. The advisability of extending Darwin and Mozart Streets is at once apparent.

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It would seem logical to extend these streets to an intersection. Lamar Street must connect with the viaduct because of the Los Angeles Railway tracks and the heavy traffic thereover to the Southern Pacific shops. Albion and Gibbon Streets, although unimportant, are shown connected by a subway.

The new viaduct, it is estimated, would cost $543,084.

FIG. 38. SOUTHERN PACIFIC BRIDGE ACROSS THE LOS ANGELES RIVER AT ALHAMBRA AVENUE

This is a through double-track riveted truss bridge, built in 1903. In this report it is proposed to leave it as it is for the present. Ultimately, when the Santa Fe and Salt Lake tracks are depressed, this bridge should be lowered to correspond.

Alhambra Avenue-Southern Pacific Bridge

Alhambra Avenue Bridge carries the double tracks of the Southern Pacific across the Los Angeles River, these tracks crossing at grade the Santa Fe tracks on the west bank and the Salt Lake tracks on the east bank. These crossings are protected by interlocking. This modern steel structure was built in 1903 and is in good condition.

As discussed elsewhere in this report, with both Macy Street and North Main Street available, it will not be necessary for many years to use Alhambra Avenue for highway purposes. The City granted the Southern Pacific a perpetual right of way over this street, and since it is well used as a principal railroad entrance and because of its directness, we have not thought it advisable to recommend any changes in the present bridge across the Los Angeles River at Alhambra Avenue.

We are, however, presenting estimates for the depression of the tracks along the river, both with Alhambra Avenue depressed and with that street as it is; and in the former case the estimate includes the cost of lowering the Alhambra Avenue bridge and the necessary changes in grade on the Southern Pacific tracks which will accompany the lowering of the bridge.

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Macy and Aliso Streets should be considered together. From the evidence presented, there was some question as to whether one or two bridges should be built, and if one, on which street. Macy Street has several advantages over Aliso Street:

1. It has a shorter approach on the east side of the river.
2. The crossing of the river is more nearly a right angle, and ,therefore, a more economical bridge is possible.
3. Macy Street connects two very important main thoroughfares—Sunset Boulevard and Mission Road.
4. Lyon, Howard and Center Streets lead from Macy Street into Aliso Street diagonally; thus a bridge on Macy Street would serve both streets.
5. Macy Street and Brooklyn Avenue already have an existing car route of the Los Angeles Railway.

Aliso Street has some points in its favor:

1. It is wider than Macy Street, having a width of 90 feet, while Macy Street is but 80 feet wide.
2. It is somewhat more direct. However, it is practically the same distance from Mission Road and Macy Street to Lyon and Aliso Streets via Lyon and Macy Streets and via Aliso Street.

The district east of the river and between Macy and First Streets is conveniently served either by First Street or by Macy Street. Aliso Street, east of the river, is unimportant and it finally intersects Macy Street, which is known as Brooklyn Avenue on the east side of the river.

Mr. H. C. Nutt, General Manager of the Los Angeles and Salt Lake Railroad, in his testimony before the Commission, favored but one bridge for the two sites, and that one at Macy Street (Trans. p. 1092). We agree with Mr. Nutt.

It will be well to bear in mind that it is best to build adequate bridges, even if fewer are constructed.

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FIG. 39. BRIDGES ACROSS LOS ANGELES RIVER AT MACY STREET

The nearer bridge is that of the Los Angeles Railway; the farther, the highway bridge. The river bed has been considerably filled up at this point by the dumping of refuse into it, with a resulting contraction of the waterway. If tracks along the river are to be depressed, such dumping should be prohibited, as contraction of the channel at one point backs the water up to a higher level.

Macy Street Bridge

Where Macy Street crosses the river, there are at present two bridges: one a single track 2-span through timber Howe truss carrying a single track of the Los Angeles Railway; the other, which carries the vehicular traffic, is a 3-span through wood Howe truss having a roadway 18.3 feet wide and one sidewalk about 6 feet wide. The railway bridge was built about 1903 and is not in very good condition on account of obsolescence. The 153 foot span sways badly (laterally) under the cars and it has been necessary to place a false bent in the center of it with suitable attachments to prevent this sway. The spans of this bridge are 153 and 129 feet long.

The highway bridge was also built about 1903 and at the present time has about reached the end of its life, both from the standpoint of natural deterioration and of obsolescence. The bridge has three 100-foot spans and is supported on steel cylinder piers, which, in turn, are supported on concrete piers. The concrete piers were added as underpinning as the bed of the river was lowered. This condition also exists at North Spring Street bridge, and, in fact, at all the bridges across the river.

Neither the railway nor the highway bridge has elevated approaches, the grade on both sides of the river practically meeting the grade of the street. On the west side, the grade of approach is 1.5 per cent; the east approach is 3.5 per cent.

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FIG. 40. ALONG MACY STREET BRIDGES
At the left is the Los Angeles Railway bridge; at the right the highway bridge. Because of the obscured view this crossing is particularly dangerous.

Reference to the plans presented for a bridge at Macy Street will show that the existing street lines have been adhered to west of the river. East of the river the street is, at present, only 60 feet wide, but it should be widened to 80 feet, the widening to take place on the south side to reduce the amount of skew for the river crossing. Macy Street is not straight, but the departure from the straight line is so slight that in our opinion the additional expense for property would not warrant a straightening. During the construction of a new bridge, First Street can be used, except for the Los Angeles Railway traffic. This traffic can be taken care of by a temporary foot bridge and a "walking transfer," or possibly by temporary transfer arrangements with the Pacific Electric. On the east side of the river it will be necessary to acquire additional property for street widening. The situation is shown on the plan.

Since the Santa Fe main line is some distance from the river where it crosses Macy Street, this bridge can be constructed with practically no interference with railroad traffic on the west side. The short approach on the east side, together with alterations on account of street widening, would shorten the period of construction and interference with the operation on the Salt Lake.

This bridge, it is estimated, would cost $357,557.

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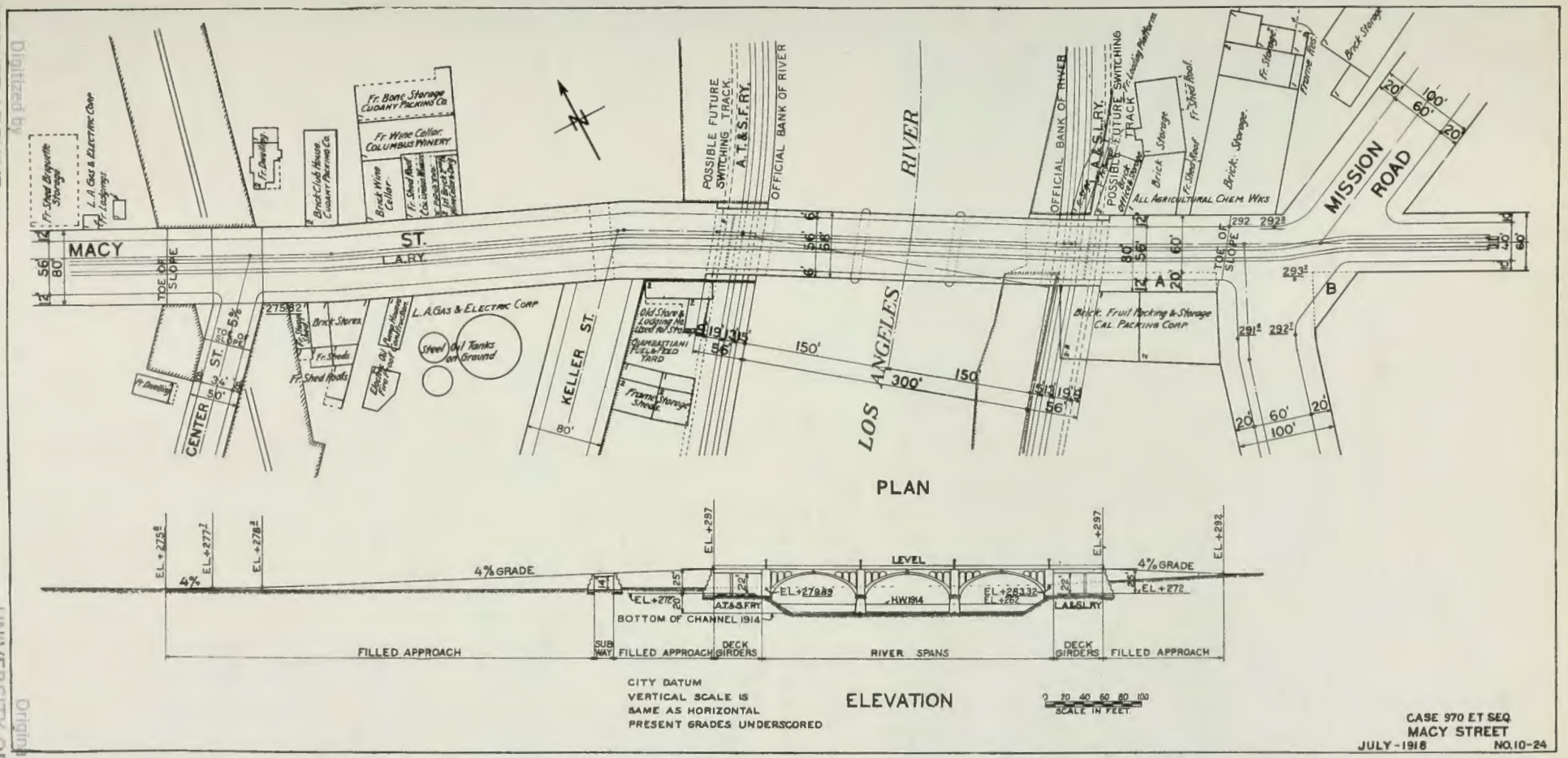

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FIG. 41. PLAN AND ELEVATION FOR A BRIDGE OVER THE LOS ANGELES RIVER AT MACY STREET

At this point the tracks along the river are shown depressed at 20 feet above the riverbed. This will result in a material saving in the length of the approaches, which are virtually regrades, and the abutting property will be served at the upper level. Macy Street has a slight slope away from the river on the west side.

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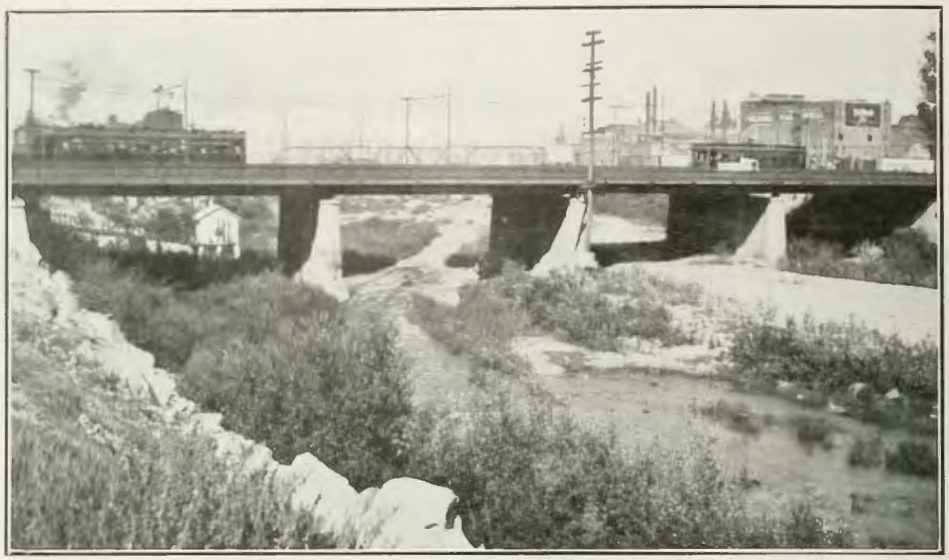

FIG. 42. ALISO STREET BRIDGE ACROSS THE LOS ANGELES RIVER

This through plate girder structure, built in 1904-1905, carries the tracks of the Pacific Electric Railway and two driveways, as is shown in another picture. This bridge is in good condition. On account of three grade crossings adjacent to its ends and as many as 95 train movements per hour, this structure is of great importance in the elimination of grade crossings.

Aliso Street Bridge

Aliso Street Bridge was built in 1904-1905 jointly by the City of Los Angeles and the Pacific Electric Railway. The total cost was $61,195.80 and the Pacific Electric paid $27,336.20, or 44.7 per cent. This is a steel through girder bridge with a roadway 78 feet wide, the center 27 feet of which is used for the double track of the Pacific Electric Railway. Outside of this there are two 20 foot driveways and outside of these two 5 foot, 7 inch sidewalks, cantilever supported. This bridge has four 75 foot spans, supported on concrete piers, and at the present time is in excellent condition. On the west side of the river the grade approach is 2.2 per cent; on the east side 1 per cent. Neither of the approaches is elevated.

All plans dealing with the elimination of these grade crossings at Macy and Aliso Streets provide for the continuance of the Pacific Electric along Aliso Street, at least for local service. One adequate highway bridge at Aliso Street should meet all the requirements, particularly as these two crossings are only 800 feet apart. This will also have a tendency to maintain the parallelism of the vehicle and railroad traffic in that they will not cross after they have left the industrial portion of the city.

In connection with several different schemes, we have prepared different plans for bridges across the river at Aliso Street.

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FIG. 43. VIEW LOOKING ALONG ALISO STREET BRIDGE ACROSS THE LOS ANGELES RIVER

The Pacific Electric tracks occupy the center of the structure between two lines of girders. There is a roadway and sidewalk on either side, the roadways being but 18 feet wide.

The strength of the present Aliso Street bridge has been investigated to determine if it can be modified to use as a four track interurban railway bridge. Using the Southern Pacific specification 1006, the present part, including stringers, floorbeams, and girders, was found to be strong enough for the Southern Pacific oil car wheel loads or Pacific Electric cars of any kind.

It will be necessary to provide new stringers, floorbeams and laterals to replace the present highway construction. They should be of the type now used for the railway part. The present outer girders are also sufficient for railway use. It will be necessary to retain the present spacing of girders because of the substructure. Although no extended study has been made, the existing piers seem adequate. In separating the grades, the bridge will be raised about 17 feet and it may be best to use steel bents on top of the present piers, framing the girders into the columns. This method will add less weight to the footings than if the piers are extended. The existing piers are somewhat narrow to be given additional height.

The total new steel required for the change would be about 658,000 pounds, not including approaches.

The life of the bridge should be about 25 years, after which it should be replaced by a concrete structure.

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Fig. 44, which accompanies the Engineering Department plan for a union station at the Plaza, shows full use of the existing bridge, which will be raised while the present highway portion will be strengthened so that the structure will carry four tracks. The local cars will continue along Aliso Street as at present. The express line, as shown, is part of an ultimate project in that it is designed to connect with a future subway in Main Street. This express line will leave Aliso Street bridge, continue as an elevated road across the property of the Los Angeles Gas and Electric Corporation, and along Ramirez Street. Near the end of this street it will descend to the ground level, where the freight and express connection can be made on the surface; still further west, the line will descend into a subway, and turning to the south, connect with a subway in Main Street. While the possible damages to the Los Angeles Gas and Electric Corporation, because of the result of reconstruction and rearrangement necessary in its plant, may seem large, the average cost per foot is the criterion whereby a project of this kind should be judged, and the right of way and property damages west of Center Street will be comparatively small. The cost per foot for the whole distance between the river and Cain Street is therefore reduced to a reasonable figure.

On the west side of the river, provision is made for four tracks to Covina Junction, passing under the Gallardo Street bridge. Elevated construction in Aliso Street gives team access to abutting property, and should not be objectionable as little use would be made of Aliso Street west of Mission Road.

As an alternative, new and higher piers could be built north of the present Aliso Street bridge, and sufficient property could be acquired on the north side of Aliso Street so that the four tracks would lie just north of the street somewhat similar to the arrangement shown on Fig. 45.

A double track bridge, with double track approaches, is estimated to cost $416,936, based on use of the existing structure.

Fig. 45 shows an arrangement which may be used in case a union passenger terminal is located at the Santa Fe site. As in all plans for a bridge at this site, no highway is provided, and the existing girders are used. They are shown erected on new piers north of, and along side the old ones.

For the express tracks, a reinforced concrete bridge is shown. Because of a bend in the river at this point, the piers can be turned somewhat to reduce the amount of skew of the spans, and, as the cross-section of the river is reduced by only one pier at a time, more and shorter spans can be used than would be practicable for a right-angle crossing.

Fig. 46 was made to show the connections in case the Southern Pacific site should be adopted for a union passenger station, with connections as proposed by the Southern Pacific and the Salt Lake. For

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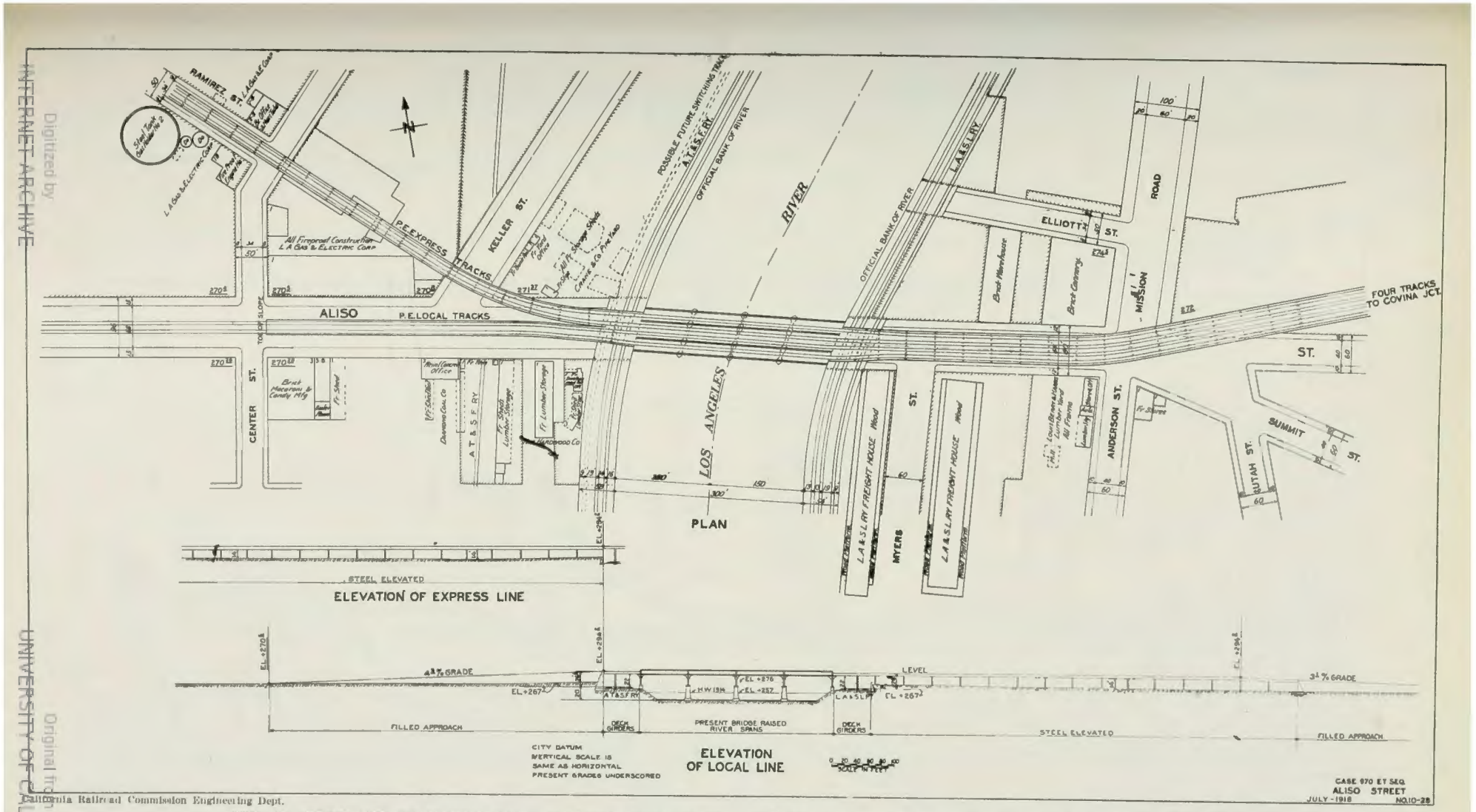

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FIG. 44. PLAN AND ELEVATION FOR AN INTERURBAN ELECTRIC RAILWAY BRIDGE ACROSS THE RIVER AT ALISO STREET

This plan shows the existing bridge raised and converted into a four-track structure for railway purposes only. This arrangement is recommended with the Union Station at the Plaza.

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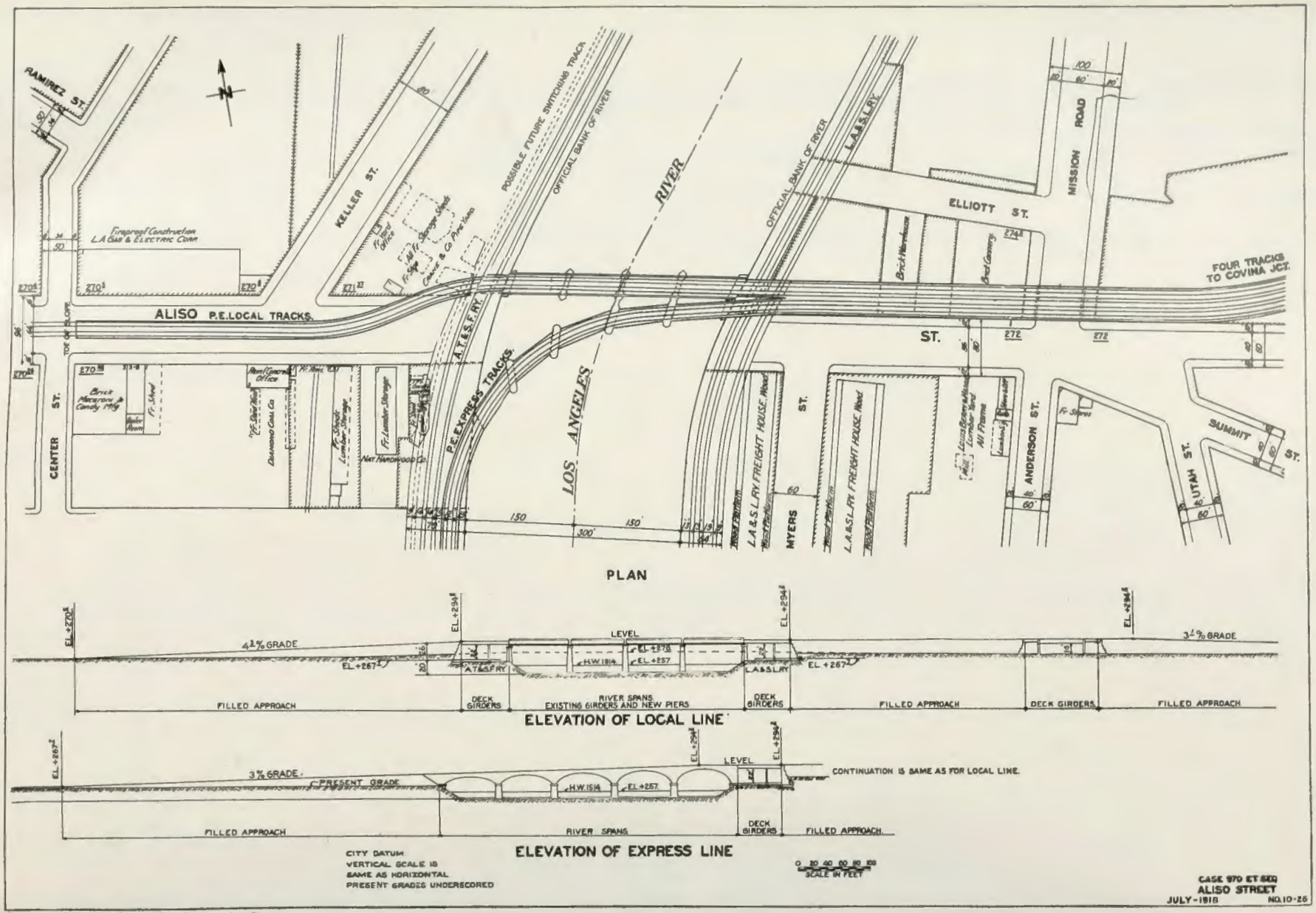

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FIG. 45. PLAN AND ELEVATION FOR AN INTERURBAN ELECTRIC RAILWAY BRIDGE ACROSS THE LOS ANGELES RIVER AT ALISO STREET

This plan shows the arrangement, if the Union Station is located at the Santa Fe Site. The east approach is shown upon private property as an alternative to placing elevated construction upon Aliso Street as in Fig. 44. This plan is not recommended.

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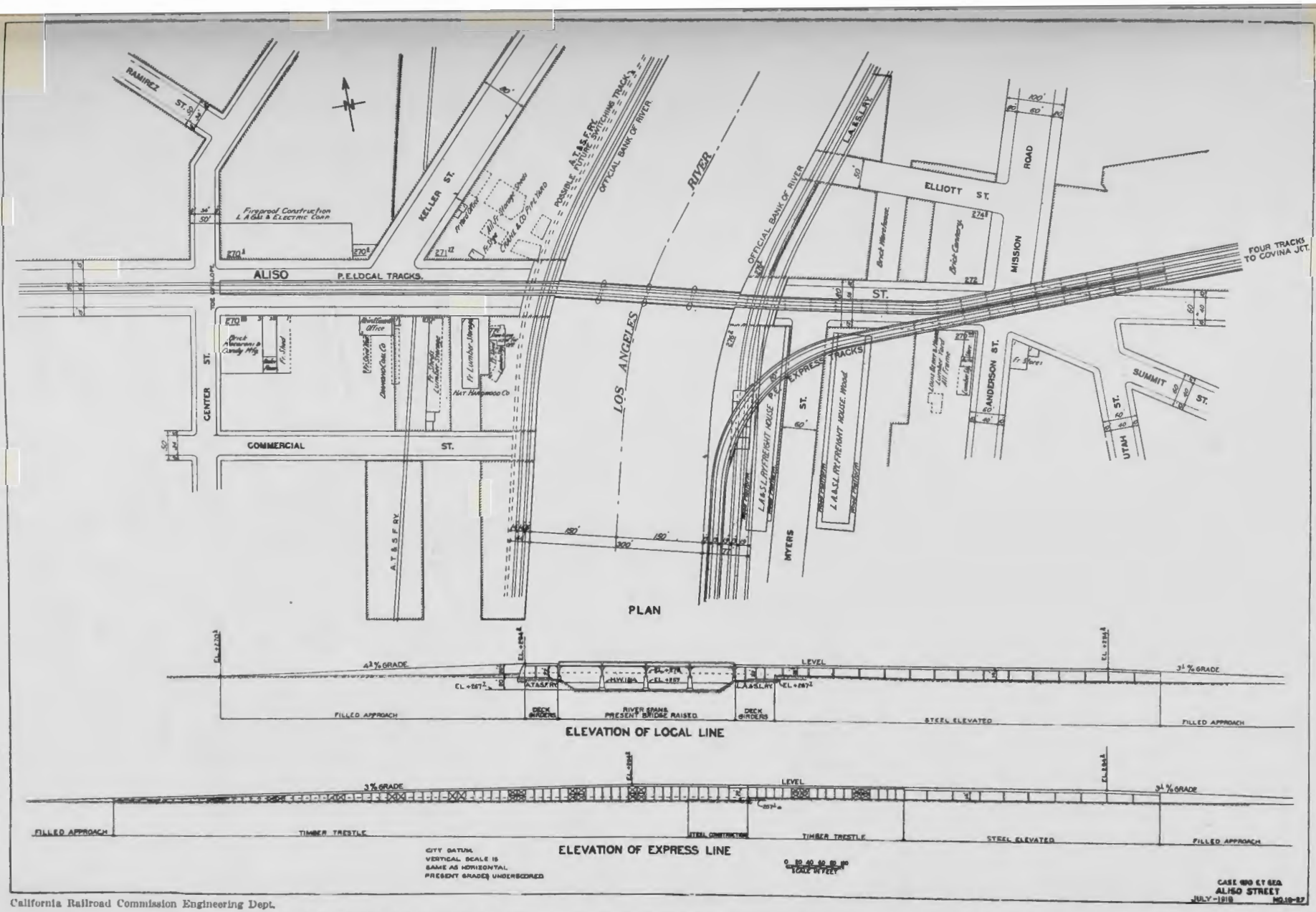

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FIG. 46. PLAN AND ELEVATION FOR AN INTERURBAN ELECTRIC RAILWAY BRIDGE ACROSS THE RIVER AT ALISO STREET

This plan shows the arrangement to accompany the plan of the Southern Pacific Company for a Union Station at the Arcade Site and provides for separating grades.

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the local tracks, the present bridge is raised, using existing girders and piers, the express tracks passing over the Salt Lake tracks, along the river, and proceeding down to grade along the river bank. Steel construction is employed, except for the approach along the river, and the approach is designed as a ballast deck frame trestle. The express route to Sixth and Main Streets is well over half a mile longer than the local route, but because of the absence of grade crossings, would be shorter in point of time. Mr. Paul Shoup, President of the Pacific Electric Railway, testified that the reduction in time to Echandia Junction would be 8 or 9 minutes, but as during part of the day but 10 minutes are consumed for the present trip to Mission Road, this figure is excessive, except possibly during rush hours. Even then the difference is due more to stops for passengers than any other feature.

First Street Bridge

First Street is carried over the tracks of the Santa Fe, the river and the tracks of the Salt Lake by a viaduct, the total length of which is approximately 1400 feet. This viaduct consists of three steel deck truss spans over the river with approaches consisting of a plank floor on steel beams supported by steel bents. The west approach is 478 feet long with a maximum grade of 7 per cent, while the east approach is 90 feet long with a maximum grade of 6 per cent, both of these distances being the length of the steel structure and exclusive of the fills on either end.

FIG. 47. FIRST STREET VIADUCT, ACROSS LOS ANGELES RIVER
This is a steel structure with a wooden floor, built prior to 1890, now in a very bad state of repair, and it has been condemned by the City Engineering Department. The approaches carry the street over the Santa Fe and Salt Lake tracks.

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This bridge is also a very old structure, built, probably, prior to 1890, as we have been advised that in 1886 a car line was constructed across it and the yokes used for cable railways remain in the bridge. The roadway is 55 feet wide, 39 feet of which is used for the street cars (which are on one side of the bridge) and vehicles, the remaining 16 feet being used for two 8-foot sidewalks. The trusses across the river are supported on steel

FIG. 48. WEST END OF FIRST STREET BRIDGE

This view shows the steepness of the approach and how it occupies part of First Street.

cylinder piers. This bridge at present is in bad condition and we have been informed by the City's engineers who are in charge of bridge work, that the structure should be condemned as it is probably overloaded and certain parts of it are very badly corroded.

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FIG. 49. WEST APPROACH TO FIRST STREET VIADUCT
View of understructure, showing insufficient support.

This viaduct is inadequate:

1. As noted heretofore, the west approach is 7½ per cent and is considered too steep.
2. It is short of the lawful clearance over the Santa Fe tracks.
3. Its strength is insufficient for modern loads.
4. It is of an obsolete type and does not conform to the standard set by the City as to appearance.
5. It is physically in very poor condition.

For all these reasons, this bridge should be abandoned and a new structure should be built at this point.

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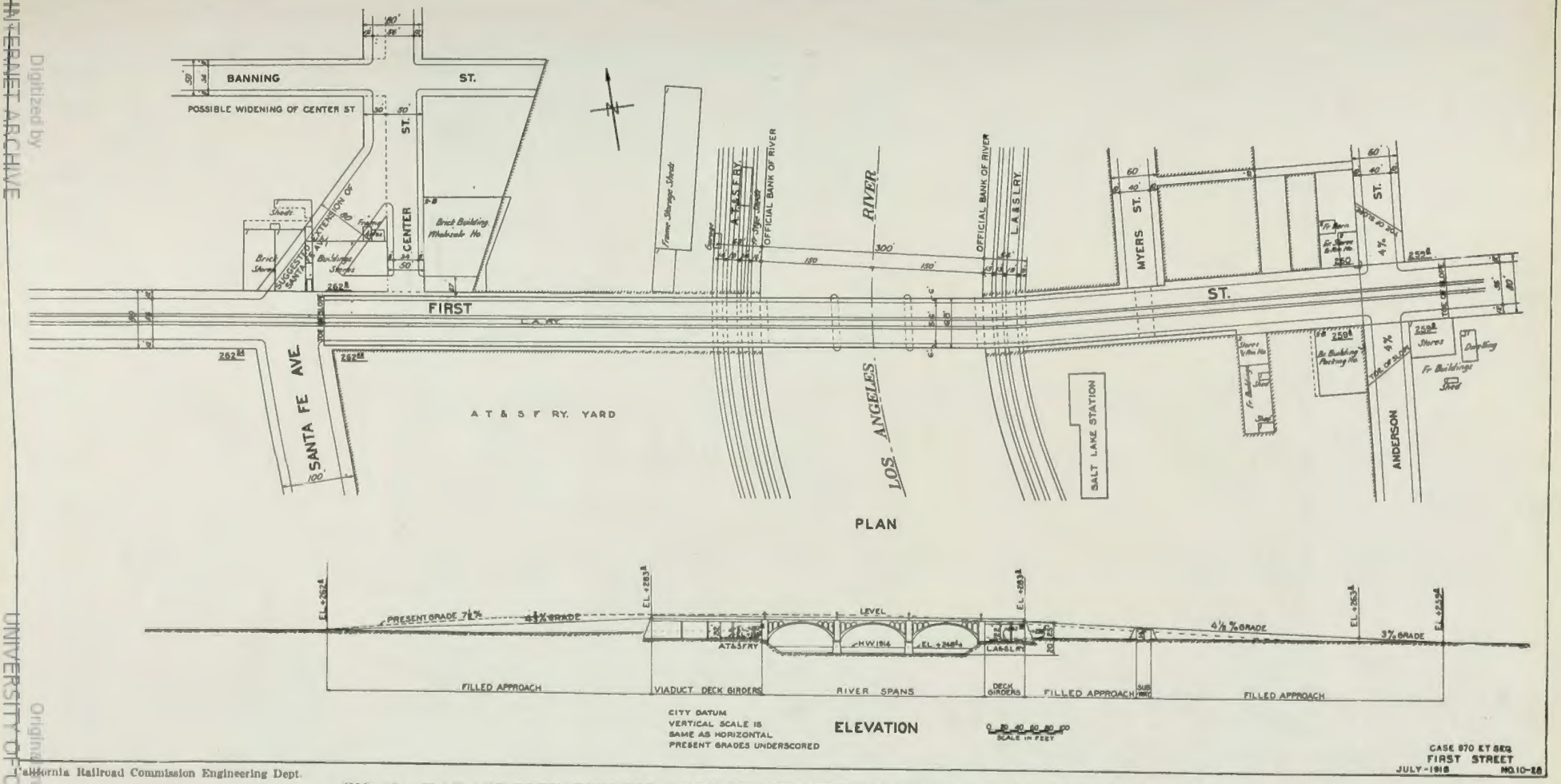

FIG. 50. PLAN AND ELEVATION FOR A BRIDGE OVER THE LOS ANGELES RIVER AT FIRST STREET

This plan shows the kind of structure which should replace the existing bridge at First Street at the time the tracks along the river are depressed. Santa Fe Avenue has been shown extended to Center Street.

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By the depression of the tracks along the river in accordance with the general plan, this bridge can be made of the same type as proposed for Main, Macy, Seventh and Ninth Streets.

On the west approach it is necessary to have sufficient length of viaduct to provide for throat and ladder tracks serving the Santa Fe yard, but it seems inadvisable to extend this approach beyond Santa Fe Avenue, which is the principal north and south street near the river, and which should have direct access to the viaduct. These conditions result in an approach grade of 4.66 per cent. If, however, a union less-than-carload freight station is established, as recommended, at the Santa Fe site, a grade of 4.0 per cent is possible.

In this connection it seems proper to here state that it is suggested that Santa Fe Avenue be extended, connected and widened where necessary from Seventh to Macy Streets. This will form a connecting link between the ends of the proposed viaducts and serve as a thoroughfare for the distribution and equalization of traffic in that part of the industrial district immediately west of the river. No estimate is made of such widening since this suggestion belongs more properly in a general scheme of city planning.

This bridge, it is estimated, would cost $390,209.

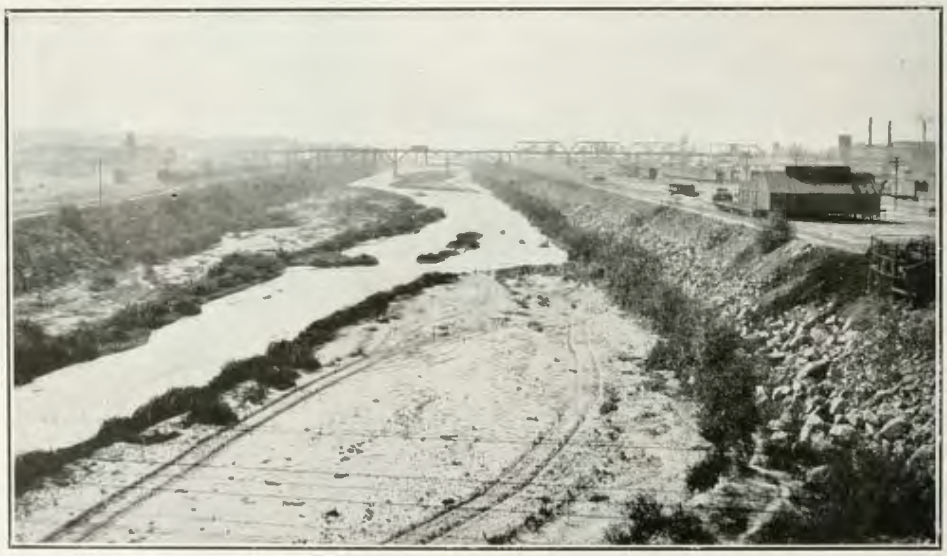

FIG. 51. FOURTH STREET BRIDGES AND THE LOS ANGELES RIVER BED
This view is taken from the north and shows the deck construction across the Los Angeles River, the through bridge across Santa Fe yards on the right and trestle approach across Salt Lake yard on the left. The character of the river bed is also well shown, although there was an unusually large amount of water in the river. The heavy rip-rap along the banks is necessary to prevent erosion in times of flood.

Fourth Street Bridge

At Fourth Street there are two composite structures each about 2,100 feet long, one carrying the street and the other the Los Angeles Railway

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across the freight yard of the Santa Fe, the river and the freight yard of the Salt Lake. For the vehicle bridge, commencing at the west end, there are 100 feet of filled approach, then approximately 300 feet of frame bents and a wooden floor, then five combination through Howe truss spans of lengths from 100 to 114 feet, then three deck combination Howe spans carrying the structure across the river and then wood floor and frame bents and ending with a filled approach about 135 feet long.

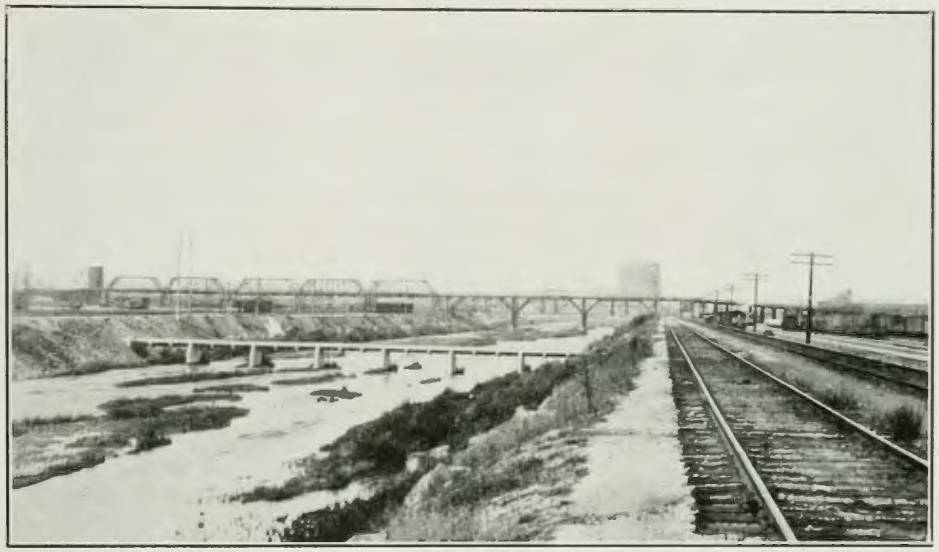

FIG. 52. LOS ANGELES RAILWAY BRIDGE ACROSS THE LOS ANGELES RIVER FOURTH STREET

There are two bridges shown. The nearer is the railway bridge; the other the highway bridge. The five through spans at the left cross the Santa Fe main line and freight yard; the deck spans at the right cross the Los Angeles River. The approach at right crosses the Salt Lake main line and freight yards. Both approaches are timber trestles.

The Los Angeles Railway Bridge is practically the same as the vehicle bridge except that tracks are carried across the Santa Fe yard on five steel through truss spans. The vehicle bridge was built about 1903 and that of the Los Angeles Railway about 1898. The wooden portion of the structure has been renewed since, a large portion of this renewal having been done in 1913. The vehicle bridge has a roadway 19 feet 6 inches wide and a 5-foot sidewalk supported on brackets.

The Los Angeles Railway bridge is double track. On the west side of the river the approach is curved, with a grade of 7.8 per cent, while the east side has a grade of 5.2 per cent. Clearance over the Salt Lake tracks is 21 feet or 1 foot less than lawful clearance. On the Santa Fe or west side, the clearances vary for the different tracks ranging from 16.8 feet to the lawful clearance of 22 feet. Under the trussed portion of the bridge, the clearance is lawful.

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The present bridges at Fourth Street are in good condition and will probably be satisfactory for several years, especially since grade separation has already been accomplished here. We are, however, showing plans for a new bridge at this point. It will be noted that this structure presents a better alignment than the old bridges, being straight, except for one curve. Some rearrangement of the Santa Fe industrial tracks will be necessary, but on the whole both the Santa Fe and the Salt Lake would have more room for tracks than they have at present.

It is suggested that in the future an approach could be built connecting with Santa Fe Avenue at Sixth Street.

The cost of this structure, exclusive of the approach to Santa Fe Avenue at Sixth Street, is estimated at $856,285, including land and damages. This is larger than the bridges at the other streets because of the greater length of the proposed structure.

Seventh Street Bridge

Seventh Street bridge is a reinforced concrete arch bridge of three 80-foot clear spans constructed in 1908-1910 and toward the cost of which (about $115,000, excluding track work and track paving) the Los Angeles Railway contributed $38,480. The roadway on this bridge is 56 feet wide and carries the double track of the Los Angeles Railway. There are two sidewalks 5.8 feet wide. The approaches are slightly raised above the level of the adjacent ground, the grade on the west side being 4 per cent and that on the east side 1.5 per cent, while the grade of Seventh Street, easterly from the bridge and up to Boyle Heights, is approximately 6 per cent. This bridge is a thoroughly modern structure, in excellent condition and cost approximately $115,000, the contract having been let in 1908.

Seventh Street is the principal crosstown street in Los Angeles, both to the east and the west of the business center. The rush-hour vehicle traffic across the bridge and adjacent tracks is nearly equal to the traffic crossing Broadway at Seventh Street.

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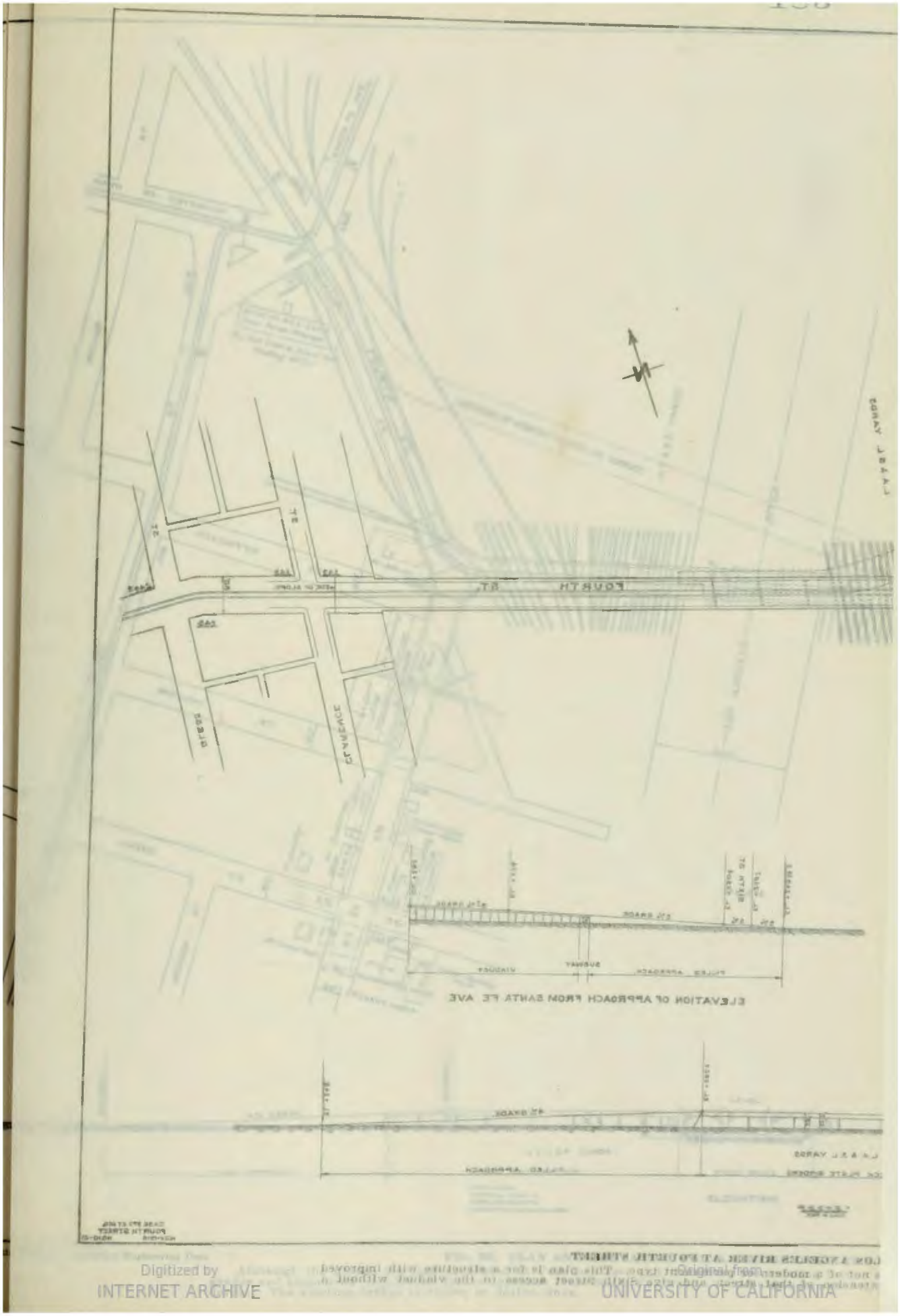

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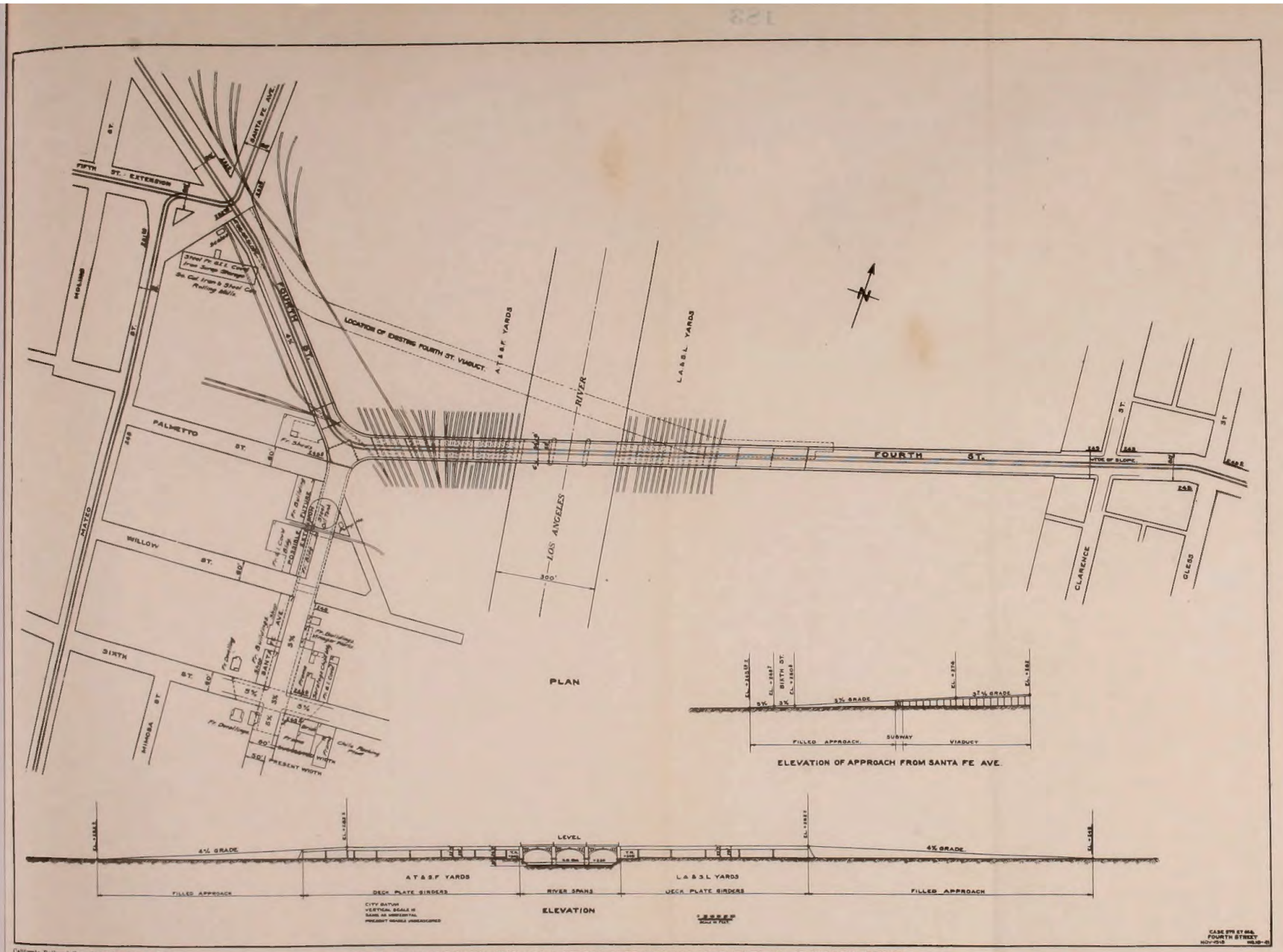

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FIG. 53. PLAN AND ELEVATION FOR A BRIDGE OVER THE LOS ANGELES RIVER AT FOURTH STREET

Although the grades are now separated at Fourth Street and the river, the existing bridge is not of a modern or permanent type. This plan is for a structure with improved grades and alignment. A possible future approach from Santa Fe Avenue would also serve as an extension of that street, and give Sixth Street access to the viaduct without a detour. The existing bridge is shown in dotted lines.

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FIG. 54. SEVENTH STREET BRIDGE ACROSS LOS ANGELES RIVER

This reinforced concrete structure, built in 1909-1910, is the last bridge built by the City of Los Angeles across the river, in which no attempt was made to separate the grades of the street and the railroads on the river bank. This bridge carries a roadway 56 feet wide and two 6-foot sidewalks. Except for the fact that they are higher, the viaducts proposed in this report would have very much the same appearance as this bridge.

FIG. 55. ANOTHER VIEW OF SEVENTH STREET BRIDGE ACROSS LOS ANGELES RIVER

Santa Fe main line is in the foreground and the Salt Lake tracks are between the striped crossing gates in the background. One of these Salt Lake tracks is the switching lead at the entrance to the freight yard over which practically all freight cars entering the yard move several times during classification. Santa Fe and Salt Lake crossings at either end of this bridge are among the most important in Los Angeles, Seventh Street being one of the busiest streets.

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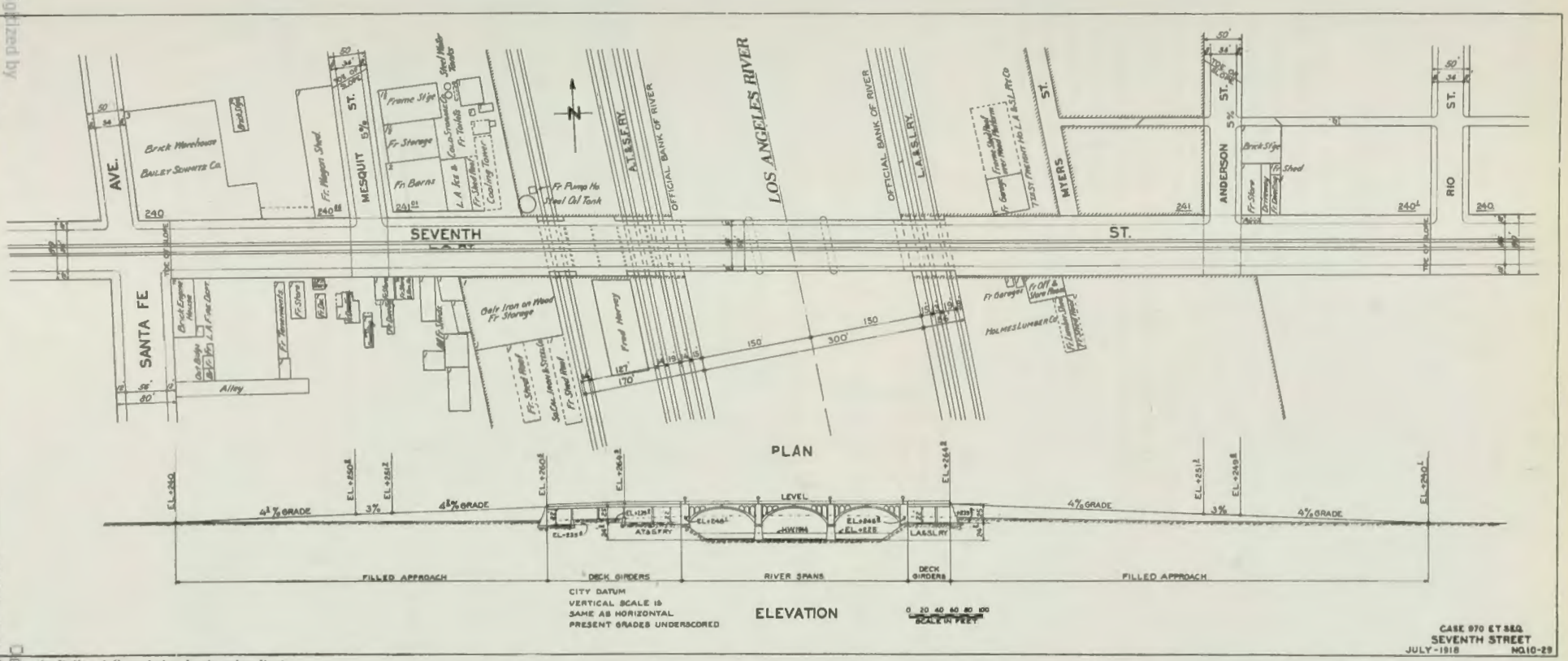

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FIG. 56. PLAN AND ELEVATION FOR A BRIDGE OVER THE LOS ANGELES RIVER AT SEVENTH STREET

This bridge is of the same general type as proposed for North Main, Macy, First, Fourth and Ninth Streets. The viaduct portion is shown extending across the Santa Fe right of way west of the river.

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At this point we have considered two plans, one by which Seventh Street is carried over the depressed tracks and the other where the tracks are carried over Seventh Street. Fig. 56 shows a bridge similar to the existing one but with the grades separated, Seventh Street being raised and the Santa Fe tracks depressed. For the west approach, the grade slightly exceeds 4 per cent, because it is not thought advisable to extend the slope beyond Santa Fe Avenue. The westerly two tracks of the Santa Fe are depressed as well as the main line tracks along the river bank.

Extension of the viaduct to Boyle Heights, as has been suggested by certain witnesses, would not seem justified at present, but this plan will not prevent such an extension when warranted in the future. Between the river and Boyle Heights there is considerable lowland suitable for industrial purposes, which would be damaged by a viaduct in Seventh Street across its frontage. This, perhaps, is one of the best reasons for descending to the present grade on the east side of the river.

This bridge, it is estimated, would cost $567,591.

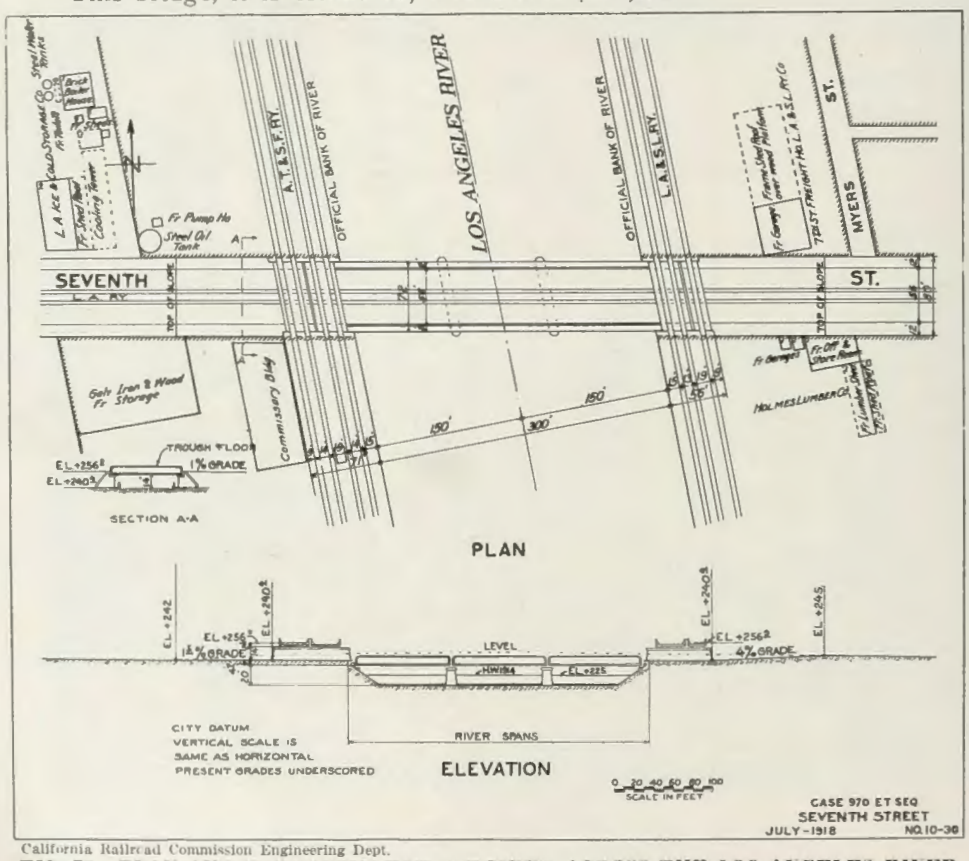

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FIG. 57. PLAN AND ELEVATION FOR A BRIDGE ACROSS THE LOS ANGELES RIVER AT SEVENTH STREET

This plan has been drawn to show a low, level structure across the river with the river banks tracks raised. Although there is some economy in first cost, the arrangement is convenient for spur track connections along the river. As this plan does not conform to the general scheme of track depression, it is not recommended.

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The arrangement in Fig. 57 in which the railroad tracks are raised to pass over Seventh Street was urged from several quarters, but we are unable to recommend this construction. The plan was drawn for purposes of analysis and shows resulting grades and clearances. Independent of the effect upon the railways paralleling the river, it is obviously of lower first cost than the plan by which the tracks are depressed and the street raised as no approaches and little regrading are required. This advantage is, however, offset by the disadvantages. The most serious objections are as follows:

1. Excessive grade for railway lines south of the bridge are introduced.
2. In a case of exceptional flood, the bridge will act as a dam.
3. An attractive design is not possible and the bridge would be far less pleasing in type than the structures proposed at other points because of limited clearances.
4. The plan is not in accordance with the general plan of the depression of tracks along the river.
5. After including cost of the track elevation, spur track connections and steel railway bridges, whatever economy there is in first cost is offset by the disadvantages.

This arrangement would cost, it is estimated, $202,826, against $567,591 for the plan recommended.

FIG. 58. NINTH STREET BRIDGE ACROSS THE LOS ANGELES RIVER

This 2-span combination steel and wood Pratt truss structure is, at this time (1910), in poor condition, and if subject to anything but lightest traffic, would probably require replacement very shortly. The roadway is but 1[illegible] feet wide. Note how the channel is obstructed under the span at the left.

Ninth Street Bridge

The present bridge at Ninth Street is a through wood Pratt truss bridge of two spans (each 158 feet) which carries vehicular traffic across the river, no street cars using this bridge. The roadway is 18.4 feet wide,

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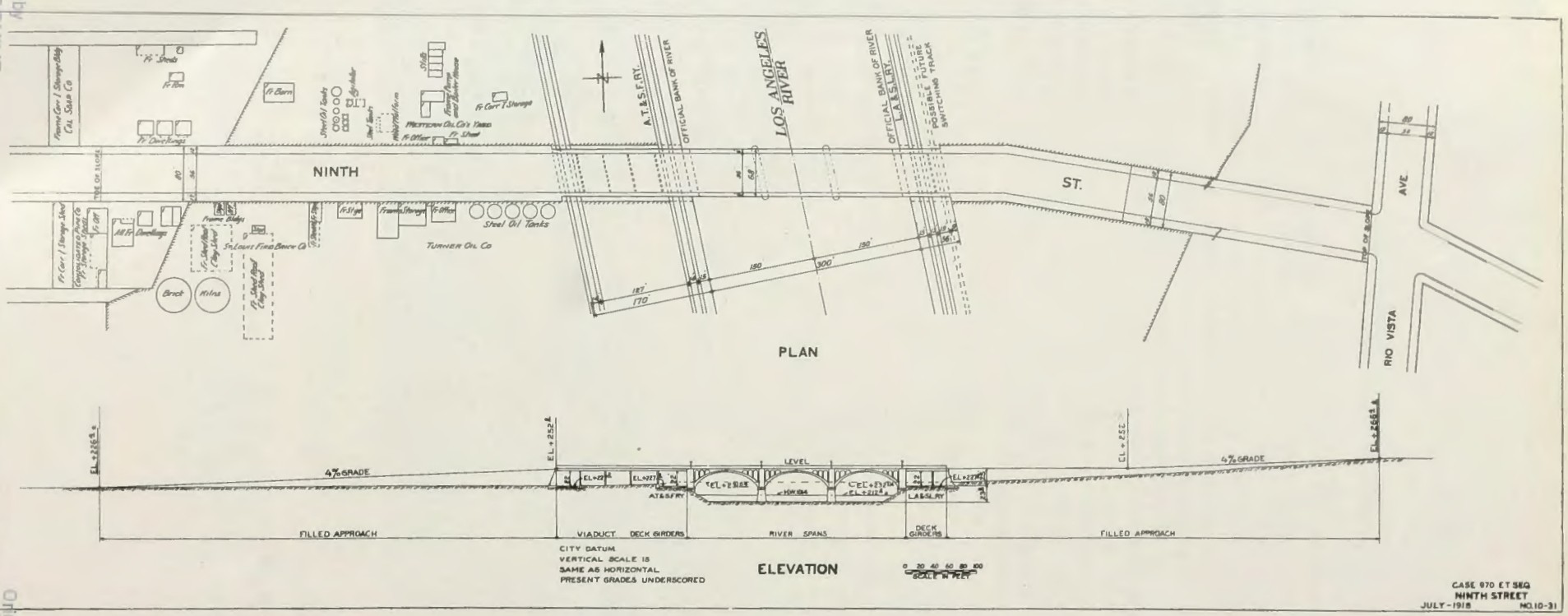

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FIG. 59. PLAN AND ELEVATION FOR A BRIDGE ACROSS THE LOS ANGELES RIVER AT NINTH STREET

This plan has been made with provision for a possible street railway extension. The bridge is of the same general type as that proposed for the other highway bridges across the river.

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and there are no sidewalks. On the west side of the river there are some 200 feet of elevated approach partly on a 2 per cent grade and partly on a 7 per cent grade, while on the east side the approach is not elevated but the grade of Ninth Street, as it extends easterly up the hill, has a grade of about 6 per cent at present. This bridge at the present time is only in fair condition and it appears as if the renewal of some, if not all, of the timber will be necessary before very long.

The new bridge suggested is of the same general type as that proposed for Seventh Street and should be built strong enough for street car loads. The approaches cross no streets. On the east side of the river the bluff is so near to the river bank that the approach could be carried horizontally until it intersects a 4 per cent grade to Rio Vista Avenue.

Ninth Street is so little used that the separation of grades here could very well be deferred. When, however, a thoroughfare to the southeast by way of Ninth Street is developed, with more favorable grades and alignment than those which exist on the present Seventh Street route to the state highway and other points in this direction, the construction of this bridge will become necessary. This bridge would cost $415,419 and is included in our estimates for future work.

The plan shows the arrangement recommended in case the union station is located at the Plaza. If the Santa Fe shop grounds are modified so as to be used as a coach yard in connection with a union station at the Santa Fe site, it will be necessary to add about 100 feet to the length of the viaduct on the west approach. The cost would then be $436,255.

FIG. 60. SALT LAKE BRIDGE ACROSS LOS ANGELES RIVER AT BUTTE STREET

This bridge was built by the Salt Lake about 1907 as part of the plan to reach the district west of the Los Angeles River.

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Butte Street-Salt Lake Bridge

The Salt Lake Bridge at Butte Street is a single track bridge and it is not affected by depression of the tracks along the river. It would, however, be affected by rerouting, as noted immediately hereafter.

FIG. 61. SANTA FE BRIDGE ACROSS LOS ANGELES RIVER SOUTH OF BUTTE STREET
This is a single track, steel structure, built in 1897, and carries the Santa Fe's main line to San Diego and San Bernardino, via Fullerton.

Santa Fe Railway Bridge South of Butte Street

The Santa Fe Bridge south of Butte Street and the Salt Lake Bridge at Butte Street should, ultimately, be replaced by one double track structure if the plan is adopted for a union terminal at any one of the three sites considered. For the present, in order to provide double tracks between Los Angeles and Hobart, it would be satisfactory to gauntlet the tracks across the Santa Fe bridge. The installation of a double track bridge is not essential at this time and the structure is included in the ultimate but not in the immediate estimates. The present bridge, although built in 1897, is of excellent design and would, no doubt, be found useful on some other part of the Santa Fe system ultimately. This structure, as will be noted from the picture, consists of two through pin connected single track spans of approximately 150 feet each. When it becomes necessary to construct a double track bridge, it is evident that the location should be changed and, while there are various possibilities for bringing the various tracks together at this point, the best plan seems to locate the bridge on the Santa Fe tangent which runs through Hobart, and is produced westerly. Our estimates, which include the cost of this bridge, are based on this assumption. The location is shown on Fig. 126, and provides connection along the

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river on the west side and east side of the river and the Santa Fe tracks to Hobart. Such a bridge is estimated to cost $161,865. An alternative scheme would be to construct the wye between the proposed track and the present Salt Lake tracks.

FIG. 62. TWENTY-SIXTH STREET BRIDGE OF THE LOS ANGELES RIVER

This bridge is beyond the southerly limit of proposed track depression and changes and is not affected by any of our recommendations.

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