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A STUDY OF THE PROPOSED SANTA FE EXTENSION FROM
THE PRESENT REDONDO BRANCH AT EL SEGUNDO TO LOS
ANGELES HARBOR

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Shumaker
1923

A SPECIAL PROBLEM
IN
RAILROAD ENGINEERING

MAP

CITY OF LOS ANGELES

SHOWING POSITION OF NEW LINE.

THE NEW LINE,

The Los Angeles Harbor at San Pedro with its natural advantages, and the big development of these now underway, will very soon be the key to the traffic routes of Southern California. The Atchafalaya, Topeka, and Santa Fe railway company realizing this and, not wishing to be caught asleep, has planned to build a line from El Segundo to the harbor. The developments of the harbor are not the only developments taking place in these localities and the proposed new line is intended to include these also.

Redondo used to be the connecting point between shipping lines and Southern California. The Santa Fe obtained all its lumber through Redondo and there was quite a demand for this lumber for railroad ties and other such constructions. National City and San Diego supply nearly all of the material now and it is being shipped by way of Los Angeles Harbor. Redondo used two piers, known as pier number two and pier number three. Pier number two is no longer in service. The franchise for pier number three was for twenty-five years and at the present date has nearly expired. There is quite a bit of doubt as to the possibility of its being renewed. The railway line connecting this pier runs for quite a distance in front of the bath houses along the beach and has been the cause of many complaints by the bathers and inhabitants. For this reason the city will be very liable to refuse a new franchise.

The fishing trade in this part has nearly all been through Redondo but has recently been routed through San Pedro. The conditions have so changed that the entire traffic of Redondo can be handled at present by one train a day. This train goes to Redondo in the morning, is loaded, and returns in the afternoon. Business conditions are too poor to even warrant the expense of keeping a switching engine there.

El Segundo is the only point on the present line turning in a profit. The oil fields of this point furnishes the Santa Fe with a business of \$90,000 a month. The entire line to the south is at the present date a losing proposition. A temporary strike at Los Angeles Harbor has caused business through Redondo to pick up but this is only a spasmodic movement and will not last. In a very short time San Pedro will have attracted all Redondo's trade and the Santa Fe intends, with the completion of their proposed line, to turn the present line into merely a spur track.

The line as planned will begin at El Segundo so as to connect with the oil fields of the Standard Oil Company in that neighborhood. Instead of taking a straight course to the harbor the intended line will be so planned as to provide for as much future developement as possible and still keep its route fairly direct and short. From El Segundo it runs direct to the south-west corner of Lawndale, and from there through El Nido to Torrence. This last named place is becoming quite an industrial center with such companies as the Union Tool Co., the Torrence Window Glass Co., and the Llewellyn Iron Works, and adds quite a bit of business to the new line. A branch track two and eight tenths miles long at the western city limits of Torrence and parallel to it, will be constructed to handle the traffic from the Torrence oil fields consisting of the Domniguez Well number one, the Torrence well number one and other wells in that neighborhood. The main line itself will supply the Chancellor Canfield Midway Oil Company Subsidiary.

South of Torrence the Santa Fe has obtained the land lying between its proposed new line and the Plaza Del Amo as far as its intersection with Washington Avenue. In this space they intend to develop manufacturing industries which can be connected by short spur tracks. It runs from

here through the towns of Lomita and Harbor City to Wilmington. The proposed classification yards will be right beside the Union Oil Company plant and spur tracks will control the business from this company.

The original intention of the Santa Fe was to construct a branch line from the classification yards down E Street to Fries Street. This would be through the center of commerce and would enable them to run spur tracks down the cross streets and so connect up the whole business district. At the end of this branch was to be constructed what is known as a "Less than Car Load Depot". This is a freight depot where cars are packed with goods in shipments too small to make one of an entire car. The cars are packed as the shipments are brought in and full cars are made up into trains. Quite a bit of opposition was met with from the city where the Santa Fe applied for their right of way franchise. The city objected to the intersection of the new line with 257th Street, L Street, and Anaheim Street, and to the branch line through E Street. After a long controversy the compromise was adopted whereby the Santa Fe was awarded the desired franchise as far as Wilmington Boulevard.

This route **connects** the Santa Fe with all the valuable points and provides a direct route to the Los Angeles Harbor at San Pedro and is a necessary improvement if that company intends to play a prominent part in the competition for commercial traffic in Southern California in the near future.

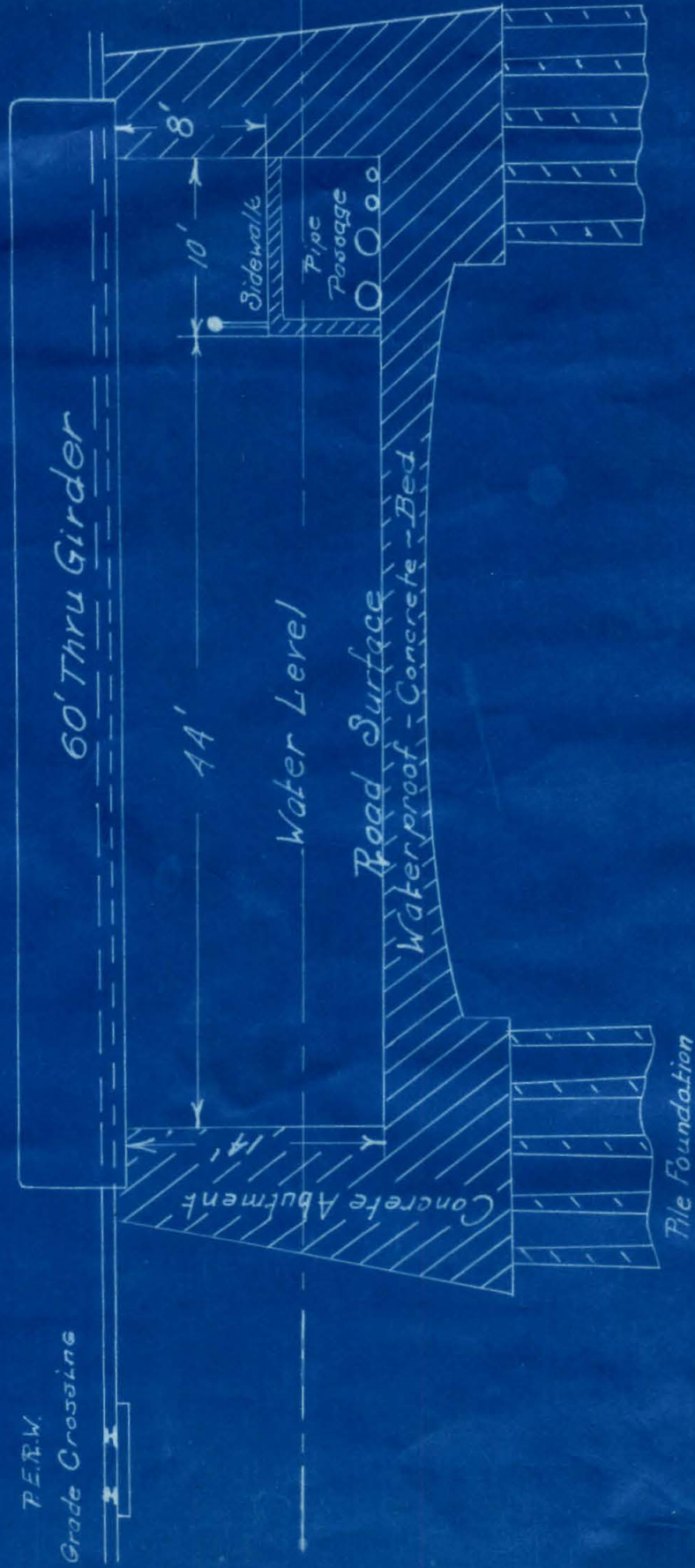
The new line is designed so as to do away with as many grade crossings and interlocking stations as possible. Every highway with the exceptions of those at Torrence would be carried underneath the proposed line. At this point the character of the land is such that there is no support available for the necessary structures. An interlocking station is done away with at

El Segundo by branching the new line off after the Santa Fe tracks have crossed the Pacific Electric line. The rebuilding of the highways under the bridges is all to be done by the Santa Fe. The proposed plans include seven separate grade structures, all of which are steel girders resting on concrete abutments. The state law requires a clearance of fourteen feet over highways and a clearance of twenty-two feet over other railroad lines. The law also requires that the decks of these structures be waterproofed to prevent dripping on the traffic passing underneath. When there is available clearance the structures are deck-girders, otherwise they are thru-girders.

The maximum grade for truck roads allowed by the state is about six percent. The Santa Fe wants to be well under this and so limit their slopes to five percent with the exception of the Wilmington to San Pedro road, which is really an extension of the main-street highway. The trucking over this road is so excessive that a maximum grade of two percent was decided upon. At this point a peculiar situation is met with. In order to carry this road underneath the cut goes below the high tide water mark. This makes it necessary that the structure supporting the girder, the necessary retaining walls, and even the road bed itself, be supported on pile foundation and be constructed of water proof material. It is estimated that this construction alone will cost \$200,000. Several designs of this structure have been suggested but the one that will probably be adopted is as in the following figure.

Sketch of Structure to Carry
Wilmington - San Pedro Road under Santa Fe

P.E.R.W.
Grade Crossing



The road will be supported by a concrete arch resting on the abutments. The sidewalk will be carried underneath by a special structure enclosing pipe line parallels the Wilmington road. It was decided to cross this at grade since very few trains are run on this line during the day and the cost of building the structures to carry the Pacific Electric under would be too exhorbitive. An interlocking system will installed here.

Between Harbor City and Wilmington is a locality called Bixby Slough or Machato Lake. After investigation by geologists it was decided that this water was not a part of any definite waterway but merely a rain water catch basin. This lake is in existance only from four to five months out of each year as it is only about two feet deep and evaporates during the dry seasons. The ground underneath is pete soil and does not provide certain foudation for concrete structures so Pile trestle will have to be resorted to. This trestle will be twenty feet high and is estimated to cost forty dollars per linear foot.

In laying out the proposed line the Santa Fe has endeavored to obtain a one hundred foot right-of-way. They have been successful in this except through Torrence at which point they have obtained only sixty feet. For present and future stations they have obtained additional land every two miles. This extra area varies from fifty feet by one thousand feet to three hundred by three thousand feet.

The maximum grade for the new line is to be one and one tenth percent running east and one percent west bound, (Wilmington to El Segundo).

Each end of the line is connected with a Wye. This type of connection is much more flexible than the ordinary V type. The north leg of the El Segundo Wye is to have a curvature of eight degrees and the south leg a curvature of six degrees, five minutes. This last corresponds to what is

known as a number eight turnout. The Wilmington Wye is to have its south leg twelve degrees, thirty inches its west leg, six degrees, five inches, and its east leg seven degrees thirty inches. The curvature of the main line is to be held to a **four degree curvature, a number ten turnout, on an open track.** The number eight turnouts will be used for curves in yard tracks.

In constructing the new line the Santa Fe will endeavor to use concrete pipe culverts wherever it is possible. These will vary in size from eighteen inches to forty-eight inches. Wherever a larger capacity is needed, batteries of concrete pipe conduits will be used. Wherever culverts must be laid under streets whose grade is liable to be changed, temporary redwood conduit will be used. When a road has had its curbs constructed it is considered to have a fixed grade line. It would be too expensive to construct concrete conduits under streets subject to change. Specifications require that that there shall be at least thirty inches between the base of the tie and the top of the pipe to prevent its injury by jar. A typical concrete culvert is shown in the following sketch

Railroad Bed

30' For Cushion



Sketch of Permanent Culverts of Santa Fe

The road is to be constructed of ninety pound relaying rails. The ties are to be of redwood six inches by seven inches by eight feet and are to be spaced so that there are twenty-two to each thirty three foot rail. The bed is to be unballasted except over bridge structures where a six inch rock ballast will be used under the ties.

The station planned at Torrence is to be about thirty feet by sixty feet with a back covered platform about thirty feet by fifty feet. It is to be built at the intersection of the Plaza Del Amo and Carson Street. Two short side tracks on each side of the station will permit loading and unloading of freight at that point. This structure is estimated to cost about eight thousand dollars. At Wilmington a station forty feet by sixty feet with a covered back platform of forty feet by eighty feet is to be built. This is estimated at twelve thousand dollars.

In constructing the road bed there will be twenty-four cuts, all of which will be at a one to one slope, and twenty fills all at a one and one half to one slope. In figuring the cost of construction there is to be no classification of dirt into earth, hard pan, soft rock, and hard rock. Cuts by team haul are to be at the rate of thirty cents per cubic yard. Cuts by steam shovel and with train haul will average about fifty cents per cubic yard. Overhaul is to be at the rate of two cents per cubic yard for every hundred feet. Overhaul cost is figured by cuts and not by cut and fill. The distance between the center of mass of the cut and the center of mass of the fill is taken as the distance of overhaul.

The Classification yard at Wilmington as planned for the present will have three interchange tracks. There are two bad features of this yard as proposed. Because of the road crossings, one just above and just below, the yard is on a sixty five hundredths of one percent slope. This makes an ever existing danger of runaways in the yard.

The other bad feature is that the yard is on a curve. Another site farther north may finally be chosen. When the size of the traffic warrants it the present proposed yard will be enlarged so as to contain a square engine house and more interchange tracks.

The city of Los Angeles has taken over all lines around the harbor and joined them into a belt line. All private companies must ship their goods over this belt line to connect with the piers. Each Railroad Company will have its own transfer yard as a junction with the belt line. The Santa Fe has obtained a thirty year lease for the city land necessary for their yard. As planned at present there will be four interchange tracks each eighteen hundred feet long.

In estimating the costs the Santa Fe figured that to complete the track after the road bed would cost two dollars and seventy-five cents per linear foot. This includes rails, track laying, fittings, ties and surfacing. There is to be about a thousand miles of fencing, costing about Twelve dollars a mile. Construction of telephone lines is rated at about seven hundred dollars per mile. The main line is to be twelve and fifty-four hundredths miles long with three and thirty-seven hundredths miles additional in spurs and ridings. It is figured to have 215,000 cubic yards of excavation and 75,000 cubic yards of borrow, giving 290,000 cubic yards of embankment. The construction of the line and the structures will require Five hundred and fifteen tons of steel and nine thousand cubic yards of concrete. It is expected that the construction of the line will take about seven months.

The following table gives the cost estimates for the entire line as planned at present.

Engineer and Expenses-----	20,000
Land and Right of Way-----	586,000
Track Construction -----	231,000
Grading-----	175,000
Bridges Trestles and Culverts-----	530,000
Fencing, Cattle Guards, Wing Fences-----	16,000
Crossings and Signs-----	36,000
Stations and Office Buildings-----	22,000
Roadway Buildings and Section Houses etc-----	12,600
Water Stations-----	2,500
Telegraph and Telephone Lines-----	9,000
Signals and Interlockers(Include changes to existing lines)---	1,000
Changes to oil and Irrigation pipe lines-----	5,000
	<u>1,646,100</u>
Superintendents and Contingencies (@ five percent)-----	82,305
	<u>1,708,405</u>

The present plan for the unification of railroad facilities around Los Angeles Harbor have been drawn up by Mr. J. W. Ludlow, Harbor Engineer. In his design he has eliminated all grade crossings. This requires in some cases constructions of three levels and the whole plan is in reality more of an idealistic design to aim at than an economically practical one. In his design the Harbor Blvd. and the main passenger line which parallels it would be depressed almost its entire length and would be carried under the entrance to the west basin by tunnel. The Pacific Electric Railway at present crosses the west slip by drawbridge. This drawbridge is so much of a hindrance to that neighborhood that the city has refused to allow any further development of this line until this drawbridge is done away with. The plans of Mr. Ludlow take this into consideration and yet make use of the Pacific Electric line as it is to-day.

The south end of the Santa Fe line when finally built will not be exactly as described above. The transfer yards and classification yards will both be moved to a more central point. Mr. Ludlow plans are based on this new location. The facts concerning this would add much interest and information to the above study, but at the request of the Santa Fe I am not at liberty to make these facts public.

PROFILE OF PROPOSED LINE
SHOWING THE GRADES, CURVES, GRADE-STRUCTURES, MILE-POSTS,
STATION SITES , etc.

The profile is as surveyed by the
SANTEE FE.