TRUNK LINE CONDITION ASSESSMENT PROGRAM

-First Phase

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Department of Water and Power - City of Los Angeles

Trunk Line Condition Assessment Program - *1st Phase*

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SECTION 1 - Overview

BACKGROUND

The Department operates 280 miles of trunk lines. Trunk lines are supply pipelines 30 inches and greater in diameter and form the major arteries for supply. They deliver and redistribute large amounts of water throughout the City of Los Angeles to assure a reliable supply is available for potable uses and fire fighting. One hundred forty-four (144) miles of these trunk lines, constructed out of steel, were installed before 1940. The 144 miles of old steel trunk lines are the focus of the Department's Trunk Line Condition Assessment Program (TCAP). The purpose of TCAP is to develop a methodology to assess the condition of and prioritize those trunk lines most at risk and in need of replacement. Many of the trunk lines are deteriorating and approaching the end of their useful life. The likelihood of significant breaks, costs associated with making repairs, payments for damage to public and private property, and exposing the public to a safety hazard are increasing over time.

PRIORITIES

A priority list of at-risk trunk lines that should be replaced first has been prepared as a result of the first phase TCAP (see Figure A and description below). The priority list consists of 36 miles (out of the 144 miles) of higher at-risk "riveted" steel trunk lines. Riveted steel trunk lines are the focus of the first phase of TCAP. Riveted steel trunk lines, in general, are assumed to be at risk due primarily to their age, method of fabrication, and lack of coating on the outside of the pipe to protect them from surrounding corrosive soil. There are a total of 65 miles of riveted steel trunk lines in the system. Figure C depicts these trunk lines and displays some of the deteriorative conditions. The second phase of TCAP is currently addressing non-riveted steel trunk lines.

ACTION PLAN

Actual pipeline replacement projects will be identified based not only on the priorities established by TCAP, but also on the effective utilization of design and construction resources, and other factors. The total estimated cost to replace the higher priority 36 miles of riveted steel trunk lines is $150 million. A prudent replacement program would be to replace the 36 miles at a capital cost of $15 million each year over 10 years. Some resources can be temporarily shifted from the small-main replacement program to begin addressing trunk line replacements. However, additional resources are needed to adequately address trunk line replacements and to restore and maintain an adequate small-main replacement program.

TCAP

Priority List

The purpose of TCAP is to develop a priority list of at-risk trunk lines. As such, it is a management tool for planning and implementing efforts to replace the highest priority trunk lines. TCAP does not predict where the next break will occur. It assesses the condition of the

FIGURE A

TCAP PRIORITY LIST

Riveted Steel

By Critical Lengths (CL)

Diameter Size	Trunk Line	From/To	Length (ft)
72"	City	Filmore St. / Rinaldi St.	13,505 – 0.664
62" - 72"	City	Van Noord Ave. / Roscoe Blvd.	30,202 – 0.523
40"	Third Street	Doheny Dr. / La Cienega Blvd.	4,038 – 0.506
30"	Ventura	Colbath Ave. / Coldwater Canyon Ave.	7,015
36"	Harbor	89th St. / 85th St.	1,675
30"	Fletcher	Casitas Ave. / Delay Dr.	4,513
39"	Roscoe	Jumilla Ave. / Tunney Ave.	1,990
30" - 33"	Hayvenhurst	Hartsook St. / Gilmore St.	8,753
30"	Ventura	375' E. of Balboa Blvd. / Colbath Ave.	18,522
36"	Harbor	79th St. / 71st St.	2,948
30" - 36"	Sunset	Crescent Heights Blvd. / Bronson Ave.	14,520
72"	City	Roscoe Blvd. / Filmore St.	14,843
39" - 50"	Roscoe	Canoga Ave. / Jumilla Ave.	10,383
42"	Hyperion	La Mirada Ave. / Westmoreland Ave.	1,585
36" - 39"	Hayvenhurst	Hart St. / Roscoe Pl.	9,090
40" - 68"	Franklin Outlet	Beverly Dr. / Sunset Blvd.	2,660
42" - 48"	Roscoe	Yarmouth Ave. / Hayvenhurst Pl.	7,770
50" - 54"	Hayvenhurst	Stare St. / Woodley-Rinaldi	10,075
36"	Alameda	Traction Ave. / Bruno St.	5,810
50" - 54"	Roscoe	Shoup Ave. / Canoga Ave.	5,225
36"	Pico	Peg Pl. / Glenville Dr.	3,768 – 0.341
36"	Pico	Orange Grove Ave. / Pickford St.	6,025 – 0.338
52"	De Soto	Chatsworth St. / De Soto Reservoir	2,545 – 0.318
36"	Pico	Wetherly Dr. / Hi Point St.	3,870 – 0.315
		TOTAL LENGTH:	**191,330 ft**
			36 miles*

*Out of 65 miles Pre-1940, 30-inch diameter or greater.

trunk lines and identifies those most at risk. It is an aid to direct the efforts of management to plan and determine capital expenditures. In addition to this report, there is a technical appendix that contains supporting documentation.

The approach used to prioritize pipeline segments was designed to account for the following criteria:

1. **Damage potential** - potential damage to property, loss of life, and repair costs.
2. **Service** - when the trunk line is down, water service cannot be provided either locally near a break and/or in other zones that are served by the trunk line.
3. **Leaks and Stress** - historic record of leaks per city block and internal pressure-related stress on trunk line.
4. **Corrosiveness of the soil** surrounding the trunk line
5. **Age of the trunk line**
6. **Age of** the trunk line's **cement mortar lining**

Methodology

The approach involves an interactive, decision-support technique called the Analytical Hierarchical Process and a related software package called Expert Choice (AHP/EC). A precise description of the AHP/EC is beyond the scope of this report. However, a description of how the AHP/EC was used in TCAP is described briefly, and in more detail, in Section 2 Methodology, and literature available from the author.

The importance of each criterion listed above has been judged relative to the others. Judgments made by Department management and staff were quantified using a graded scale, and the relative importance of each criterion was then determined. The criteria are listed in order of importance. Damage, Service, and Leaks and Stress were deemed to be the highest, and of nearly equal, importance. The remaining criteria were considered significantly less important to determining at-risk trunk line segments.

Every trunk line segment has been rated by its intensity in attaining the highest measure of the criteria. The higher or more "intense" the rating, the more the segment is at risk . The trunk lines have been broken into individual city block segments along the trunk line route. The individual segments were rated against each criterion by selecting the proper intensity. For example, if a segment had many leaks per city block, it would rate high on the Leaks criteria.

In carrying out the process, the software produced a priority listing of city block segments for each trunk line based on all the criteria and ratings. In other words, each city block segment was given a total or "score" based on the summation of their rated intensity in each criteria. A higher score signifies a higher risk. To compile the priority list, adjacent segments close in scored value were grouped together to form "critical lengths" (CLs), that is, the most at-risk portions of the trunk line. CLs are those grouping of continuous segments of at least 1500 feet in length that when combined have an above average score.

Critical Lengths

The TCAP Priority List (Figure A) is sorted by critical length scores. Figure B graphically depicts all 65 miles of riveted steel trunk line included in this phase of TCAP with the

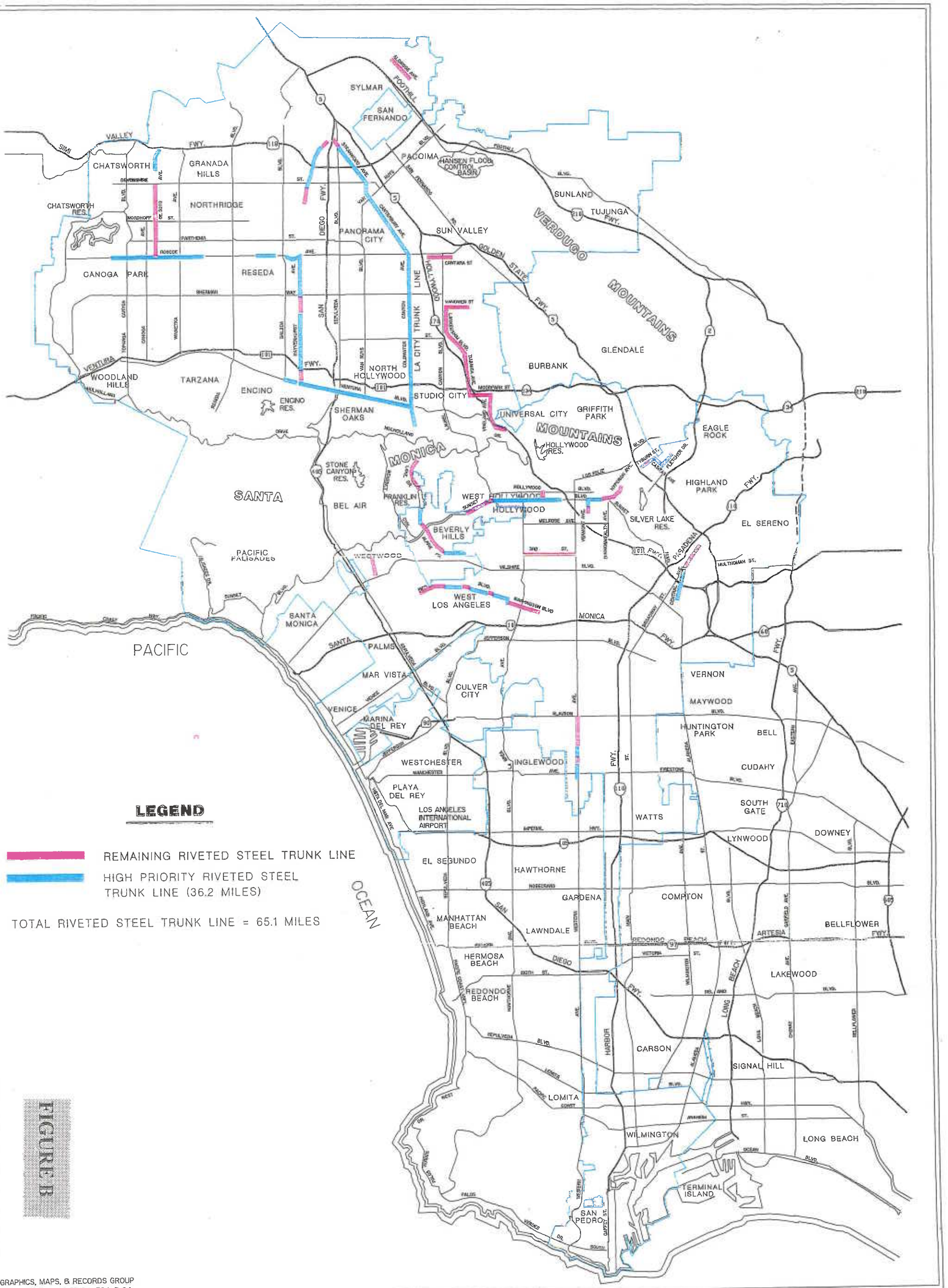


FIGURE B

GRAPHICS, MAPS, & RECORDS GROUP
ACAD \ RVTD2_TL.DWG \ FC \ 3-94

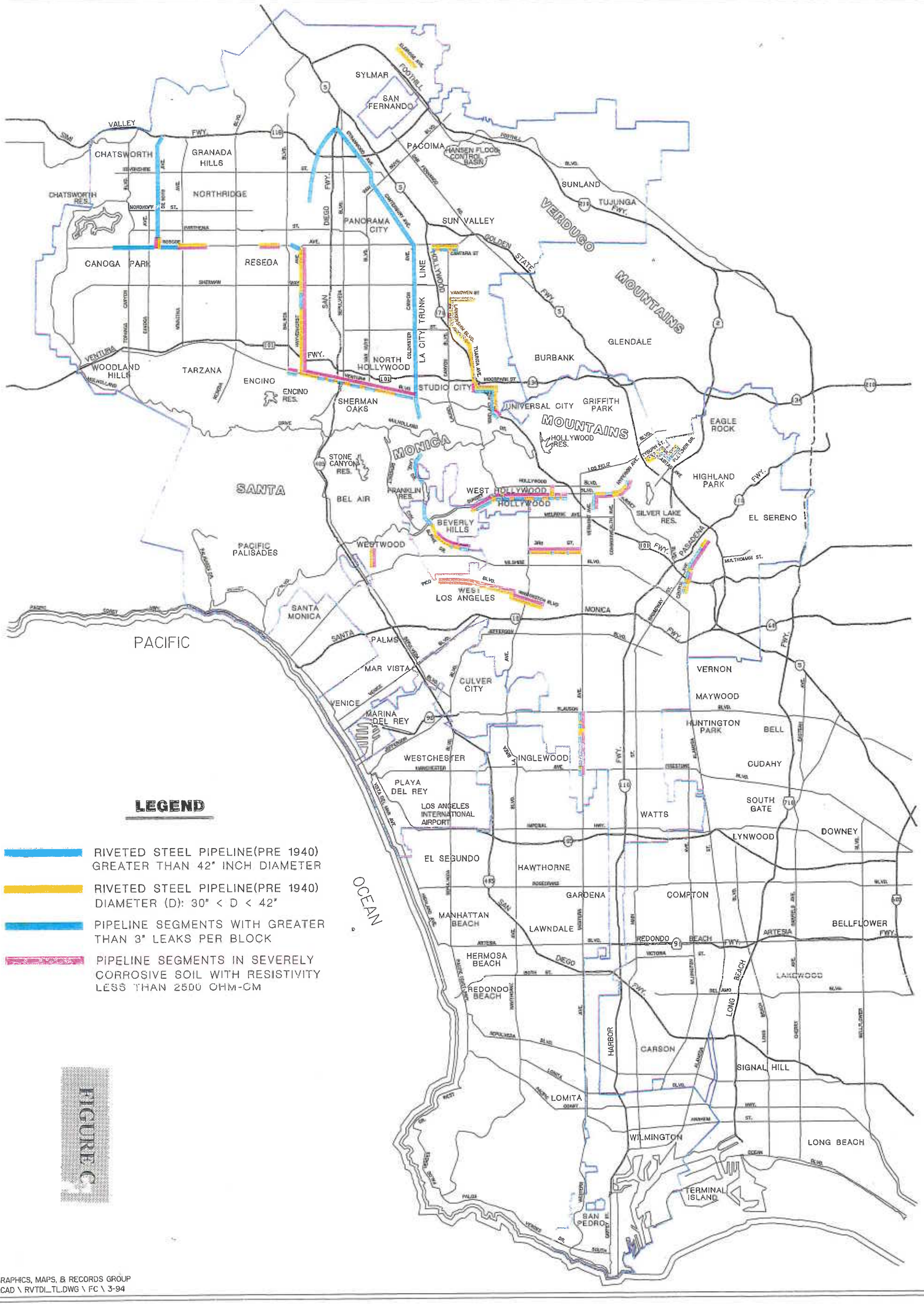


FIGURE C.1

GRAPHICS, MAPS, & RECORDS GROUP
ACAD \ RVTDI_TL.DWG \ FC \ 3-94

priority CLs highlighted in blue. The overall average score for all trunk line segments was 0.308 out of a possible 1.000. In most cases, such as the Alameda Trunk Line, only a portion of the trunk line has a CL. Other lines, such as the City Trunk Line, had more than one distinct grouping of similar scores labeled CL1, CL2 etc. There are also some trunk lines in which no significant portion scored above average. These lines have no CLs.

The most at-risk length of trunk line is that portion of the City Trunk Line from Filmore Street to Rinaldi Street. This length of adjacent grouped segments is 13,505 feet in length and has a CL average score of 0.664, more than twice the average. The TCAP Priority List contains 36 miles of at-risk critical lengths of pre-1940, 30-inch or greater, riveted steel trunk line.

Other Methods Considered

Discussions with other water utilities, vendors, and consultants revealed that technology is not presently available to the water industry to perform non-destructive testing of riveted steel water pipelines. Most water utilities make decisions on pipeline replacements based on subjective factors. Some water utilities perform benefit/cost or probability analyses based on the cost of repairing leaks and breaks. Others meld their pipe replacement program into their street reconstruction programs. After evaluation, it was decided that AHP/EC was the best methodology to satisfy the needs of the Department.

Summary

The Water System operates an aging distribution system in need of continual repair and upgrade. A large portion of trunk lines in the system are over 60 years old and approaching the end of their useful life. These trunk lines carry increased liability in operation because of the amount of damage and disruption of service they can cause if they break. By some method, the most at-risk trunk lines should be Prioritized. Additional resources must then be procured to increase and accelerate required replacements of these trunk lines in the system so that current tentative conditions do not degrade.

TCAP is the method by which priorities have been set to identify those portions of trunk lines to be replaced first. The results of the first phase of TCAP indicate that 36 miles of pre-1940 , 30-inch diameter and greater, riveted steel trunk lines are at risk and should be replaced first.

SECTION 2 - Methodology

The approach to prioritize trunk line segments for replacement involved an interactive, decision-support technique called the Analytical Hierarchical Process and a related software package called Expert Choice (AHP/EC). AHP/EC relies on the expertise of Department management and staff to deal with problems and objectives involving multiple criteria. It is suitable for use in complex situations involving qualitative, subjective information, as well as quantitative, objective data. An important feature of this type of approach to multiple-criteria decision making is that it enables the decision maker to apply the methodology in problem situations that, as in our case, depend somewhat on subjective judgment.

AHP/EC breaks down the problem of deciding priorities into separate elements or criteria. Each criteria is then ranked by relative importance. The trunk lines have been broken into individual city block segments along the trunk line route. The individual segments are rated against each criterion using an absolute measurement.

Criteria Selection and Ranking

Both the Water Operating and Water Engineering Design Divisions were consulted to pick the criteria by which trunk lines would be judged. The six criteria selected are listed below. These divisions also ranked the relative importance of each criteria using the AHP/EC "pairwise comparison" process. In this process they were asked to complete a questionnaire (Figure D) to compare and rate the importance for each criteria. For example, when comparing criteria, one would be answering such a question as "When prioritizing segments, how much more important is the broken segment's potential for 'Damage to property' than its inability to be a 'Source of water'". This is Question 1 in Figure D. A scale was used as shown from 1 to 9, EQUAL to EXTREME to indicate preference. If a rater thought "Damage" was extremely more important than "Source", they would circle 9 on the left side of the "Damage" side of the questionnaire. The raters were asked to indicate their preferred importance for all 15 comparison questions. EC calculated the geometric mean of all the raters' answers for each question. EC also ensured that all comparisons were consistent and not contradictory to each other.

The final weights for each criteria are as follows and can also be seen in Figure E in the criteria boxes preceded by the letter "G". G signifies the overall relative importance to the goal. It stands for global. Note that both subjective and objective criteria are used.

1. **Damage potential (28.5%)** - potential damage to property, loss of life, and repair costs.
2. **Service (28.7%)** - when the trunk line is down, water service cannot be provided either locally near a break and/or in other zones that are served by the trunk line.
3. **Leaks and Stress (24.1%)** - historic record of leaks per city block and pressure-related stress on trunk line.
4. **Corrosiveness of** the **soil** surrounding the trunk line **(10.9%)**.
5. **Age of** the **trunk line (4.3%)**.
6. **Age of** the trunk line's **cement mortar lining (3.6%)**.

Criteria Intensities

Each segment is rated against each of the six criteria by selecting the proper "intensity". The goal is to prioritize segments using absolute measurement and compare the segments against established standards. For example the rating intensities for the Soil Resistivity criteria (in terms of ohms) are Very Severe, Severe, Moderate, and Mild/Slight; for the Damage criteria the rating intensities are High Risk, Commercial, Residential Development; and so on for the other criteria. The priorities for rating intensities were derived from the pairwise comparison process as well. See Figure E as well for the weight of the ratings' intensities preceded by the letter G.

FIGURE D

QUESTIONNAIRE
CROSS-WISE COMPARISONS

Compare the relative IMPORTANCE with respect to: GOAL

Circle one number per comparison below using the scale:
1=EQUAL 3=MODERATE 5=STRONG 7=VERY STRONG 9=EXTREME

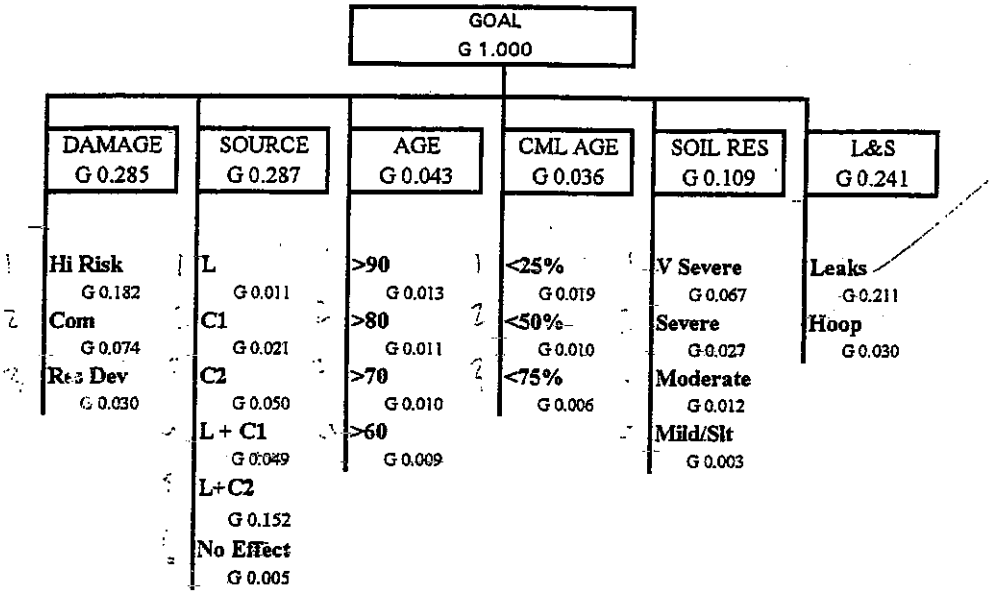
1	Damage	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Source
2	Damage	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Age
3	Damage	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Cml Age
4	Damage	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Soil Res
5	Damage	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	L&S
6	Source	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Age
7	Source	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Cml Age
8	Source	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Soil Res
9	Source	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	L&S
10	Age	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Cml Age
11	Age	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Soil Res
12	Age	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	L&S
13	Cml Age	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Soil Res
14	Cml Age	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	L&S
15	Soil Res	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	L&S

Goal: Prioritize segments w/in pipelines for capital expenditures

AGE... Age of pipe in years.
CML AGE... Age of Cml expressed as % of total age. Low % = worst condition.
DAMAGE... Potential for damage to property, loss of life, and repair costs.
L&S... Leaks and hoop stress.
SOIL RES... Soil resistivity.
SOURCE... Can't serve area either locally and/or in other zones till 7th day.

FIGURE E

PRIORITIZED SEGMENTS W/IN PIPELINES FOR CAPITAL EXPENDITURES



<25%	... Less than 25% of the pipe age
<50%	... Less than 50% of total age
<75%	... Less than 75% of the pipe age
>60	... Greater than 60 years old
>70	... Greater than 70 years old
>80	... Greater than 80 years old
>90	... Greater than 90 years old
Age	... Age of pipe in years
C1	... Up to 2 zones out of service
C2	....Over 2 zones out of service
Cml Age	... Age of Cml expressed as % of total age. Low % = worse condition.
Com	. At least 50% commercial development
Damage	... Potential for damage to property, loss of life, and repair costs
Hi Risk	... Unusual/important/high risk development
Hoop	... Hoop stress in segment
L	... Local outage
L + C1	... Combination of L + C1
L + C2	... Combination of L + C2
L&S	... Leaks and hoop stress
Leaks	... Leaks per city block segment along the line.
Mild/Slt	... <25,000 OHMS
Moderate	... <5500 OHMS
No Effect	... No effect to customers
Res Dev	... Residential
Severe	... <2500 OHMS
Soil Res	... Soil resistivity
Source	... Can't serve area either locally and/or in other zones till 7th day
V Severe	... < 1000 OHMS
G	... Global priority: Priority relative to goal. THE GOAL IS TO PRIORITIZ SEGMENTS W/IN PIPELINES FOR CAPITAL EXPENDATURES.

In much the same way students are graded A, B, C, D, and F in subjects, the trunk lines were rated high or low against the criteria. For example, a line that is over 90 years old is rated higher than one that is 70 years old in terms of the "Age of the trunk line" criteria. The higher or more "intense" the rating score, the more at-risk the segment. The segments are rated against each criteria by selecting the proper intensity.

In carrying out the process, the software produced a priority listing of the segments for each trunk line based on all the judgments and ratings. In other words, each city block segment was given a total or "score" based on their rated intensity in each criteria. A higher score, again, signifies a higher risk. Please see Section 3-TCAP Critical Length Graphs, and Appendices XIII and XIV of the data report available from the author for a complete accounting of every segment of each trunk line.

Figure F shows how the EC total score for the Alameda Trunk Line was developed. Each segment is rated against each criteria. For example, Traction Avenue was rated High Risk as its intensity in terms of the Damage Potential, a Local outage for Source of Supply, 90 years for age of trunk line, less than 50 percent of the age of the trunk line for Age of Cement Mortar Lining, Mild to Slight for Soil Resistivity, Greater than one leak but less than five under Leaks per Block, and less than 15,000 psi for Hoop Stress. Based on the weights for each criteria and ratings intensity, the Traction Avenue segment scored a total of 0.385. The EC total scores for sample segments can be found in Section 3-TCAP Critical Length Graphs.

SECTION 3 - Critical Lengths and Results

The TCAP Critical Length Graphs following this section are a graphical presentation of the Expert Choice (EC) scores (totals) listed with the graphs and found in Appendix XIII of the data report available from the author. These scores are the basis upon which priorities have been determined. Also included in this section is a summary of results from an analysis of the known physical data.

Critical Length Graphs

The graphs are a plot of the EC scores for each segment. The score for each segment is actually representative of the city block segment preceding the cross street. For example, on the 36"-40" Alameda Trunk Line graph, the score for Second Street is for the length of trunk line from Traction Avenue to Second Street.

Also plotted on the graphs is the "TL Average", the average score for the particular trunk line shown. For the Alameda Trunk Line the TL Average is 0.346. The "Overall Average" is also plotted on all the graphs. It is the average of all the scores of every trunk line and is equal to 0.308.

Trunk lines are active and vital to the operation of the distribution system and therefore cannot remain out of service for significant periods of time while replacements and repairs are being made. Although there is redundancy in the system, its utilization is limited in terms of duration and to low demand seasons of the year. What this means is that if a trunk line is being replaced in situ, it can be out of service only for a portion of the year, generally in the non-summer months. It is recognized that when the trunk lines are replaced, they will be longer than one or two block segments. Therefore, to reduce outages due to construction time, and to

FIGURE F

Alameda Trunk Line - Expert Choice Totals

Alternatives	Damage 0.2852	Source 0.2867	Age 0.0430	Cml Age 0.0356	Soil Res 0.1087	Leaks 0.2107	Hoop 0.0301	Total
1 Traction Ave.	Hi Risk	L	>90	<50%	Mild/Slt	>1	<15,000	0.385
2 Second St.	Hi Risk	L	>90	<50%	Mild/Slt	>1	<15,000	0.385
3 First St.	Hi Risk	L	>90	<50%	Mild/Slt	>10	<15,000	0.479
4 Banning St.	Hi Risk	L	>90	<50%	Mild/Slt	0	<15,000	0.374
5 Turner St.	Hi Risk	L	>90	<50%	Moderate	>1	<15,000	0.400
6 Jackson St.	Hi Risk	L	>90	<50%	Moderate	0	<15,000	0.389
7 Temple St.	Hi Risk	L	>90	<50%	Moderate	0	<15,000	0.389
8 Ducommun St.	Hi Risk	L	>90	<50%	Moderate	>1	<15,000	0.400
9 Commercial St.	Hi Risk	L	>90	<50%	Mild/Slt	0	<15,000	0.374
10 Aliso St.	Hi Risk	L	>90	<50%	Moderate	>1	<15,000	0.400
11 Sunset Blvd.	Hi Risk	L	>90	<50%	Moderate	>5	<15,000	0.442
12 Los Angeles St.	Com	L	>90	<50%	Moderate	>1	<15,000	0.230
13 Macy St.	Com	L	>90	<50%	Moderate	0	<15,000	0.220
14 Bauchet St.	Hi Risk	L	>90	<50%	Mild/Slt	>1	<15,000	0.385
15 N. Main St.	Hi Risk	L	>90	<50%	Mild/Slt	0	<15,000	0.374
16 Ord St.	Hi Risk	L	>90	<50%	Mild/Slt	0	<15,000	0.374
17 Alpine St.	Hi Risk	L	>90	<50%	Moderate	>5	<15,000	0.442
18 Bruno St.	Hi Risk	L	>90	<50%	Moderate	>1	<15,000	0.400
19 N. Spring St.	Com	L	>90	<50%	Moderate	>1	<15,000	0.230
20 College St.	Com	L	>80	<50%	Moderate	0	<15,000	0.215
21 N. Broadway	Com	L	>80	<50%	Severe	>1	<15,000	0.249
22 Bernard St.	Com	L	>80	<50%	Severe	>1	<15,000	0.249
23 Cottage Home St.	Com	L	>80	<50%	Severe	0	<15,000	0.239
24 Bishops Rd.	Com	L	>80	<50%	Severe	>1	<15,000	0.249
25 Savoy St.	Com	L	>80	<50%	Severe	>1	<15,000	0.249
26 Solano Ave.	Hi Risk	L	>80	<50%	Severe	0	<15,000	0.408
27 Casanova St.	Hi Risk	L	>80	<50%	Severe	0	<15,000	0.408

See Figure E for Legend

maximize efficiencies, replacement projects will most likely be in the 2,000 to 5,000 foot range or longer. This point was taken into account when the critical lengths (CLs) were established.

The CLs that are identified on the graphs are those groupings of continuous segments, that when combined, average over the 0.308 Overall Average score. They are those portions along the trunk line that are above average in their risk to operate. There is a further delineation that such lengths must be at least 1,500 feet long. As can be seen on the Alameda Trunk Line Graph, there is a continuous 5,810-foot length that scores over the Overall Average line. There is, however, a portion from Sunset Boulevard to Bauchet Street within that length that is below the Overall Average line. It is still included in the CL because replacement projects do not generally start and stop between each end. That means that some good pipe may be taken out, or abandoned, with poor pipe during construction of replacements. This inclusion of small stretches of low score with high score segments in the Cls occurs elsewhere in the graphs. Also occurring repeatedly in the graphs are trunk lines that have two or three different critical lengths separated by significant lengths of low scored segments. It should be noted that some trunk lines have no CLs. This means they have no continuous segments totaling over 1,500 feet that average over 0.308.

The CLs are the basis for the TCAP Priority List (Figures A and B). This list also shows the CL averages.

Actual trunk line replacement projects may be smaller than the full CL. What the CL indicate is that all portions within the lengths should be replaced. They will most likely be replaced when resources are available and opportunities present themselves.

Summary of Key Results

Much of the physical information used in the prioritization model has been analyzed and cross-compared. Some basic information and listings of trunk line data is included in this section before the critical length graphs.

When the physical information is analyzed outside of prioritization an important conclusion can be made. Although cement mortar lining has been virtually completely effective in stopping leaks, it cannot be assumed that the trunk lines are not still corroding away from the outside in. The fact is that most leaks occurred in severely corrosive soil before being cement mortar lined in pipes with no or suspect exterior lining. It is a reasonable assumption to make that the trunk lines were corroding on the inside and the outside, and that now, after cement mortar lining, they are still corroding on the outside. It is equally reasonable to conclude then that the cement mortar lining is bridging over holes and thinned out portions in the pipe. The lining actually becomes the pipe. It is performing a structural function it was never intended, designed, or capable to do. The best support of this conclusion is the failed portion of the cement mortar lined City Trunk Line that occurred south of Ventura Boulevard in September of 1993. Close inspection of the pipe revealed extreme thinning of the wall thickness (from the outside in) along the initial line of failure. It appeared that the only structural integrity that the pipe had was the composite strength of the lining and what little wall thickness remained. There is no reason to believe that this same scenario will not occur just a few feet away from that failure point, or anywhere else along the city Trunk Line, or any other trunk line contained in this study.

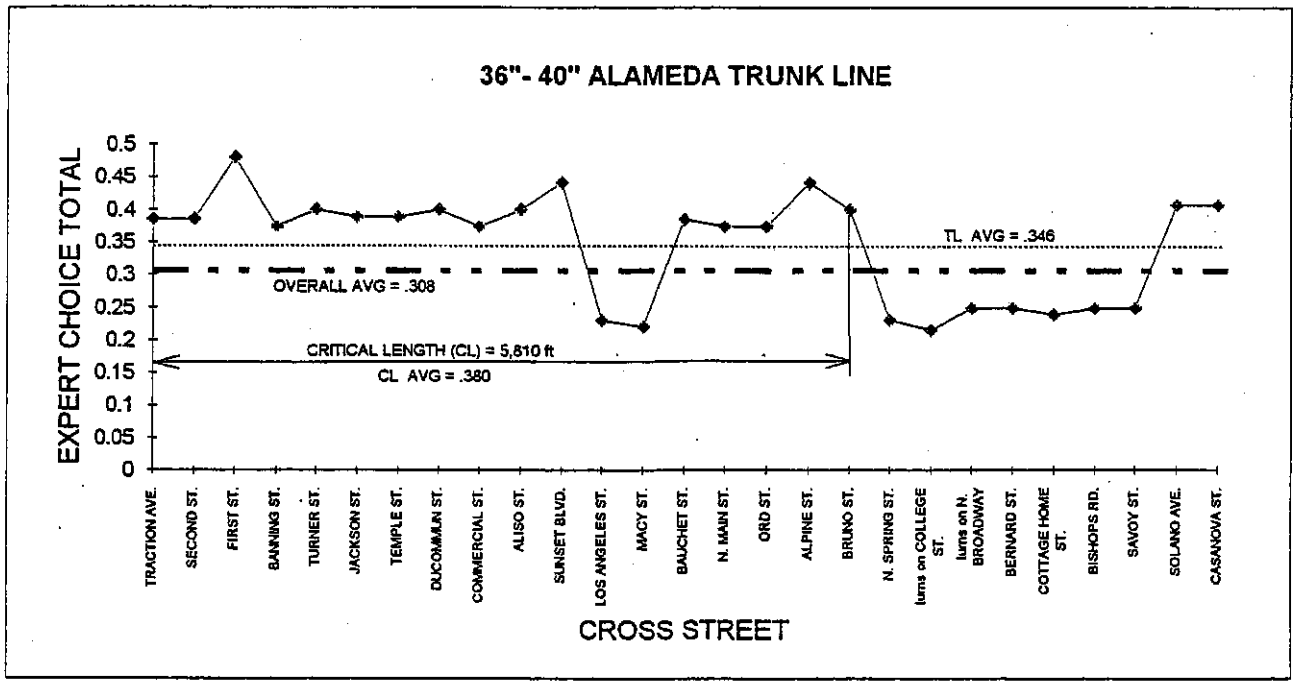
A summary of the analysis results is as follows:

- 62% or 40.2 miles of the trunk lines are located in severely corrosive soil, that is soil with resistivity less than 2500 ohm-cm. There are no complete records of what, if any, type of exterior coatings exists.
- 43% of the 664 city blocks segments had a record of leaks.
- The City Trunk Line is 74% overstressed. It was the only trunk line that had any overstressed segments other than one segment of the Franklin Trunk Line.
- 97% of all recorded leaks occurred before cement mortar lining.
- Seven of the 20 trunk lines stopped having leaks after being cement mortar lined. Others dramatically reduced the number of recorded leaks. For example: the Sunset Trunk Line recorded 220 leaks in its first 58 years of service, and only two since being cement mortar lined 35 years ago; the Ventura Trunk Line recorded 169 leaks in its first 45 years, and only 4 in the 33 years since being lined.
- Considering all lines, an average of 26 years passed until the first leak was recorded. There was no correlation of those in severely corrosive soil leaking at an earlier date than the average.
- Prior to being cement mortar lined, most leaks occurred in severely corrosive soil; the only exceptions being the Cantara, Fletcher, Lankershim and Sunset Trunk Lines. Only a total of 21 were recorded for all the trunk lines after being cement mortar lined. Most of those were in severely corrosive soil.
- 37% of the city block segments are in high-risk areas. High risk is defined as those segments of a trunk line that are aligned next to a 16-inch or greater natural gas line, or an oil pipeline; run along city blocks that have churches, schools, gas stations, police stations, or hospitals; or under private property.

36"- 40" ALAMEDA TRUNK LINE

EXPERT CHOICE TOTALS

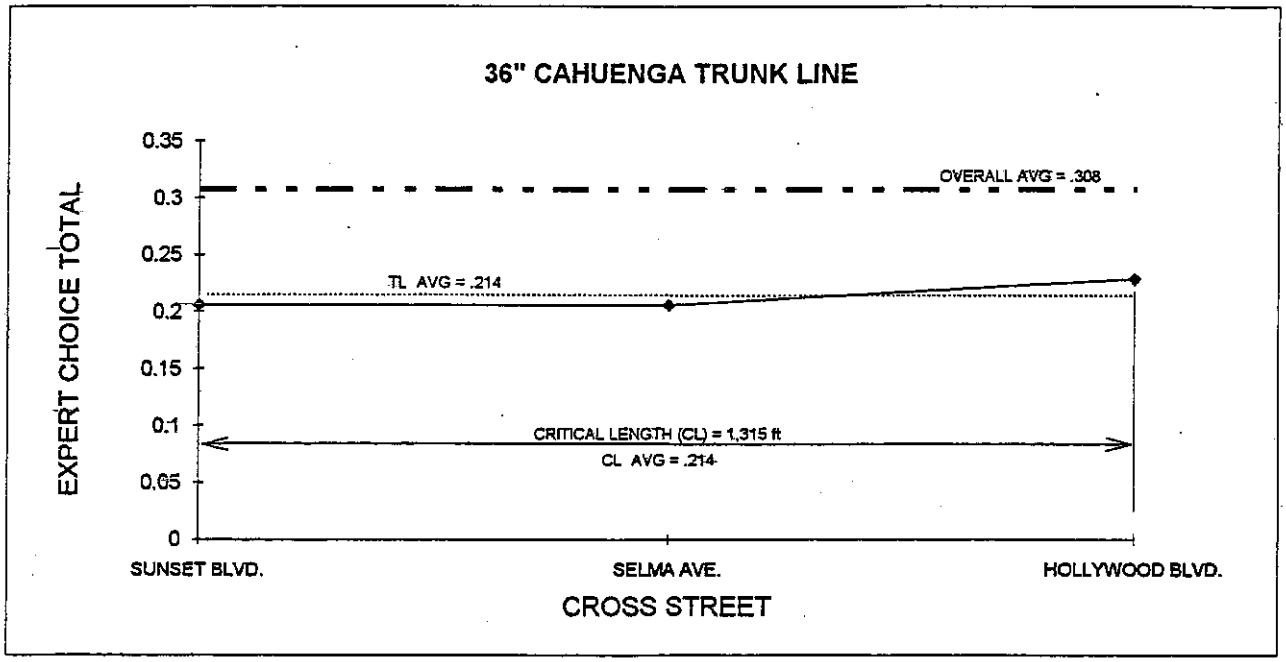
CROSS STREET	STATION	EC TOTAL
TRACTION AVE.	1000	0.385
SECOND ST.	1075	0.385
FIRST ST.	1755	0.479
BANNING ST.	1990	0.374
TURNER ST.	2312.5	0.4
JACKSON ST.	2515	0.389
TEMPLE ST.	2540	0.389
DUCOMMUN ST.	3150	0.4
COMMERCIAL ST.	3412.5	0.374
ALISO ST.	3645	0.4
SUNSET BLVD.	4362.5	0.442
LOS ANGELES ST.	4765	0.23
MACY ST.	5102.5	0.22
BAUCHET ST.	5360	0.385
N. MAIN ST.	5552.5	0.374
ORD ST.	5602.5	0.374
ALPINE ST.	6402.5	0.442
BRUNO ST.	6810	0.4
N. SPRING ST.	6995	0.23
turns on COLLEGE ST.	7142.5	0.215
turns on N. BROADWAY	7605	0.249
BERNARD ST.	8710	0.249
COTTAGE HOME ST.	8950	0.239
BISHOPS RD.	9795	0.249
SAVOY ST.	10170	0.249
SOLANO AVE.	11045	0.408
CASANOVA ST.	11385	0.408
AVERAGE (TL AVG):		***0.346***



36" CAHUENGA TRUNK LINE

EXPERT CHOICE TOTALS

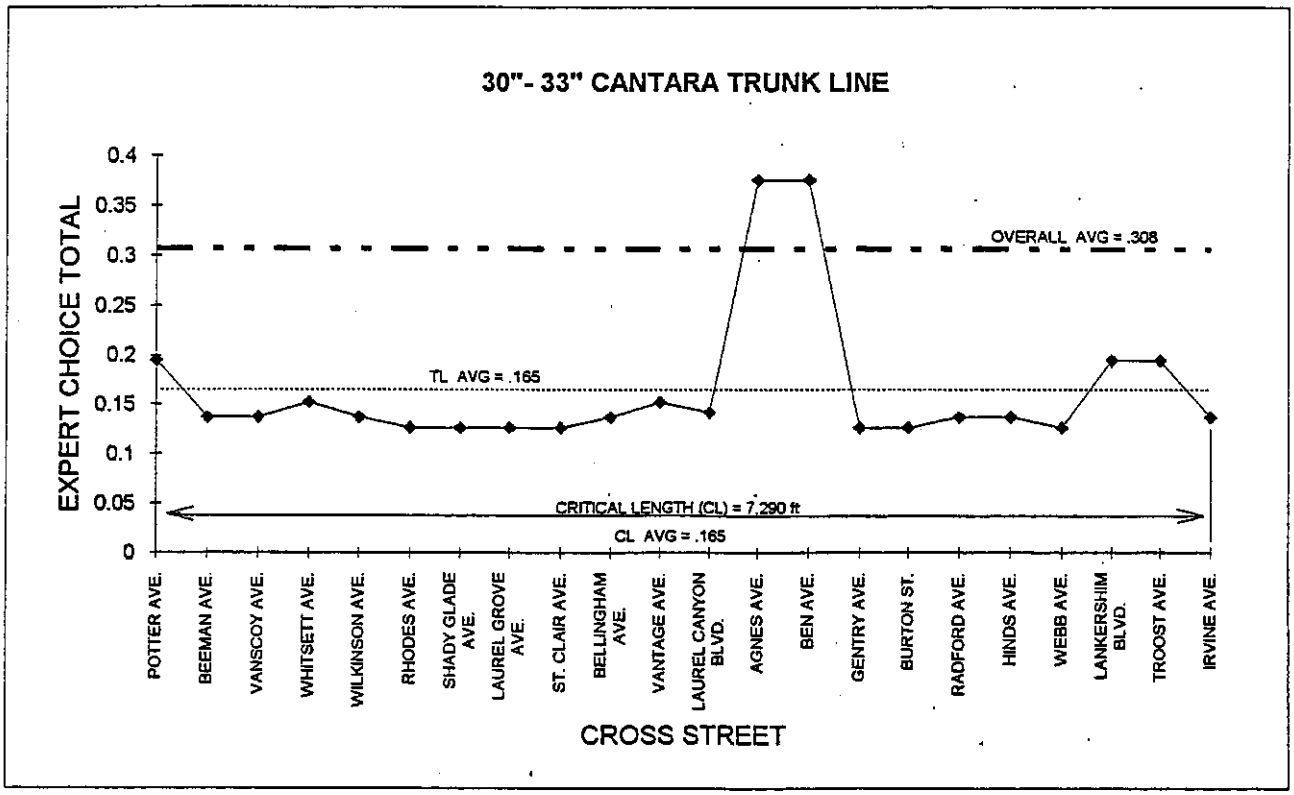
CROSS STREET	STATION	EC TOTAL
SUNSET BLVD.	1000	0.206
SELMA AVE.	1650	0.206
HOLLYWOOD BLVD.	2315	0.229
AVERAGE (TL AVG):		***0.214***



30" - 33" CANTARA TRUNK LINE

EXPERT CHOICE TOTALS

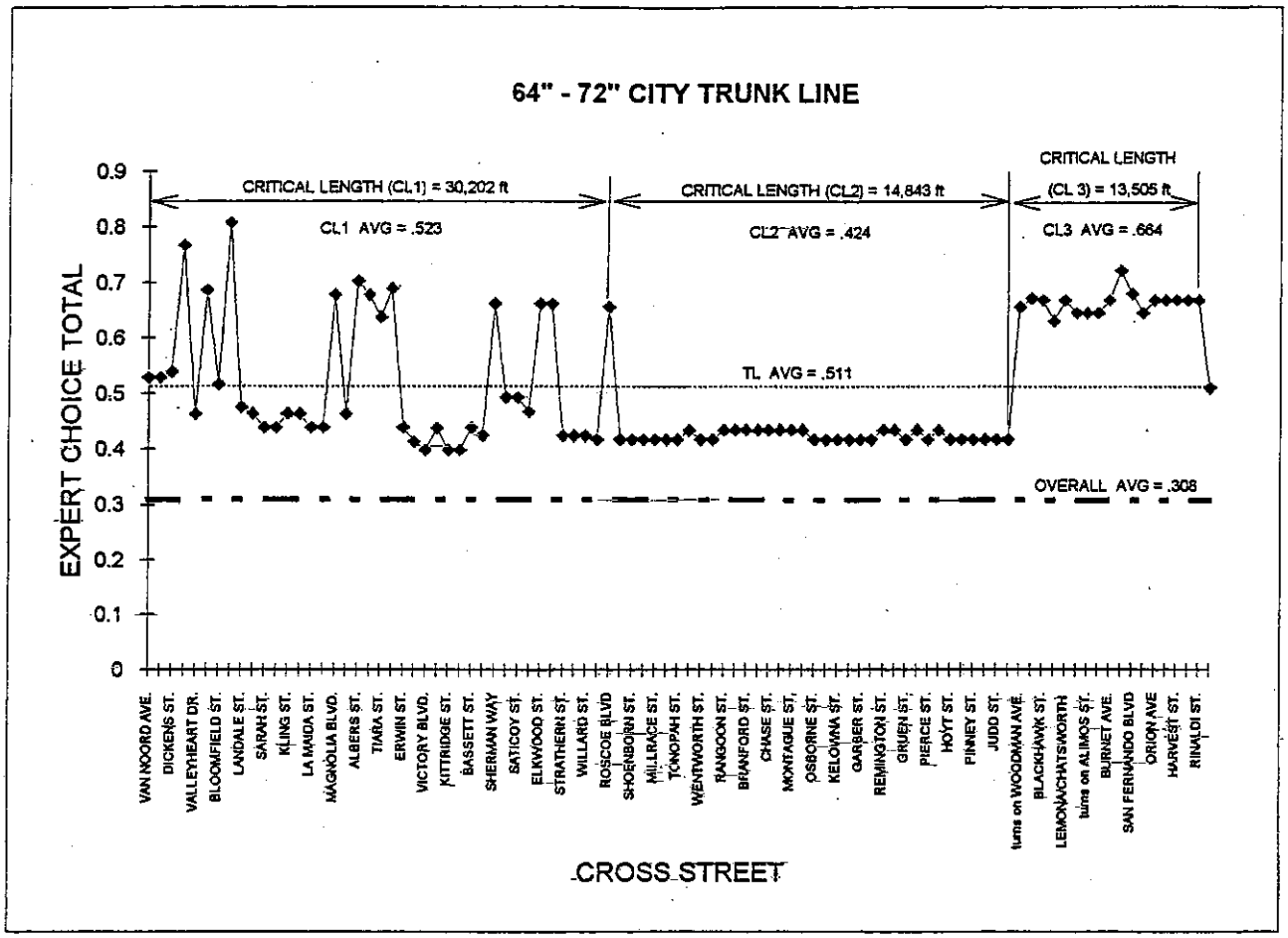
CROSS STREET	STATION	EC TOTAL
POTTER AVE.	1000	0.195
BEEMAN AVE.	1305	0.137
VANSCOY AVE.	1805	0.137
WHITSETT AVE.	2117.5	0.152
WILKINSON AVE.	2470	0.137
RHODES AVE.	2810	0.126
SHADY GLADE AVE.	3140	0.126
LAUREL GROVE AVE.	3472.5	0.126
ST. CLAIR AVE.	3800	0.126
BELLINGHAM AVE.	4122.5	0.137
VANTAGE AVE.	4442.5	0.152
LAUREL CANYON BLVD.	4800	0.142
AGNES AVE.	5127.5	0.375
BEN AVE.	5415	0.375
GENTRY AVE.	5755	0.126
BURTON ST.	5970	0.126
RADFORD AVE.	6130	0.137
HINDS AVE.	6460	0.137
WEBB AVE.	6477.5	0.126
LANKERSHIM BLVD.	7457.5	0.195
TROOST AVE.	7902.5	0.195
IRVINE AVE.	8290	0.137
AVERAGE (TL AVG):		***0.165***



64" - 72" CITY TRUNK LINE

EXPERT CHOICE TOTALS

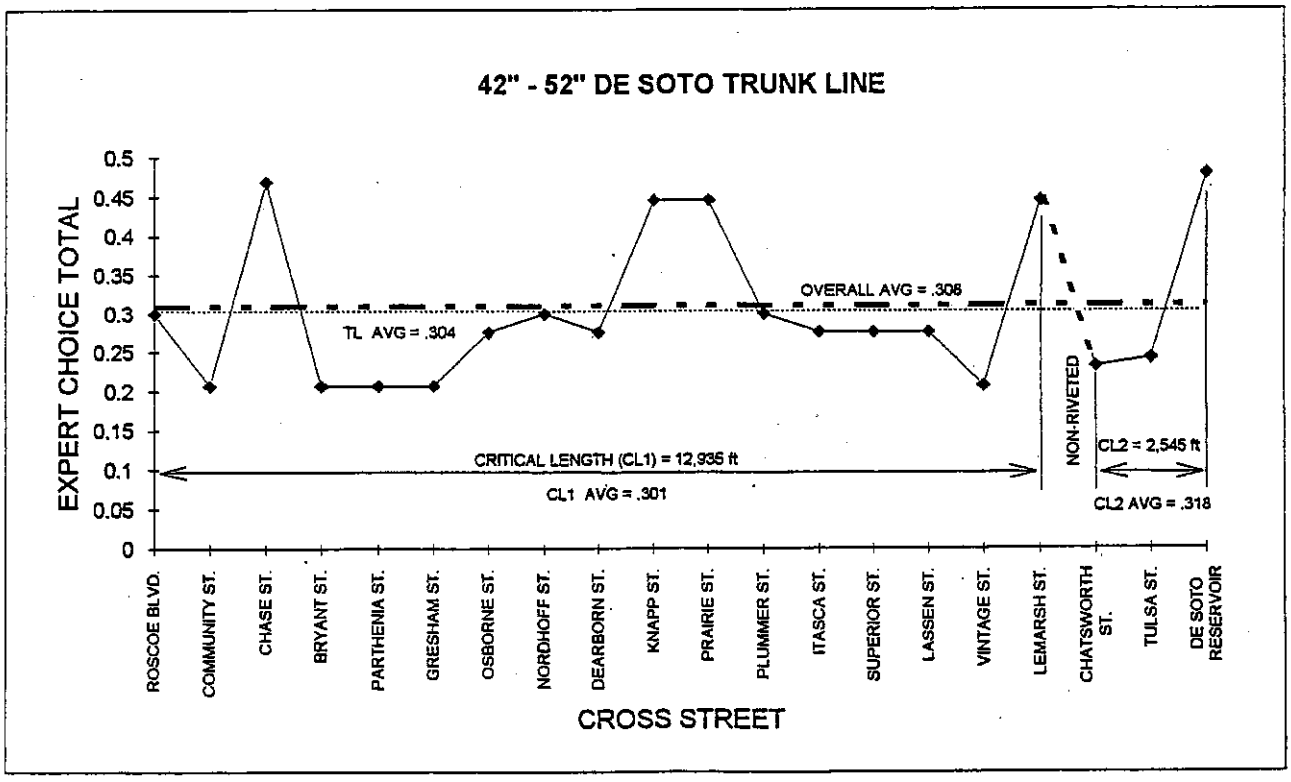
CROSS STREET	STATION	EC TOTAL
VAN NOORD AVE.	1225	0.528
HALKIRK ST.	1737.5	0.528
DICKENS ST.	2490	0.539
VENTURA BLVD.	2895	0.767
VALLEYHEART DR.	3462.5	0.463
WOODBRIDGE ST.	4025	0.686
BLOOMFIELD ST.	4427.5	0.516
MOORPARK ST.	4807.5	0.807
LANDALE ST.	5407.5	0.474
MILBANK ST.	5865	0.463
SARAH ST.	6132.5	0.439
HORTENSE ST.	6462.5	0.439
KLING ST.	6795	0.463
RIVERSIDE DR.	7455	0.463
LA MAIDA ST.	7770	0.439
ADDISON ST.	8760	0.439
MAGNOLIA BLVD.	10082.5	0.678
CHANDLER BLVD.	11405	0.463
ALBERS ST.	12085	0.702
BURBANK BLVD.	12775	0.678
TIARA ST.	14880	0.636
OXNARD ST.	15220	0.688
ERWIN ST.	15562.5	0.439
SYLVAN ST.	16892.5	0.413
VICTORY BLVD.	17565	0.398
HAMLIN ST.	18862.5	0.437
KITTRIDGE ST.	19545	0.398
VANOWEN ST.	20870	0.398
BASSETT ST.	21547.5	0.439
VOSE ST.	22527.5	0.424
SHERMAN WAY	23530	0.662
RAYMER ST.	24760	0.493
SATICOY ST.	25515	0.493
WIXOM ST.	26852.5	0.466
ELKWOOD ST.	27495	0.662
BLYTHE ST.	28100	0.662
STRATHERN ST.	28880	0.424
BELLAIRE AVE.	29632.5	0.424
WILLARD ST.	29772.5	0.424
CANTARA ST.	30345	0.418
ROSCOE BLVD	31202.5	0.656
on CANTEBURY AVE.	31825	0.418
SHOENBORN ST.	31830	0.418
COMMUNITY ST.	32115	0.418
MILLRACE ST.	32400	0.418
NAGLE ST.	33000	0.418
TONOPAH ST.	33235	0.418
REEDLEY ST.	33722.5	0.434
WENTWORTH ST.	34447.5	0.418
RELIANCE ST.	34735	0.418
RANGOON ST.	35020	0.434
OTTOMAN ST.	35577.5	0.434
BRANFORD ST.	35900	0.434
BRACKEN ST.	36212.5	0.434
CHASE ST.	36470	0.434
DEBELL ST.	36770	0.434
MONTAGUE ST.	37347.5	0.434
RAYEN ST.	38475	0.434
OSBORNE ST.	38795	0.418
SUNBURST ST.	39112.5	0.418
KELOWNA ST.	39985	0.418
KAGEL CANYON ST.	40240	0.418
GARBER ST.	41380	0.418
TERRA BELLA ST.	41692.5	0.418
REMINGTON ST.	41995	0.434
GAIN ST.	42332.5	0.434
GRUEN ST.	42612.5	0.418
GAGER ST.	42880	0.434
PIERCE ST.	43142.5	0.418
CARL ST.	44015	0.434
HOYT ST.	44275	0.418
VAN NUYS BLVD.	44595	0.418
PINNEY ST.	45210	0.418
MERCER ST.	45490	0.418
JUDD ST.	45765	0.418
FILMORE ST.	46045	0.418
on WOODMAN AVE.	48540	0.656
DEVONSHIRE ST.	48615	0.672
BLACKHAWK ST.	48960	0.669
SAN JOSE ST.	49945	0.63
LEMONA/CHATSWORTH	51790	0.669
on CHATSWORTH DR.	52345	0.646
on ALIMOS ST.	52745	0.646
NOBLE AVE.	53187.5	0.646
BURNET AVE.	53607.5	0.669
on STRANWOOD AVE.	55905	0.722
SAN FERNANDO BLVD	55955	0.68
SEPULVEDA BLVD.	56950	0.646
ORION AVE	57740	0.669
BLUCHER AVE.	58320	0.669
HARVEST ST.	58872.5	0.669
DANUBE AVE.	59295	0.669
RINALDI ST.	59550	0.669
L. Van Norman Chl. Sta.	62475	0.51
AVERAGE (TL AVG):		***0.511***


64" - 72" CITY TRUNK LINE
CRITICAL LENGTH (CL1) = 30,202 ft
CRITICAL LENGTH (CL2) = 14,843 ft
CRITICAL LENGTH
(CL 3) = 13,505 ft
CL1 AVG = .523
CL2 AVG = .424
CL3 AVG = .664
TL AVG = .511
OVERALL AVG = .308
EXPERT CHOICE TOTAL
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
VAN NOORD AVE.
DICKENS ST.
VALLEYHEART DR.
BLOOMFIELD ST.
LANDALE ST.
SARAH ST.
KLING ST.
LA MANDA ST.
MAGNOLIA BLVD.
ALBERS ST.
TIARA ST.
ERWIN ST.
VICTORY BLVD.
KITTRIDGE ST.
BASSETT ST.
SHERMAN WAY
SATICOY ST.
ELKWOOD ST.
STRATHERN ST.
WILLARD ST.
ROSCOE BLVD
SHOENBORN ST.
MILLRACE ST.
TONOPAH ST.
WENTWORTH ST.
RANGOON ST.
BRANFORD ST.
CHASE ST.
MONTAGUE ST.
OSBORNE ST.
KELOWNA ST.
GARBER ST.
REMINGTON ST.
GRUEN ST.
PIERCE ST.
HOYT ST.
PINNEY ST.
JUDD ST.
turns on WOODMAN AVE.
BLACKHAWK ST.
LEMONA/CHATSWORTH
turns on ALAMOS ST.
BURNET AVE.
SAN FERNANDO BLVD
ORION AVE
HARVEST ST.
RINALDI ST.
CROSS STREET

42" - 52" DE SOTO TRUNK LINE

EXPERT CHOICE TOTALS

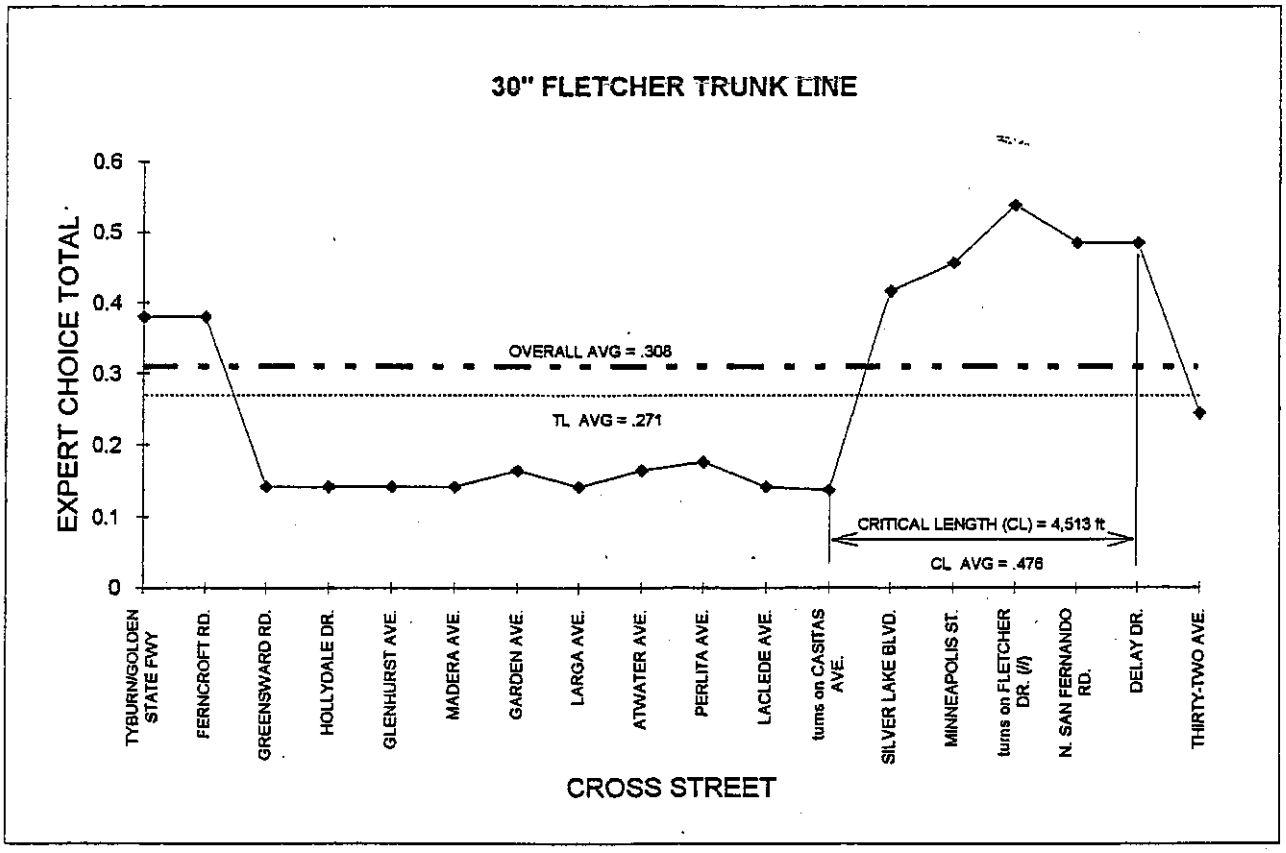
CROSS STREET	STATION	EC TOTAL
ROSCOE BLVD.	1000	0.3
COMMUNITY ST.	1810	0.207
CHASE ST.	2705	0.469
BRYANT ST.	3590	0.207
PARTHENIA ST.	4032.5	0.207
GRESHAM ST.	4915	0.207
OSBORNE ST.	5800	0.276
NORDHOFF ST.	6680	0.3
DEARBORN ST.	7322.5	0.276
KNAPP ST.	7695	0.446
PRAIRIE ST.	8660	0.446
PLUMMER ST.	9325	0.3
ITASCA ST.	10077.5	0.276
SUPERIOR ST.	10645	0.276
LASSEN ST.	11970	0.276
VINTAGE ST.	12630	0.207
LEMARSH ST.	13935	0.446
CHATSWORTH ST.	17260	0.231
TULSA ST.	18587.5	0.242
DE SOTO RESERVOIR	19805	0.48
AVERAGE (TL AVG):		***0.304***



30" FLETCHER TRUNK LINE

EXPERT CHOICE TOTALS

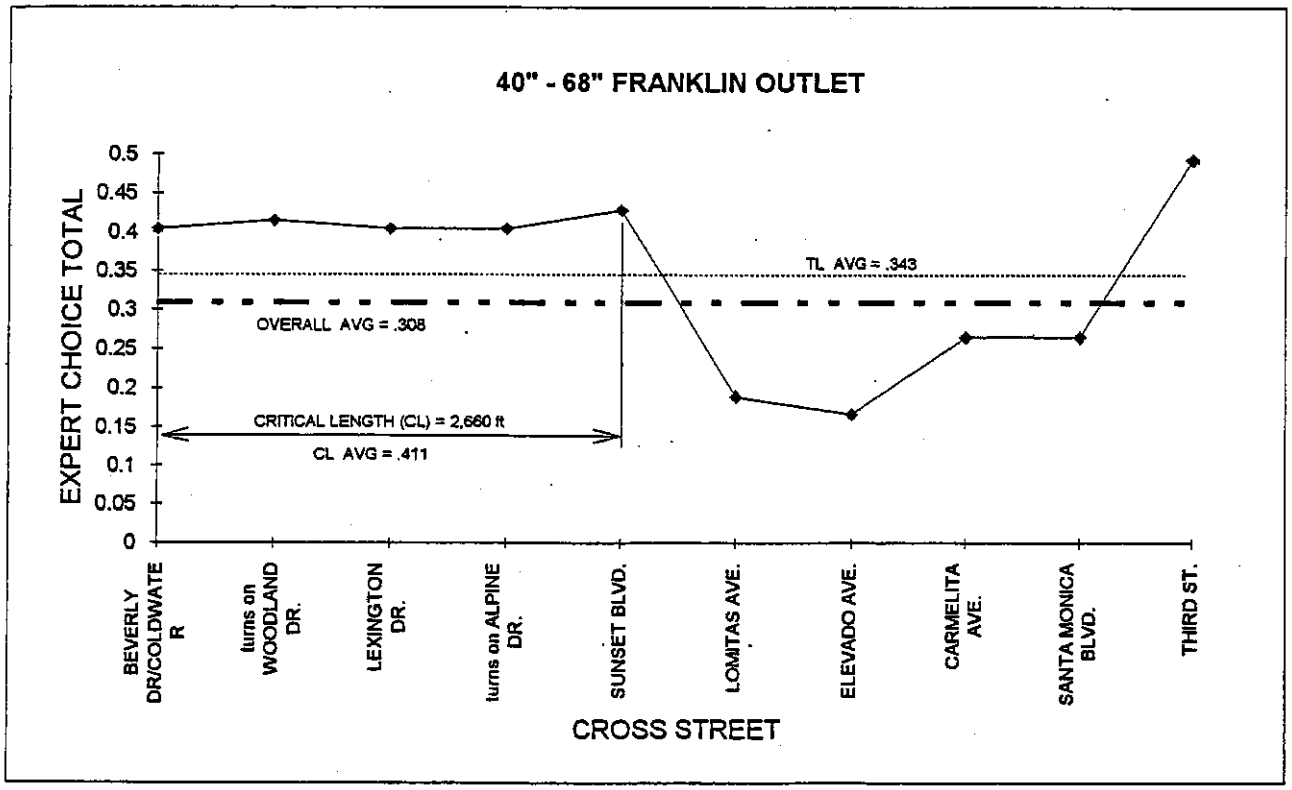
CROSS STREET	STATION	EC TOTAL
TYBURN/GOLDEN STATE FWY	1000	0.38
FERNCROFT RD.	1535	0.38
GREENSWARD RD.	1825	0.142
HOLLYDALE DR.	2135	0.142
GLENHURST AVE.	2450	0.142
MADERA AVE.	2775	0.142
GARDEN AVE.	3105	0.165
LARGA AVE.	3435	0.142
ATWATER AVE.	3765	0.165
PERLITA AVE.	4097.5	0.176
LACLEDE AVE.	4427.5	0.142
turns on CASITAS AVE.	4752.5	0.137
SILVER LAKE BLVD.	5605	0.417
MINNEAPOLIS ST.	6575	0.456
turns on FLETCHER DR. (//)	7240	0.538
N. SAN FERNANDO RD.	8565	0.485
DELAY DR.	9265	0.485
THIRTY-TWO AVE.	9500	0.245
AVERAGE (TL AVG):		***0.271***



40" - 68" FRANKLIN OUTLET

EXPERT CHOICE TOTALS

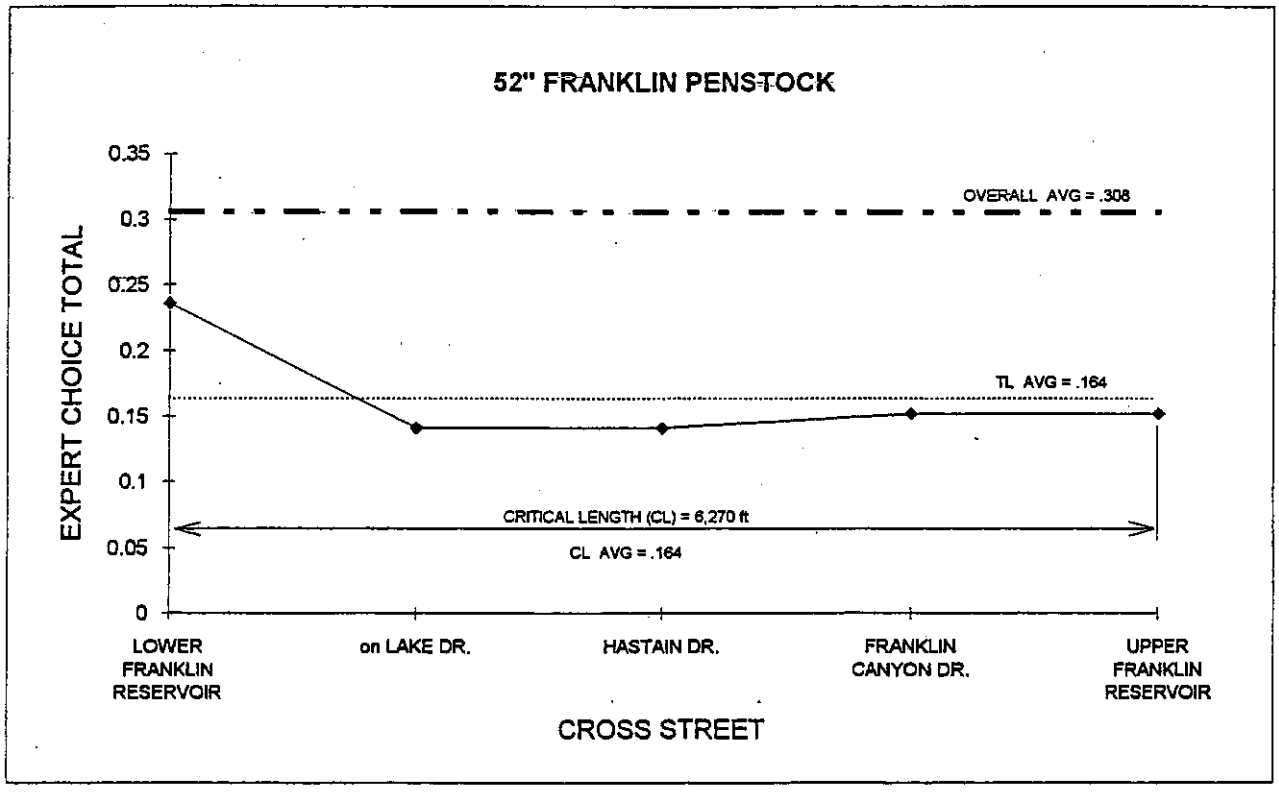
CROSS STREET	STATION	EC TOTAL
BEVERLY DR/COLDWATER	1125	0.404
turns on WOODLAND DR.	2505	0.415
LEXINGTON DR.	2880	0.404
turns on ALPINE DR.	3335	0.404
SUNSET BLVD.	3660	0.428
LOMITAS AVE.	4660	0.189
ELEVADO AVE.	5760	0.166
CARMELITA AVE.	7195	0.265
SANTA MONICA BLVD.	8470	0.265
THIRD ST.	8895	0.493
AVERAGE (TL AVG):		***0.343***



52" FRANKLIN PENSTOCK

EXPERT CHOICE TOTALS

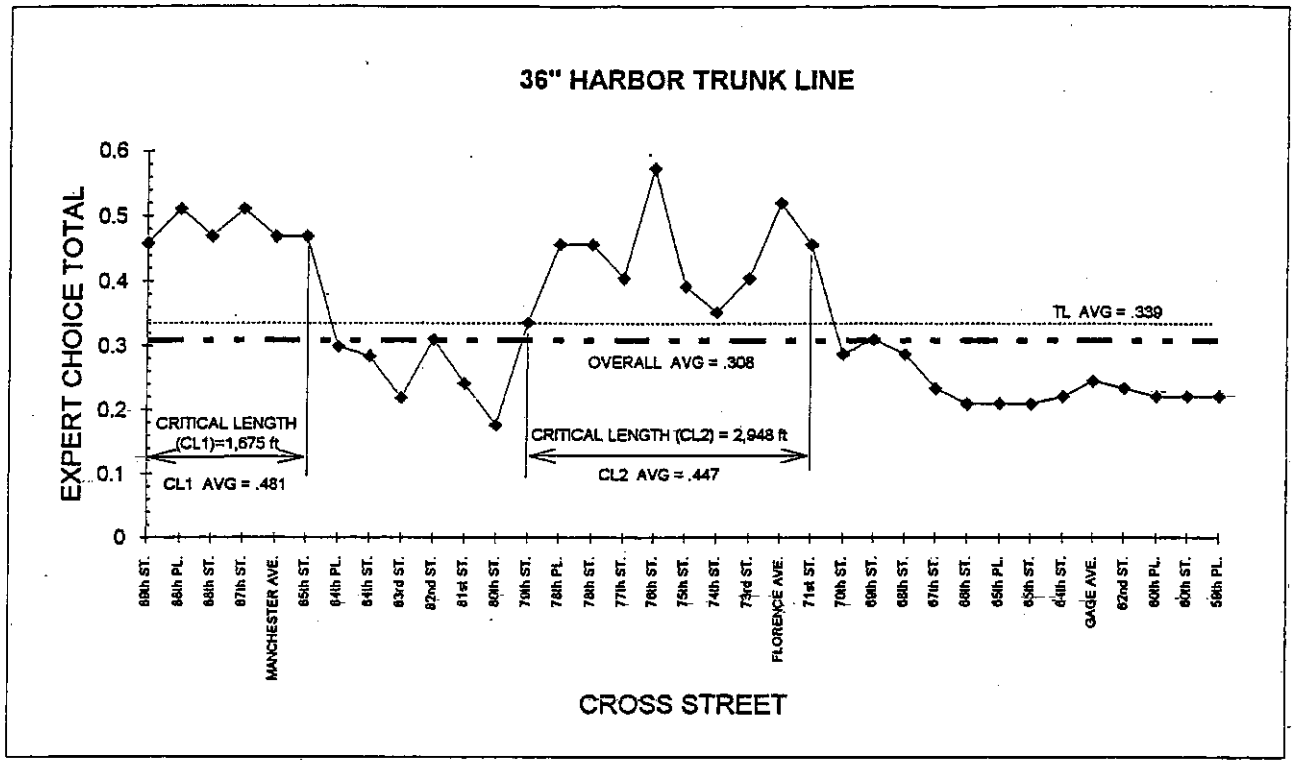
CROSS STREET	STATION	EC TOTAL
LOWER FRANKLIN RESERVOIR	1000	0.236
on LAKE DR.	2380	0.141
HASTAIN DR.	3850	0.141
FRANKLIN CANYON DR.	5535	0.152
UPPER FRANKLIN RESERVOIR	7270	0.152
	AVERAGE:	***0.164***



36" HARBOR TRUNK LINE

EXPERT CHOICE TOTALS

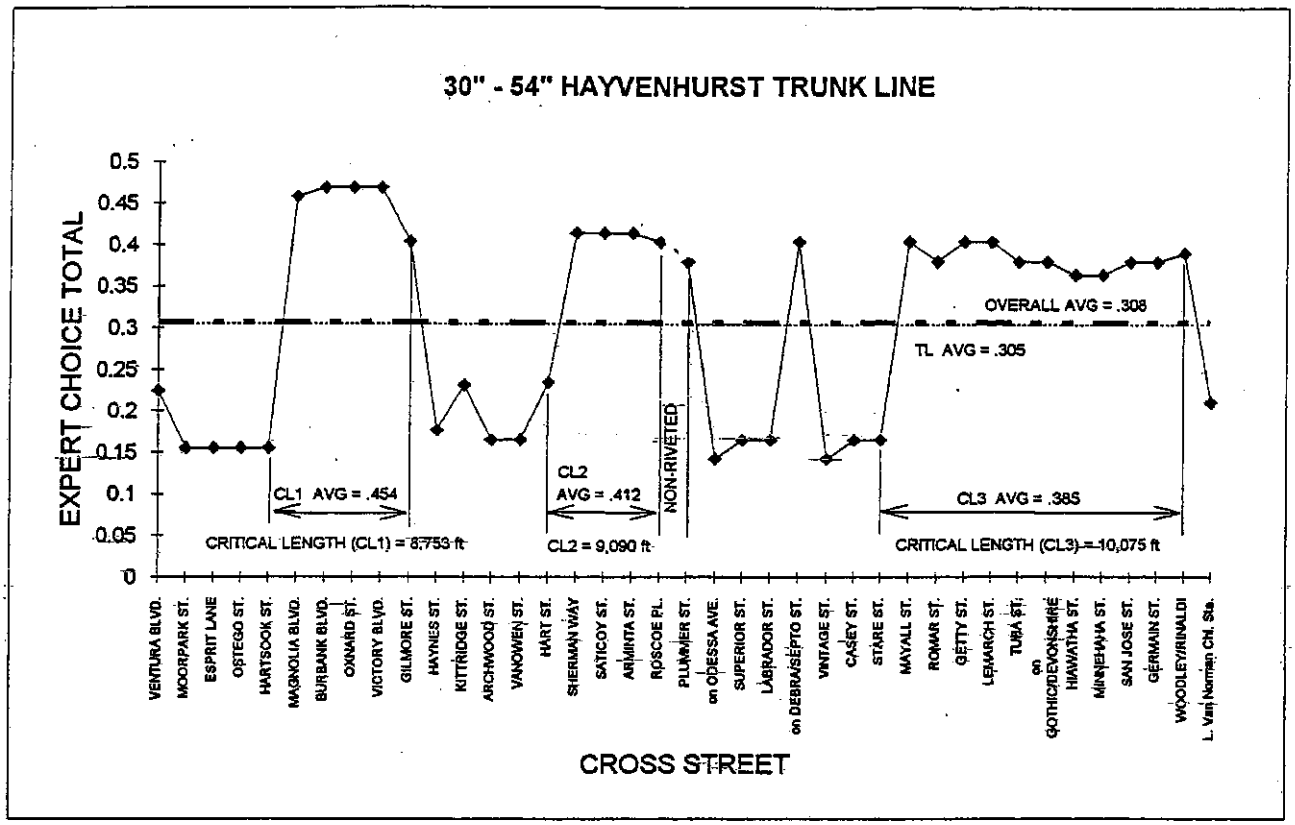
CROSS STREET	STATION	EC TOTAL
89th ST.	1000	0.458
88th PL.	1335	0.511
88th ST.	1667.5	0.469
87th ST.	2000	0.511
MANCHESTER AVE.	2332.5	0.469
85th ST.	2675	0.469
84th PL.	3000	0.299
84th ST.	3330	0.283
83rd ST.	3672.5	0.218
82nd ST.	4012.5	0.31
81st ST.	4342.5	0.241
80th ST.	4677.5	0.176
79th ST.	5002.5	0.336
78th PL.	5322.5	0.457
78th ST.	5650	0.457
77th ST.	5980	0.405
76th ST.	6325	0.574
75th ST.	6667.5	0.392
74th ST.	7000	0.352
73rd ST.	7322.5	0.405
FLORENCE AVE.	7655	0.521
71st ST.	7950	0.457
70th ST.	8242.5	0.287
69th ST.	8545	0.31
68th ST.	8840	0.287
67th ST.	9097.5	0.234
66th ST.	9325	0.21
65th PL.	9577.5	0.21
65th ST.	9862.5	0.21
64th ST.	10155	0.221
GAGE AVE.	10410	0.245
62nd ST.	10885	0.234
60th PL.	11487.5	0.221
60th ST.	11675	0.221
59th PL.	12102.5	0.221
AVERAGE (TL AVG):		***0.339***


36" HARBOR TRUNK LINE
EXPERT CHOICE TOTAL
0.6
0.5
0.4
0.3
0.2
0.1
0
TL AVG = .339
OVERALL AVG = .308
CRITICAL LENGTH (CL1)=1,675 ft
CL1 AVG = .481
CRITICAL LENGTH (CL2) = 2,948 ft
CL2 AVG = .447
88th ST.
86th PL.
86th ST.
87th ST.
MANCHESTER AVE.
85th ST.
84th PL.
84th ST.
83rd ST.
82nd ST.
81st ST.
80th ST.
79th ST.
78th PL.
78th ST.
77th ST.
76th ST.
75th ST.
74th ST.
73rd ST.
FLORENCE AVE.
71st ST.
70th ST.
69th ST.
68th ST.
67th ST.
66th ST.
65th PL.
65th ST.
64th ST.
GAGE AVE.
62nd ST.
60th PL.
60th ST.
58th PL.
CROSS STREET

30" - 54" HAYVENHURST TRUNK LINE

EXPERT CHOICE TOTALS

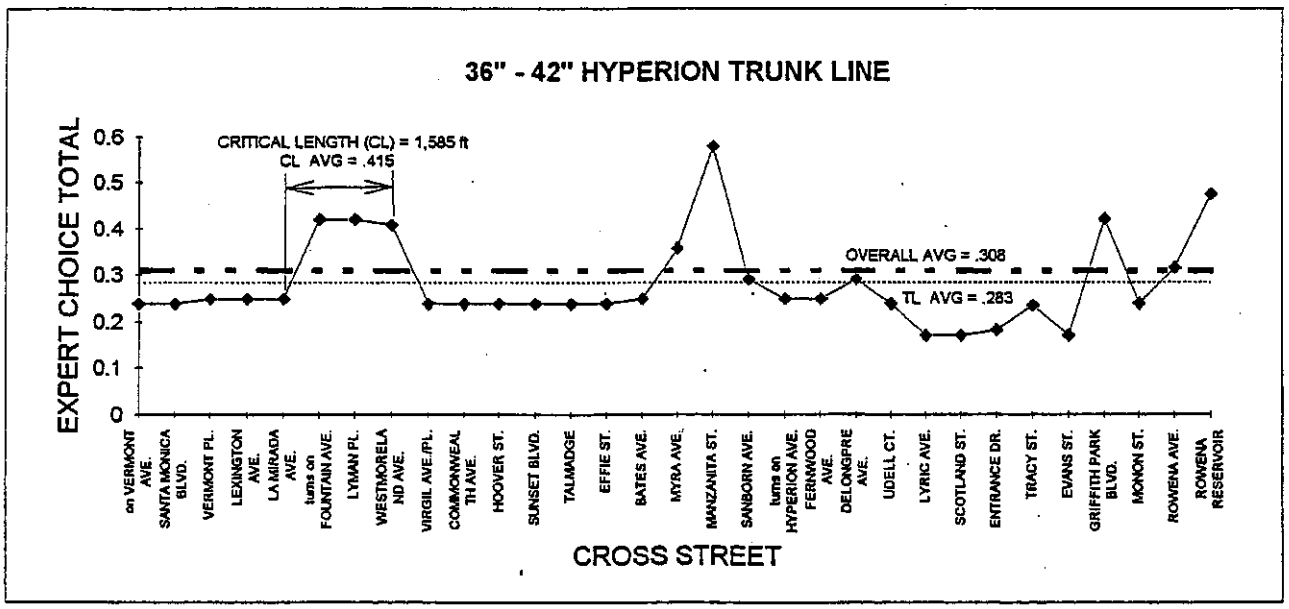
CROSS STREET	STATION	EC TOTAL
VENTURA BLVD.	1000	0.224
MOORPARK ST.	1462.5	0.155
ESPRIT LANE	1710	0.155
OSTEGO ST.	2865	0.155
HARTSOOK ST.	3195	0.155
MAGNOLIA BLVD.	3692.5	0.458
BURBANK BLVD.	4455	0.469
OXNARD ST.	9315	0.469
VICTORY BLVD.	11627.5	0.469
GILMORE ST.	11947.5	0.404
HAYNES ST.	12580	0.176
KITTRIDGE ST.	12955	0.231
ARCHWOOD ST.	13925	0.165
VANOWEN ST.	14280	0.165
HART ST.	15605	0.234
SHERMAN WAY	16930	0.414
SATICOY ST.	19580	0.414
ARMINTA ST.	21930	0.414
ROSCOE PL.	24695	0.404
PLUMMER ST.	32600	0.38
on ODESSA AVE.	33720	0.142
SUPERIOR ST.	34035	0.165
LABRADOR ST.	35032.5	0.165
on DEBRA/SEPTO ST.	35697.5	0.404
VINTAGE ST.	35940	0.142
CASEY ST.	36190	0.165
STARE ST.	36440	0.165
MAYALL ST.	36700	0.404
ROMAR ST.	36950	0.38
GETTY ST.	37205	0.404
LEMARCH ST.	37440	0.404
TUBA ST.	37720	0.38
on GOTHIC/DEVONSHIRE	38135	0.38
HIAWATHA ST.	38855	0.364
MINNEHAHA ST.	39155	0.364
SAN JOSE ST.	39470	0.38
GERMAIN ST.	39755	0.38
WOODLEY/RINALDI	46515	0.39
L. Van Norman Chl. Sta.	48690	0.21
AVERAGE (TL AVG):		***0.305***


30" - 54" HAYVENHURST TRUNK LINE
EXPERT CHOICE TOTAL
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
OVERALL AVG = .308
TL AVG = .305
CL1 AVG = .454
CRITICAL LENGTH (CL1) = 8,753 ft
CL2
AVG = .412
CL2 = 9,090 ft
NON-RIVETED
CL3 AVG = .385
CRITICAL LENGTH (CL3) = 10,075 ft
VENTURA BLVD.
MOORPARK ST.
ESPRIT LANE
OSTEGO ST.
HARTSOOK ST.
MAGNOLIA BLVD.
BURBANK BLVD.
OXNARD ST.
VICTORY BLVD.
GILMORE ST.
HAYNES ST.
KITTRIDGE ST.
ARCHWOOD ST.
VANOWEN ST.
HART ST.
SHERMAN WAY
SATICOY ST.
ARMINTA ST.
ROSCOE PL.
PLUMMER ST.
on ODESSA AVE.
SUPERIOR ST.
LABRADOR ST.
on DEBRA/SEPTO ST.
VINTAGE ST.
CASEY ST.
STARE ST.
MAYALL ST.
ROMAR ST.
GETTY ST.
LEMARCH ST.
TUBA ST.
on GOTHIC/DEVONSHIRE
HIAWATHA ST.
MINNEHAHA ST.
SAN JOSE ST.
GERMAIN ST.
WOODLEY/RINALDI
L. Van Norman Ch. Sta.
CROSS STREET

36" - 42" HYPERION TRUNK LINE

EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
on VERMONT AVE.	1000	0.239
SANTA MONICA BLVD.	1045	0.239
VERMONT PL.	1572.5	0.249
LEXINGTON AVE.	1947.5	0.249
LA MIRADA AVE.	2332.5	0.249
turns on FOUNTAIN AVE.	2732.5	0.419
LYMAN PL.	3682.5	0.419
WESTMORELAND AVE.	3917.5	0.408
VIRGIL AVE./PL.	4250	0.239
COMMONWEALTH AVE.	4600	0.239
HOOVER ST.	4982.5	0.239
SUNSET BLVD.	5045	0.239
TALMADGE	5380	0.239
EFFIE ST.	5445	0.239
BATES AVE.	5750	0.249
MYRA AVE.	6137.5	0.357
MANZANITA ST.	6412.5	0.579
SANBORN AVE.	6770	0.291
turns on HYPERION AVE.	7350	0.249
FERNWOOD AVE.	7580	0.249
DELONGPRE AVE.	7955	0.291
UDELL CT.	8035	0.239
LYRIC AVE.	8760	0.17
SCOTLAND ST.	9575	0.17
ENTRANCE DR.	10447.5	0.181
TRACY ST.	10680	0.235
EVANS ST.	11255	0.17
GRIFFITH PARK BLVD.	11700	0.419
MONON ST.	12160	0.239
ROWENA AVE.	12635	0.315
ROWENA RESERVOIR	13050	0.474
AVERAGE (TL AVG):		***0.283***



30" - 36" LANKERSHIM TRUNK LINE

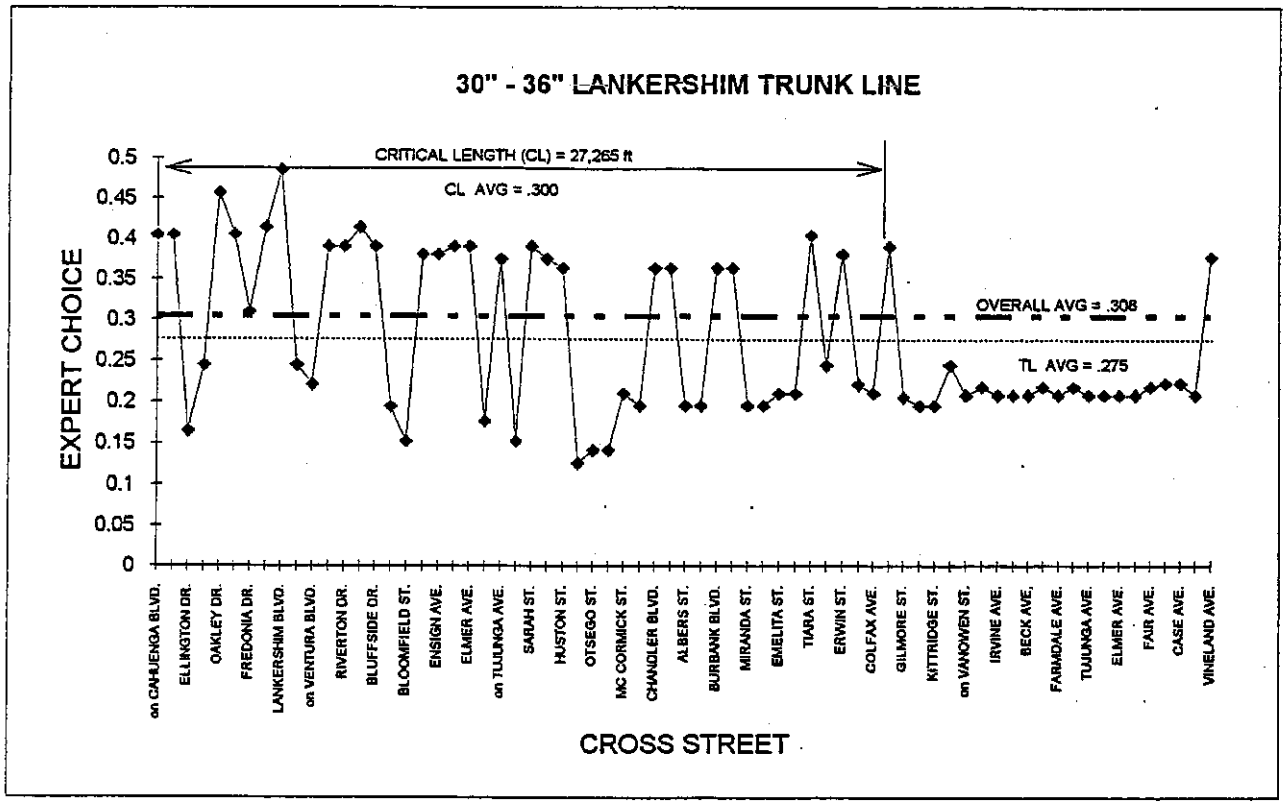
EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
on CAHUENGA BLVD.	1000	0.404
BENNETT DR.	1165	0.404
ELLINGTON DR.	1545	0.165
IONE DR.	2312.5	0.245
OAKLEY DR.	2940	0.456
BROADLAWN DR.	3555	0.405
FREDONIA DR.	4660	0.31
REGAL PL.	5330	0.414
LANKERSHIM BLVD.	6375	0.485
WILLOWCREST AVE.	6765	0.245
on VENTURA BLVD.	6885	0.221
FRUITLAND DR.	7375	0.39
RIVERTON DR.	7957.5	0.39
on VINELAND AVE.	8837.5	0.414
BLUFFSIDE DR.	9415	0.39
AQUA VISTA ST.	10505	0.194
BLOOMFIELD ST.	11200	0.152
on MOORPARK ST.	11595	0.38
ENSIGN AVE.	11900	0.38
BELLFLOWER AVE.	12585	0.39
ELMER AVE.	13650	0.39
BAKMAN AVE.	13950	0.176
on TUJUNGA AVE.	14275	0.375
LANDALE ST.	14955	0.152
SARAH ST.	15515	0.39
CAMARILLO/RIVERSIDE	16995	0.375
HUSTON ST.	17835	0.364
MORRISON ST.	18160	0.126
OTSEGO ST.	18952.5	0.142
MAGNOLIA BLVD.	19655	0.142
MC CORMICK ST.	20042.5	0.21
WEDDINGTON ST.	20425	0.195
CHANDLER BLVD.	20975	0.364
CUMPSTON ST.	21470	0.364
ALBERS ST.	21710	0.195
on LANKERSHIM BLVD.	22255	0.195
BURBANK BLVD.	22335	0.364
COLLINS ST.	23080	0.364
MIRANDA ST.	23465	0.195
HATTERAS ST.	23817.5	0.195
EMELITA ST.	24167.5	0.21
CALIFA ST.	24555	0.21
TIARA ST.	24927.5	0.404
OXNARD ST.	25295	0.245
ERWIN ST.	26777.5	0.38
SYLVAN ST.	27540	0.221
COLFAX AVE.	28210	0.21
VICTORY BLVD.	28265	0.39
GILMORE ST.	28567.5	0.205

30" - 36" LANKERSHIM TRUNK LINE

EXPERT CHOICE TOTALS

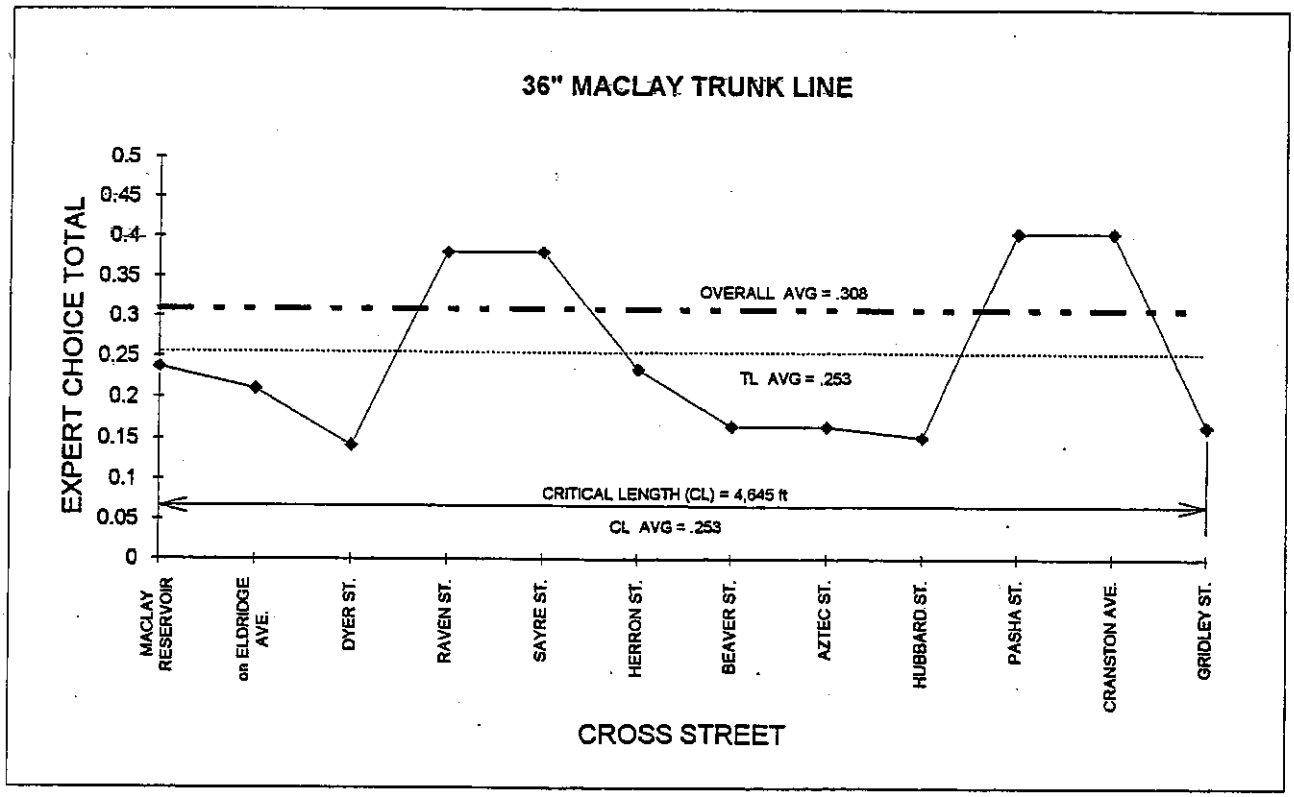
CROSS STREET	*STATION*	*EC TOTAL*
HAMLIN ST.	28972.5	0.195
KITTRIDGE ST.	29590	0.195
ARCHWOOD ST.	30245	0.245
on VANOWEN ST.	30895	0.208
TROOST AVE.	31290	0.218
IRVINE AVE.	31595	0.208
LEMP AVE.	31915	0.208
BECK AVE,	32245	0.208
CAMELLIA AVE,	32575	0.218
FARMDALE AVE.	32907.5	0.208
KRAFT AVE.	33242.5	0.218
TUJUNGA AVE.	33572.5	0.208
BACKMAN AVE.	33910	0.208
ELMER AVE.	34240	0.208
KLUMP AVE.	34585	0.208
FAIR AVE.	34902.5	0.218
WELBY WAY	35355	0.223
CASE AVE.	35635	0.223
ENSIGN AVE.	35910	0.208
VINELAND AVE.	36260	0.377
AVERAGE (TL AVG):		***0.275***



36" MACLAY TRUNK LINE

EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
MACLAY RESERVOIR	1000	0.237
on ELDRIDGE AVE.	1265	0.21
DYER ST.	1407.5	0.142
RAVEN ST.	1690	0.38
SAYRE ST.	2045	0.38
HERRON ST.	2420	0.234
BEAVER ST.	2765	0.165
AZTEC ST.	3110	0.165
HUBBARD ST.	3490	0.152
PASHA ST.	4500	0.404
CRANSTON AVE.	5330	0.404
GRIDLEY ST.	5645	0.165
AVERAGE (TL AVG):		***0.253***



36" PICO TRUNK LINE

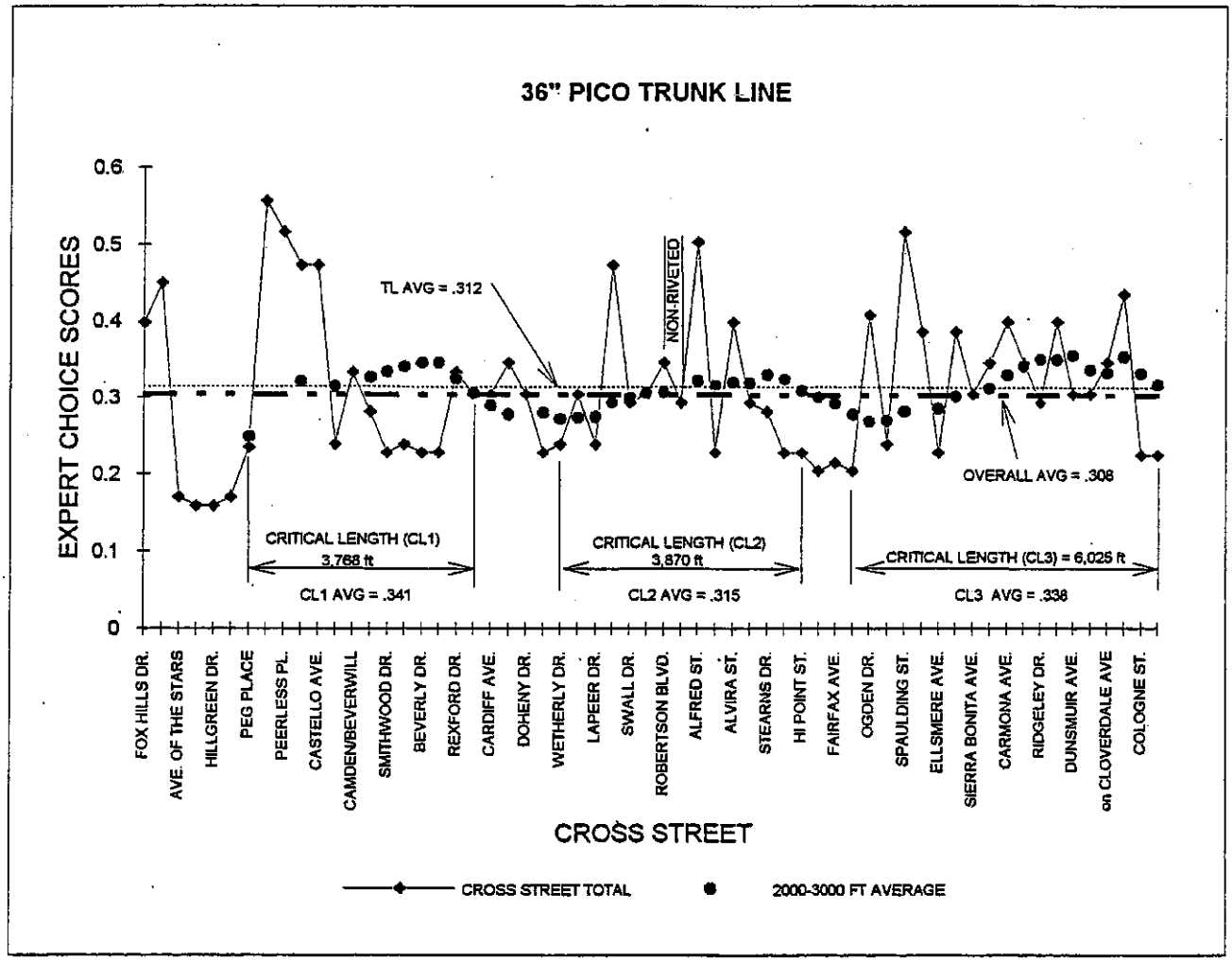
EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL	AVERAGE 2000-3000 FT	CROSS STREET 2000-3000 FT AWAY
FOX HILLS DR.	1000	0.398		
MOTOR AVE.	1897.5	0.45		
AVE. OF THE STARS	2680	0.17		
CENTURY PARK EAST	3550	0.159		
HILLGREEN DR.	3620	0.159		
BEVERLY GREEN DR.	3942.5	0.17		
PEG PLACE	3952.5	0.235	*0.249*	FOX HILLS DR.
AMBASSADOR ST.	4260	0.556		
PEERLESS PL.	4560	0.516		
ROXBURY DR.	4880	0.473	*0.321*	MOTOR AVE.
CASTELLO AVE.	5250	0.473		
DANIELS DR.	5345	0.239	*0.315*	AVE OF THE STARS
CAMDEN/BEVERWILL	5862.5	0.333		
EDRIS DR.	6285	0.281	*0.327*	CENTURY PARK EAST
SMITHWOOD DR.	6555	0.228	*0.333*	HILLGREEN DR.
REEVES ST.	6685	0.239	*0.340*	BEVERLY GREEN DR.
BEVERLY DR.	6950	0.228	*0.346*	PEG PLACE
ELM DR.	7155	0.228	*0.345*	AMBASSADOR ST.
REXFORD DR.	7405	0.333	*0.325*	PEERLESS PL.
GLENVILLE DR.	7720	0.304	*0.305*	ROXBURY DR.
CARDIFF AVE.	8045	0.304	*0.290*	CASTELLO AVE.
OAKHURST DR.	8365	0.346	*0.278*	DANIELS DR.
DOHENY DR.	8655	0.304		
CANFIELD AVE.	8822.5	0.228	*0.280*	CAMDEN/BEVERWILL DR.
WETHERLY DR.	8990	0.239	*0.272*	EDRIS DR.
CREST DR.	9370	0.304	*0.274*	SMITHWOOD DR.
LAPEER DR.	9612.5	0.239	*0.275*	REEVES ST.
LIVONIA AVE.	9752.5	0.473	*0.294*	BEVERLY DR.
SWALL DR.	9952.5	0.293	*0.300*	ELM DR.
CLARK DR.	10252.5	0.304	*0.306*	REXFORD DR.
ROBERTSON BLVD.	10580	0.346	*0.307*	GLENVILLE DR.
LA CIENEGA BLVD.	12930	0.293		
ALFRED ST.	13220	0.503	*0.321*	CARDIFF AVE.
LA JOLLA AVE.	13555	0.228	*0.315*	OAKHURST DR.
ALVIRA ST.	13885	0.398	*0.319*	DOHENY DR.
CRESCENT HEIGHTS BLVD.	14170	0.293	*0.319*	CANFIELD AVE.
STEARNS DR.	14505	0.281	*0.330*	CREST DR.
POINT VIEW ST.	14850	0.228	*0.323*	LAPEER DR.
HI POINT ST.	15210	0.228	*0.309*	SWALL DR.
HAYWORTH AVE.	15557.5	0.204	*0.301*	CLARK DR.
FAIRFAX AVE.	15875	0.215	*0.292*	ROBERTSON BLVD.
ORANGE GROVE AVE.	16200	0.204	*0.278*	ALFRED ST.
OGDEN DR.	16555	0.408	*0.269*	LA JOLLA AVE.
GENESSE AVE.	16890	0.239	*0.270*	ALVIRA ST.
SPAULDING ST.	17227.5	0.516	*0.282*	CRESCENT HEIGHTS BLVD.
STANLEY AVE.	17622.5	0.386		
ELLSMERE AVE.	17625	0.228	*0.286*	POINT VIEW ST.

36" PICO TRUNK LINE

EXPERT CHOICE TOTALS

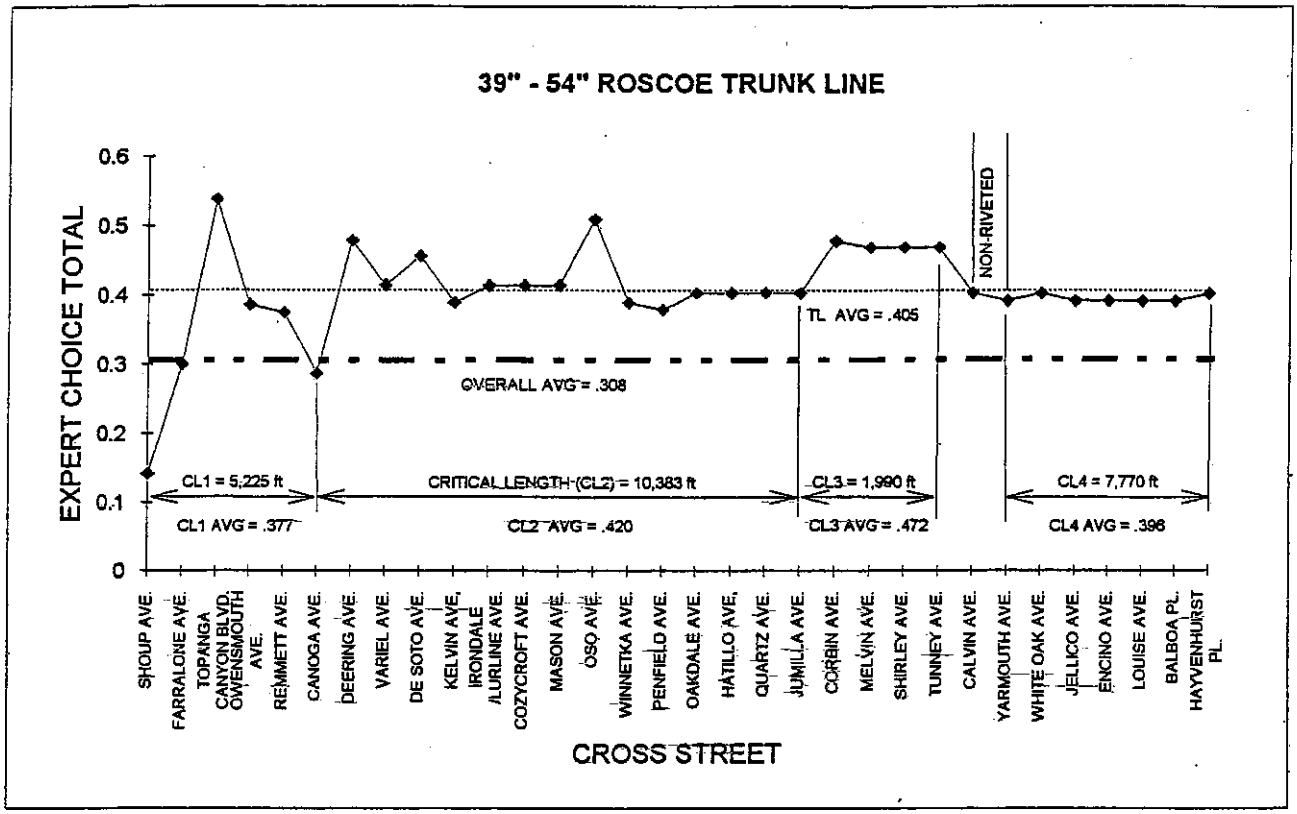
CROSS STREET	STATION	EC TOTAL	AVERAGE 2000-3000 FT.	CROSS STREET 2000-3000 FT AWAY
CURSON AVE.	18035	0.386	*0.301*	HI POINT ST.
SIERRA BONITA AVE.	18335	0.304		
MASSELIN AVE.	18562.5	0.346	*0.312*	HAYWORTH AVE.
CARMONA AVE.	18845	0.399	*0.330*	FAIRFAX AVE.
HAUSER BLVD.	19050	0.346	*0.342*	ORANGE GROVE AVE.
RIDGELEY DR.	19395	0.293	*0.350*	OGDEN DR.
BURNSIDE AVE.	19700	0.399	*0.349*	GENESSE AVE.
DUNSMUIR AVE.	20000	0.304	*0.355*	SPAULDING ST.
COCHRAN AVE.	20330	0.304	*0.336*	STANLEY AVE.
on CLOVERDALE AVE	20680	0.346	*0.332*	ELLSMERE AVE.
VENICE BLVD.	21910	0.435	*0.353*	CARMONA AVE.
COLOGNE ST.	21960	0.225	*0.332*	HAUSER BLVD.
PICKFORD ST.	22225	0.225	*0.316*	RIDGELEY DR.
AVERAGE (TL AVG):		***0.312***		



39"- 54" ROSCOE TRUNK LINE

EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
SHOUP AVE.	1000	0.142
FARRALONE AVE.	2307.5	0.3
TOPANGA CANYON BLVD.	3645	0.538
OWENSMOUTH AVE.	4972.5	0.386
REMMETT AVE.	5375	0.375
CANOGA AVE.	6225	0.287
DEERING AVE.	6970	0.479
VARIEL AVE.	7635	0.414
DE SOTO AVE.	8965	0.456
KELVIN AVE,	9630	0.39
IRONDALE /LURLINE AVE.	10292.5	0.414
COZYCROFT AVE.	10955	0.414
MASON AVE.	11622.5	0.414
OSO AVE.	12952.5	0.509
WINNETKA AVE.	14280	0.39
PENFIELD AVE.	14945	0.38
OAKDALE AVE.	15610	0.404
HATILLO AVE,	15942.5	0.404
QUARTZ AVE.	16275	0.404
JUMILLA AVE.	16607.5	0.404
CORBIN AVE.	16940	0.479
MELVIN AVE.	17605	0.469
SHIRLEY AVE.	18265	0.469
TUNNEY AVE.	18597.5	0.469
CALVIN AVE.	18930	0.404
YARMOUTH AVE.	29850	0.393
WHITE OAK AVE.	30175	0.403
JELLICO AVE.	30527.5	0.393
ENCINO AVE.	31420	0.393
LOUISE AVE.	32745	0.393
BALBOA PL.	35415	0.393
HAYVENHURST PL.	37620	0.403
AVERAGE (TL AVG):		***0.405***


39" - 54" ROSCOE TRUNK LINE
EXPERT CHOICE TOTAL
0.6
0.5
0.4
0.3
0.2
0.1
0
NON-RIVETED
TL AVG = .405
OVERALL AVG = .308
CL1 = 5,225 ft
CRITICAL LENGTH (CL2) = 10,383 ft
CL3 = 1,990 ft
CL4 = 7,770 ft
CL1 AVG = .377
CL2 AVG = .420
CL3 AVG = .472
CL4 AVG = .396
SHOUP AVE.
FARRALONE AVE.
TOPANGA CANYON BLVD.
OWENSMOUTH AVE.
REMMETT AVE.
CANOGA AVE.
DEERING AVE.
VARIEL AVE.
DE SOTO AVE.
KELVIN AVE.
IRONDALE
LURLINE AVE.
COZYCROFT AVE.
MASON AVE.
OSO AVE.
WINNETKA AVE.
PENFIELD AVE.
OAKDALE AVE.
HATILLO AVE.
QUARTZ AVE.
JUMILLA AVE.
CORBIN AVE.
MELVIN AVE.
SHIRLEY AVE.
TUNNEY AVE.
CALVIN AVE.
YARMOUTH AVE.
WHITE OAK AVE.
JELLICO AVE.
ENCINO AVE.
LOUISE AVE.
BALBOA PL.
HAYVENHURST PL.
CROSS STREET

30" - 36" SUNSET TRUNK LINE

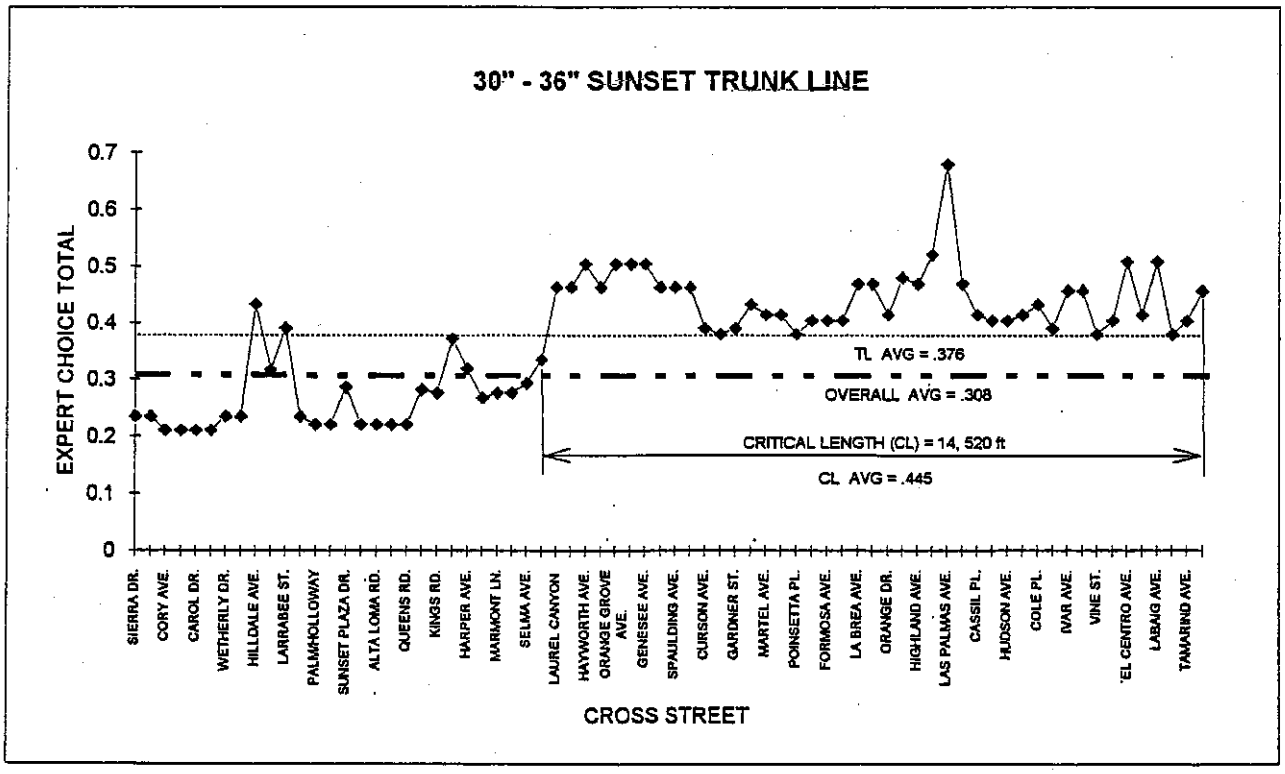
EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
SIERRA DR.	1000	0.234
PHYLLIS ST.	1117.5	0.234
CORY AVE.	1675	0.21
DOHENY RD.	1735	0.21
CAROL DR.	2022.5	0.21
DOHENY DR.	2420	0.21
WETHERLY DR.	2780	0.234
HAMMOND ST.	3065	0.234
HILLDALE AVE.	3375	0.433
CLARK ST.	3697.5	0.316
LARRABEE ST.	4030	0.39
HORN AVE.	4360	0.234
PALM/HOLLOWAY	4457.5	0.221
SHERBOURNE DR.	4887.5	0.221
SUNSET PLAZA DR.	5662.5	0.287
LONDONDERRY PL.	6150	0.221
ALTA LOMA RD.	6375	0.221
MILLER DR./LA CIENEGA BLVD.	6935	0.221
QUEENS RD.	7417.5	0.221
OLIVE DR.	7685	0.282
KINGS RD.	8052.5	0.277
SWEETZER AVE.	8937.5	0.372
HARPER AVE.	9477.5	0.319
ROXBURY RD.	9545	0.267
MARMONT LN.	9810	0.277
HAYVENHURST DR.	9995	0.277
SELMA AVE.	10215	0.293
CRESCENT HEIGHTS BLVD.	10515	0.335
LAUREL CANYON	10727.5	0.462
LAUREL AVE.	10942.5	0.462
HAYWORTH AVE.	11372.5	0.504
FAIRFAX AVE.	11785	0.462
ORANGE GROVE AVE.	12125	0.504
OGDEN DR.	12455	0.504
GENESEE AVE.	12785	0.504
COURTNEY AVE.	13105	0.462
SPAULDING AVE.	13140	0.462
STANLEY AVE.	13425	0.462
CURSON AVE.	13770	0.39
SIERRA BONITA AVE.	14097.5	0.38
GARDNER ST.	14430	0.39
VISTA ST.	14872.5	0.433
MARTEL AVE.	15187.5	0.414
FULLER AVE.	15512.5	0.414
POINSETTA PL.	15865	0.38
ALTA VISTA BLVD.	16180	0.404
FORMOSA AVE.	16350	0.404
DETROIT ST.	16695	0.404
LA BREA AVE.	17075	0.469
SYCAMORE AVE.	17570	0.469
ORANGE DR.	17890	0.414

30" - 36" SUNSET TRUNK LINE

EXPERT CHOICE TOTALS

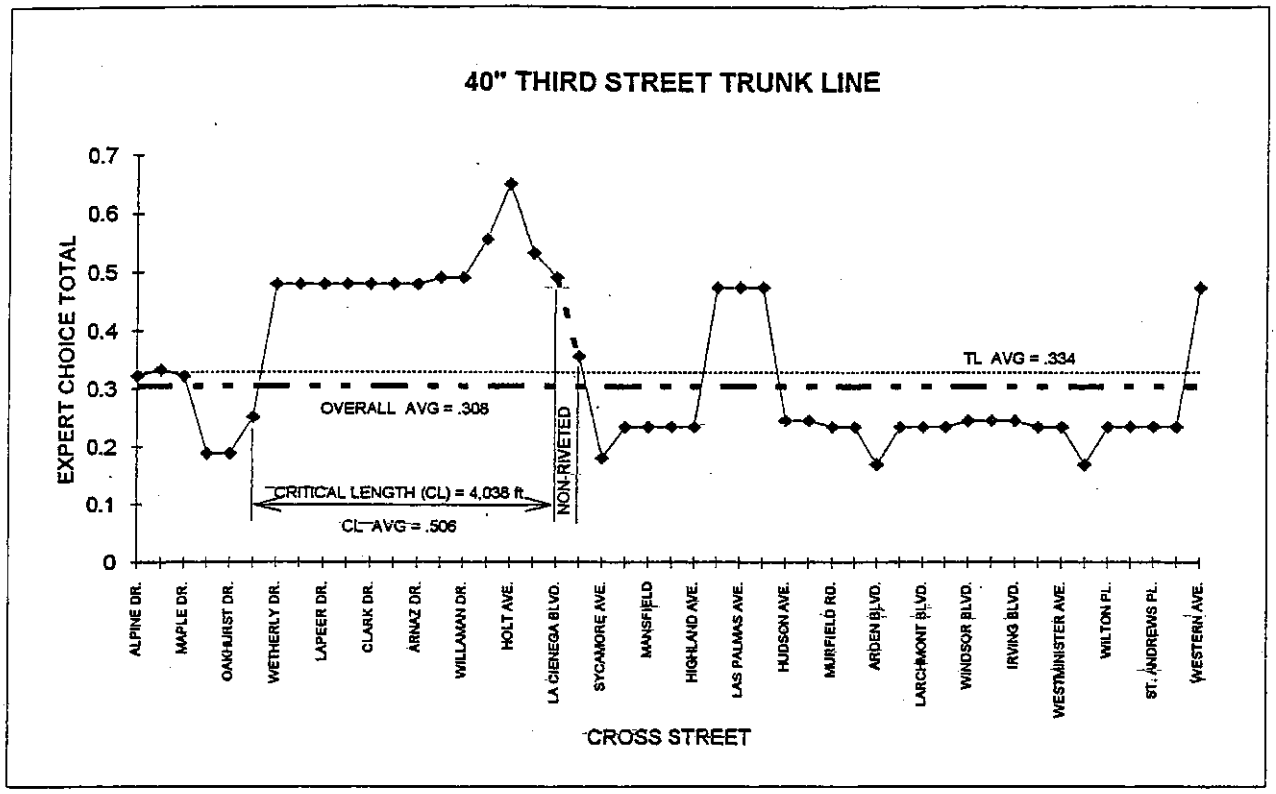
CROSS STREET	STATION	EC TOTAL
MANSFIELD AVE.	18185	0.479
HIGHLAND AVE.	18742.5	0.469
MC CADDEN PL.	19005	0.521
LAS PALMAS AVE.	19405	0.68
CHEROKEE AVE.	19767.5	0.469
CASSIL PL.	20220	0.414
SEWARD ST.	20392.5	0.404
HUDSON AVE.	20762.5	0.404
WILCOX AVE.	21065	0.414
COLE PL.	21290	0.433
CAHUENGA BLVD.	21525	0.39
IVAR AVE.	21745	0.456
MORNINGSIDE CT.	22065	0.456
VINE ST.	22390	0.38
ARGYLE AVE.	22847.5	0.404
EL CENTRO AVE.	23275	0.509
GOWER ST.	23715	0.414
LABAIG AVE.	24250	0.509
GORDON ST.	24445	0.38
TAMARIND AVE.	24705	0.404
BRONSON AVE.	25035	0.456
AVERAGE (TL AVG):		***0.376***



40" THIRD STREET TRUNK LINE

EXPERT CHOICE TOTALS

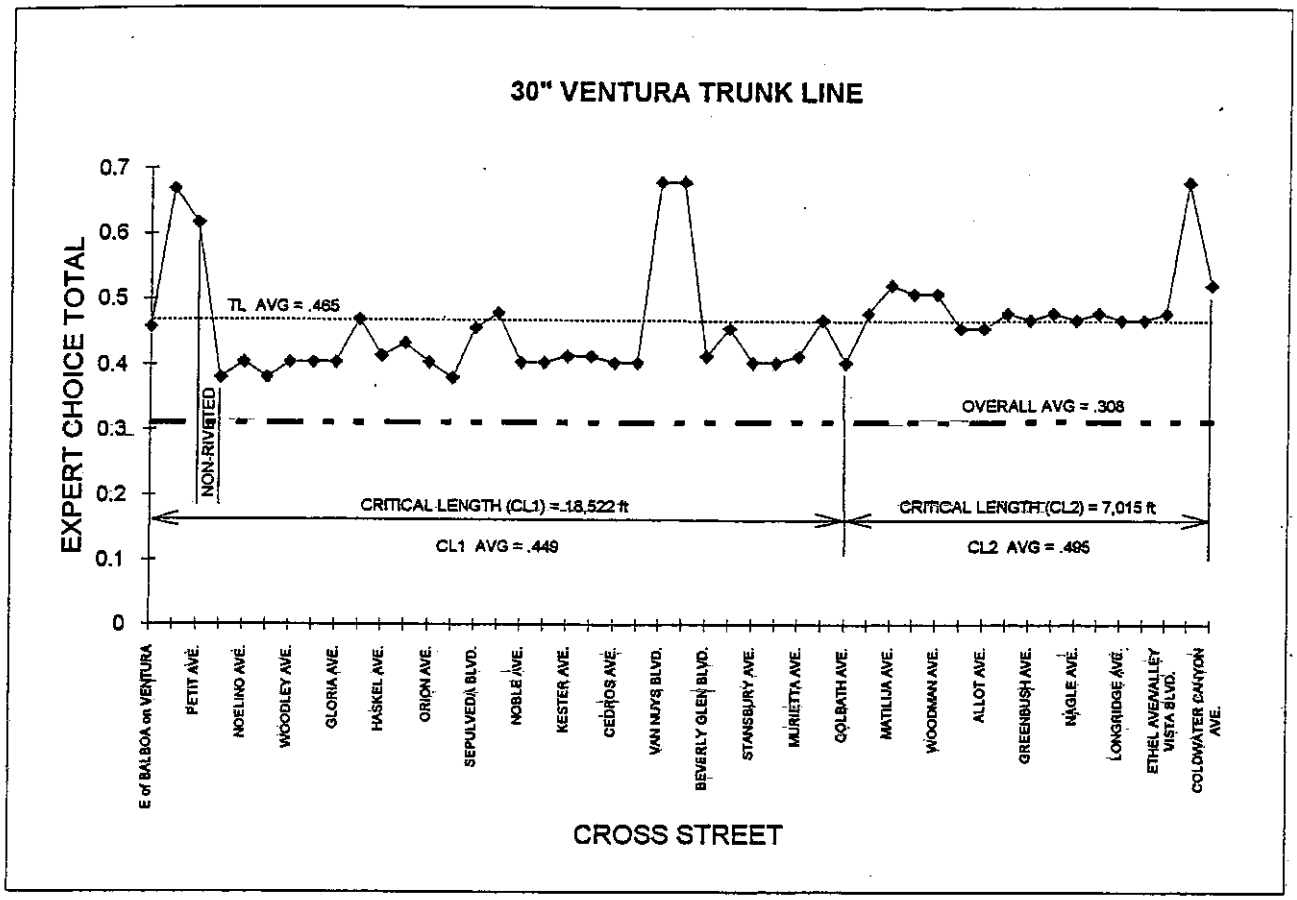
CROSS STREET	STATION	EC TOTAL
ALPINE DR.	1000	0.323
FOOTHILL RD.	1745	0.334
MAPLE DR.	2530	0.323
PALM DR.	2917.5	0.189
OAKHURST DR.	3305	0.189
DOHENY DR.	3682.5	0.252
WETHERLY DR.	3985	0.48
ALMONT DR.	4287.5	0.48
LAPEER DR.	4580	0.48
SWALL DR.	4875	0.48
CLARK DR.	5175	0.48
ROBERTSON BLVD.	5497.5	0.48
ARNAZ DR.	5822.5	0.48
HAMEL RD.	6142.5	0.491
WILLAMAN DR.	6465	0.491
SHERBOURNE DR.	6785	0.556
HOLT AVE.	7110	0.651
SAN VICENTE BLVD.	7335	0.533
LA CIENEGA BLVD.	7720	0.491
LA BREA AVE.	17755	0.357
SYCAMORE AVE.	18085	0.181
ORANGE DR.	18410	0.235
MANSFIELD	18742.5	0.235
CITRUS AVE.	19075	0.235
HIGHLAND AVE.	19417.5	0.235
MC CADDEN PL.	19842.5	0.474
LAS PALMAS AVE.	20250	0.474
JUNE ST.	20655	0.474
HUDSON AVE.	21160	0.246
RIMPAU BLVD.	21920	0.246
MURFIELD RD.	22390	0.235
ROSSMORE AVE.	22840	0.235
ARDEN BLVD.	23270	0.17
LUCERNE BLVD.	23665	0.235
LARCHMONT BLVD.	23965	0.235
PLYMOUTH BLVD.	24187.5	0.235
WINDSOR BLVD.	24630	0.246
LORRAINE BLVD.	25075	0.246
IRVING BLVD.	25515	0.246
NORTON AVE.	25920	0.235
WESTMINISTER AVE.	26230	0.235
VAN NESS AVE.	26472.5	0.17
WILTON PL.	26857.5	0.235
GRAMERCY PL.	27267.5	0.235
ST. ANDREWS PL.	27640	0.235
MANHATTAN	28020	0.235
WESTERN AVE.	28465	0.474
AVERAGE (TL AVG):		***0.334***


40" THIRD STREET TRUNK LINE
EXPERT CHOICE TOTAL
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TL AVG = .334
OVERALL AVG = .308
CRITICAL LENGTH (CL) = 4,038 ft.
CL AVG = .506
NON-RIVETED
ALPINE DR.
MAPLE DR.
OAKHURST DR.
WETHERLY DR.
LAPEER DR.
CLARK DR.
ARNAZ DR.
WILLAMAN DR.
HOLT AVE.
LA CIENEGA BLVD.
SYCAMORE AVE.
MANSFIELD
HIGHLAND AVE.
LAS PALMAS AVE.
HUDSON AVE.
MURFIELD RD.
ARDEN BLVD.
LARCHMONT BLVD.
WINDSOR BLVD.
IRVING BLVD.
WESTMINISTER AVE.
WILTON PL.
ST. ANDREWS PL.
WESTERN AVE.
CROSS STREET

30" VENTURA TRUNK LINE

EXPERT CHOICE TOTALS

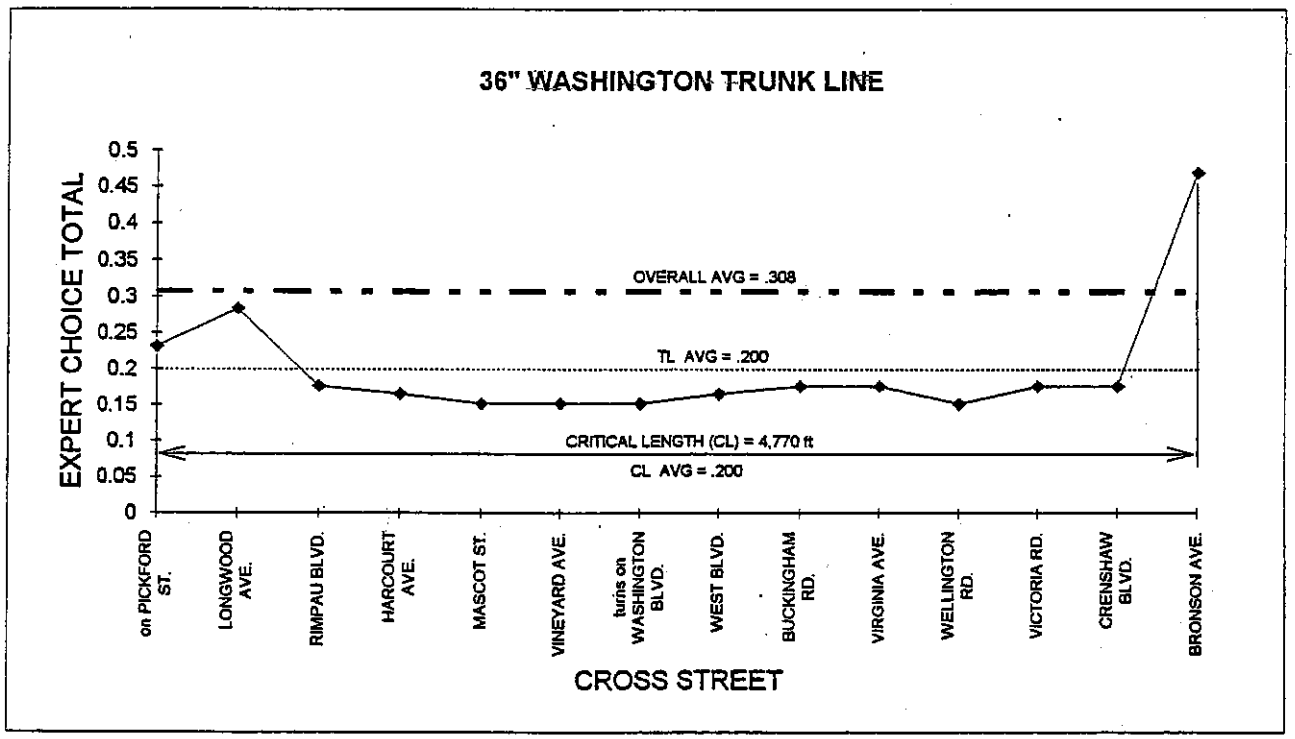
CROSS STREET	STATION	EC TOTAL
E of BALBOA on VENTURA	1000	0.458
LA MAIDA ST.	1350	0.669
PETIT AVE.	2207.5	0.616
HAYVENHURST AVE.	3360	0.38
NOELINO AVE.	4035	0.404
LIBBIT AVE.	4702.5	0.38
WOODLEY AVE.	6045	0.404
GAVIOTA AVE.	6715	0.404
GLORIA AVE.	7387.5	0.404
DENSMORE AVE.	7990	0.469
HASKEL AVE.	8840	0.414
FIRMAMENT AVE.	9505	0.433
ORION AVE.	10240	0.404
SHERMAN OAKS AVE.	10565	0.38
SEPULVEDA BLVD.	11420	0.456
COLUMBUS AVE.	12095	0.479
NOBLE AVE.	12790	0.404
LEMONA AVE.	13455	0.404
KESTER AVE.	14265	0.414
WILLIS AVE.	14805	0.414
CEDROS AVE.	15720	0.404
VESPER AVE.	16145	0.404
VAN NUYS BLVD.	16830	0.68
TYRONE AVE.	17640	0.68
BEVERLY GLEN BLVD.	17705	0.414
CALHOUN AVE.	18860	0.456
STANSBURY AVE.	19175	0.404
HAZELTINE AVE.	19625	0.404
MURIETTA AVE.	20065	0.414
COSTELLO AVE.	20410	0.469
COLBATH AVE.	20675	0.404
STERN AVE.	21005	0.479
MATILIJA AVE.	21405	0.521
MAMMOTH AVE.	21820	0.509
WOODMAN AVE.	22242.5	0.509
VENTURA CANYON	22772.5	0.456
ALLOT AVE.	23215	0.456
SUNNYSLOPE AVE.	23525	0.479
GREENBUSH AVE.	23840	0.469
DIXIE CANYON AVE.	24215	0.479
NAGLE AVE.	24595	0.469
FULTON AVE.	24955	0.479
LONGRIDGE AVE.	25345	0.469
MARY ELLEN AVE.	25850	0.469
ETHEL AVE/VALLEY VISTA BLVD.	26255	0.479
VAN NOORD AVE.	27160	0.68
COLDWATER CANYON AVE.	27690	0.521
AVERAGE (TL AVG):		***0.465***


30" VENTURA TRUNK LINE
EXPERT CHOICE TOTAL
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TL AVG = .465
OVERALL AVG = .308
NON-RIVETED
CRITICAL LENGTH (CL1) = 18,522 ft
CRITICAL LENGTH (CL2) = 7,015 ft
CL1 AVG = .449
CL2 AVG = .495
E of BALBOA on VENTURA
PETIT AVE.
NOELINO AVE.
WOODLEY AVE.
GLORIA AVE.
HASKEL AVE.
ORION AVE.
SEPULVEDA BLVD.
NOBLE AVE.
KESTER AVE.
CEDROS AVE.
VAN NUYS BLVD.
BEVERLY GLEN BLVD.
STANSBURY AVE.
MURIETTA AVE.
COLBATH AVE.
MATILIJA AVE.
WOODMAN AVE.
ALLOT AVE.
GREENBUSH AVE.
NAGILE AVE.
LONGRIDGE AVE.
ETHEL AVE
VALLEY VISTA BLVD.
COLDWATER CANYON AVE.
CROSS STREET

36" WASHINGTON TRUNK LINE

EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
on PICKFORD ST.	880	0.231
LONGWOOD AVE.	1000	0.283
RIMPAU BLVD.	1475	0.176
HARCOURT AVE.	1820	0.165
MASCOT ST.	2240	0.152
VINEYARD AVE.	2630	0.152
turns on WASHINGTON BLVD.	3295	0.152
WEST BLVD.	3360	0.165
BUCKINGHAM RD.	3610	0.176
VIRGINIA AVE.	3995	0.176
WELLINGTON RD.	4390	0.152
VICTORIA RD.	4825	0.176
CRENSHAW BLVD.	5250	0.176
BRONSON AVE.	5650	0.469
AVERAGE (TL AVG):		***0.200***



36" WESTWOOD TRUNK LINE

EXPERT CHOICE TOTALS

CROSS STREET	STATION	EC TOTAL
WILSHIRE BLVD.	1000	0.223
LINDBROOK	1382.5	0.299
KINROSS / BROXTON AVE.	1850	0.289
WEYBURN AVE.	2525	0.289
LE CONTE AVE.	2927.5	0.228
SUNSET BLVD.	6682.5	0.374
Sawtelle Chl. Station	6955	0.384
AVERAGE (TL AVG):		***0.298***