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GENERAL PLANNING CONSULTANT

TECHNICAL MEMORANDUM 89.4.5

METHODOLOGY FOR PHASE II VALIDATION ANALYSIS

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Prepared for:

Southern California Rapid Transit District

Prepared By:

Schimpeler·Corradino Associates

in conjunction with

Cordoba Corporation
The Planning Group

March 1989

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1.0 INTRODUCTION

The purpose of this report is to outline a proposed method for conducting a Metro Rail Before-and-After Study designed to identify, isolate and quantify, to the extent possible, the monetary benefits that accrue over time to property as a result of the property's proximity to the Los Angeles Metro Rail stations. This methodology outline is proposed for application to stations included in Phase II of Metro Rail, i.e., the Wilshire Boulevard, Vermont Avenue, and Hollywood Boulevard corridors, and the stations at Universal City and North Hollywood (see Figure 1). A Validation Study for the MOS-1 Metro Rail stations was conducted and the findings of that study are provided in "Technical Memorandum 89.4.3 Metro Rail Before-and-After Study: Validation Analysis."

In general, monetary benefits accrue to properties near Metro Rail stations because of improved accessibility accompanied by increased business opportunities and development. Benefit Assessment is a means of capturing a portion of these benefits to assist in the construction of Metro Rail. The purposes of the Validation Study are to evaluate the types and extent of Metro Rail associated monetary benefits, quantify the levels of benefits to the extent possible, and determine the amount of monetary benefits realized from Metro Rail within the Benefit Assessment Districts established by the SCRTD.

The work accomplished on the MOS-1 Metro Rail Validation Study offers several "lessons learned" and, therefore, serves as a partial guide for the development of an enhanced methodology for the Phase II Metro Rail Validation Study. As for MOS-1, it is recommended that the Validation Study be conducted in four phases: (A) identify benefit indicators and data sources; (B) develop a final, detailed study design; (C) collect and organize the data; and (D) analyze the data. Each of these steps is discussed later in this paper.

In general, it is proposed that the methodology employed for the Phase II Validation Study include the techniques utilized for MOS-1, but with several modifications. These modifications are proposed as a result of "lessons learned" on the MOS-1 Study, and include:

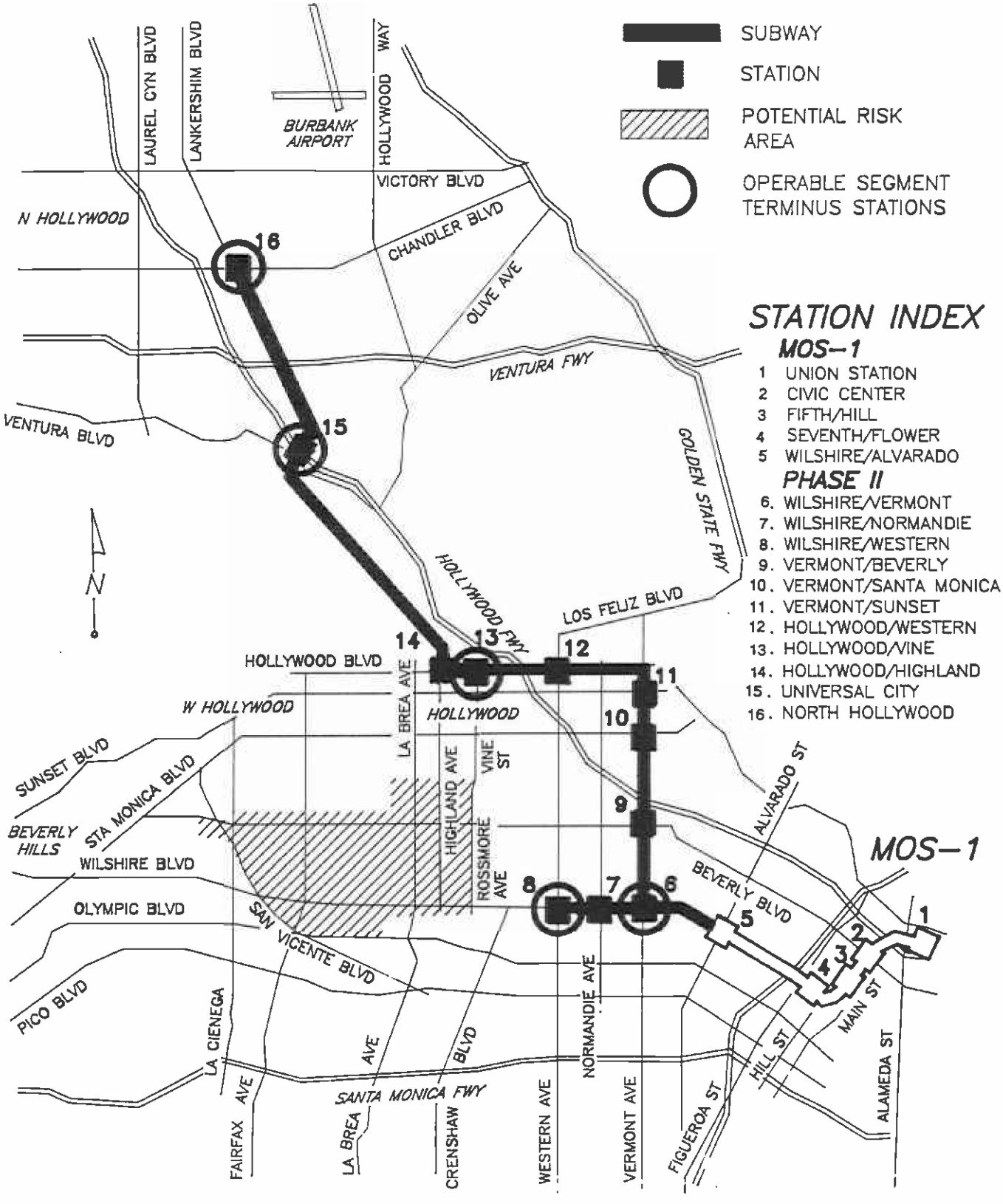
- **Adding the monetary benefit indicators of office lease rates and retail sales.** Use of office lease rates and retail sales as additional indicators will increase the number of samples available for analysis.

- **Supplementing quantitative research with interviews.** A purely quantitative analysis may not be appropriate for this type of research, due to problems in collecting and analyzing quantitative data and in isolating only those benefits attributable to Metro Rail. It is recommended that interviews be held with objective professionals with knowledge of land values in the subject areas (e.g., real estate agents, leasing agents, appraisers and developers).

FIGURE 1

SCRTD METRO RAIL
NEW LOCALLY PREFERRED ALTERNATIVE
VERMONT/HOLLYWOOD BLVD. SUBWAY

LPA SELECTED BY SCRTD BOARD OF DIRECTORS JULY 14, 1988



- Use of case studies from other cities. The data and information developed for the Los Angeles area can and should be supplemented with case studies from other communities. At a minimum, these case studies will aid in refinement of the methodology utilized for the Metro Rail system and should offer additional insight into the land economics associated with development of a heavy rail system in other cities and in Los Angeles.

- Adjustments to the data base to provide greater flexibility. Several adjustments to the organization and content of the data base deserve consideration. For example, variables that provide a physical description of the location of a property (e.g., CRA Area) and that contain values that are blank should be filled in with dummy values due to the way that the SPSS package works. The proposed data base structure will be discussed in further detail in the companion document entitled, " Technical Memorandum 89.4.6: Structure of Phase II Validation Data Base. "

- Elimination of analysis variables that did not prove significant in MOS-1 analysis. After a more thorough analysis, it is recommended that certain variables that were utilized in the MOS-1 data base be eliminated. Possible variables for elimination include: prime interest rate, % change in prime interest rate, unemployment rate, and foreign exchange rate.

- Careful handing of skewed variables. Additional techniques need to be investigated for the handling of outliers, which can tend to substantially skew the results of the multiple linear regressions.

- Different handling of cases with missing or incomplete data. At times, it may be advisable to fill in data for missing data, or, if the data are not available, eliminate the variable.

2.0 POTENTIAL BENEFIT INDICATORS AND DATA SOURCES

Although a data base and methodology were developed for MOS-1, the focus of this work will be to build on the work accomplished in MOS-1 and to design a program geared to the development of an improved, streamlined, and more flexible data base for property sales and values. Benefit indicators will be analyzed according to their potential to meet the following criteria:

- o applicability to benefit measurement;
- o sources of data for indicator measurement;
- o useability of available data, and
- o area of coverage.

The MOS-1 study looked at one benefit indicator, property value. The Phase II study should also include examination of the feasibility of including retail sales and office lease rates as benefit indicators.

Data utilized in the MOS-1 study and possible new data will be examined relative to the four criteria mentioned above and in regard to several observations on the MOS-1 study effort:

- o A number of variables included in the MOS-1 data base should be considered for elimination. Examples are variables defined as the percent change or absolute change from one year to the next for factors such as the Building Cost Index and the Consumer Price Index.

- o Other variables should be considered for addition to the data base such as age of the building or the number of years since a major renovation. Some indication of the building's condition may prove significant, if condition can be related to some relative index or value scale.

- o The DAMAR data base proved to be less useful than anticipated. The availability of alternatives to this source will need to be investigated.

- o Missing values associated with certain variables should be minimized to the extent possible. For non-analysis variables (e.g., identification or location variables), if the case does not fall under any of the assigned values for that variable, a dummy value should be inserted for that case. This is to ensure consistency in the selection of cases for analysis. For analysis variables, missing values for a large number of cases may indicate the variable is not suitable for the analysis process.

The ultimate outcome of this portion of the study will be a set of recommendations for modifications to the set of variables included in the data base and identification of appropriate sources for the data.

3.0 DEVELOP A STUDY DESIGN

Results from the MOS-1 study indicate that the methodology used for that study can be effective. Thus, only minor changes to that methodology may be necessary. Three characteristics of the MOS-1 approach are especially critical to the goal of advancing transit benefit measurement methodology.

- The study design avoids the need for exogenous control areas by providing complete internal control for all exogenous factors.
- The approach isolates Metro Rail impacts from other impacting variables for closer and more detailed examination.
- The approach allows for annual post-Metro Rail impact analysis in order to discern the time-critical dimension of Metro Rail impact.

The null hypothesis throughout the analysis is that Metro Rail will have no significant effect upon changes in the value of properties in Metro Rail station areas.

Two aspects of this approach may somewhat modified:

- The multi-variate statistical analysis used in MOS-1 shows promise in identifying and measuring benefits due to Metro Rail stations. It is recommended that the development of this approach be continued. However, the decision fixing the alignment for the New Locally Preferred Alternative is less than one year old, and has not been finalized by UMTA. Meaningful results from this approach therefore may be several years away. On the other hand, the location of 5 stations (three on Wilshire Boulevard, one at Universal City, and one in North Hollywood) have been known since 1984. These locations were never considered for change during the CORE Study. Careful consideration will need to be given to the determination of pre-versus post-Metro Rail conditions.
- A more general approach should also be pursued, including use of case studies and personal interviews with a cross-section sampling of property developers, real estate professionals, and leasing agents. Such interviews should provide insights into the investment decision process including variables and data sources used in property transfer and leasing decisions.

The following steps are therefore proposed:

(1) **Prepare a set of multiple regression equations for estimating property value based upon pre-Metro Rail property sales.** Separate pre-Metro Rail base line predictive equations will be formulated for major land uses in geographic subareas, as appropriate. The resulting equations will capture, to the extent possible, the significant pre-Metro Rail trends and factors which are now influencing property value and which are inherent in the pre-Metro Rail sales

data. These equations will be used to estimate the price of property in the future "as if Metro Rail had not occurred".

(2) Collect data on actual property sales (and lease rates and retail sales, as appropriate) in station areas. This data will provide the "after with Metro Rail" condition for the property.

(3) Determine the difference between the projected price "as if Metro Rail had not occurred" and the actual price "with Metro Rail".

(4) Conduct a second analysis on this so-called "delta" difference. This delta impact value may contain any or all of three possible factors.

a) Changes due to the introduction of Metro Rail. Because the predicted equation for property value "as if Metro Rail had not occurred" does not contain the Metro Rail influence on property value, the complete influence of Metro Rail on property value is contained in the delta value. This is critical to the analysis which is to be conducted in this phase.

b) Changes due to new trends and factors not included in the pre-Metro Rail baseline predictive equation.

c) Error in estimation of the pre-Metro Rail baseline predictive equation caused by changes in the influence of the variables contained in that equation.

The focus of this investigation is the influence of Metro Rail on item (a) above. The approach examines the relationship between the delta value and distance from individual properties to the nearest Metro Rail station.

This approach provides specific advantages:

1) It emphasizes the impact of Metro Rail on property value by isolating those impacts in the delta value. Because the delta value is smaller than the total change in property value, analysis of the delta value serves to highlight the influence Metro Rail may have and precludes the "swamping" effect of other variables.

2) Once the pre-Metro Rail equations are formulated to approximate post-Metro Rail sales prices "as if Metro Rail had not occurred," they will serve as a control to estimate most of the underlying non-Metro Rail influences affecting changes in actual property sales values. Most importantly, these equations will reflect the actual factors at work in the area where benefits are being measured, thus eliminating the doubts which may arise if non-Metro Rail influences were estimated by observing an exogenous control area where the same forces may or may not be influential. This approach, therefore,

eliminates the need for exogenous control areas, since all non-Metro Rail property value influences will have been accounted for.

3) With the pre-Metro Rail equations, the impacts of Metro Rail can be recalculated for any post-Metro Rail calendar year, enabling the tracking of impacts over time.

Study design for office lease rates and retail sales would include identification of sample businesses and properties for which data would be collected and organized into a data base.

Issues that deserve careful consideration during the course of the study include the degree to which:

- it is too early to detect significant impacts of Metro Rail on property value.
- lease rates serve as an effective surrogate for property value. The negotiation of lease rates is an ongoing process and should be reflective of property value increases and current market conditions.
- indices of development activity within station areas are reflective of Metro Rail induced benefits.
- retail sales data derived from sales tax receipts are available in station areas. Retail sales increases should be reflective of Metro Rail induced benefits. However, retail sales increases are not likely until Metro Rail operations begin.
- property investment decisions by U.S. investors are based on different criteria than those used by international investors.

Based on the information collected in these studies and coordination with the SCRTD, an analysis technique will be selected to achieve Validation Study goals.

4.0 DATA COLLECTION AND ORGANIZATION

The data associated with each variable identified for inclusion in this study during the first two phases must be collected, compiled, and organized into one or several data bases in correspondence with the requirements of the study methodology developed. Data needs to be disaggregated to the individual parcel level to the extent possible, with each data base record consisting of several fields, each containing parcel specific information as required for the methodology.

Certain problems were identified in the MOS-1 Before-and-After Study related to the data. These problems can be used to modify the methodology used for the Phase II Study:

1) Multiple use properties - Some properties in the office use category may have less than 10% of the improvement space devoted to office space, which resulted in a distorted view of office land use for the MOS-1 Study. Preliminary research suggests that more meaningful results are observed if the analysis of office space is carried out for properties with 60% or more office space of the total improved space.

2) Number of variables - When a large number of variables are analyzed for several cases, the calculation of the correlation matrix requires extensive computation time on the micro-computers utilized. The number of variables considered in any analysis should be kept to a reasonable level. Certain variables, such as absolute change and percent change from one year to the next for various market indicators are unlikely candidates for regression models. Market indicators include variables such as Gross National Product, Consumer Price Index, Prime Interest Rate, and employment in various categories such as government and service.

3) Zero values - Variables with extraordinary numbers of zero values require special treatment. The variables tend to have very low or missing correlations and are eliminated from consideration by the regression procedures if all values are zero in a particular data subset. In some instances, it is more appropriate to eliminate cases from the analysis when a variable is non-zero for only a few cases. In this event, the variable may enter the regression at a very high significance level but the R^2 value increases only slightly.

4) Missing values - Some variables have large numbers of missing values. If the variable is a regression variable, missing values may cause the entire case to be deleted from consideration. Variables with large numbers of missing values should have these values resolved or should be considered for omission from the process. Identifier or descriptive variables that will never be regression candidates should always have an entry in the field, albeit a dummy entry.

5) Variable range - Additional research must be done on variables with ranges covering several orders of magnitude, especially when skewed to the right. Logarithmic transformations on certain variables may prove desirable, but attempts to do this in the MOS-1 analysis did not improve the situation.

The data base should be designed for easy access and manipulation. The data will need to be accessible to a variety of analytical software tools including the SPSS/PC+[1] Multiple Regression function.

[1] SPSS/PC+ Advanced Statistics V2.0, marketed by SPSS Inc.

5.0 DATA ANALYSIS

The analysis of data will be conducted in accordance with the study methodology, including both the detailed multi-variate statistical analysis and the more general approach. Data can be analyzed for entire assessment districts and for subparts, if necessary.

The SPSS/PC+ multiple regression function can be used to carry out the multi-variate statistical analysis of the data. A multiple regression analysis is to be performed on the cases identified, using sale price or a surrogate, as the dependent variable. The regression function produces an equation and a set of evaluative statistics for the regression:

1) The coefficient of determination (R^2) is the primary measure of goodness-of-fit. R^2 indicates the amount of variation in the dependent variable that is explained by the relationship between the dependent and the independent variables.

2) The F-test tests the hypothesis that there is no linear relationship between the dependent and independent variables. When this hypothesis can be rejected, confidence can be placed in the linear relationship represented by the regression model. SPSS/PC+ constructs an Analysis of Variance (ANOVA) table and partitions the total sum of squares for regression and for residuals. Division of sum of squares by the degrees of freedom yields the mean square. The F statistic is equal to the mean square for regression divided by the mean square for residuals. In this context, residual refers to the vertical deviation between the observed value and the value predicted by the regression. If these residuals are small, the mean square for residuals is also small and the F statistic is large. Thus, a large F statistic implies that a linear relationship exists and the hypothesis of no linear relationship can be rejected. In fact, SPSS/PC+ calculates the probability of observing a given F value if no linear relationship exists. The hypothesis is rejected whenever this probability is 0.05 or less. SPSS/PC+ checks the F statistic at each stage of model development.

3) The t-test also tests the hypothesis that there is no linear relationship. However, the test is on the hypothesis that the coefficient of the independent variable (the slope of the regression line) is zero. The t statistic is calculated as the coefficient divided by the standard error of the coefficient for each variable in the model. The same logic used in the F test is applied to the t-test concerning rejection of the hypothesis that no linear relationship exists. SPSS/PC+ checks the t statistic at each stage of model development.

6.0 CONCLUSION

A study methodology for conducting a Before-and-After study of property values in the vicinity of Phase II Metro Rail stations is outlined briefly in this report. The proposed approach included "lessons learned" from both the data base and study methodology employed in the Before-and-After Study for MOS-1 of Metro Rail. Requisite data will be collected and organized into the prescribed data base format, and the data will be analyzed according to the study methodology.

At each phase of the study effort, a Technical Memorandum documenting the analyses and findings will be prepared for submission to the SCRTD. The Technical Memoranda will include the following:

(1) The analysis of potential benefit indicators including an evaluation of data sources.

(2) The details of the study design and methodology including the benefit indicator variables to be measured, the data collection plan, and the cost of data to be obtained from various agencies.

(3) The data base structure and the formulation of procedures for the acquisition of data revisions and updates from identified sources and for the incorporation of updated data into the data base.

(4) The documentation of the analytical procedures employed in utilizing the methodology developed for this study including a detailed presentation and discussion of study findings.

BIBLIOGRAPHY

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Technical Memorandum 88.4.7 Metro Rail Before-and-After Study: Data Base Development, Organization and Structure.

Technical Memorandum 89.4.3 Metro Rail Before-and-After Study: Statistical Analysis and Presentation of Results.