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PLANNING AND ECONOMIC CONSIDERATIONS AFFECTING TRANSPORTATION IN THE LOS ANGELES REGION



prepared by
DANIEL, MANN, JOHNSON, & MENDENHALL
PLANNING & ARCHITECTURE & ENGINEERING & SYSTEMS

for SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT



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SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

PLANNING AND ECONOMIC CONSIDERATIONS
AFFECTING TRANSPORTATION
IN THE
LOS ANGELES REGION

May 1965

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SECTION I

FINDINGS AND CONCLUSIONS

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SECTION I

FINDINGS AND CONCLUSIONS

The Southern California Rapid Transit District asked DMJM to analyze the following questions concerning Rapid Transit in the Los Angeles Metropolitan Region:

- A. What are the discernible development trends of the Region?
- B. What is the appropriate future pattern of community form?
- C. What degree of mobility will the community likely require in the future?
- D. How can Rapid Transit assist in providing this mobility?
- E. What are the benefits to the community of Rapid Transit?

An analysis of each of these questions generates subquestions which in turn are the basis of the findings and conclusions of each primary question. These questions are presented here with answers as developed by the DMJM staff.

PART A. WHAT ARE THE DISCERNIBLE DEVELOPMENT TRENDS OF THE REGION?

Q. What has been a primary factor in establishing locational trends in the Region?

A. The expenditure of vast sums of capital, both public and private, in facilities to accommodate growth and development. The initial locations were along natural transportation routes which were improved and expanded to accommodate the growth. Subsequent transportation developments have followed basically the same routes and further promoted the locational trends.

Q. What is the effect of the predominant reliance upon the private automobile for mobility?

A. An apparent trend toward a loose-knit, equal intensity community development attempting to equalize access from all directions.

Q. Is this apparent trend confirmed by analysis?

A. Yes and no. General population dispersion is evident in the great suburban growth. However, in terms of high value and intensity of residential capital formation, a centralizing trend is apparent as evidenced by the absorption rate per thousand new residents of various housing types. In the suburban areas, this rate for multiple housing is only 40.8% of that for single family, while in the Regional Core it is 387%. This results in an intensification of residential capital formation in the Regional Core nearly 8 times that of the suburbs. This is taking place through land reuse and intensification in the Regional Core.

Q. What are the industrial trends of the Region?

A. Clearly one of centralizing economic activity. By dividing the entire Region into 11 economic units for study purposes, only one - the Regional Core - showed a high concentration of industry. (Industry here is used in its broad interpretation to include all forms of employment.) Only four others - Santa Monica, Pasadena, Pomona and Glendale - showed normal concentrations, and even these were below the Regional average. In addition, the Regional Core actually increased its concentration from 1956 to 1964.

Q. Since many new industries are being developed in suburban locations, what form of industry is centering in the Regional Core?

A. This growth of industry in the suburbs is a natural shift of those industries requiring large holdings of land moving to suburban locations as the land values in the Regional Core become more suitable for other more intense uses. The high value service industries, such as financial, institutional, and business service, requiring central locations and a large labor market are concentrating in the Regional Core.

Q. Are there indications that this trend will continue?

A. Yes. An analysis of existing office space in 1964 shows that, of the 60,000,000+ square feet contained in Los Angeles County, over 50% is contained in the Regional Core, a land area of only 4% of the total Los Angeles County. Approximately 77% of all the new office space constructed between 1962 and 1964 located in the Regional Core, which indicates a strong current continuation of this trend.

Q. What then is the primary discernible trend of development in the Region?

A. A trend toward the centralization of higher value economic activity and a corresponding increase in employment. Even with higher residential densities expected in the Regional Core, this will generate an added demand for import of labor from areas outside the Regional Core.

PART B. WHAT IS THE APPROPRIATE FUTURE PATTERN OF
COMMUNITY FORM?

Q. What has been the general pattern of development in the past?

A. In general, one of horizontal expansion into relatively flat, easily developed land areas, close to transportation arteries, with subsequent filling in of the intervening space. The initial termini of these arteries developed into substantial urban centers.

Q. As the population increased, what has been the effect upon this pattern?

A. The horizontal expansion has, in general, caused these various sub-centers to overlap with the resulting loss of at least visual identity. This has been followed by substantial conversion to multiple dwelling units which in many cases has again overlapped. The net effect is that of applying a second layer of dwellings over the entire Region.

Q. What are current overall densities?

A. Based upon approximately 1000 square miles of readily developable land within the Los Angeles Metropolitan Region, average densities reached 7000 persons per square mile in 1964. Allowing for other uses, only some 30% of this area is available for residential development, which results in nearly 36 persons per acre, or an average nearly 3 times normal single-family development.

Q. Can this current pattern be perpetuated?

A. Not if we want to maintain any reasonable opportunity for choice and preference in residence type. Population increase will only contribute to rebuilding residential areas to 3 or 4 story density levels. The net effect would be to make single-family residences so expensive as to be out of reach of the average family. Another limiting factor is the inability of the current transportation system to accommodate densities at this level. The net effect will be to reduce the potential growth of the region.

Q. Is there an acceptable alternative?

A. Not only an acceptable one, but a much more appropriate one in which high densities and high levels of economic concentration are developed in an organized manner. This would permit

substantial economies in time as well as services such as utilities, police, and fire protection, etc., and could easily be accomplished by overlaying the current "spread city" pattern with very high capacity travel arteries in the form of rapid transit. In this manner high densities would be encouraged along the transit routes, and the Regional Core as well as the suburban centers could develop to full potential. The densities in this pattern could be much greater than could be serviced by the automobile using streets and freeways which would permit the space between transit routes to remain single family and preserve choice and preference of residence. The money saved by economies in utility service and automobile facilities could be redirected to other community needs such as parks and recreation, and space would be available to provide them.

PART C. WHAT DEGREE OF MOBILITY WILL THE COMMUNITY
LIKELY REQUIRE IN THE FUTURE?

Q. What is the primary cause of congestion on our streets and freeways?

A. The peak-hour traffic occasioned by the commuter moving from residence to work and return. Approximately 1/3 of the total daily traffic is a direct result of this commuter movement which occurs during approximately a 4-hour period (7 to 9 a. m. and 4 to 6 p. m.) or about 16% of the total day.

Q. Are the freeways aiding in reducing traffic congestion?

A. Certainly freeways are the main stream of transportation in Los Angeles today and without them traffic would be at a virtual standstill. However, while the opening of a new freeway reduces travel times between points served by the route, traffic buildup soon offsets the gains. Travel-Time studies conducted by the Auto Club of Southern California would seem to bear this out. Their studies indicated that of 14 point-to-point comparisons, 8 showed increased travel times from 1962 to 1963. Also, the net area enclosed by a travel time of 30 minutes showed a reduction of 7% over the same period. This would indicate that the freeways are, at best, maintaining the "status quo."

Q. How much land area is being devoted to automobile facilities?

A. Currently 55% of all land in the C. B. D. area of Los Angeles City is devoted to streets, freeways and parking. Projections in the Centropolis Report indicate a future demand for four new 8-lane freeways and 9 1/2 four-lane streets in the 2 1/2 mile square central city if sole reliance upon the automobile is maintained. Removing this amount of land from productive use is in conflict with the other plans and projections and would have a disastrous effect on the area. Similar situations prevail in many urban centers throughout the Region.

Q. What will be the effect of continued reliance upon a single transport mode?

A. Currently, there are 315,000 more jobs in the Regional Core than there are employed persons living in the area. By 1980 this excess employment could range from 537,000 to 665,000, an increase of between 222,000 and 350,000 net import of labor. To accommodate

this amount of added commuter traffic during the peak commute hours would require at least doubling the number of new freeways planned or contemplated to serve the Regional Core by 1980. Without this accessibility, from 95,000 to 225,000 of the potential new jobs in the Regional Core would not be filled, with the result of reduced income potential in both Regional Core and suburban locations.

- Q. How does reduced employment in the Regional Core affect the suburbs?
- A. This import of labor into the Regional Core represents suburban residents who buy homes and products in suburban areas. In addition, each employee in the "basic" industries generates about 1.5 service employees. This means that at least 35-40% of the total suburban income is currently dependent upon this import of labor to the Regional Core. Therefore, any restriction upon the core development has a multiplicative effect in the suburbs.
- Q. How much mobility is required?
- A. The ability to move goods and services, the employment opportunities, and the ability of people to move with relative speed between home and work have been the essence of developing our urban society. The day may come when the necessity for mobility will be reduced through revolutionary changes in technology. However, this is not apparent in the foreseeable future. Today, the total transportation capability in the Los Angeles Region is a little less than adequate. In order to promote the Regional development, a balanced system is required where the traveling public has a choice of mode as well as route. In order to provide this choice, the capability of all the systems must be just a little more than adequate.

PART D. HOW CAN RAPID TRANSIT ASSIST IN PROVIDING THIS
REQUIRED MOBILITY?

- Q. Mass transportation seems to be losing patronage everywhere in the U.S. How then can we assume a Rapid Transit System in Los Angeles would be used?
- A. Mass transportation is losing patronage, but the losses are almost entirely on surface systems, buses and streetcars. Where a true Rapid Transit system exists, operating on completely grade separated, exclusive rights-of-way, patronage has remained virtually constant and in several instances has shown substantial increases. Further, every area which has rapid transit is expanding the system and most major metropolitan areas are actively planning or constructing systems.
- Q. Who would use the system?
- A. There are basically two categories of transit riders: Those who ride through necessity and those who ride by choice. In 1964, the Los Angeles Metropolitan Region contained approximately 2 1/2 million people 15 years old and older who did not have drivers licenses. These people do not have independent personal transportation capability and are in the first category. Many others who do not need their autos during the day use them because there is no other satisfactory mode of travel. A fast, convenient, comfortable and economical rapid transit system would provide the choice necessary to attract these people.
- Q. Is the potential use significant?
- A. Yes. Travel studies conducted by Coverdale & Colpitts in 1958 showed that over 52% of the total travel in the Los Angeles region is within the eight corridors proposed to be served by the Transit District. The system will thus be able to offer service to a substantial portion of the traveling public, linking the important community centers throughout the area and providing greatly enhanced capacity for movement of people, particularly in areas where rush-hour congestion is most acute.

PART E. WHAT ARE THE BENEFITS TO THE COMMUNITY OF
RAPID TRANSIT?

Q. Are there other benefits beyond reduced traffic and congestion?

A. Reduced traffic is, in fact, only a secondary benefit. The primary benefits are financial, economic and social in nature.

Q. What are the financial benefits attributable to the system?

A. The immediate financial benefits would result from the expenditure in the region of nearly \$2 billion for material, service, and labor to construct the 8-corridor system. This money will be spent primarily in the Region while, for the most part, it will originate from outside sources in the form of bond sales. This "new" money in circulation in the Los Angeles Region will have immediate effects by producing income, sales and general business activity.

Q. What are the economic benefits?

A. There are many economic benefits, only one of which has been quantified to illustrate the potential. It has been estimated that inadequate freeway capacity during peak hours will reduce potential employment in the Regional Core by from 95,000 to 225,000 employees. The proposed transit system has a capacity to accommodate these people with ease, thereby removing the mobility restraint. These employees represent an increase in Regional gross income of from \$665,000,000 to \$1,575,000,000 annually with derived effects to suburban communities between \$1.7 and \$4.0 million annual sales tax and \$35 and \$115 million in added real estate tax. Therefore, this one factor alone represents a potential economic benefit, when capitalized over 40 years, of between \$2 and \$7 billion.

Q. Are there other benefits which have not been quantified?

A. There are many social and real benefits which will accrue to the community, as well as the direct user benefits. These can be quantified by a more comprehensive study to determine benefit cost ratios. However, in subjective terms, these benefits will include the following:

Provide transportation framework on which regional form could be planned.

Accommodate a population of 20 million or more and serve the increased population more efficiently.

Permit land to be retained on the tax rolls which otherwise would be required for freeways and parking.

Increase tax return through higher intensity development.

Reduce tax burden on single-family residential areas.

Contribute to furthering community identity by:

- a. The greater variety and diversity of community form and residential type.
- b. Making unnecessary the further severing of neighborhoods by more streets and freeways.

Allow greater suburban expansion within one hour from Regional Core.

Q. What is the overall conclusion to be reached from the study?

A. That the community cannot afford continued reliance upon a single mode of transportation and that the benefits to be derived from developing a rapid transit system far exceed the monetary costs. The thought has been expressed that the Los Angeles Region is already large enough and that added growth should be discouraged. However, the growth of this region in a free society cannot readily be stopped. This Region is already one of the largest markets in the Nation and therefore a prime target for industry of all types. Industry moves in and provides more jobs for the constant flow of in-migrants which further expands the market, and the cycle starts over. Even without industry moving to the area, the much publicized amenities of Southern California represent a powerful drawing force. To discourage this natural influx of people would require conditions which would be intolerable for those already residing in the Region.

SECTION II

SUMMARY

SECTION II

SUMMARY

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SECTION II

SUMMARY

A. THE TRENDS

1. The Background

In order to define the discernible trends upon which the future Los Angeles Metropolitan Region will build, it is necessary to compare past and current development of the area. The large expenditures of public and private capital on facilities to accommodate the growth and development of the Region have established definite locational trends. These trends are not likely to be materially altered except by severe artificial restraint and then only over long periods of time.

The transportation system which originally permitted these trends to be established has since been developed to accommodate and thereby promote them. The trends of locational preference of both industrial (used in the broad sense to include all employment sources) and residential development coupled with the rising population and expanding market provide an excellent indication of the future development potential of the Region. The transportation system in the future will play an even more important role in shaping the community, as well as in the level of activity which can be attained.

The primary trend in transportation mode has been toward an ever increasing dependency upon the private automobile for mobility within the Region. In 1964 private passenger automobile registration (excluding government and public ownership) reached 3,220,849, equal to one automobile for each 2.12 persons of the total Los Angeles County population. The demand upon facilities to accommodate this auto population has resulted in the most comprehensive system of urban highways, existing and projected, of any in the world. The resulting trend has been toward a loose-knit, equal intensity community development, attempting to equalize accessibility from all directions.

2. Centralization or Decentralization

While on the surface this would tend to indicate a complete decentralization of Regional activity, a critical analysis of the economic factors provides additional insight into the development trends. The economic analysis examines two primary factors of the region to determine whether the trends are toward centralization or decentralization. This is

the critical trend in terms of economic development and the influence of transportation on the development. These factors are (1) residential location (loci of urban residential capital formation) and (2) employment location (loci of industrial/commercial capital formation).

3. The Residential Factor

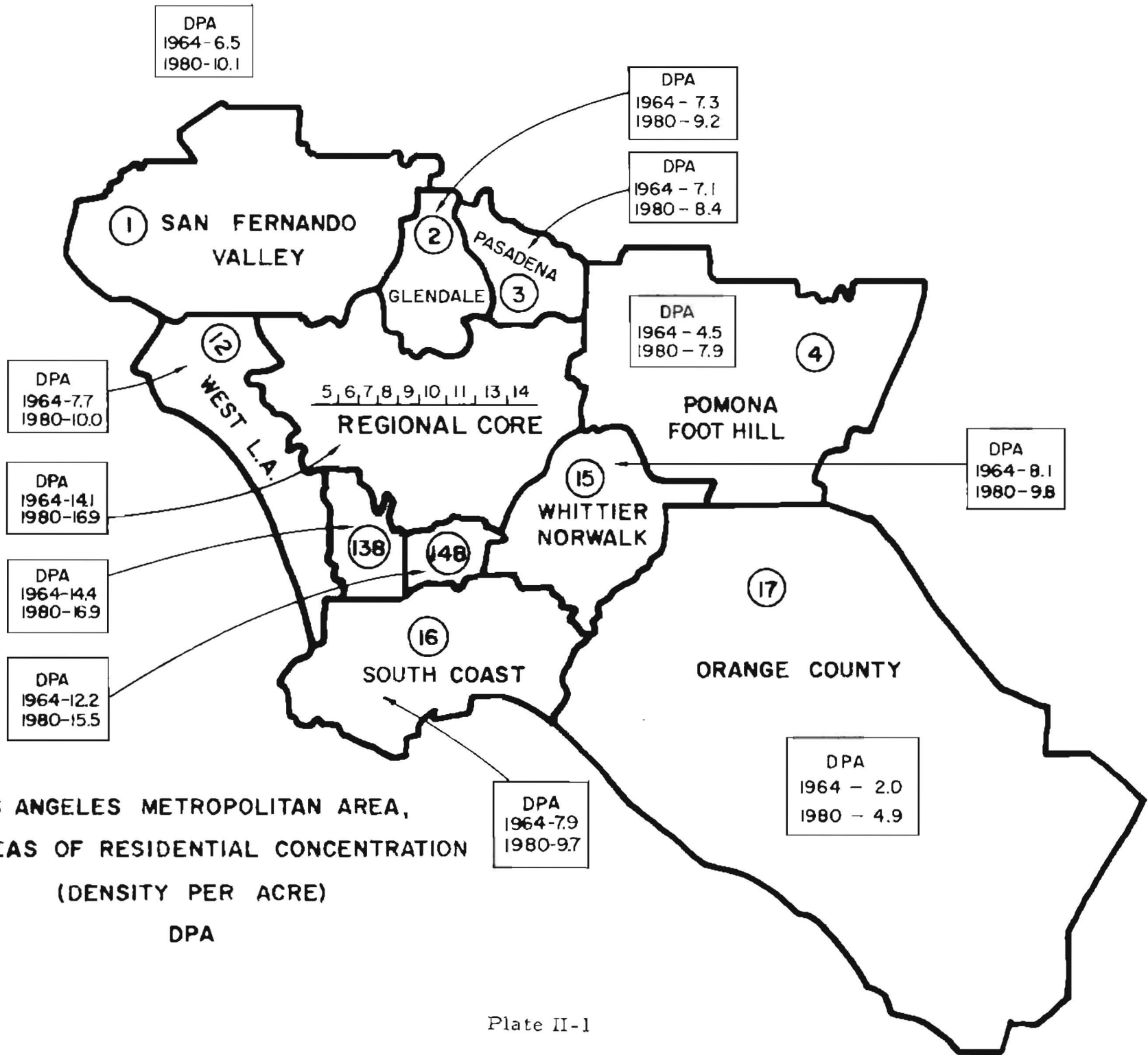
In analyzing the residential factor, the Region has been subdivided into subareas (see following map) which are statistically determinant and special emphasis has been placed upon subdividing these into economic entities. The critical element in this entire analysis is the Regional Core. This is the area which would correspond to the "Central City" in the classical or historic definition of a Metropolitan area. It is essential to realize that in the Los Angeles Metropolitan Region this core encompasses an area of approximately 160 square miles and includes downtown Los Angeles, the Wilshire Boulevard and Westwood Complex, the Hollywood area and the East Los Angeles industrial complexes. While at first glance this would seem a large area, it must be recognized that it is the core of a total area exceeding 4000 square miles, of which it comprises approximately 4%.

4. Population Densities

In terms of population, the Los Angeles Metropolitan Region has experienced the highest growth rate of any of the large Metropolitan Areas in the Nation. Los Angeles County alone has grown from about 500,000 in 1910 to nearly 7 million in 1964. Projections indicate that the Metropolitan Area will exceed 12 million by 1980 and that Los Angeles Region population could reach at least 15 million by the year 2000. In terms of 1964 population density, there were 7 square miles in Los Angeles County with densities over 20,000 per square mile (31 per gross acre). These are entirely contained within the Regional Core. In addition, there were 140 square miles having densities between 10,000 and 20,000 per square mile (15 to 31 per gross acre), again predominantly in or adjacent to the Regional Core. With the projected population growth, it is safe to predict a much greater area with these and higher densities in the future. The residential densities for 1964 and projected for 1980 in the analytical subdivisions are shown on the following plate.

A significant fact is shown by density comparisons between 1940, 1950, and 1960 in that increased density patterns have, in fact, followed the historic classical pattern of expansion around the Regional Core area. This expansion has not been in a homogeneous manner, but has taken place in established centers of activity such as Santa Monica, Van Nuys, Glendale, Long Beach, etc. While this expansion has been accompanied by a normal expansion of retail and industrial activity, these areas have remained predominantly suburban residential.

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LOS ANGELES METROPOLITAN AREA,
AREAS OF RESIDENTIAL CONCENTRATION
(DENSITY PER ACRE)

DPA

5. Dwelling Units Analyzed

An analysis of dwelling units (homes and apartments) throughout the Los Angeles Metropolitan Region shows that increases in absolute numbers in suburban areas has substantially exceeded the increase in the Regional Core, particularly since 1950. This is to be expected since the increase in the Core area, which had relatively much higher densities to begin with, must be accomplished through rebuilding existing areas. However, the absorption rate per 1000 population (number of new housing units by type constructed per 1000 new residents in the area) indicates a strong intensification of residential capital formation in the Regional Core. In terms of multiple dwelling units constructed, the absorption rate in the suburban area was 40.8% (less than 1/2) that of single family, while in the Regional Core it was 387% (nearly 4 times) single family units. This indicates the transformation of the Regional Core into an area of even higher residential density and provides a real indication of a trend toward centralized economic activity.

6. The Industrial/Commercial Factor

For the industrial/commercial analysis, the Region was again divided into subareas (see following map) which could be defined from available data. In this division, the areas are established to approximate as closely as possible those used in the residential analysis to provide a comparable basis. Again, the physical size of the central area or Regional Core prevents overstatement of its importance by any individual small unit or area of extreme concentration.

On the basis of employment and population, a series of employment concentration and specialization coefficients were developed which permit each area to be compared to the Region as a whole, as well as to every other area. In this coefficient, the employment per 1000 population for various industrial categories is developed for the Region as a whole and set equal to 1.00 in each category. This enables each area to be compared directly. The following breakdown of comparative indices indicates relative concentrations:

.00 to .50	Substantial lack of concentration
.51 to .80	Relatively unconcentrated
.81 to 1.20	Normal concentration
1.21 to 1.50	Relatively concentrated
1.51 plus	Highly concentrated

EMPLOYMENT AREAS

AT LOS ANGELES METROPOLITAN AREA



II-5

On this direct comparison basis, only the Regional Core showed a highly concentrated activity with a coefficient of 1.68. Of the remaining 10 areas, only 4 - Santa Monica (.95), Glendale (.84), Pasadena (.93), and Pomona (.88) - indicated even normal concentration and then in the lower ranges and below the region as a whole. These results for 1964 are comparable to the results of a similar analysis for 1956 and in fact indicate that the Regional Core has increased its employment concentration (see following tables).

This analysis clearly indicates that even with a substantial industrial development in suburban areas, there is a strong and continuing trend toward a centralized economic activity.

These specialization coefficients also indicate the types of industry in the various areas. It is significant to note that the shift by type is normal in terms of economic pressures occasioned by land value, land scarcity, and market locations. Retail and local service industry follows population expansion, industries such as aircraft, etc., requiring large land areas shift to suburban locations where land is relatively inexpensive, while high value, labor intense industries such as business service and financial institutions concentrate in the Core area.

7. Location of Office Space

An analysis of office space substantiates this trend of concentration of high value industry in the Regional Core. In 1964, an estimate of total office space in Los Angeles County was 60,230,000 square feet. Of this, 14,607,000 square feet was contained in the Central Business District of Los Angeles, 9,855,000 in the Wilshire Boulevard extension westward to the San Diego Freeway, plus an estimated 16,000,000 in the balance of the Regional Core including Hollywood. This represents over 50% of the total office space in the entire Los Angeles County contained in approximately 4% of the County area. Even more significant is the fact that of all office space constructed in the County from 1962 to 1964, approximately 77% was constructed in this Regional Core area.

This would certainly confirm the trend toward centralization of high value, labor intense industry into the Regional Core.

TABLE II-1

INDUSTRY SPECIALIZATION AND CONCENTRATION
LOS ANGELES METROPOLITAN AREA AND SUB-AREAS
1964

	1	2	3	4	5	6	7	8	9	10	11*
Total Emp. /1000	.79	.95	.62	.78	.66	.55	.93	.84	1.68	.88	---
Contr. Const./1000	1.53	1.04	1.79	1.05	.86	1.66	.78	.98	.75	1.38	---
Mfg./1000	.94	1.08	1.26	.84	1.20	1.16	.67	1.38	.81	1.22	---
P & F Metals/1000	.61	.40	---	.48	---	1.08	---	.68	1.48	---	---
Trans. eq. & ord./1000	1.92	1.11	---	3.44	---	.96	---	---	.48	---	---
Other mfg./1000	.72	1.70	---	.83	---	1.83	---	---	1.27	---	---
T.C. & U./1000	.55	.66	.43	1.42	.97	.58	.53	.66	1.30	.63	---
W. & R./1000	1.04	.86	.88	1.03	1.00	.98	1.08	1.00	1.06	.77	---
W/1000	.61	.60	.24	.69	.59	.51	.41	.77	1.63	.40	---
R/1000	1.50	1.09	1.30	1.31	1.32	1.30	1.51	1.23	.93	1.03	---
F.I. & R.E./1000	1.00	.48	.30	.54	.46	.35	.90	.59	1.52	.35	---
Service/1000	.71	1.14	.65	.80	.67	.89	1.61	.96	1.09	.93	---
Government/1000	1.02	1.36	1.00	1.71	1.16	1.18	1.04	.67	.86	1.26	---
Pop. as % of Total	11.3	8.3	8.2	9.7	9.2	10.5	4.4	9.0	27.3	2.2	---

Source: Derived from data contained in Community Labor Market Survey, California Dept. of Employment

* 1962 change in S.M.S.A. omitting Orange County changes the employment base in Orange County and does not permit comparison with 1956 data.

TABLE II-2

INDUSTRY SPECIALIZATION AND CONCENTRATION
LOS ANGELES METROPOLITAN AREA AND SUB-AREAS
1956

	1	2	3	4	5	6	7	8	9	10	11
Total Emp. /1000	.63	.99	.59	.96	.49	.68	1.04	1.04	1.62	.87	.69
Contr. Const. /1000	1.57	.97	1.10	.94	1.46	2.20	.96	.81	.57	1.04	1.99
Mfg. /1000	.84	1.10	1.36	.85	.50	.75	.54	1.32	1.12	1.05	.39
P & F/1000	.28	---	2.64	---	.75	.97	.43	.53	2.80	---	---
Trans. eq. & ord./1000	2.37	---	---	2.72	---	---	---	---	1.36	---	---
Other mfg./1000	.52	---	1.54	.50	.61	.90	.68	1.75	.49	---	---
T.C. & U./1000	.67	.86	.80	1.53	1.08	1.10	.81	.92	.81	.96	1.06
W. & R./1000	1.06	.84	.68	1.10	1.24	1.04	1.23	.83	1.06	.70	1.28
W./1000	.44	.81	---	.83	---	---	1.08	.47	2.00	---	1.56
R./1000	1.32	1.12	---	1.46	---	---	.89	.76	1.14	---	1.64
F.I. & R.E./1000	.87	.68	.45	1.05	1.56	.71	1.69	.66	1.16	1.10	1.37
Service/1000	1.13	1.24	.82	.83	1.06	.99	1.32	.91	1.03	.65	.82
Government/1000	.97	.62	.76	.67	1.29	.88	1.76	.80	.62	.97	2.65
Pop. as % of Total	14.3	12.0	6.4	14.5	6.6	4.4	5.8	9.5	16.6	5.5	4.4

Source: Derived from data contained in the Community Labor Market Surveys, 1956, California Department of Employment

B. THE PATTERNS

1. Transportation Influence

The pattern and form of the future Metropolis must recognize the interdependency of the Core and Suburbs. In the interest of economy, it must permit coordination of public service such as water, sewer and transportation. It must also preserve the diversity and variety of opportunity in the sub-areas of the Metropolis.

The Los Angeles Metropolitan Region does not have a single planning agency with power to implement an area-wide Regional Plan. In this circumstance, it should be recognized that transportation is probably the major instrument through which form and extent of land use may be influenced. This is evident from the patterns produced in the past. The historical development of the Region has been along transportation routes, first the Pacific Electric and other railways and currently the freeway system.

2. Present Patterns and Their Effects

The general pattern of development in the past has been in easily developed, relatively flat areas. The initial developments were adjacent to the transportation arteries with subsequent filling in of population in the interstices. The terminal points of these transportation arteries have generally developed into substantial urban centers.

The growth pressures have generally caused these centers to overlap with the resulting loss of visual community identity. As population increased, substantial conversion to multiple dwelling units occurred, often in a haphazard manner and into areas wherein community services and facilities were more appropriately suited for single family development. The result is often congestion, overtaxed service capabilities and loss of residential choice. The effect on the urban form is that of applying a second layer of dwellings over the entire region.

This is apparent in terms of average overall densities. Based upon approximately 1000 square miles of readily developable land in the Los Angeles Metropolitan Region, residential densities reached approximately 7000 persons per gross square mile in 1964. Allowing for streets, schools, parks, commercial/industrial, etc., results in approximately 30% net residential area or an average of nearly 36 people per net acre of readily developable land. This density is approximately three times the normal single family development.

3. Restraints to Horizontal Development

There are obvious restraints to horizontal development in the Los Angeles Metropolitan Region. The natural or physical barriers are the mountains and the ocean which surround the Los Angeles Basin. An artificial restraint is the transportation capacity of the traffic arteries. In addition, there are economic restraints to horizontal development which are related to the mobility phenomenon of acceptable travel times within the region.

To date, the freeway system has offered the means of opening up large areas of inexpensive, easily developed lands in the outlying areas of the Region. This has made single family residences with open space and privacy of suburban living available at much lower cost than a comparable style of living in close-in areas such as Beverly Hills, Pacific Palisades, Sherman Oaks-Encino, Mt. Washington, etc. The cost of these outlying suburban homes is then within the budget capability of the younger families which make up the majority of new residents in the Region.

4. The Basis for Future Patterns

The future development pattern of the Region must accommodate the immense population growth within the topographic limits of the Region and within reasonable time-distances from employment sources. Since the average density is already at a multiple residence level, it is essential to develop a pattern which will permit high density areas and still preserve the remaining low density single family areas. The alternative would be a gradual rebuilding of residential areas to a constant three to four story density level.

The selection of a development pattern should be made on the basis of that which will achieve the apparent goals and potential of the Region. It is clearly evident from the economic analysis that this potential is dependent upon the ability of the Regional Core area to realize its potential as the center of finance, industry, government and culture. Thus, it is essential that the large number of employees in this area be able to travel to, from and through the Core in reasonable time periods.

In establishing goals and objectives for the Region, Hans Blumenfield in "The Urban Patterns" from the Annals of the Academy of Political and Social Science specifies the following objectives:

"Minimize need and maximize opportunity for commuting to work . . ."

"Access to Center and to periphery . . ."

"Separation and integration of functions . . ."

"Identification with a part and identification with the whole . . ."

"Continuity and change . . ."

"Finally, whatever demands may be derived from these or other criteria, they must be satisfied at the least possible cost."

Kevin Lynch in his "The Pattern of the Metropolis" emphasizes:

"The individual should have maximum choice of goods, services and facilities available to him, including housing types and habitats."

"The individual should have the greatest number of social contacts and social isolation should be minimized."

"Linked open spaces are provided."

"Minimum first cost and operating cost."

5. Perpetuating the Current Pattern Cannot Accommodate the Future

It seems apparent that we are already beyond considering perpetuating the current pattern which encourages continued uniform expansion, since the present average density is on a multi-level basis. It is suggested that continuing this pattern cannot be achieved within the framework of the previous criteria and, more importantly, it would seriously limit the potential economic development of the entire region.

6. The Alternative

It is further suggested that the more logical alternative development pattern would utilize rapid transit lines overlaying the existing spread city to provide high capacity, high speed travel arteries. In this manner, high residential density could be developed in station areas and along the transit routes since transportation capacity would exist to accommodate it. The net result would be to permit the intervening areas to remain at relatively low density and preserve the pattern of choice and preference which characterizes this Region. The advantages are obvious and manifold.

The addition of a Rapid Transit system would permit a vast increase in passenger capacity with virtually no loss of income-producing land area. It would substantially increase the area within acceptable commuting time of the major employment centers in the Regional Core. It would encourage concentration of specialized functions within the Regional Core needed to support the entire community. It would reduce the demands upon highway funds to build urban freeways and parking facilities in areas of high development at \$10 to \$20 million per mile and would permit the construction of more routes in outer areas at less cost, which in turn would benefit the recreation-oriented weekend traffic and improve circulation in those areas. It would permit monies saved by the community through reduced demands for parking to be spent on other public needs, such as parks and education. And, most importantly, it would permit the Los Angeles Region to grow and develop its full potential.

C. THE MOBILITY

1. The Demand for Mobility

It is often asked, "How much mobility is required?" Historically, mobility is the essence of our urban society and industrialized nation. In light of the discernible economic trends, this question should be rephrased to ask, "To what extent are we willing to retard growth and development through restraints on mobility?"

The Los Angeles Regional Transportation Study (LARTS) in the recently published 1960 Base Year Report analyzes the travel characteristics of the Region. They determined that the average 1960 week-day traffic of over 12,000,000 trips could be broken down by types as follows:

Home	-	Other	-	30.3%
Other	-	Other	-	21.5%
Work	-	Other	-	11.3%
Home	-	Shopping	-	15.2%
Home	-	Work	-	21.7%

2. The Commuter Movement

Since the home-work or commuter trip is the primary source of freeway congestion, it is important to relate these trips to the peak hour. Comparison of these percentages to other data reveals that, in fact, the actual commute move represents a larger portion than the 21.7% indicated as home-work. Employment in the 1960 Los Angeles Standard Metropolitan Statistical Area (only part of the LARTS Area) was 2,352,800, which represents 4,705,600 person trips (assuming one round trip per day). On the basis of 1.2 persons per car, this is equal to 3,921,350 vehicle trips or about 32% of the total LARTS Area trips. On this basis, it is apparent that the work-other trips are actually a part of the commute move (with intermediate stops) and therefore occur during peak hours. Therefore, it can be seen that at least 1/3 of the total daily traffic occurs during a four-hour period, or about 16% of the total day.

3. The Peak Hour and Congestion

This commuter movement is significant in light of freeway capacity which cannot economically be provided to meet the peak-hour demands. The resulting extreme congestion during these peak hours is evident to anyone driving the freeways. It can safely be stated that congested conditions will occur on every freeway serving the Regional Core on virtually any working day during the year. Seasonal variations only complicate and compound this condition.

The reasons for this congestion are apparent. The necessity of merging traffic lanes at on-off ramps and interchanges, lane changing, and reasonable following distances are the key factors. Inclement weather conditions and the most minor incidents on the freeway further compound the problems.

4. Travel Time in the Region

The latest travel time studies conducted by the Southern California Automobile Club in 1963 revealed that of 14 point-to-point comparisons with 1962 times, travel times increased in 8 instances, decreased in 5 and remained constant in 1. In addition, the area within 30 minutes travel time of their offices on Figueroa Street decreased by 7% from 1962 to 1963. This would seem to indicate that the freeway system is unable to keep pace with increasing demands.

While travel times from a given point may improve markedly with the opening of a new freeway, experience indicates that the increase in traffic, both diverted and induced, soon negates the gain. While it is often stated that the situation will be much better when the freeways are all complete and operating as a "system," it is significant to note that in the area of severest congestion (in and adjacent to the Regional Core) the "system" is virtually complete.

5. The Amount of Land Devoted to the Automobile

That the land area required by this vast system of highways and street systems combined with automobile terminal facilities is reaching monumental proportions is evident from the fact that, in the Los Angeles C.B.D., 55% of the total land area is primarily devoted to the automobile.

If the projections for this Region are realized, this is only the beginning of spatial demands of the automobile. The demands for lane capacity projected by the Centropolis Report, Volume 3, are equivalent to four new 8-lane freeways and 9 1/2 new four-lane streets within a 2 1/2-mile square Central City in an area already served by a complete street system and three freeways. The amount of additional land area lost to these facilities, coupled with the projected requirement to double parking capacity in the Central City, is impractical of fulfillment without imposing serious development restraints on the area.

6. Conflicting Use of the Surface Streets

The Central City area is typical of similar conditions in other urban centers in the Region in that existing arteries are over-capacity and increasing through traffic will ultimately stifle the function of these urban centers as regional trade centers.

Additionally, the requirements of the movement of goods will most certainly increase in future years. Regardless of the method employed in long-haul freight movement, distribution and collection of goods within the Metropolitan Region will continue to utilize trucks on urban streets and freeways. The LARTS report indicates that 12.8% of the total 1960 vehicle trips were made by trucks. With the increasing demands of a growing Region, the overlap of truck and passenger automobile traffic will materially affect the ability of the freeway network to adequately serve either group.

7. Regional Core Employment and Import of Labor

Employment analysis indicates a concentration of employment in the Regional Core. In 1964, the net import of labor (excess of jobs over resident employed persons) into this area was 315,000 employees. With the exception of a very slight import (1840 employees) into the Pomona-Fullerton area, this is the only area where jobs exceeded resident labor potential. This deficit is made up by commuters from the surrounding suburbs. On the basis of very conservative estimates this import could increase by 350,000 additional employees by 1980. It must be pointed out that this is net import only and does not reflect total inter-area transfer of labor.

The importance to the entire Region of this import of labor into the Regional Core cannot be overlooked. Suburban employment is in most cases largely local service such as retail trade, local finance and business service and basic real estate. Based upon a "normal" rate of 1.5 service oriented employees for each basic industry employer results in 472,500 suburban jobs in 1960 dependent upon the 315,000 employment import into the Regional Core. On this basis, it is apparent that at least 30% of the total suburban employment is a direct result of suburban export of labor to the Regional Core. From an income standpoint, this could result in 35 to 40% of suburban income derived from Regional Core employment. It is clear, therefore, that any restraint to development in the Regional Core will have multiplicative adverse effects upon the suburban areas also.

8. Future Freeways Alone Cannot Meet the Demand

At least one such restraint will result from failure to provide additional transportation capability. The 1980 freeway system as planned will result in a total of 13 freeways serving the Regional Core. Of these, 8 are currently in service and operating at and above capacity during peak hours. In addition to the five future freeways currently in the plan, one additional is under consideration in the vicinity of Western Avenue for a total of six new freeways.

Assuming 8-lane freeways, the four inbound lanes per freeway result in a total count of 24 lanes to accommodate added traffic.

Assuming only 80% auto usage (extremely conservative by Los Angeles standards), 80% peak-hour movement assumed as employees, 1.2 persons per car, 2000 vehicles per hour per lane for a two-hour peak period, and 12% truck and commercial vehicle traffic, the potential increase of between 222,000 and 350,000 commuters into the Regional Core results in a demand for a minimum of 42 lanes and as many as 67 lanes to accommodate only the net added commuter traffic during the peak hour. This indicates that between 95,000 and 225,000 potential jobs in the Regional Core will not be filled due to lack of mobility.

The obvious conclusion to be reached from these mobility considerations is that the private automobile, together with bus operating competing for the same street and freeway space, simply cannot cope with the magnitude of the future mobility demands.

D. THE ROLE OF TRANSIT

1. Present Use

Even in auto-dominant Los Angeles, the role of public transit is not insignificant. A report by Coverdale & Colpitts in 1958 showed that on the average weekday, an equivalent of 209,000 vehicle trips were accommodated by public transit during the peak traffic hours. The 1964 "Beverly Hills Freeway and Traffic Study" by Wilbur Smith & Associates states that transit carried 30% of the total peak hour passenger traffic on Wilshire Boulevard in Beverly Hills, thus clearly demonstrating the important contribution of public transit to current mobility.

The present trend in transportation planning is predicated on the Freeway System. While the importance of this system to the Region is recognized by every responsible planning agency, it must also be recognized that any one system acting alone cannot satisfy the needs of the future.

2. Alternate Transportation Links

There have been many possible links to an overall transportation system suggested. Included in these are double-decked freeways, express buses operating in exclusive freeway lanes, miniature cars hauled between central pick-up locations by truck and/or rail. Aside from the anticipated higher costs for any such systems, the inherent operational problems present insuperable obstacles to fulfillment. Except in the outlying and circumferential portion of a transportation system, where buses could be used to extend the service area of a transit system, freeway buses do not offer an effective solution to the problem.

The need for Rapid Transit, operating on completely grade separated, exclusive rights of way, seems clear. On the commuter type of trip, time spent in travel plus reliable on-time performance are major considerations. Buses competing for lane space on surface streets or freeways cannot satisfy these considerations.

3. The Potential Rapid Transit Riders

Two types of users make up the potential transit patronage; the necessity riders who cannot drive or do not have access to an automobile, and those who prefer to ride transit.

In the Los Angeles Metropolitan Region in 1964, there were approximately 2,500,000 people 15 years old or more who did not have a drivers license and were therefore dependent upon some transportation other than their own automobile. These people make up the first group.

The second group is made up of people who currently drive because of habit, convenience or necessity. The automobile is not required in the performance of their daily work. The level of service offered by the transit system must be directed at this group since, with competitive comfort, convenience and cost, many of them would divert to a transit system. In the case of a suburban resident who maintains a second automobile primarily as a commute means (a common necessity in the Region), the individual can realize a substantial cost saving and also enjoy his trip reading the morning paper rather than combating freeway traffic.

On the basis of the Coverdale & Colpitts 1958 estimated travel within the eight corridors proposed for transit, it is shown that 52.16% of the total regional travel occurred along these corridors. Considering that commuter travel makes up approximately 1/3 of all trips in the region, it follows that at least a proportionate amount of this travel is within these primary commuter routes. Therefore, at least 16% of the total Regional travel of over 12 million trips represents a prime transit potential. Of even greater significance is the fact that in the corridor areas, the full commuter traffic, or nearly 1/3, represents a potential market. The impact of this potential upon the freeway congestion is obvious.

It is also important to realize that the location of a transit line will also foster a change in community form along the routes to higher density. This fact alone will create added potential transit patronage and preclude necessity of these people using the freeways daily.

E. THE BENEFITS

1. Benefits Defined

The benefits to be derived from the transit system will accrue to the general public (community benefits) and to private individuals (user benefits). This discussion does not consider the user benefits but deals only with the major community benefits and then only in exemplary terms. A benefit cost ratio cannot be determined since a much more comprehensive study would be required.

The basic form of the benefits to be discussed is as follows:

Financial Benefits: The direct contributions in dollar terms to the community or private beneficiary.

Economic Benefits: The direct or indirect contributions to the resource base of the community or the individual.

Social Benefits: The direct, indirect, tangible or intangible values added to the social, economic or physical base of the community at large.

Real Benefits: The total of direct, indirect, tangible or intangible benefits whether financial, economic or social.

2. Financial Benefits

The benefits which will accrue to the Region result from the fact that, while the expenditure (estimated at nearly \$2 billion) of money for the eight-corridor system will be spent primarily within the Region for labor and material, the primary source of funds will be outside the Region. The immediate expenditure is transformed into new income and new sales from new capital.

3. Economic Benefits

These benefits to be derived from rapid transit in Los Angeles arise largely due to increased mobility. For example, it has been estimated that inadequate peak-hour freeway capacity will result in a reduction of potential employment between 95,000 and 225,000, depending upon the future distribution of labor within the Region. The proposed rapid transit system can readily accommodate these commuters, thereby removing the capacity restraint. These employees reaching jobs in the Regional Core represent an increase in Regional income of from

\$665,000,000 to \$1,575,000,000 annually. The derived effect upon suburban communities would be from \$1,700,000 to \$4,000,000 in added sales tax and \$35,000,000 to \$115,000,000 additional real estate taxes. Therefore, the potential economic benefit attributable to rapid transit over a 40-year period results in an average capitalized value between \$2 billion and \$7 billion.

4. Social and Real Benefits

These benefits include many that cannot readily be assigned a dollar value. One great social benefit to be derived from Rapid Transit is a continued and expanded variety and diversity of community form which avoids monotony and expands residential choice. Rapid transit supplementing the other modes of transport will provide the only apparent means of efficiently accommodating the projected 20-million population in this Region in future years. It can aid in the preservation of urban and suburban areas by permitting concentration of specialized areas which in turn will attract business and industry of all types. It will expand both the labor market for the employer and the job opportunity for the employee. It will have a stabilizing effect upon tax costs to single family residential areas through higher tax returns from high density, high value properties served by the transit system. It will permit many acres of prime land area to remain in productive use rather than being devoted to parking and thoroughfares. It would also enhance the accessibility of cultural and recreational areas by non-drivers and also afford a reasonable choice to a great many people who would prefer a relaxing trip to and from work rather than driving an automobile in congested traffic.

APPENDIX A

DEFINITIONS

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DEFINITIONS

The following list of definitions of terms and geographic areas used in this report is provided to give a common base of understanding.

AREAS:

The Los Angeles Metropolitan Region is that portion of Los Angeles County south of the San Gabriel Mountains and including the northern portion of Orange County.

The Southern California Rapid Transit District is slightly smaller than the Los Angeles Metropolitan Area, having the same general boundaries but excluding any portion of Orange County.

The Regional Core is that area generally bounded by the Santa Monica Mountains - Hollywood Hills - Golden State Freeway on the north; the Long Beach Freeway on the east; Slauson Avenue on the south; and the San Diego Freeway on the west.

The Central Area is defined as an egg-shaped area between the Hollywood Freeway on the north and the Santa Monica Freeway on the south and extending from the Santa Ana Freeway on the east and including Beverly Hills on the west.

The Civic Center is defined as that 320-acre area extending from Sunset Boulevard to 2nd Street and between Figueroa and Alameda Streets as defined in the Centropolis Report.

The Central Business District is defined as that 470-acre area extending from 2nd Street on the north to Olympic Boulevard on the south and between Los Angeles and Figueroa Street and does not include the area of Bunker Hill, which is contained in the area between Hill Street on the east, the Harbor Freeway on the west, First Street on the north and generally Fifth Street on the south.

TERMS:

Transportation System is defined as an integrated complex of all modes of transportation, facilities and vehicles.

Roadway Network is defined as the total complex of facilities for the movement of rubber-tired vehicles from minor streets to freeways.

Freeway System is defined as those freeways currently in existence and proposed by State Division of Highways for construction by 1980.

Transit System is defined as the network(s) of routes, facilities, and equipment, publically or privately owned, intended for the mass movement of passengers.

Rapid Transit is defined as high speed, high capacity fixed facility transit operating on exclusive right of way and completely grade separated.

APPENDIX B

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