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Optimum BUS System

Marin County
Transit District

August 1969

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STAFF REPORT TO THE BOARD Of DIRECTORS

OF

MARIN COUNTY TRANSIT DISTRICT

OPTIMUM BUS SYSTEM

AND

SUMMARY OF WATER TRANSPORTATION STUDY

Economic Consultant: R. L. Banks & Associates, Inc.

August 6, 1969

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MARIN COUNTY TRANSIT DISTRICT

CIVIC CENTER
SAN RAFAEL, CALIFORNIA 94903

BOARD OF DIRECTORS

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PETER R. ARRIGONI	Supervisor, Second District
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THOMAS T. STORER	Supervisor, Fourth District

STAFF

Seymour Kashin	General Manager
Y. Tito Sasaki	Projects Engineer
Jerome Kuykendall	Transportation Analyst
Elsie M. O'Leary	Secretary
Cheryl A. Marcovich	Stenographer

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MARIN COUNTY TRANSIT DISTRICT
CIVIC CENTER
SAN RAFAEL, CALIFORNIA 94903

TELEPHONE:
479-1100

August 6, 1969

The Honorable Board of Directors
Marin County Transit District
Civic Center
San Rafael, California 94903

Gentlemen:

Forwarded herewith is the final report of staff pertaining to the design of an optimum bus system and a summary of the findings in the Water Transportation Study, both of which were undertaken pursuant to the Work Program and Budget adopted by your Board for fiscal year 1968-1969.

The bus transit system described in this report takes as its point of departure the series of studies which has been undertaken for the Transit District since 1965. The economic analysis of the proposed bus system was completed by R. L. Banks & Associates, Inc., under contract with the Transit District. The Water Transportation Study was prepared by Arthur D. Little, Inc., under the joint sponsorship of the City and County of San Francisco and the Transit District.

Staff effort has been devoted to updating the findings of the earlier studies and to designing a bus system which would be capable of replacing the present Greyhound services and meeting the commuter needs of the Marin-San Francisco corridor as they now exist. The system proposed herein must be viewed as a solution at a specific time rather than the ultimate solution.

In view of the findings contained in this report, it is recommended that the following procedure be adopted:

1. Immediate implementation of Plan II as the most desirable course of action at this time. Plan II is an intermediate commitment which should not limit the ability of the operating agency to undertake a ferry operation when the additional required technical work has been completed nor the adoption of Plan III as warranted by the performance of the proposed bus system. It would permit the operating agency to meet present commuter requirements and maintain complete flexibility with regard to the next step in a long-range transit program.

2. Create a technical committee representing the City and County of San Francisco, the Marin County Transit District and Golden Gate Bridge & Highway District to act upon the recommendations contained in the Arthur D. Little ferry system report.

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3. Acquire the rights-of-way of the Northwestern Pacific Railroad in Marin County to preserve such rights-of-way for future transit use.

4. Continue the long-range transit planning program adopted by your Board.

Respectfully submitted,

Seymour Kashin
General Manager

SK:cm

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ACKNOWLEDGMENTS

The staff of the District wishes to acknowledge with thanks the aid and cooperation which it received in the preparation of this study, as follows:

Alameda-Contra Costa Transit District

Bay Area Transportation Study Commission

Fireman's Fund American Insurance Companies

Golden Gate Bridge and Highway District

Marin County Department of Public Works

Marin County Planning Department

Peerless Stages, Inc.

Presidio of San Francisco

San Francisco Department of City Planning

San Francisco Department of Public Works

San Francisco Municipal Railway

Sonoma County Planning Department

Western Greyhound Lines

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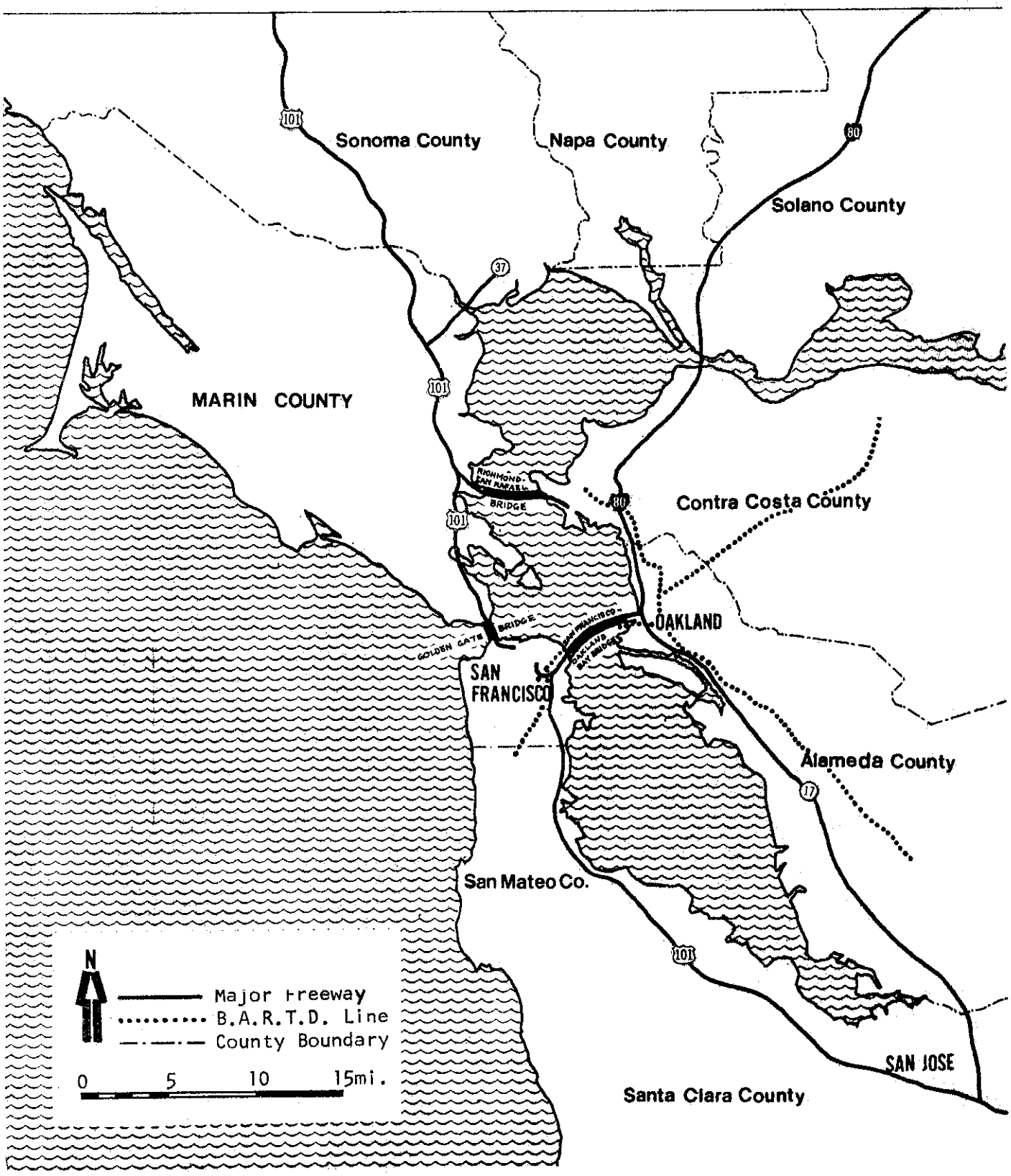
Marin County and Its Environs



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CHAPTER I

SUMMARY DESCRIPTION OF THE SYSTEM

The Optimum Bus System described herein is a completely new bus system capable of replacing the present Greyhound service and of being implemented promptly, It has been designed primarily for the purpose of meeting commuter travel demands in the San Francisco-Marin corridor. However, an attempt has been made to design a service within the system that would also greatly facilitate other trips, such as those within Marin as well as midday and weekend trips between Marin and San Francisco. Finally, the system has been made capable of serving Sonoma County.

By placing routes closer to commuters' homes and work places and by running buses directly between origins and destinations with schedules closely adjusted to commuters' work hours, the proposed system is expected to attract up to twice as many commute passengers as are now carried by Greyhound. This share can be increased in future by continuous improvement of the service. The proposed system thus could avert further commute traffic congestion along Highway 101 and on the Golden Gate Bridge for some years to come, while permitting the current rate of residential development in Marin and Sonoma Counties to continue.

Undertaking a full-scale inter-county commute bus system would permit the District to operate intra-county bus service at small additional cost. The midday/weekend service was designed to serve intra-county as well as inter-county trip demands by connecting residential areas of communities to their centers, which were then connected to each other and to San Francisco. Owing to its extensive route coverage and frequent service, the system is expected to alleviate the problem of immobility experienced by many who cannot drive or do not have automobiles at their disposal.

All the costs and revenues developed in the course of this study are based upon the assumption that the operation would be undertaken independently by a public agency. The system is, however, also capable of being operated under contract with another agency. The advantages and disadvantages of the latter course can be explored in detail only through the negotiation process.

The system is described in terms of three alternative plans, namely, Plans I, II and III. Each of the plans provides for a different level of service and patronage, although all three of them operate on the same route pattern.

Plan I is actually a transitional stage wherein the existing Greyhound bus fleet would be leased to the District at a nominal fee pending delivery of a new fleet of District-owned buses. This plan would require 106 buses and could be in operation within three months from the time a decision is made to enter into the bus business. Plans II and III require 132 and 166 buses respectively, and either one could he operative within one year from the time a decision is made. With the inclusion of Sonoma County the plans would require 126, 152 and 186 buses respectively.

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As has already been pointed out, Plan I is essentially transitional and would he phased out and replaced by either Plan II or Plan III as new buses were delivered. The main advantage in Plan I is that the District could be operative at a much earlier date than with either Plan II or III, On the other hand, there are substantial risks involved in adopting Plan I. It would, for example, perpetuate the operation of the present Greyhound bus fleet, which is both old and ill-equipped for the type of service being rendered. This would not permit the District to take full advantage of the new image which a new bus fleet would afford, and therefore the service would not fully meet public expectations. Furthermore, the number of buses available would not permit the District to operate a substantially more frequent peak-hour service than is now furnished by Greyhound, although it would be adequate to expand the area coverage possible with the proposed new route pattern.

In designing the system consideration was given to those factors which would produce different levels of patronage, such as quality, frequency and cost of service. Lesser consideration was given to external factors beyond our control except to the extent they could be predicted. It is expected that both the quality and frequency of service will have been predetermined and fixed prior to the inception of the operation. The cost of the service to be rendered will be fixed somewhat less precisely due to a relatively large number of factors which cannot be controlled until after the service has actually begun. It is for the latter reason that the fares which it is proposed to charge are at the same level as present Greyhound charges, with minor adjustments. All revenue estimates are based on these fares.

The following exhibits describe in summary the Optimum Bus System in terms of its route pattern, service level, financial performance, and effects upon highway traffic conditions.

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Exhibit 1

COMPARISON OF PRESENT GREYHOUND OPERATION
WITH PROPOSED PUBLIC OPERATION (MARIN-SAN FRANCISCO)

Revenue Bus Miles	Greyhound	MARIN TRANSIT Plan I	Plan II	Plan III
Commute	1,013,216	1,017,828	1,434,888	1,802,304
(Index)	(100)	(100)	(142)	(178)
Non Commute	1,178,556	2,236,508	2,236,508	2,236,508
(Index)	(100)	(190)	(190)	(190)
Total	2,191,772	3,254,336	3,671,396	4,038,812
	(100)	(148)	(168)	(184)
PASSENGERS				
Commute	2,094,372	2,376,360	3,309,264	4,345,992
(Index)	(100)	(113)	(158)	(208)
Non Commute	1,497,328	1,930,987	1,988,917	1,988,917
(Index)	(100)	(129)	(133)	(133)
Total	3,591,700	4,307,347	5,298,181	6,334,909
	(100)	(120)	(148)	(176)
BUSES REQUIRED	103	106	132	166
(Index)	(100)	(103)	(128)	(161)

NOTE: Total Greyhound passengers are for the year ended June 30, 1967, the latest available. The distribution between commute and non commute is based upon a March 1969 sample.

Source: R. L. Banks & Associates, Inc., Working Papers.

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Exhibit 2

CAPITAL REQUIREMENTS
(PROPOSED MARIN-SAN FRANCISCO OPERATION)

	Estimated Life (Years)	ALTERNATIVE LEVELS OF SERVICE		
		Plan I (low)	Plan II (medium)	Plan III (high)
			(000 omitted)	
Acquisition of Land		$ 0	$ 250	$ 250
Improvements to Land	40	0	249	249
Garage	40	0	159	159
Administration Building	40	0	200	200
Contingency Allowance[1]		0	73	73
Garage Equipment	8	0	100	100
Buses	12	0	5,610	7,055
Fare Boxes	25	121	151	190
Shelters	15	0	15	15
Automobiles	4	8	8	8
Office Furniture	10	24	24	24
Office Equipment	5	20	20	20
Two-Way Radios	5	4	4	4
		$177	$6,863	$8,347

[1]Land Improvements, Buildings and Interest During Construction.

Source: R. L. Banks & Associates, Inc., Working Papers.

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Exhibit 3A

SUMMARY INCOME STATEMENT - PROPOSED BUS OPERATION
(MARIN-SAN FRANCISCO)

	ALTERNATIVE LEVELS OF SERVICE		
	[1]Plan I (low)	[2]Plan II (medium)	[2]Plan III (high)
		(000 omitted)	
Total Operating Revenues	$2,669	$3,290	$3,924
Total Operating Expenses	2,948	4,007	4,700
Total Operating Income (Loss)	(279)	(717)	(776)
Non Operating Income (Expense)	-	(335)	(405)
NET INCOME (LOSS)	$ (279)	$(1,052)	$(1,181)

Exhibit 3B

ANALYSIS OF INCOME STATEMENT - PROPOSED BUS OPERATION
(MARIN-SAN FRANCISCO)

Total Operating Revenues	$2,669	$3,290	$3,924
Total Operating Expenses	2,948	4,007	4,700
LESS: Depreciation & Amortization	65	540	665
Direct Operating Expenses	2,883	3,467	4,035
NET OPERATING INCOME (LOSS) (Line 1 minus Line 4)	$ (214)	$ (177)	$ (111)
Interest on Long Term Debt, Depreciation & Amortization (Public Subsidy)	$ 65	$ 875	$1,070

[1]Fiscal year September 1969-August 1970.
[2]Fiscal year September 1970-August 1971.

Source: R. L. Banks & Associates, Inc., Working Papers.

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Exhibit 4

PROPOSED COMMUTER BUS ROUTES IN MARIN COUNTY

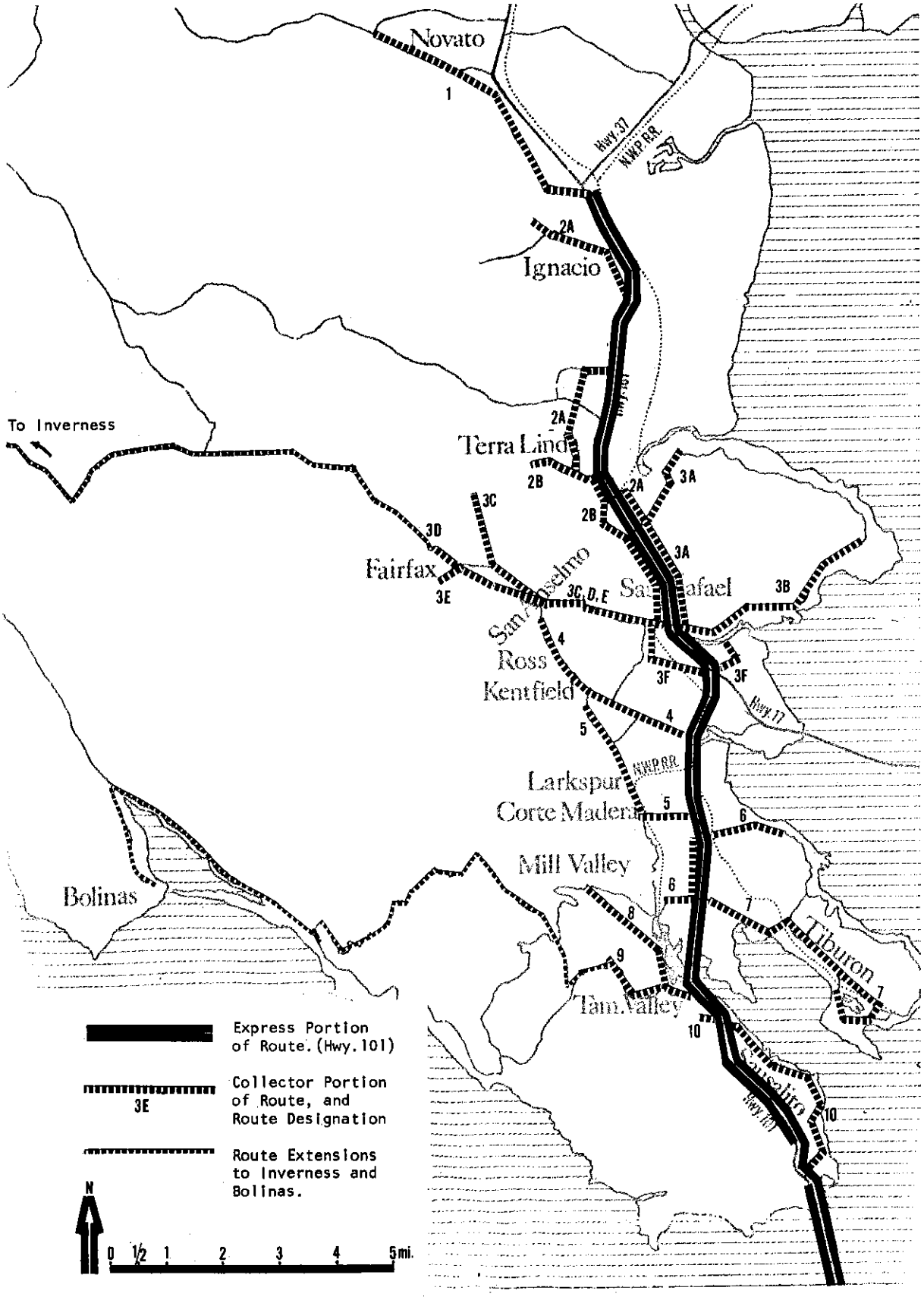

Exhibit 5

PROPOSED COMMUTER BUS ROUTES IN SAN FRANCISCO

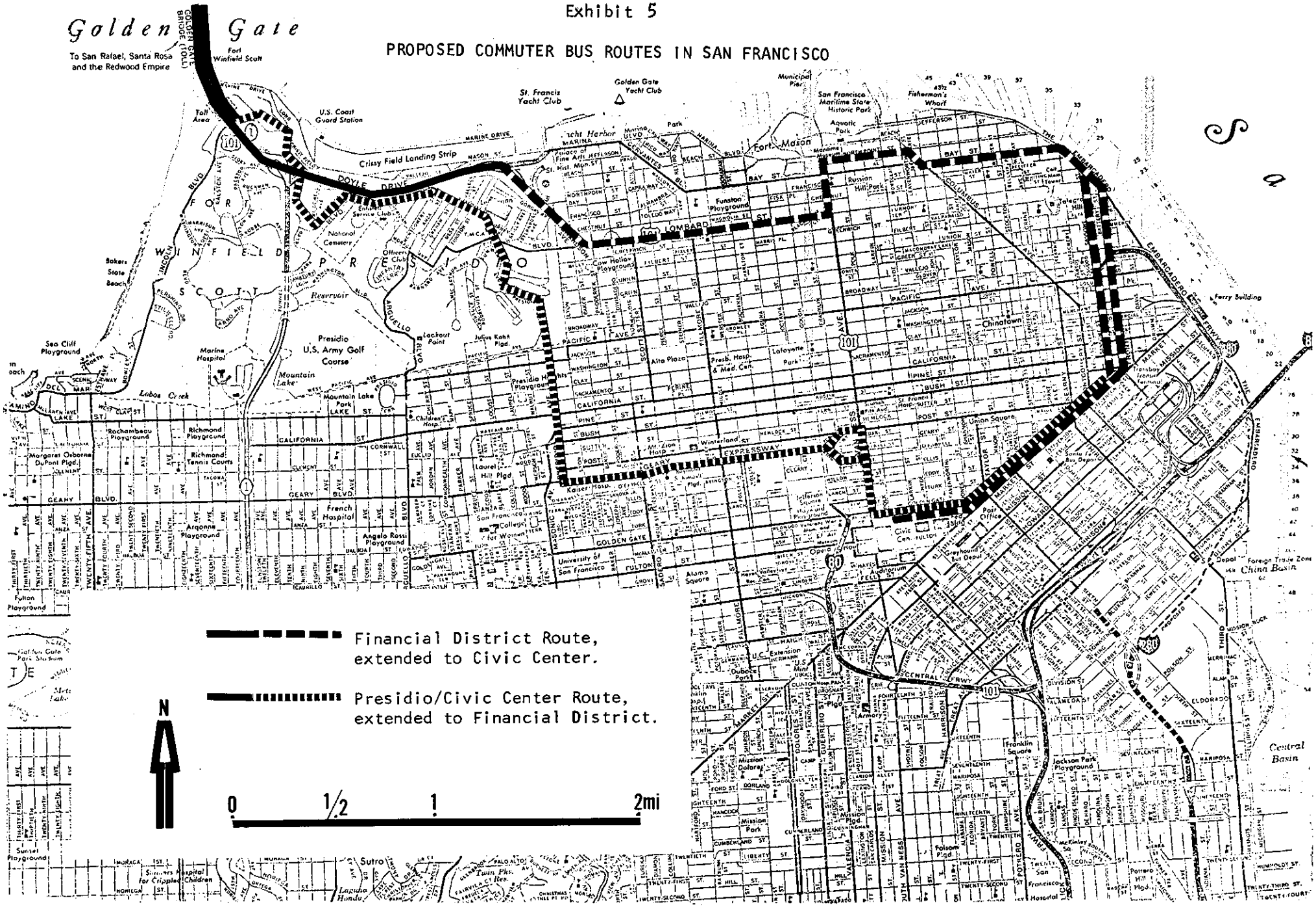

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EXHIBIT 6A

NUMBER OF BUSES BY APPROXIMATE ARRIVAL TIME AT SAN FRANCISCO DESTINATION

	Arrival Time (A.M.)					
Plan	7:00	7:30	8:00	8:30	9:00	Total
I	5	13	39	28	8	93
II	10	19	49	41	12	131
III	11	26	61	48	19	165

EXHIBIT 6B

NUMBER OF BUSES BY APPROXIMATE DEPARTURE TIME FROM SAN FRANCISCO

	Departure Time (P.M.)					
Plan	4:00	4:30	5:00	5:30	6:00	Total
I	5	28	33	20	7	93
II	10	37	49	27	8	131
III	10	54	60	31	10	165

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Exhibit 7

PROPOSED MID-DAY/WEEKEND BUS ROUTES IN MARIN COUNTY
AND RESPECTIVE HEADWAYS BETWEEN 6 A.M. AND 9 P.M.

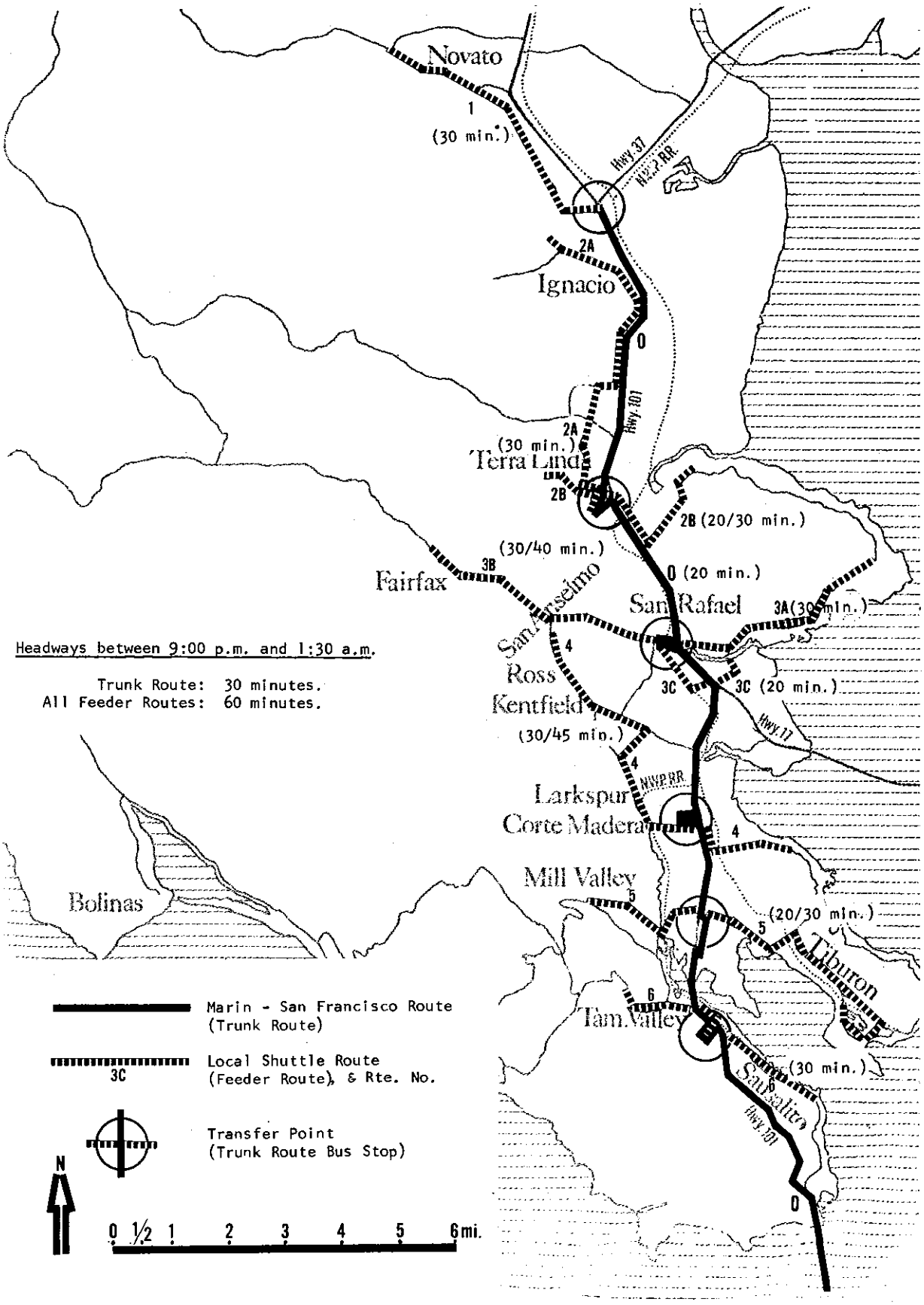


Exhibit 8

PROPOSED MID-DAY/WEEKEND BUS ROUTES IN SAN FRANCISCO

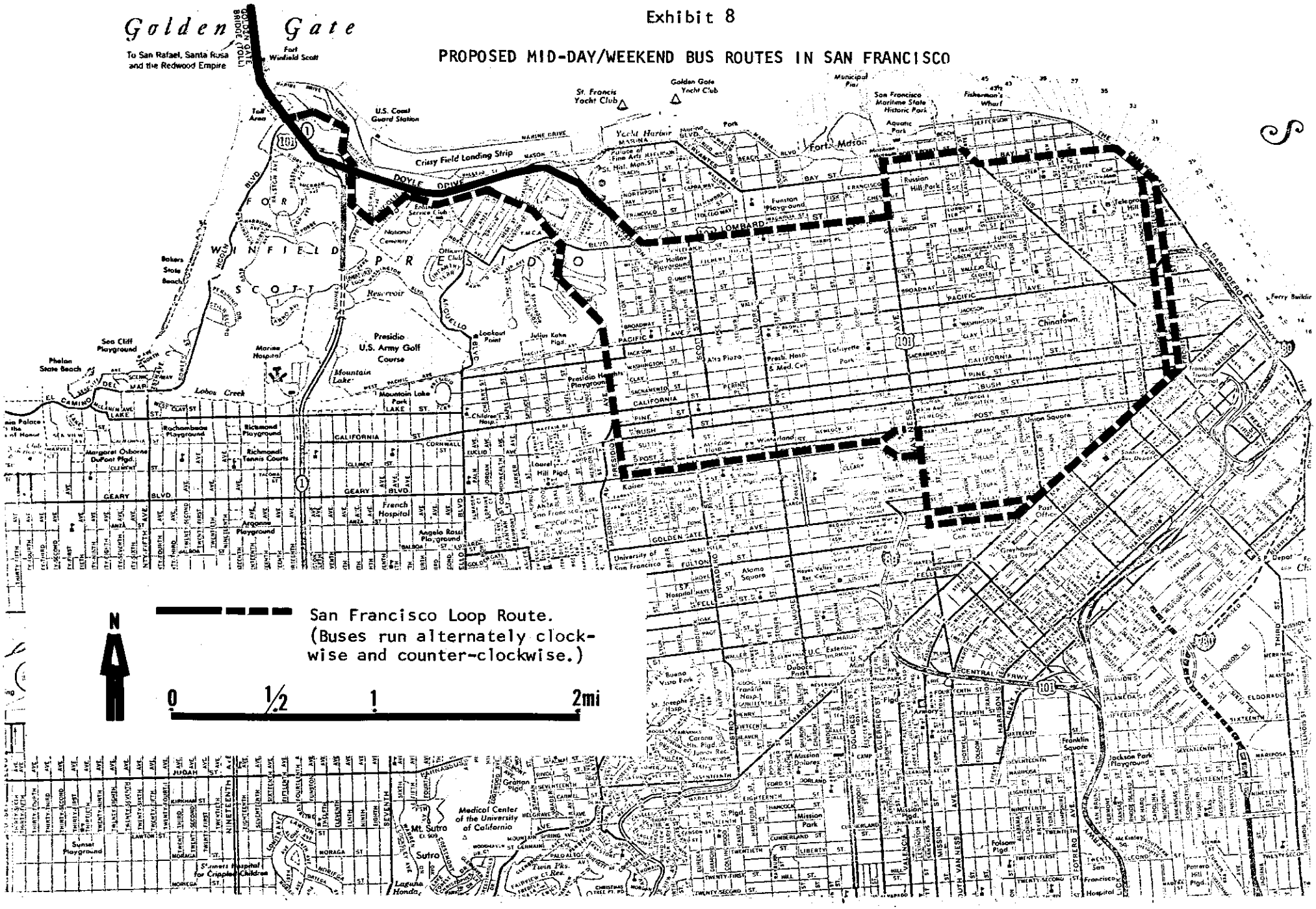
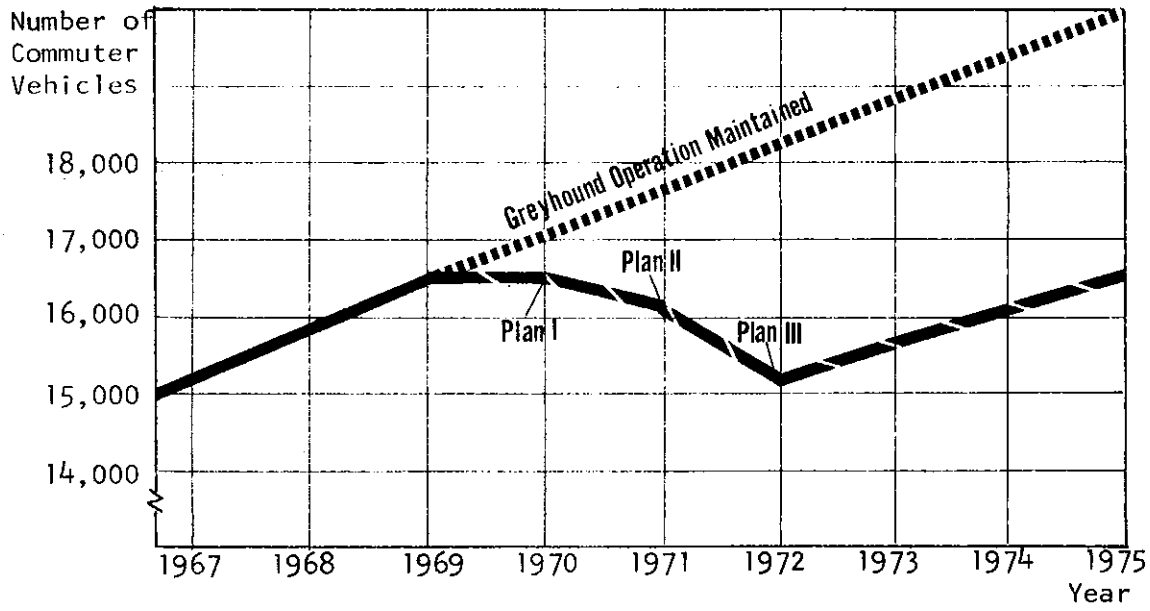

Golden Gate
To San Rafael, Santa Rosa and the Redwood Empire
Fort Winfield Scott
U.S. Coast Guard Station
Crissy Field Landing Strip
St. Francis Yacht Club
Golden Gate Yacht Club
Fort Mason
San Francisco Maritime State Historic Park
Fisherman's Wharf
Presidio U.S. Army Golf Course
Mountain Lake
Lobos Creek
Sea Cliff Playground
Phelan State Beach
Baker State Beach
Chinatown
Union Square
Alta Plaza
Lafayette Park
Alamo Square
Mission Park
Jackson Park Playground
Franklin Square
Medical Center of the University of California
Mt. Sutro
Sutro
Laguna Honda
Sunset Playground
Stanford Hospital for Crippled Children
Twin Pks.
Corona Hts. Pkgd.
Dolores Park
Folsom Pkgd.
Potrero Hill Pkgd.
Russian Hill Park
Funston Playground
Cow Hollow Playground
Presidio Heights Playground
Rochambeau Playground
Richmond Playground
Richmond Tennis Courts
Margaret Osborne DuPont Pkgd.
Argonne Playground
French Hospital
Angelo Rossi Playground
Laurel Hill Pkgd.
Julius Kahn Pkgd.
Lookout Point
Presidio Hospital
Marine Hospital
Kaiser Hospital
Ferry Building
Municipal Pier
Golden Gate Bridge (Toll)
Toll Area
Fort Winfield Scott
Presidio
Fort Mason
Yacht Harbor
Marina
Palace of Fine Arts
Exploratorium
Exploratorium
Presidio
Fort Mason
Chinatown
Union Square

Exhibit 9

PROJECTED NUMBER OF COMMUTER VEHICLES ACROSS
THE GOLDEN GATE BRIDGE, BY ALTERNATIVE TRANSIT PLANS
1969-1975



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CHAPTER II

THE PROBLEM AND ITS CONTEXT

One of the most pressing issues in Marin County is commuter traffic congestion. In order to mitigate this problem the Marin County Transit District was established and the Optimum Bus System study was prepared. However, the problem is not an isolated one inasmuch as it stems from the historical development pattern of the County, and more recently from several political decisions.

The problem, then, will have to be seen in its broader context, just as the system proposed herein has to be viewed as a solution at a specific time in history rather than the ultimate solution.

A. MARIN COUNTY, ITS PEOPLE AND LAND

Marin County with its natural beauty, congenial climate and geographic proximity to San Francisco has been an ideal place in which to reside for many of those working in San Francisco. In this century the County has developed primarily as an exclusive residential community closely linked to San Francisco.

The total population of Marin for 1970 is estimated to be 218,000 and the number of commuters to San Francisco around 32,000, or nearly one in every two households in Marin. The total population and number of commuters are projected to be 327,000 and 41,000, respectively, in 1980.

Residential development in the County has been confined mainly to the eastern coastline and the valleys opening to it. These areas are the lowlands of Marin with relative ease of access, and some 95% of the County population live within four miles of Highway 101, which runs along the east coast of the County. This highway serves as the only transport artery catering not only to Marin commuters to San Francisco but also commuters from Sonoma County, which has large areas for further residential development. The rest of the County, which accounts for approximately three-quarters of the total County area, is predominantly hilly, and its wilderness and natural beauty have been preserved as important assets of Marin.

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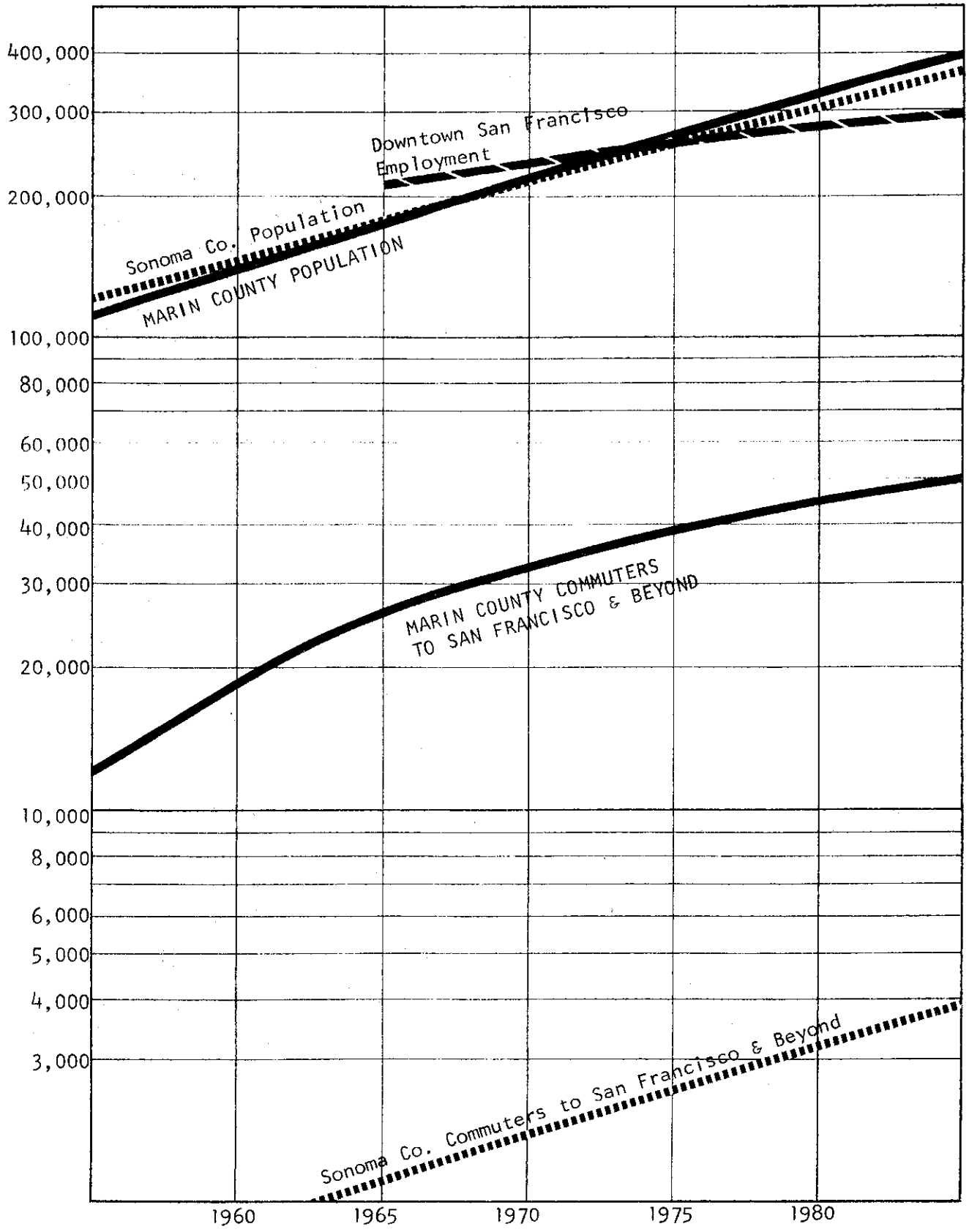
Exhibit 10

POPULATION, EMPLOYMENT & COMMUTER TRENDS -
MARIN COUNTY, SONOMA COUNTY & SAN FRANCISCO



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B. EARLY PUBLIC TRANSPORT SYSTEMS IN MARIN

The current settlement pattern in Marin, with its heavy concentration of population along the eastern shoreline and valleys, was in part determined by the early railroad pattern.

At the turn of the century, major settlements in the eastern part of the County, such as Sausalito, Mill Valley, Tiburon, Corte Madera, Ross, San Anselmo, and San Rafael, were connected by a network of railroads, which in turn were linked to San Francisco by means of ferries sailing from railroad terminals in Sausalito and Tiburon. This rail/ferry system remained as the main base of all transportation for Marin, even through the period of development and use of the automobile, until the opening of the Golden Gate Bridge. Upon discontinuance of the rail/ferry service in 1941, Pacific Greyhound Lines (now Western Greyhound Lines) assumed the commuter service between Marin and San Francisco. Greyhound perpetuated the railroad service pattern in Marin. The original bus route structure is still maintained more or less unchanged by Western Greyhound Lines.

Exhibit 11A	Exhibit 11B
MARIN-SAN FRANCISCO RAIL/FERRY ROUTES circa 1910	MARIN-SAN FRANCISCO GREYHOUND COMMUTE BUS ROUTES.(SCHEMATIC). -1969

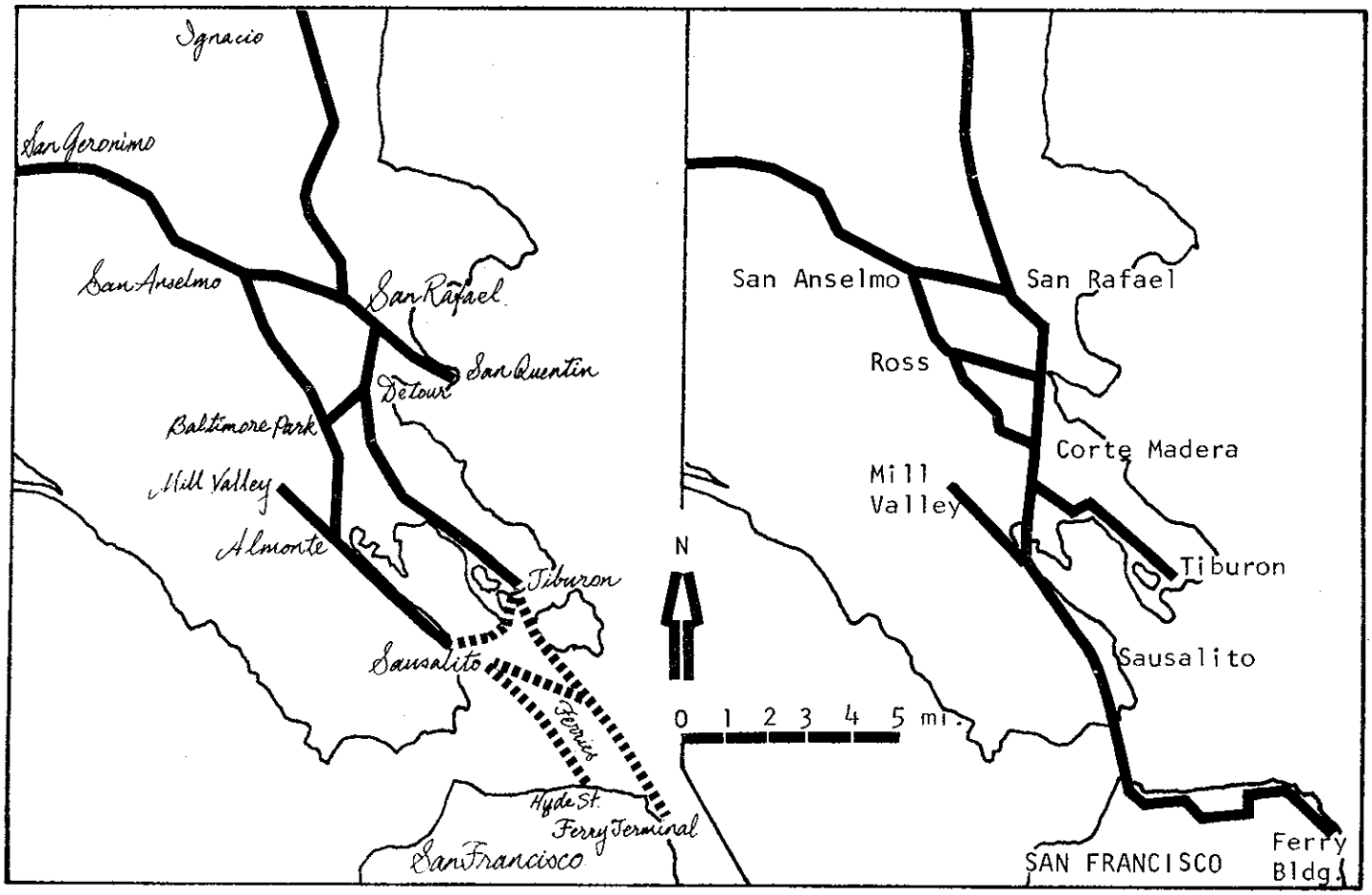

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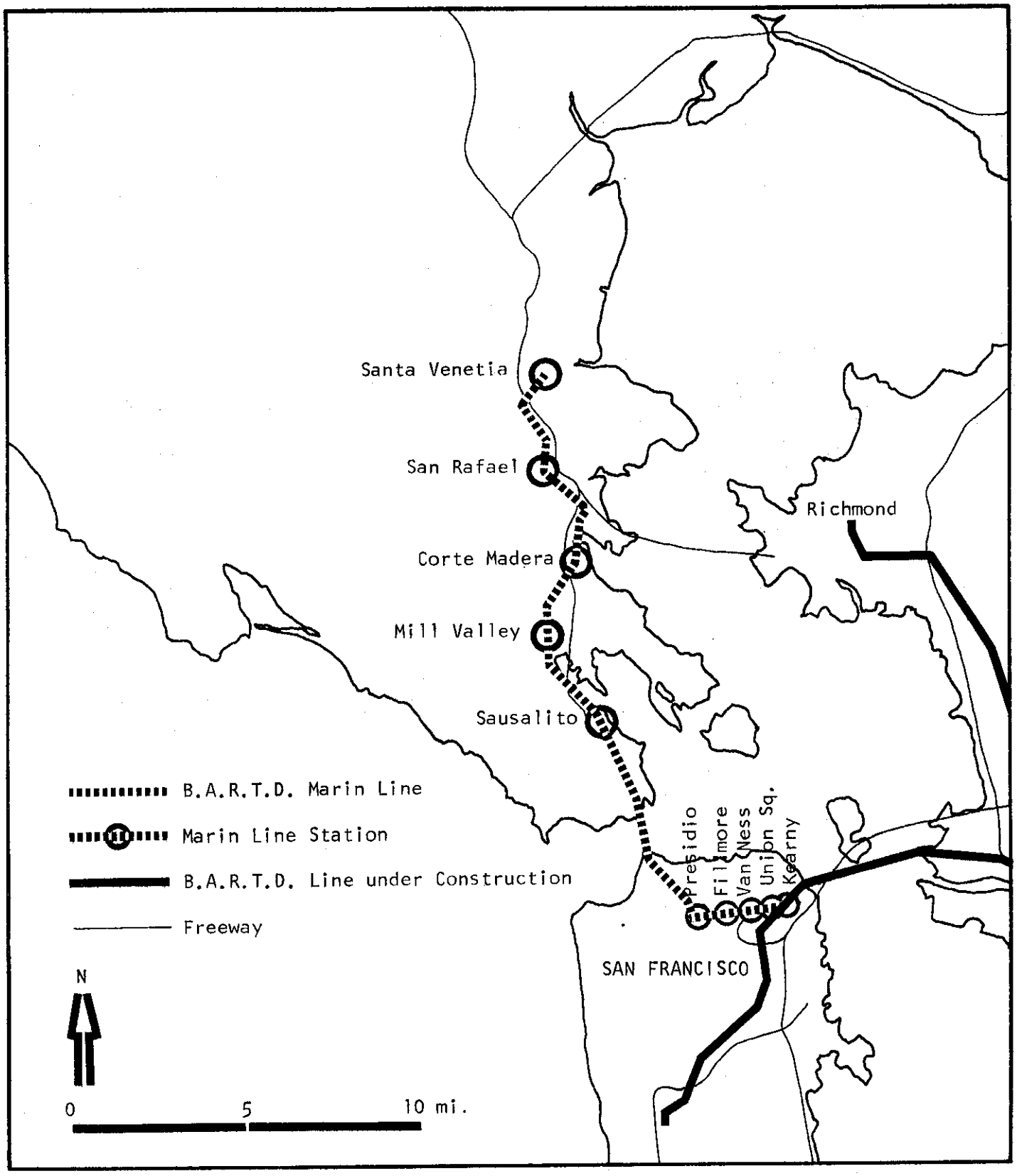
Exhibit 12

BAY AREA RAPID TRANSIT DISTRICT'S MARIN LINE PLAN,
PROPOSED IN 1961



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C. BAY AREA RAPID TRANSIT DISTRICT (BARTD)

Between 1940 and 1960, the population of the Bay Area doubled and that of Marin County nearly tripled. The increasing population and expanding economic activity created ever-growing transport demands, which were in large part met by construction and improvement of highways and increased usage of automobiles.

However, it soon became evident that in the 1970's expected transport demands, particularly commuter traffic, would surpass planned highway capacity in several critical corridors, such as the Golden Gate and Bay Bridges. The need for a long-range regional transit plan was publicly recognized.

In 1957 the San Francisco Bay Area Rapid Transit District (BARTD) was created by the California Legislature to include the counties of Alameda, Contra Costa, Marin, San Francisco, and San Mateo. The District's primary function was to plan and implement a regional rapid transit system to improve the transport efficiency of the area and alleviate anticipated highway congestion.

In 1961 BARTD revealed a regional rail rapid transit system plan, which included a line extending from downtown San Francisco via a second deck of the Golden Gate Bridge to Santa Venetia. A peak hour travel time of 22 minutes between San Rafael and the Financial District of San Francisco was promised in the plan.[1] Marin County, however, withdrew from the District primarily because an engineering review panel recommended against placement of rapid transit facilities on the Golden Gate Bridge.[2] San Mateo County had previously withdrawn from the District for other reasons, and the District proceeded with construction of the San Francisco-East Bay lines, leaving the Marin and San Mateo lines as possible future extensions.

The BARTD lines are expected to be opened in 1971, mitigating transit problems in and between Alameda, Contra Costa and San Francisco for many years to come.

---

[1]Stone & Youngberg, "Rapid Transit for the Bay Area," Sept. 1961, p. 21.

[2]Parsons-Brinckerhoff-Tudor-Bechtel; Smith, Barney & Co.; Stone & Youngberg; Van Beuren Stanbery; "The Composite Report, Bay Area Rapid Transit, May 1962," p. 6.

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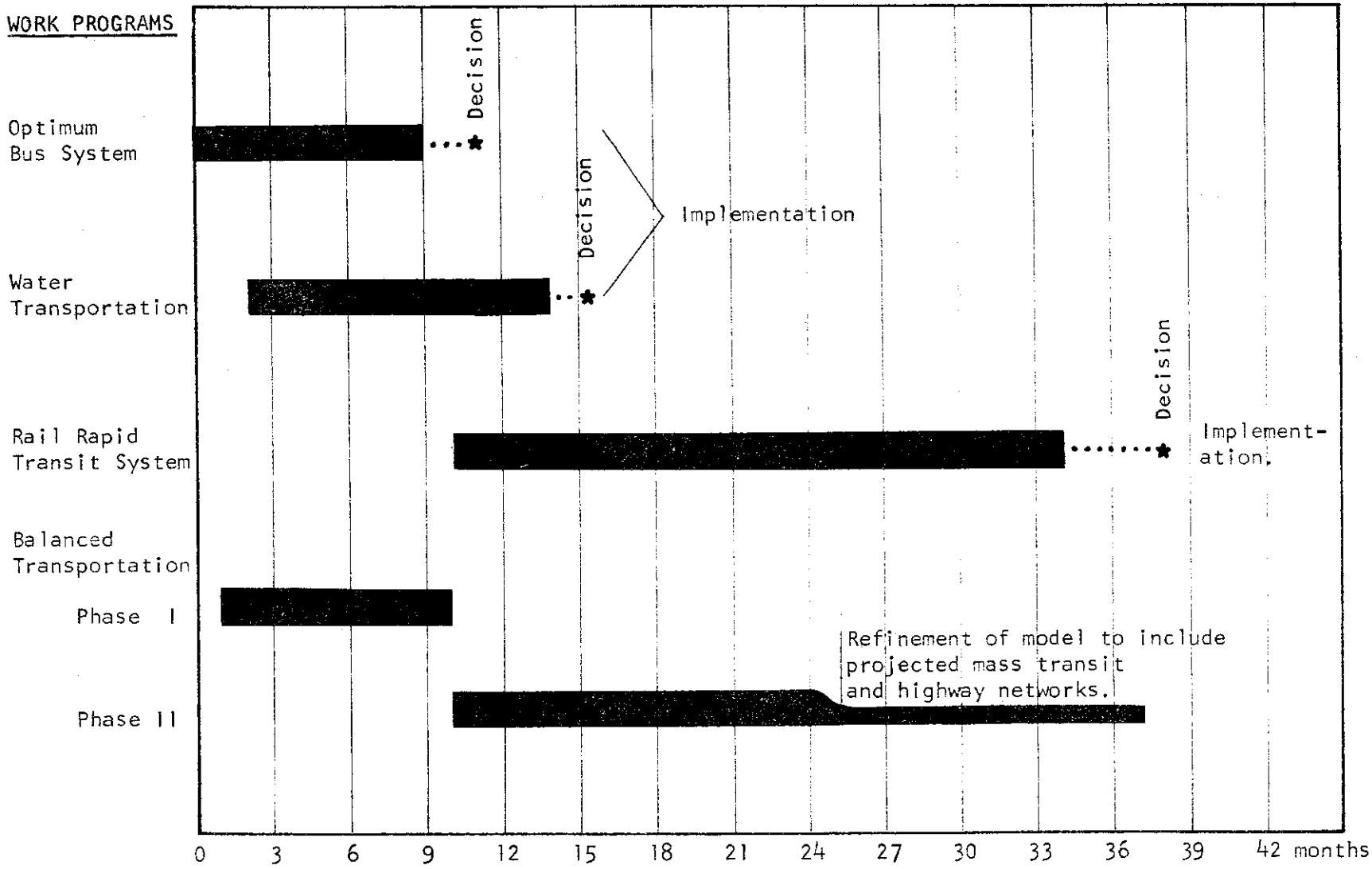
Exhibit 13

COMPOSITE WORK PROGRAM
ADOPTED IN THE 1968-69 WORK PROGRAM OF THE MARIN COUNTY TRANSIT DISTRICT



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D. MARIN COUNTY TRANSIT DISTRICT

Without the immediate prospect of implementing a rail transit system in the County, and facing the commute traffic congestion that had been worsening year after year, Marin residents in 1964 voted for creation of the Marin County Transit District. The District was created in the following year with two specific objectives: "...to provide an interim solution to the transit problem of this area pending inclusion of Marin County into the Bay Area Rapid Transit District," and "...to establish, when financing therefor becomes feasible, a permanent rapid transit system designed to be part of a unified San Francisco Bay area wide regional system."[1]

For the first two years, the District received a number of reports[2] pertaining to bus operation, undertaken and completed by outside consultants. In April 1967 the District Board passed a resolution titled, "Resolution of the Marin County Board Declaring Policy Favoring Improved Bus Transportation Between San Francisco and Marin County," in which the Board officially recognized in a bus system as the most feasible interim solution.

During the latter part of 1967, a General Manager was appointed to translate the work of the consultants into a program of action. He subsequently prepared a three-year work program. The program consisted of an Optimum Bus System Study to be undertaken and completed by the District staff, a Water Transportation Study to be completed by consultants, a Rail Rapid Transit System Study to follow the Bus Study, and a Balanced Transportation Study to be carried out jointly with the Marin County Planning and Public Works Departments throughout the period considered.

In July 1968, the 1968-69 work program was officially adopted, and technical staff was appointed in August and September 1968.

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[1]Marin County Transit District Act, Section 70010.

[2]Fanning, Paul J., "A Plan of Transit Operation for Marin County," June 1965; Coverdale & Colpitts, "Report on Public Transportation in County of Marin," December 1966; and Coverdale & Colpitts, "Answers to Questions of Marin County Administrators," February 1967.

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E. OPTIMUM BUS SYSTEM

District staff collected and analyzed a wide range of data pertinent to determination of the spatial, temporal, quantitative, and qualitative aspects of the transit demands in the area, and then designed a bus system that should alleviate the commute traffic congestion and provide the people of Marin with convenient means of transport without adversely affecting the environmental quality of Marin.

The Optimum Bus System is described in this report in terms of operational characteristics and financial performance.

The Optimum Bus System, as described herein, is not meant to be the comprehensive solution to all public transport problems in Marin. Mid-day and late night services, weekend services, and intra-county services in general will require detailed follow-up analyses of the services that are implemented initially. This is because the demand elasticity for non-commute transport service is very large (in other words, the demand can be increased or decreased directly by changing the level of service), necessitating evaluation of the actual effect on patronage of an improved service before determining the most satisfactory level of service.

The system described is not meant to be the ultimate solution to the commuter problems of the area. Because of rapid residential development in Marin and Sonoma Counties and increasing daytime employment population in San Francisco, commuter traffic will undoubtedly continue to increase. On the other hand, new transit modes may become feasible which could contribute to further alleviation of the commute traffic problem. The commute bus system should, therefore, be capable of modification in order that it may be easily adapted to changing conditions as they take place.

A transit mode under study at this writing is the ferry. With the Water Transportation Study now completed by consultants, careful consideration should be given to possible adjustment of the bus system in order that any possible ferry services would be integrated with the bus operation to offer maximum service to the commuter.

Consideration should also be given to the provision of an exclusive trunk route for transit in the not too distant future, and a long-range transit solution should be studied.

The Optimum Bus System that is described in the following pages is, then, the blueprint for the initial phase of the interim solution to the commuter transport problems of the area. It will provide the prototype from which a continuously improving public transit system can be evolved.

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CHAPTER III

OPTIMUM BUS SYSTEM DESIGN

The Optimum Bus System was designed with the following objectives and constraints in mind:

1. The new bus system should be capable of alleviating the existing commuter traffic congestion and absorbing much of the incremental traffic in the years to come until a regional rapid transit system is implemented in the County.

2. Conversion of auto commuters to buses should be achieved primarily by the bus system's own merits such as better scheduling, better routing, and better equipment rather than by imposing negative incentives, such as increased tolls upon automobiles.

3. The bus service should be available to a greater portion of the County population throughout the day and improve the mobility of even those who do not have a private means of transport at their disposal.

4. The system should be capable of replacing the existing Greyhound service and of being implemented promptly.

5. The deficit of the operation should be minimal.

6. The physical appearance of the system equipment and facilities should be such that it enhances the visual quality of the environment.

The technical objective of the study was then defined as to design a bus system which meets the aforementioned requirements and describe it in terms of route, time schedule, patronage estimate, capital equipment and facilties, organizational structure, and income statement for the first year of operation.

A work program was devised subsequently, which is shown in Exhibit 14. It must be noted that most of the steps described in the Exhibit are for design of a Sonoma/Marin/San Francisco commute bus service and also that the design of the commute service preceeds that of the non-commute service.

It was recognized from the outset of the study that commute and non-commute bus riderships are very different matters. Commute trip demands are inflexible in volume and trip pattern. As long as one lives in one place and works in another, he will have to travel between his residence and work place at a certain time of the day taking the best available transport means. Therefore, the essence of the commute bus system design is to find the existing travel demand pattern so that the system may be adjusted to such a pattern. Here the incremental share of the public transit system derives mainly from the modal switch of people from the automobile to the transit system.

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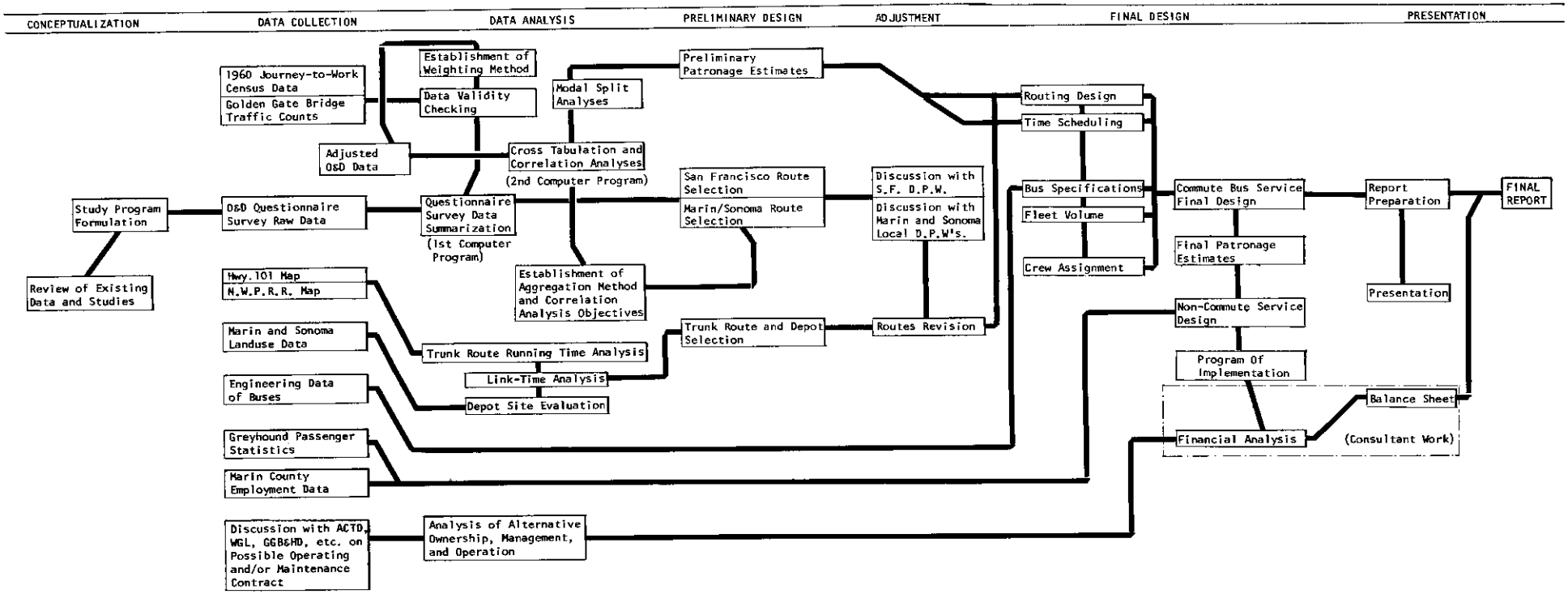
Exhibit 14

Optimum Bus System Work-Flow Chart

January 1969



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Non-commute trips, on the other hand, are often generated by newly available transport means. In other words, a large part of the non-commute trip demands are latent and cannot be assessed directly from the existing trip pattern. A non-commute bus system will, therefore, have to be designed with much insight into the local problems, and a large portion of its patronage will come from those people who hitherto have traveled little.

Also, it was obvious from the beginning of the study, that the commute bus service would require more buses than the non-commute service, and a critical problem of designing the non-commute service would be how best to utilize the equipment and facilities provided by the commute service.

For the aforementioned reasons, elaborate steps were taken to assess accurately the commute trip demands first and then to design a commute bus service accordingly. Finally, upon defining the commute service and compiling relevant data, a non-commute bus service was designed to complete the description of the total system. The system described was thereupon analyzed in financial terms by a consultant.

The following sub-chapters describe the procedures and findings of the study item by item.

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A. PATRONAGE ESTIMATE, TIME SCHEDULING, AND ROUTING

1. Data Collection

In order to design a bus system that is tailored to commuters' trip demands, the following sets of information were thought to be essential:

1) Information on the trip origin/destination, sufficiently detailed to facilitate route selection.

2) Information on the time by which the commuter has to be at the destination.

3) Information on the time at which the commuter starts his return trip.

The existing data were examined in the light of the aforementioned four requirements. As summarized in Exhibit 15, the available studies, either independently or in combination, did not provide all the needed information.

As a consequence, it was decided that the Transit District should undertake a questionnaire survey.

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EXHIBIT 15

Availability of Useful Information, by Source and Type of Information

SOURCE	TYPE OF INFORMATION			
	Origin (in Marin)	Destination (in S.F.)	Origin/Destination Conjugates (Marin to S.F.)	Arrival/Departure Time
1960 Journey-to Work Census	Available[1]	N.A.[2]	N.A.	N.A.
Bay Toll Crossing Study, Nov.1962	Available[5]	Available[5]	Available[5]	N.A.
B.A.T.S.C.1965 Household Survey	Available[4]	Available[4]	Available[4]	N.A.
Coverdale and Colpitt Study 1966	Partially Available[3]	Partially Available[3]	N.A.	Partially Available[3]
Bay Toll Crossing Study, May 1967	Available[6]	Available[6]	Available[6]	N.A.

[1]Marin County divided into 33 census tracts.

[2]San Francisco aggregated into a single zone.

[3]Concerning bus riders only.

[4]Origins and destination classified into 17 and 40 zones respectively; but, the sample magnitude (80l or 0.8% for the County) is small, and the resulting data are not meant for use in detailed analysis on the county level.

[5]Concerning vehicular trip origins and destinations, 6 Marin Zones, 8 San Francisco zones.

[6]Origins and destinations are classified into 23 and 22 zones respectively.

Most of the trip data was produced mathematically from demographic data, necessitating some emperical data for checking if they were to be used for bus operation planning.

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a. Commuter Origin & Destination Survey Design

At the inception of the survey design, it was decided that a large-scale survey rather than a limited scale sample survey should be undertaken for the following two reasons.

1) A large scale survey can be undertaken with relative ease since the questions are few in number and relatively simple.

2) A small sample survey requires a sophisticated sampling technique and careful interpretation, yet leaves a large margin for possible error.

It was then decided that a simple form of self-addressed, postage prepaid questionnaire card should be distributed to commuters mainly at the Golden Gate Bridge Toll Gate during the morning commute period. Additional cards were to be distributed to bus and ferry passengers.

Choice of the Bridge as the major distribution point was based on the unique geography of the area that funnels almost all the San Francisco bound Marin commuters into a single corridor, the Golden Gate Bridge. Also, at the Bridge, all cars are stopped for toll collection, facilitating distribution of the questionnaire cards.

Use of the morning commute period was desirable because, in general, the office atmosphere would be conducive to filling in and mailing the questionnaire card.

Having previewed the Transit District's work program and reviewed the studies of other agencies, the kinds of information to be obtained from the commuters were spelled out. These were:

1) Purpose of the trip (in order to differentiate commuter trips from occasional trips).

2) Location of the trip origin

3) Location of the trip destination.

4) Time by which one has to be at the destination.

5) Time at which one begins his return trip home.

6) Mode of transport taken by the commuter.

7) Reason for the modal choice.[1]

8) Number of cars in the household.

9) Name and address of the respondent.[2]

---

[1]Collection of this information was requested by the Golden Gate Bridge District, one of the collaborating agencies in this study.

[2]Some names and addresses of respondents were desired for call-back purposes.

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Having itemized the information needed, efforts were focused upon how to phrase the questions explicitly and clearly in order to obtain the intended information. The rationale behind the choice of phrasing is briefly described below.

1) Purpose of the trip.

The trip purposes were classified into four categories, i.e. work, school, shopping, and other.

Separation of school trips from work trips and of shopping trips from the rest of non-commute trips were made mainly to provide check points for other information, in particular, destination. Because of the few trip purpose categories this information could be obtained using a multiple choice question. Since this question was presumably an easy one to answer and also likely to set a proper frame of reference for subsequent questions, it was decided that this question should be placed at the beginning of the questionnaire.

2) Location of the Trip Origin.

Since the survey was planned to take place during the morning commute period, it was assumed that the trip origin of most of the people to be canvassed by the survey would be their home. Therefore, it was preferred that their home location, rather than an ambiguous notion as "origin", should be asked.

However, people are known to be reluctant in making public some personal information such as income, age and home address. In order not to discourage response and yet to obtain a sufficiently detailed information of the trip origin, the name of the street on which one lives and that of the nearest crossroad was asked. Such information is sufficiently detailed for the purpose of bus route planning.

3) Location of the Trip Destination.

Since there is little privacy involved in telling one's commute trip destination, a straight-forward question was posed as to the address of the destination.

In order to minimize misinterpretation of the question (vehicular trip end in lieu of the final destination) any phrase that was strongly associated with the trip itself was avoided. Such phrasings as "Where are you going?" or "Where do you terminate your trip?" were discarded because they may result in answers indicating bus terminals or parking garages.

4) Time by which one has to be at the Destination.

In order to design a bus system responsive to commuters' needs, it is necessary to know the time at which one wants to be at the destination.

Parking problems and traffic congestion often force people to arrive at his work place unnecessarily early or embarrassingly late. Thus, the actual time of arrival is not necessarily a good indication of the time distribution on which to base a bus schedule.

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Since shopping and other non-commute trips are not the major object of our study and they are small in percentage, the time at which one starts work or school was asked in order to get information on the desired arrival time.

5) Time at Which One Begins His Return Trip Home.

A major problem in designing this question was whether the information to be obtained should concern the time one finishes his work (or school) or the time he actually starts his trip home.

Dissimilarly to the previous question concerning the arrival time, the time one terminates his work or school may often not coincide with the time he begins his trip home. Therefore, the question emphasized the preferred time of leaving for home.

6) Mode of Transport Taken by the Commuter.

There are two types of transport means available for crossing the Golden Gate Bridge: automobile and bus.

The particular mode of transport means taken by a commuter on the survey day could be known by distributing differently coded cards to auto commuters and bus commuters.

In order to know a commuter's usual mode of transport, which might be different from the mode taken on the survey day, a simple question was posed:

"How do you usually commute?"

7) Reason for the Modal Choice.

It was contemplated first to provide the respondents with a multiple choice question concerning the reason for his modal choice. Though convenient for tabulation, such a question would force the respondents to think in the terms available in the question.

Consequently, an open-type question was employed in order to obtain some insight into the modal choice reasons, although it was clear that an open-type question would result in fewer responses and the reason cited would require analysis.

8) Number of Cars in the Household.

A straight-forward question was posed here. However, in view of the fact that this question might somewhat encroach upon an individuals privacy and discourage response, the question was placed at the end of the questionnaire.

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9) Name and Address of the Respondents.

Because of the risk of a drastic decrease in the response rate, name and address were asked as an optional question at the end of the questionnaire. This request was included to permit use of a call back procedure if it became necessary.

10) Comments and Suggestions.

In order to obtain any additional information and personal opinions of the respondents which could be useful for our study, a space was provided at the bottom of the card for possible comments and suggestions.

After the wording of each question had been decided upon, the questions were arranged in order of the ease of response and according to the sequence of thoughts in the respondent's minds.

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Exhibit 16

Questionnaire Survey Card

MARIN COUNTY TRANSIT DISTRICT

The Transit District is designing a new commuter system to serve Marin County. Your assistance in answering these questions is essential to us in accomplishing this task. Thank you.

PLEASE FILL IN AND MAIL TODAY. POSTAGE FREE.

1. What is the purpose of this trip? Work ☐ School ☐ Shopping ☐ Other ☐
2. Where do you live? _____ (City or community)

   On what street? _____

   Nearest crossroad: _____
3. What is the address of your destination?

   (Number - Street - City)
4. What time do you start work or school? _____ : _____ A.M.
5. What time do you begin your return trip home? _____ : _____ P.M.
6. How do you usually commute? By bus ☐ By car ☐

   And why this choice? _____
7. If you commute by car, how many people ride with you? _____
8. How many cars are in your household? _____

Comments or suggestions (if you care to make any)

Name and mailing address (if you wish)

7041

FIRST CLASS
PERMIT NO.
- 516 -
SAN RAFAEL, CA.

BUSINESS REPLY MAIL NO POSTAGE NECESSARY IF MAILED IN THE U.S.A.

POSTAGE WILL BE PAID BY –

MARIN COUNTY TRANSIT DISTRICT

CIVIC CENTER, SAN RAFAEL, CALIF. 94903

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b. Survey Card Distribution

On Wednesday, October 30, 1968, a 300-card pretest was conducted to finalize the card design and distribution method.

The results were favorable, but one change was made in the questionnaire card as a result of a request by the Golden Gate Bridge & Highway District that only one card be distributed to each vehicle in order to minimize delay and possible resulting congestion.

Consequently, question number 7 was added which asked how many passengers were in each car.

A total of 25,000 questionnaire cards were printed on different colors as follows:

4,000 Green Cards	- for distribution at the Bridge between 6:00 and 6:59 a.m.
7,000 Orange Cards	- for the Bridge, 7:00 & 7:59 a.m.
7,000 Blue Cards	- for the Bridge, 8:00 & 8:59 a.m.
7,000 Yellow Cards	- for Buses and Ferries

The yellow cards were also numerically coded for different runs of buses and ferries.

Buses

The night before the survey day, three coded sets of 65 cards each were delivered to the drivers of the Eastshore Lines chartered buses for distribution on the following day.

Distribution of cards in Greyhound buses by District staff and volunteers was reasonably smooth. In all, 86 Greyhound bus runs were covered by the survey.

It was originally intended that the bus drivers retrieve all unused survey cards and return them to the Transit District in envelopes provided. However, this proved to be impractical and District staff went to bus terminals and depots, immediately after the distrivution was completed, to collect the leftover cards. Most of the unused cards were thus retrieved. These unused cards were needed to estimate the number of cards actually distributed to passengers.

Ferries

Distribution of specially coded cards to ferry commuters was carried out without difficulty. A total of 251 cards were handed out.

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Automobiles (Golden Gate Bridge)

Green cards, one to each automobile and pick-up truck, were distributed at all the toll booths between 6:00 and 6:59 a.m.

At the end of the hour, the undistributed green cards were retrieved and new stacks of orange cards were furnished to distributors, and at 8:00 a.m. the cards were switched to blue ones.

Toward the end of the third hour it became apparent that a nearly sufficient number of cards to cover the traffic between 9:00 and 10:00 a.m. would be left undistributed. It was therfore decided to extend the survey by marking those cards left and distributing them from 9:00 a.m. onward. This fourth hour distribution ended at about 9:40 a.m. when all the cards were exhausted. The excellent cooperation received from the Bridge District and its personnel added significantly to the success of the survey. The number of cards distributed for each mode of transport is shown in Exhibit 17.

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Exhibit 17

Number of Questionnaire Cards
Distributed, by Mode, 11-20-68

Mode	No. of Cards Alloted	No. of Cards Distributed
Eastshore Line Chartered Buses	130	112
Greyhound Buses	6,110	3,200*
Ferries	400	251
Automobiles		
6:00-6:59 a.m.	4,000	3,300*
7:00-7:59 a.m.	7,000	5,600*
8:00-8:59 a.m.	7,000	6,000*
9:00-9:40 a.m.	--	3,100*
TOTAL	24,640	21,500*

*Estimated

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2. Data Analysis

a. Survey Card Coding Procedure

Approximately 12,100 questionnaire cards were returned of which about 12,080 were deemed to be usable. These 12,080 cards were then coded for key punching and subsequent data processing.

The information with regards to most of the questions could be directly punched without any translation. However, in the case of trip origins, destinations, reasons for modal choice, and comments and suggestions some pre-coding systematization was necessary.

The rationale and method for coding are explained in subsequent sections. A summary of coding is shown in tabular form in Exhibit 18.

1) Identification Number

Each card was given a code number which uniquely identified that individual card and also noted the mode of travel and time (hour) at which the respondent crossed the Golden Gate Bridge. The time information was obtainable from the color codes on the cards distributed to auto riders and from the schedule numbers of buses and ferries stamped on other cards.

The numbers are two part. The first part coding the mode and time and the second being a number in a consecutive list of numbers. The consecutive list was from one to a maximum equal to the number of cards which were returned during that hour if the mode was auto, or to the number of cards returned from the vehicle if the mode was bus or ferry.

2) Trip Origin and Destination

Since the study was to lead to precise descriptions of a bus system, the zonal system set up for gathering and processing information had to be sufficiently fine grained to allow for route and time block comparisons. Furthermore, it was desirable that the zone boundaries be consistent with the subdivisions of existing zonal systems so that the data generated in this study would be readily usable by other agencies.

The zonal system developed for the Marin County Balanced Transportation Study, which consisted of 317 zones as subdivisions of the Census Tracts, was used for Marin County. (See Exhibits 19 - 20)

San Francisco was divided into 56 zones as used by the Bay Area Transportation Study Commission except for 9 B.A.T.S.C. zones which were further subdivided because of their special interest to Marin commuters. (See Exhibits 21 - 22)

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Before trip origins and destinations could be coded, it was necessary to make a list of all the streets in the counties of Marin and San Francisco showing the zone in which each lay. With this accomplished, a zone number was then given for each origin and destination in the questionnaire returns. In the event two or more destinations were given, additional zone numbers could be recorded. Also, 99999 was recorded to indicate that the destination varied.

3) Time of Trip

The start times and return trip times were recorded using "military clock" notation. 9999 was recorded if the respondent indicated that the time varied.

4) Reasons for Modal Choice, Comments and Suggestions

Before coding of the reasons for modal choice and "comments and suggestions", a sample of 500 cards was analyzed as to the most frequent reasons and suggestions given.

Nineteen reasons and twenty-one comments were selected for coding and given numbers to represent them (See Exhibits 23 and 24). Two answers could be recorded for each of these two questions. If a question was unanswered, it was coded "blank."

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Exhibit 18

Coding System For Questionnaire Information

Information	Code	Original Question
1. Mode & Time of Travel		No. Question -- (Color of cards and schedule numbers)
Auto 6:00-6:59 a.m.	100001 to 101566	
7:00-7:59	200001 to 203276	
8:00-8:59	300001 to 303562	
9:00-9:40	400001 to 401496	
Greyhound Buses	7nnn01 to 7nnnxx nnn = Sched. No. xx = total no. cards from given bus	
Eastshore Buses	8n0001 to 8n00xx n = Bus No. xx = total no. cards from given bus	
Ferry	9n0001 to 9n0xxx n = ferry boat no. xxx = total no. cards from given ferry	
2. Trip Purpose		What is the purpose of this trip?
Work	1	Work _____
School	2	School _____
Shopping	3	Shopping _____
Other	4	Other _____
No Answer	--	
3. Trip Origin	Zone No. (See Exhibit 8)	Where do you live? On what street? Nearest crossroad?
No Answer	--	
4. Trip Destination	Zone No. (See Exhibit 10)	What is the address of your destination?
Varies	99999	
No Answer	--	
(2 destinations may be coded)		
5. Time to Start Work	Hour and Minute expressed in Military Notation	What time do you start work or school? ____:____ a.m.

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Exhibit 18 Continued

6. Time to Start Return Trip Home		Hour and Minute expressed in Military Notation	What time do you begin your return trip home? ____:____ p.m.
	Varies	9999	
No Answer		--	
7. Usual Commute Mode			How do you usually commute? By Bus _____ By Car _____
	Bus	1	
	Car	2	
	Ferry	3	
No Answer		--	
8. Reason for Modal Choice (2 answers may be coded)		01-29 (See Exhibit 11)	And why this choice?
No Answer		--	
9. No. of passengers in car (Excluding driver)			If you commute by car, how many people ride with you?
	Number	As Given (0-9)	
No Answer		--	
(Note: on tape, zero and nine both represent a zero answer)			
10. Number of cars in household			How many cars are in your household?
	Number	As Given (0-9)	
No Answer		--	
(Note: on tape, zero represents no answer and nine represents a zero answer)			
11. Comments & Suggestions (2 Answers may be coded)		01-31 (See Exhibit 12)	Comments or Suggestions (if you care to make any)
12. Name & Mailing Address			Name & Mailing Address (if you wish)
	Where Given	1	
No Answer		--	

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Exhibit 19

Marin County Zone Numbers

Area or Census Tract	Zone Numbers
1	01101-01208
2	02101-02211
3	03101-03206
4	04101-04303
5	05001
6	06001-06010
7	07001-07004
8	08101-08203
9	09001-09005
10	10101-10205
11	11001-11006
12	12101-12204
13 & Inverness	13000
14	14101-14203
15	15001-15006
16	16001-16003
17	17001-17005
18	18101-18204
19	19101-19205
20	20001-20005
21	21101-21205
23	23001
24	24101-24207
25	25001-25003
26	26101-26205
27	27001-27005
28	28101-28211
29	29001-29002
30	30101-30207
31	31001-31005
32 (except Inverness)	32103-32110
Petaluma	50000
Santa Rosa	60000
Rohnert Park	70000
Other Locations North of Marin	40000

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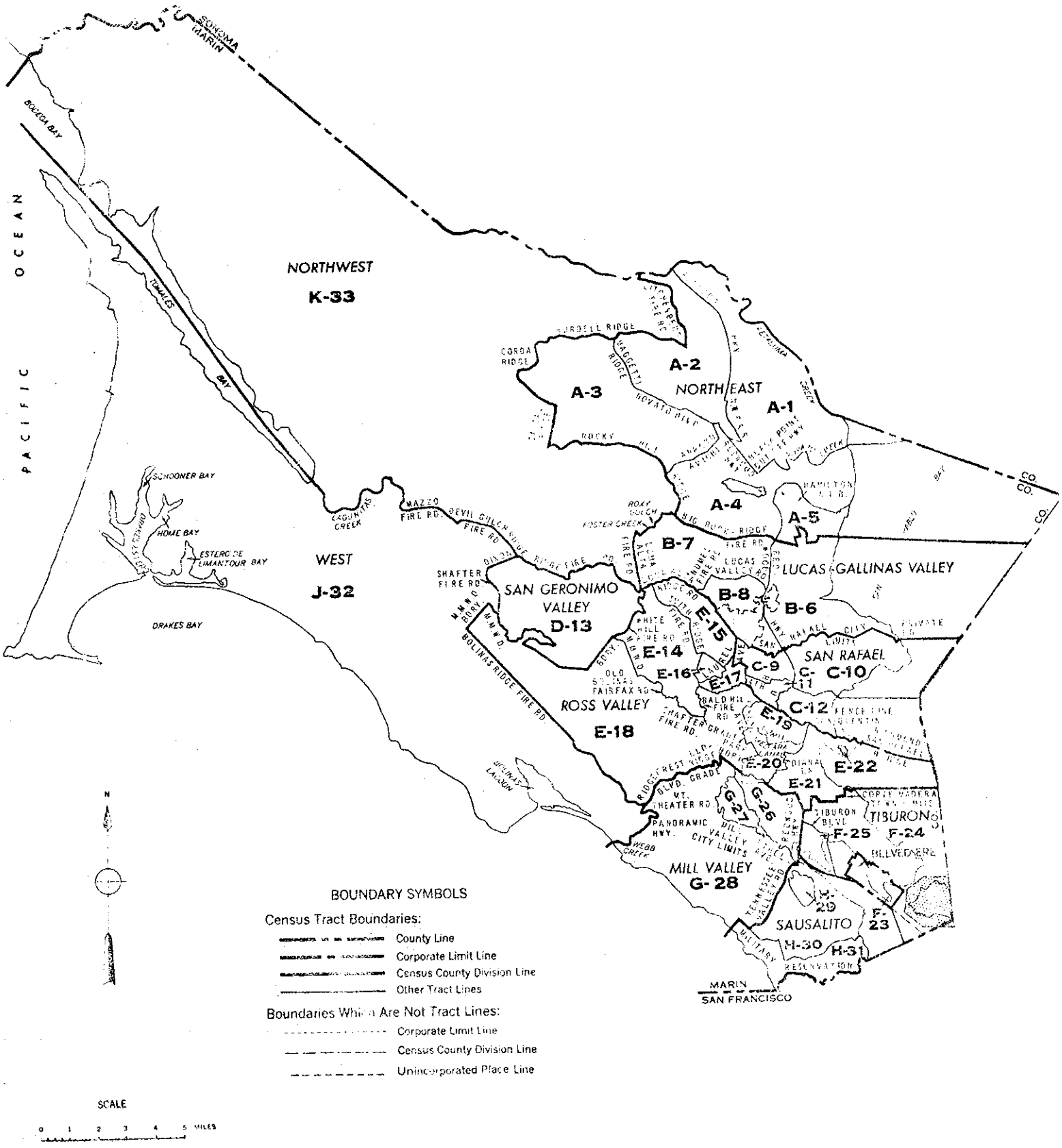
Exhibit 20

Marin County Census Tracts



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STUDY ZONES IN SAN FRANCISCO

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Exhibit 22

San Francisco Zone Numbers

11	150	330
12	160	340
13	170	350
21	180	361
22	190	362
23	201	371
24	202	372
31	210	380
32	220	391
40	230	392
51	240	393
52	250	394
60	260	395
70	271	396
80	272	401
90	280	402
100	290	500
110	300	600
120	310	700
130	320	800
140		

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Exhibit 23

Reasons For Modal Choice

01. Convenience (flexibility)

02. Economy

03. Faster

04. Comfort

05. Hate bus (emotional or aesthetic rejection)

06. Poor bus service

07. Need car in work (also use of company car) (carry tools)

08. Hate driving (too much congestion)

09. Safety, relaxation, to read, to sleep

10. No other means (no other transportation available)

11. Have no car available

12. Bus route inconvenient (bus stop too far away)

13. Bus times inconvenient (early or late hours)

14. Do not drive

15. Poor connections (too many transfers)

16. Parking problems

17. Reliability

18. Car pool inconvenient

19. Other

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Exhibit 24

Comments and Suggestions

01. Better public transport

02. Ferry system

03. Rapid transit

04. Monorail

05. BARTD

06. Reserved lane or right of way for buses

07. Second Crossing (NOT second deck)

08. Freeway 101 (widen, improve, etc.)

09. Keep heavy vehicles and/or trailers off 101

10. Stagger working hours

11. All comments on Golden Gate Bridge

12. Keep bus fares low (lower bus fares)

13. More frequent buses and express buses

14. Provide better routing of buses

15. Better bus service (In General)

16. Earlier bus departures to and from S.F.

17. Later bus departures to and from S.F.

18. Better buses

19. Keep buses clean

20. More parking lots near bus stops

21. Too much traffic congestion

22. Other

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b. Validation of Survey

Upon translating the original questionnaire answers into numerical codes, the information was first transferred to punch cards and then to magnetic tape.

A computer program was then written to tabulate the frequency of each type of answer. Through this program, some 150,000 pieces of original information were reduced to approximately 700. The survey then was checked for validity against information obtained from other studies.

The most meaningful check was afforded by comparison of the data with that of the 1960 Journey to Work Census prepared by the U.S. Bureau of Census. The following chart illustrates such a comparison.

Percentage of Marin to San Francisco
Commuters as Reported by the
1960 Journey to Work Census &
the November 1968 Survey

			% of Total Workers Commuting to S.F.		
Area	Census Tract 1960	Census Tract 1970	MCTD Survey	1960 Census Expanded to 1968[1]	1960 Census
Novato	A	1-5	8.8	6.7	5.3
Terra Linda	B	6-8	12.0	12.9	10.0
San Rafael	C	9-12	13.1	10.9	10.2
Ross Valley	D	13			
Corte Madera	E	14-22	30.4	31.9	34.9
Tiburon Peninsula	F	23-25	11.2	12.1	10.1
Mill Valley	G	26-28	16.4	17.5	19.1
Sausalito	H	29-31	8.1	8.0	10.4
			100.0	100.0	100.0

It is apparent from the chart that a small change in distribution of commuters has occurred since 1960. Before accepting this apparent change as fact further investigation was made. For each census tract the percentage of increased commuters since 1960 to increased number of housing units since 1960 was obtained as shown below.

[1]The 1960 Census number of commuters was increased by census tract in direct proportion to the increase in housing units in that census tract.

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New Commuters as a Percent of New Housing Units

Census Tracts	Increase in Commuters	Increase In Housing Units	%
A (Novato)	1816	4501	40.3
B (Terra Linda)	1941	3074	63.1
C(San Rafael)	2319	3949	58.7
D/E (Ross Valley, Corte Madera)	3246	4519	71.8
F (Tiburon Peninsula)	1737	2087	83.2
G (Mill Valley)	1768	1941	91.1
H (Sausalito)	678	347	195.4

The increase in commuters, when looked at in this way, seems both reasonable and consistent in that the closer a new house is to San Francisco, the greater the likelihood that it will be occupied by a commuter. Therefore, the above chart shows a general increase in percentages as one goes from Novato to Sausalito where commuters are increasing at an even faster rate than are new housing units.

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Exhibit 25

San Francisco Aggregated Zones
Followed by Number Responses
In Parenthesis
(Unadjusted Data)

SO1 - 11, 12, (390)

S02 - 13, (482)

S03 - 21, 23, 24, 52, 393, 394, 401, (3296)

S04 - 22, 395, 402, (1445)

S05 - 31, 32, 391, 392, (995)

S06 - 60, (97)

S07 - 70, 40, (265)

S08 - 80, (255)

S09 - 202, 271, (249)

S10 - 220, (154)

S11 - 230, 240, (322)

S12 - 250, (173)

S13 - 260, (101)

S14 - 371, 372, (227)

S15 - 396, (88)

S16 - 272, 310, (858)

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Exhibit 26

Marin Aggregated Zones
Followed by Number Responses
In Parenthesis
(Unadjusted Data)

M01 - 2206, 3104, 3105, (264)

M02 - 2204, 2205, 2207, 2208, 3203, 3204, 4108, (179)

M03 - 4104, 4105, 4106, (183)

M04 - 4202, (75)

M05 - 4101, 4203, (118)

M06 - 7003, 7004, (361)

M07 - 8103, 8104, (97)

M08 - 8101, 8102, 8203, (669)

M09 - 8201, (86)

M10 - 6001, 6002, 6003, 6004, 6005, (136)

M11 - 10104, 10105, (185)

M12 - 9004, (104)

M13 - 10101, 10102, 10103, 10201, 10202, 10203, 10204, (417)

M14 - 12203, 12204, (188)

M15 - 12101, 12102, 12103, (163)

M16 - 11001, 11002, 11003, 11004, 11006, (148)

M17 - 9001, 9002, 9003, 17004, (323)

M18 - 13000, (99)

M19 - 14201, (53)

M20 - 15002, 15003, (284)

M21 - 15005, 15006, 15004, (121)

M22 - 16002, (78)

M23 - 16001, (84)

M24 - 14102, 14106, (87)

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Exhibit 26(Continued)

M25 - 14101, 14104, 14107, (229)

M26 - 14202, (55)

M27 - 17001, 17003, (122)

M28 - 18101, 18102, (149)

M29 - 18201, 20001, 20002, 20003, 20004, 21101, 21102, 21103, 21104
21104, (843)

M30 - 19101, 19102, 19103, 19201, 19202, 19203, (626)

M31 - 21202, 21203, (308)

M32 - 23001, 24101, 24104, 24105, 24106, 24107, 24202, 24204,
24205, 24206, 25001, 25002, (1201)

M33 - 24102, (52)

M34 - 26201, 26203, (199)

M35 - 26102, 26104, 26105, 27002, 27003, 27004, 27005, (612)

M36 - 26103, (188)

M37 - 28206, 28210, (271)

M38 - 28102, 28108, 28111, 28211, (481)

M39 - 28106, 32103, 32110, (38)

M40 - 29002, (18)

M41 - 30201, 30202, 30203, 30204, 30205, 30206, 30207, 31004, (908)

M42 - 40000, (150)

M43 - 50000, (146)

M44 - 60000, 70000, (116)

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3. Patronage Estimates

With the validity of the survey established, an analysis of all origin and destination concentrations was made. If a zone had a sufficient number of commuters and was in a location which could physically be served by bus, it was deemed as a potential market deserving further study.

These designated zones of interest were then combined into 16 aggregated zones in San Francisco, 41 in Marin County, and 3 in surrounding counties. It is characteristic of these aggregated zones that they are capable of further aggregation into linear bus service areas contiguous to possible routes at a later time in the study. (See Exhibits 25 and 26.)

In order to determine the optimum level of bus service in each aggregated zone it was necessary to make a preliminary estimate of bus patronage based on a hypothetical level of service. In order to obtain a tool to isolate the ptoential bus patronage from the total number of commuters, a study of modal split was made.

a. Modal Split Analyses

Two analyses were made with regards to modal split: the first for the purpose of estimating the potential patronage for the new bus system; and the second to evaluate the importance of shifting the San Francisco route closer to the commuter's work place. The second type of analysis will be explained later in the section on routing.

In determining the modal split for the new system, a conservative estimate could be made by using the present modal split as evidenced in an area which has a service frequency and routing at the level intended to be characteristic of the new system. Such an estimate would be conservative because it does not take into consideration the possible effects of the better equipment and better public relations efforts of the new system.

In selecting a model area for the modal split analysis, care was taken that such an area should be characteristic of the county as a whole at least with regards to the commuting population. A portion of Mill Valley, basically around downtown and along the Miller Avenue areas, was deemed satisfactory and selected for study. This area has direct and rather frequent service to the Ferry Terminal area between 7:30 and 9:00 a.m.

The intent of this analysis was to find some parameter by which the modal split in any area might be estimated. Commonly used for this purpose are income, autos per household, and persons per household or combinations of these and other factors. In general, the most successful parameter has probably been autos per household and therefore, was selected in this case.

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The results of the analysis, as summarized in the following table, show a strong correlation between car ownership and modal choice. It is noted that commuters who indicated it was necessary for them to use cars were excluded since they did not believe they had a choice of mode.

COMMUTERS FROM MILL VALLEY TO FERRY TERMINAL AREA

Between 7:40 a.m. and 9:09 a.m. by Mode of Commute
And Autos per Household (adjusted)

Study Zones

Origin - 26102, 26103, 26104, 27002, 27003, 27004, 27005, 28206, 28210

Destination - 13, 21, 22, 24, 80, 394, 395, 396, 401, 402

Autos/H.H.	Bus		Auto		Total	
0	43	(91%)	4	(9%)	47	(100%)
1	213	(55%)	176	(45%)	389	(100%)
2	77	(29%)	193	(71%)	270	(100%)
3-8	8	(21%)	31	(79%)	39	(100%)
	341	(46%)	404	(54%)	745	(100%)
			144*		144*	
	341	(38%)	548	(62%)	889	(100%)

*Commented that auto was required for job.

With these modal split ratios and the car ownership data, it was possible to split the toal number of commuters in each aggregated zone into bus commuters and auto commuters.

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b. Preliminary Patronage Estimate

At this point, a computer program was written to produce origin-destination tables. In these tables, the number of commuters from each aggregated zone in Marin to each San Francisco aggregated zone was determined and then broken down into classifications of "autos per household." The number of those commuters who felt they needed their car for work were subtracted, and the factors developed from the Mill Valley modal split analysis were then applied to the remainder to estimate the bus patronage. (See Exhibit 27.)

The above estimate was made for all who reportedly started work between 8:00 a.m. and 9:09 a.m., subdivided by ten-minute intervals. The number of potential patrons for other hours was subsequently obtained in the following manner. A program was written which produced tables with the dimensions of origin, destination, and time. In other words, all the commuters (less those who needed cars for work) going from each Marin aggregate zone to each San Francisco aggregate zone were classified and enumerated according to the time they started work. The time intervals were every ten minutes of the entire day. The derived number of commuters for each origin-destination pair and for each time-interval was then reduced to the respective bus patronage by application of the modal split ratio obtained earlier for each origin-destination pair.

The same techniques were used in estimating the potential bus patronage for return trips.

All of the bus system patronage estimates so far have been based on the modal split of a portion of Greyhound's existing service. As mentioned earlier, this method of estimation does not take into consideration the possible effects upon patronage of the new and better buses and a fresh public image a new bus system could offer. This set of estimates was, therefore, applied to an alternative service configuration which utilizes the existing Greyhound fleet. Such a configuration is referred to as Plan I in this report.

If the proposed system utilizes new and better buses, the patronage would undoubtedly be greater. Although there were no concrete data with which to predict accurately the effects of new equipment and image, the staff's experience and the comparison of the performance of the Alameda-Contra Costa Transit service with that of Greyhound's Marin service indicated that factoring of the base figures by 1.2 and 1.5 would produce a range of patronage which a new system could easily secure. The lower estimates (1.2x) and higher estimates (1.5x) were subsequently used to design service configurations which are termed in this report Plan II and Plan III respectively.

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Exhibit 27

Estimated No. of Patrons
To S.F. by Origin Destination
Between 8:00 a.m. & 9:09 a.m.

Origin Marin Zone	Destination Financial District (3, 4, 6, 8, 13, 15)	Destination Firemans-CC (5, 10, 11, 16)	Destination UC-State (9, 14)
1.	79.49	33.36	0.98
2.	62.24	15.72	2.14
3.	88.64	28.02	1.64
4.	14.90	7.86	1.50
5.	51.42	14.56	1.04
6.	144.56	38.17	8.54
7.	25.72	14.61	1.04
8.	258.51	117.14	12.95
9.	29.42	4.04	0.52
10.	44.92	15.38	1.27
11.	42.79	15.13	2.34
12.	30.50	9.98	0.98
13.	108.54	48.33	4.47
14.	59.33	22.75	6.98
15.	38.01	14.93	3.32
16.	39.45	19.07	5.34
17.	89.91	31.15	4.04
18.	24.31	10.16	1.55
19.	28.18	4.45	0.38
20.	63.51	23.09	7.79
21.	25.13	6.54	1.04
22.	16.81	12.41	2.02
23.	24.70	9.82	1.04

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Exhibit 27 (Continued)

24.	13.64	17.09	5.07
25.	97.69	16.79	8.54
26.	14.65	6.47	0.52
27.	38.51	16.34	1.96
28.	38.83	7.18	0.89
29.	264.45	70.14	18.16
30.	138.33	67.44	6.54
31.	71.90	35.76	4.61
32.	429.25	118.07	27.92
33.	8.30	3.52	--
34.	56.19	14.65	3.86
35.	177.90	76.99	18.54
36.	48.51	12.48	4.61
37.	78.91	42.22	9.00
38.	145.52	65.99	20.95
39.	12.81	0.52	6.63
40.	14.41	3.98	-
41.	296.14	84.00	32.09
42.	32.81	13.41	0.52
43.	48.33	15.91	3.75
44.	23.36	17.97	0.52
	3452.15	1223.62	247.59

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c. Final Patronage Estimates

The patronage estimates described so far are all "potential" figures in that such numbers of commuters would take buses if convenient services are available to all of them. In other words, in order to carry all the "potential" riders, buses would have to be run at such times and places where the expected number of passengers was one or two.

In order for a bus operation to be reasonably economical, the number of passengers in a bus should not be too small. In preparing time schedules, a bus was assigned, in general, to a route where the potential patrons exceeded 35 at any given 10 minute interval, and only those potential patrons who would have convenient services available were recounted. As a rule, those potential patrons who would have to adjust their time more than 10 minutes or who would not get a seat in the bus were automatically discounted as not going to patronize the bus.

The patronage figures used in the financial analysis and elsewhere in the report are the final estimate figures. These figures might well be conservative due to the rather modest estimation of the effects of the better equipment and fresh image of the system in the first place, and, secondly, due to the highly intolerant attitides assumed on the part of potential riders.

The preliminary and the final estimate figures are summarized below:

The Preliminary and the Final
Estimates of Patronage
(One-Way Commute Trips)

	Greyhound	Plan I	Plan II	Plan III
Preliminary Estimate (Potential Patronage)	------	5,620	6,740	8,430
Final Estimate	------	4,511	6,102	8,014
Actual Patronage (1968)	3,800	-----	-----	-----

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4. Time Scheduling

There is a widely held notion that short headways, on frequent service, is synonymous with good service. This is valid where the trip pattern is time-wise very random such as in midday services, but not necessarily so for commute services where the desired arrival time is clearly defined. In scheduling buses, efforts were made to adjust the arrival and departure time of buses closely to the commuter's desired arrival and departure time.

In the process of estimating patronage, a complete break-down of potential bus riders by origin-destination pair and by ten-minute interval was made. The time interval indicates the approximate time (± 5 min.) by which the commuter has to arrive at his work place or at which he usually starts his return trip home.

As a rule, a bus was assigned to a route where the potential patronage exceeded 35 at any given 10 minutes interval. The seating capacity of the bus was assumed to be 52; therefore, when and where the potential patronage exceeded 87, a second bus was assigned.

The entire schedule was expressed at this stage by the arrival and departure time in San Francisco. (See Exhibits 28A, B, C, and 29A, B, C.)

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Exhibit 28A

Number of Buses, by Origin and Approximate Arrival Time at Financial District (F) and Civic Center (CC)

Plan I

Origin	Destination & Arrival Time (A.M.)														
	7:00		7:30		8:00		8:10		8:30		9:00		Totals		Combined
	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	Total
Novato	0	0	0	1	2	1	1	0	2	0	0	0	5	2	7
Ignacio	0	0	0	1	2	1	0	0	2	0	0	0	4	2	6
Terra Linda	1	0	0	1	2	1	1	0	2	0	0	0	6	2	8
Santa Venetia	0	0	0	0	1	0	0	0	1	0	0	0	2	0	2
So. San Pedro	0	0	0	0	1	0	0	0	1	0	0	0	2	0	2
Canal	0	0	0	0	1	0	0	0	1	0	0	0	2	0	2
Manor	0	0	0	0	1	0	0	0	1	0	0	0	2	0	2
Fairfax	0	1	1	0	2	1	0	0	1	1	0	1	4	4	8
Sleepy Hollow	0	0	0	1	1	1	0	0	1	0	0	0	2	2	4
Ross/Greenbrae	0	0	0	1	1	0	1	0	1	1	1	0	4	2	6
Corte Madera	0	0	1	0	1	1	1	0	2	0	1	0	6	1	7
E. Corte Madera/Alto	0	0	0	0	1	0	0	0	1	0	0	0	2	0	2
Tiburon	1	0	1	1	2	1	1	0	3	1	2	0	10	3	13
Mill Valley	1	0	0	1	2	1	1	0	1	1	1	0	6	3	9
Tam Valley	0	0	0	1	1	1	0	0	1	0	0	0	2	2	4
Sausalito	1	0	1	1	2	1	0	0	2	1	2	0	8	3	11
TOTALS	4	1	4	9	23	10	6	0	23	5	7	1	67	26	93
Combined TOTALS	5		13		33		6		28		8		93		

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Exhibit 28B

Number of Buses, by Origin and Approximate Arrival Time at
Financial District (F) and Civic Center (CC)

Plan II

Origin	Destination & Arrival Time (A.M.)												
	7:00		7:30		8:00		8:30		9:00		Totals		Combined
	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	Total
Novato	1	0	1	1	3	1	2	1	0	0	7	3	10
Ignacio	1	0	1	1	3	1	3	1	1	0	9	3	12
Terra Linda	0	1	1	1	4	2	2	1	0	0	7	5	12
Santa Venetia	0	0	0	0	1	1	1	0	0	0	2	1	3
So. San Pedro	0	0	0	1	1	1	1	0	0	0	2	2	4
Canal	0	0	0	0	1	0	1	0	0	0	2	0	2
Manor	1	0	1	1	2	0	1	0	1	0	6	1	7
Fairfax	0	0	0	0	2	1	1	1	0	0	3	2	5
Sleepy Hollow	0	0	0	0	1	1	2	0	0	0	3	1	4
Ross/Greenbrae	1	0	0	1	2	1	2	1	1	0	6	3	9
Corte Madera	1	0	1	0	2	1	2	1	1	1	7	3	10
E. Corte Madera/Alto	0	1	0	1	1	1	1	1	0	0	2	4	6
Tiburon	1	0	1	1	4	1	4	1	2	1	12	4	16
Mill Valley	0	1	1	1	2	1	3	1	1	0	7	4	11
Tam Valley	0	0	0	1	2	1	2	0	1	0	5	2	7
Sausalito	1	0	1	1	3	1	3	1	2	0	10	3	13
TOTALS	7	3	8	11	34	15	31	10	10	2	90	41	131
Combined TOTALS	10		19		49		41		12		131		

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Exhibit 28C

Number of Buses, by Origin and Approximate Arrival Time at Financial District (F) and Civic Center (CC)

Plan III

Origin	Destination & Arrival Time (A.M.)												
	7:00		7:30		8:00		8:30		9:00		Totals		Combined
	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	Total
Novato	1	0	1	1	4	1	2	1	1	0	9	3	12
Ignacio	1	0	1	1	3	1	3	1	1	0	9	3	12
Terra Linda	1	1	1	2	5	3	3	1	0	1	10	8	18
Santa Venetia	0	0	0	1	2	1	1	0	0	0	3	2	5
So. San Pedro	0	0	0	1	2	1	1	1	1	0	4	3	7
Canal	0	0	0	1	1	1	1	1	0	0	2	3	5
Manor	1	0	1	0	1	1	1	0	0	0	4	1	5
Fairfax	0	0	0	1	2	1	2	1	1	0	5	3	8
Sleepy Hollow	0	0	0	1	2	1	2	0	0	0	4	2	6
Ross/Greenbrae	1	0	1	1	3	1	2	1	1	1	8	4	12
Corte Madera	1	0	1	1	3	1	3	1	1	1	9	4	13
E. Corte Madera/Alto	0	0	0	1	1	1	1	1	1	0	3	3	6
Tiburon	1	0	2	1	5	2	5	1	3	0	16	4	20
Mill Valley	0	1	1	1	2	2	4	1	1	1	8	6	14
Tam Valley	0	1	0	1	2	1	1	1	1	0	4	4	8
Sausalito	1	0	1	1	3	1	3	1	2	1	10	4	14
TOTALS	8	3	10	16	41	20	35	13	14	5	108	57	165
Combined TOTALS	11		26		61		48		19		165		

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Exhibit 29A

Number of Buses, by Destination and Approximate Time of Departure from Financial District (F) And Civic Center (CC)

Plan I

Destination	Origin and Departure Time (P.M.)												
	4:00		4:30		5:00		5:30		6:00		Totals		Combined
	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	Total
Novato	0	0	1	1	2	1	1	0	1	0	4	3	7
Ignacio	0	0	0	2	2	1	1	0	0	0	3	3	6
Terra Linda	1	0	1	2	2	1	1	0	0	0	5	3	8
Santa Venetia	0	0	0	0	1	0	1	0	0	0	2	0	2
So. San Pedro	0	0	0	0	1	0	1	0	0	0	2	0	2
Canal	0	0	0	0	1	0	1	0	0	0	2	0	2
Manor	0	0	0	0	1	0	1	0	0	0	2	0	2
Fairfax	0	1	2	0	2	1	1	0	0	1	5	3	8
Sleepy Hollow	0	0	0	2	1	1	1	0	0	0	2	3	5
Ross/Greenbrae	0	0	1	2	1	0	1	1	1	0	4	3	7
Corte Madera	0	0	2	0	1	1	1	0	1	0	5	1	6
E. Corte Madera/Alto	0	0	0	0	1	0	1	0	0	0	2	0	2
Tiburon	1	0	2	2	2	1	2	1	1	0	8	4	12
Mill Valley	1	0	1	2	2	1	1	0	1	0	6	3	9
Tam Valley	0	0	0	2	1	1	1	0	0	0	2	3	5
Sausalito	1	0	2	1	2	1	1	1	1	0	7	3	10
TOTALS	4	1	12	16	23	10	17	3	6	1	61	32	93
Combined TOTALS	5		28		33		20		7		93		

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Exhibit 29B

Number of Buses, by Destination and Approximate Time of Departure from Financial District (F) And Civic Center (CC)

Plan II

Destination	Origin and Departure Time (P.M.)												
	4:00		4:30		5:00		5:30		6:00		Totals		Combined
	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	Total
Novato	1	0	2	2	3	1	1	0	0	0	7	3	10
Ignacio	1	0	2	2	3	1	2	0	1	0	9	3	12
Terra Linda	0	1	2	2	4	2	1	0	0	0	7	5	12
Santa Venetia	0	0	0	0	1	1	1	0	0	0	2	1	3
So. San Pedro	0	0	0	1	1	1	1	0	0	0	2	2	4
Canal	0	0	0	0	1	0	1	0	0	0	2	0	2
Manor	1	0	1	1	2	1	1	0	1	0	6	2	8
Fairfax	0	0	0	0	2	1	1	1	0	0	3	2	5
Sleepy Hollow	0	0	0	1	1	1	1	0	0	0	2	2	4
Ross/Greenbrae	1	0	0	2	2	1	1	1	1	0	5	4	9
Corte Madera	1	0	2	1	2	1	1	1	1	0	7	3	10
E. Corte Madera/Alto	0	0	2	1	1	1	1	0	0	0	4	2	6
Tiburon	1	1	2	2	3	1	3	1	1	0	10	5	15
Mill Valley	0	1	2	2	2	1	1	1	1	0	6	5	11
Tam Valley	0	0	0	2	2	1	1	0	1	0	4	3	7
Sausalito	1	0	2	1	3	1	3	1	1	0	10	3	13
TOTALS	7	3	17	20	33	16	21	6	8	0	86	45	131
Combined TOTALS	10		37		49		27		8		131		

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Exhibit 29C

Number of Buses, by Destination and Approximate Time of Departure from Financial District (F) And Civic Center (CC)

Plan III

Destination	Origin and Departure Time (P.M.)												
	4:00		4:30		5:00		5:30		6:00		Totals		Combined
	F	CC	F	CC	F	CC	F	CC	F	CC	F	CC	Total
Novato	1	0	2	1	4	1	1	1	1	0	9	3	12
Ignacio	1	0	2	2	3	1	2	0	1	0	9	3	12
Terra Linda	1	1	2	3	5	3	2	1	0	0	10	8	18
Santa Venetia	0	0	1	1	1	1	1	0	0	0	3	2	5
So. San Pedro	0	0	1	2	2	1	1	0	0	0	4	3	7
Canal	0	0	1	1	1	1	1	0	0	0	3	2	5
Manor	0	0	1	1	1	1	1	0	0	0	3	2	5
Fairfax	0	0	1	2	2	1	1	1	0	0	4	4	8
Sleepy Hollow	0	0	1	1	2	1	1	0	0	0	4	2	6
Ross/Greenbrae	1	0	2	2	3	1	1	1	1	0	8	4	12
Corte Madera	1	0	2	2	3	1	2	1	1	0	9	4	13
E. Corte Madera/Alto	0	0	1	2	1	1	1	0	0	0	3	3	6
Tiburon	1	0	4	2	5	2	3	1	2	0	15	5	20
Mill Valley	0	1	2	2	2	2	2	1	1	1	7	7	14
Tam Valley	0	1	1	2	2	1	1	0	0	0	4	4	8
Sausalito	1	0	2	2	3	1	2	1	1	1	9	5	14
TOTALS	7	3	26	28	40	20	23	8	8	2	104	61	165
Combined TOTALS	10		54		60		31		10		165		

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5. Routing

a. Origin and Destination Distribution

From the questionnaire survey, data on the geographic distribution of the commute trip origins and destinations were obtained.

As illustrated in Exhibit 30, trip origins in Marin are concentrated in the eastern portion of the County along Highway 101. This pattern is consonant with residential population distribution, except that commuters are more heavily concentrated in the southern portions of Marin.

It was noted that many areas, in particular, the east-central and northern portions of the County where an estimated 8,000 commuters live, are very poorly served by public transit at present.

The trip destinations in San Francisco, as illustrated in Exhibit 31, are found mainly in the Financial District and to a lesser extent around the Civic Center. These two areas are currently served by Greyhound buses. There are also sizable concentrations of trip destinations at Presidio and around the California St./Presidio Ave. intersection, which are not served by Greyhound.

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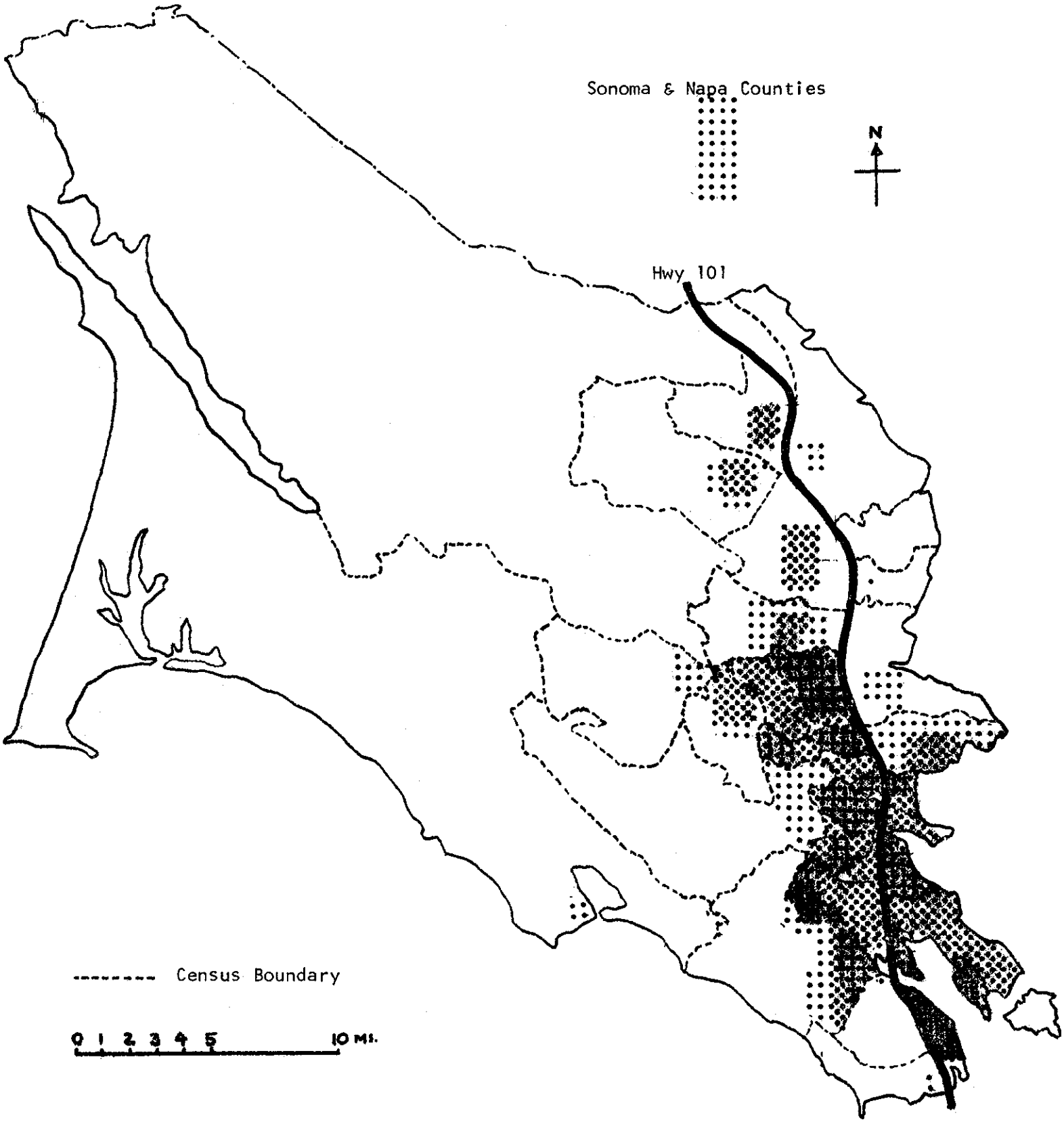
EXHIBIT 30

Distribution of San Francisco-Bound Commuter Trip Origins
By Census Tract 1968

One dot represents ten questionnaire responses, or approximately 28 commuters.



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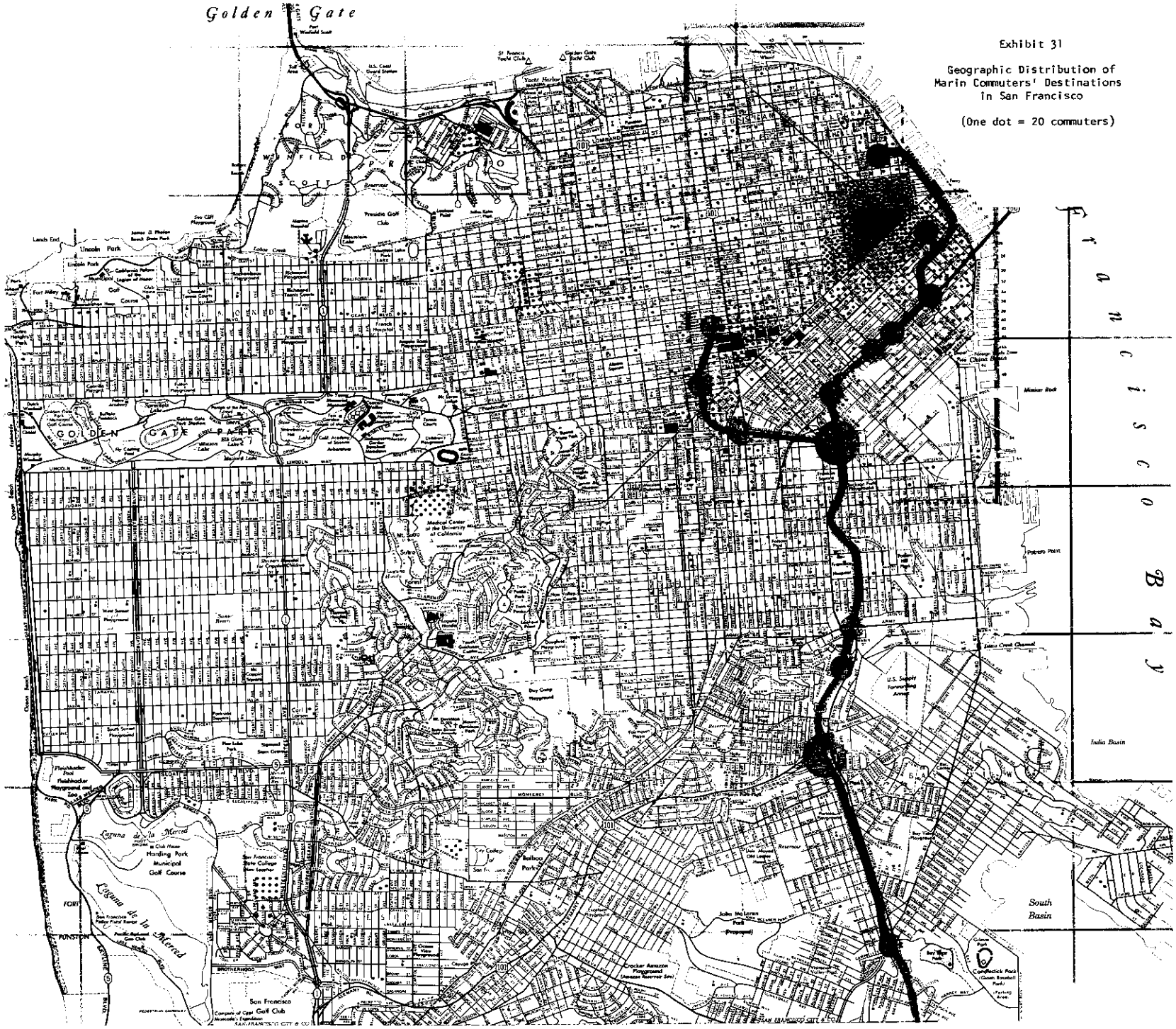
Golden Gate
Lands End
Lincoln Park
Presidio Golf Club
GOLDEN GATE PARK
Medical Center of the University of California
Laguna de la Merced
Harding Park Municipal Golf Course
San Francisco State College
City College
Balboa Park
Cow Palace
Candlestick Park
India Basin
South Basin
Mission Rock
Potrero Point
Islais Creek Channel
U.S. Supply Forwarding Annex
Reservoir
Crocker Amazon Playground
San Francisco Golf Club
Fisherman's Wharf
Ocean Beach
Fort Mason
Golden Gate Yacht Club
St. Francis Yacht Club
Yacht Harbor
Presidio Golf Club
Sea Cliff Playground
Fulton Creek
Mountain Lake
Stow Lake
Spreckels Lake
Mission Lake
Rifle Range Lake
Lake Merced
Fort Funston
Fort Miley
Fort Mason
Fort Winfield Scott
Fort Point
Fort Baker
Fort Cronkhite
Fort Funston
Fort Miley
Fort Mason

b. Routing in Marin

After examining the pattern of trip origin distribution in Marin, three alternative routing principles that are generally applicable to Marin were scrutinized as to their relative merits. These three principles are as follows: (See also Exhibit 32.)

Principle A

This is essentially a single-route system where buses go through all populated areas, collecting passengers and carrying them to their destinations.

When the destinations are concentrated at the end of the route, as in the case of the Marin-San Francisco commute line, this principle is disadvantageous primarily because of the long trip time for the majority of passengers.

This principle is advantageous, however, where short trips of random origins and destinations constitute the bulk of total transit demand.

In Marin, at present, Greyhound's San Rafael/Ross/Sausalito/San Francisco (7th St.) route is a conspicuous example of the application of this principle.

Principle B

This is a multiple-route operation in which each community (trip origin concentration) is connected to the metropolitan center (trip destination concentration) independently from other communities.

This principle offers potentially the most direct and fastest service between an origin and a destination and, as such, is a highly attractive solution for the commuter journey.

In order for this principle to be applicable, each "trip origin concentration" must be large enough to warrant a minimum acceptable load-factor for each bus to be run from it, and for this reason a "trip origin concentration" may encompass more than one "community" in a colloquial sense.

Greyhound's present Mill Valley-San Francisco route is a partial example of this routing system.

Principle C

This is a hierarchical route operation in that it consists of a primary trunk route and secondary feeder routes which serve the former.

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Exhibit 32

THREE PRINCIPLE OF ROUTING

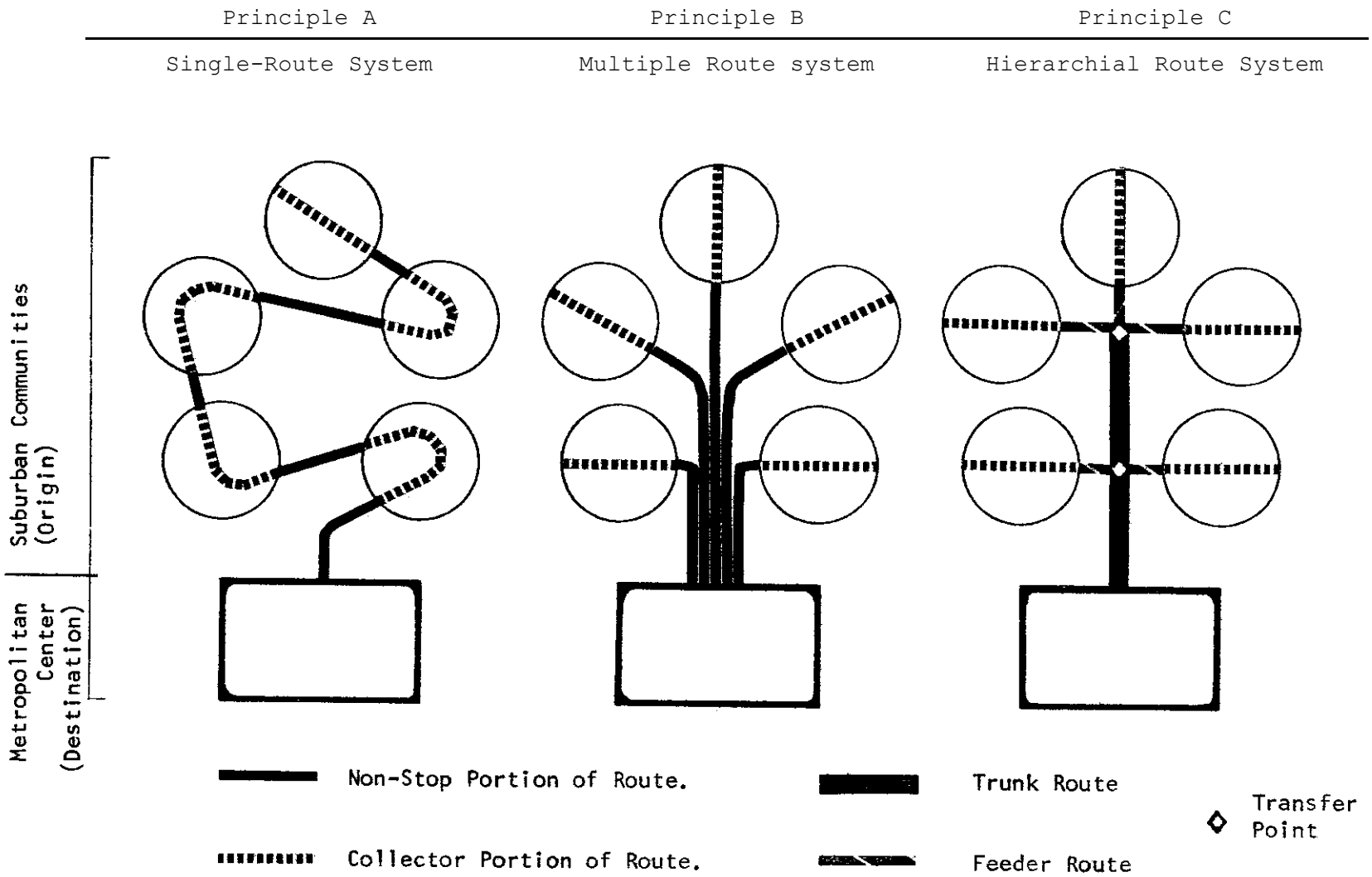

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Exhibit 33

DESCRIPTION OF COMMUTER BUS ROUTES IN MARIN COUNTY

Route Designation	Local Streets & Roads Served
1. Novato	San Marin Drive Novato Blvd. South Novato Blvd. to Hwy. 101
2. Terra Linda	A. Ignacio (Bridge Drive, Alameda de la Loma, Alameda del Prado), Hwy. 101, Marinwood (Miller Creek Rd., Las Gallinas Ave.), Manuel T. Freitas Parkway, Marin County Civic Center to Hwy. 101
	B. Las Ovejas Ave., Del Ganado Rd., Manuel T. Freitas Pkwy., Las Gallinas Ave., Los Ranchitos Rd. to Hwy. 101
3. San Rafael	A. Santa Venetia (La Pasada, North San Pedro Rd.), Civic Center, Grand Ave., San Rafael Greyhound Depot, to Hwy. 101
	B. Peacock Gap (Biscayne Dr.), South San Pedro Rd., 3rd St., San Rafael Greyhound Depot to Hwy. 101
	C. Sleepy Hollow (San Domenico School, Butterfield Rd.), Sir Francis Drake Blvd., Red Hill Ave., Fourth St., Second St. (alternatively, Third St. for return trip), San Rafael Greyhound Depot to Hwy. 101
	D. (Inverness, San Geronimo Valley), Manor, Fairfax (Sir Francis Drake Blvd.), Center Blvd., Red Hill Ave., Fourth St., Second St. (alternatively Third St. for return trip), San Rafael Greyhound Depot to Hwy. 101
	E. Fairfax (Cascade Park) Bolinas Ave., Broadway, Center Blvd., Red Hill Ave., Fourth St., Second St. (alternatively Third St. for return trip), San Rafael Greyhound Depot to Hwy. 101
	F. Canal St. (at Medway Rd.), Fairfax Rd., Kerner Blvd., Bellam Blvd., Woodland Ave., B St., Second St. (alternatively Third St. for return trips), San Rafael Greyhound Depot to Hwy. 101

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With a system based on this principle, most passengers have to transfer between the trunk route and the feeder route, experiencing some time-loss and inconvenience. Therefore, in order for such a system to be competitive, the trunk route portion of the system should offset the transfer disadvantages by virtue of fast, frequent and dependable service. It is for this reason that most applications of this principle are seen in rail rapid transit operations where trains act as the trunk route carrier and private automobiles and local buses act as feeders.

In Marin, where it is envisaged that a rail rapid transit system may eventually be implemented, and there already exists a railroad right-of-way[1] going through the populated areas, application of this principle deserves careful study even if express buses are to be used as the interim trunk route mode. However, immediate implementation of such a system is extremely difficult due to the large amount of work involved in converting the rail bed and/or buses to fit such an operation.

* * * * * *

Since only Principle B offers a potentially viable system capable of early implementation, application of this principle to the local situation of Merin was studied in depth.

First of all, the inadequate route pattern of the existing Greyhound service was replaced by a series of new collector routes including those to East Corte Madera, Canal/Bret Harte, Peacock Gap, Santa Venetia, Terra Linda, Marinwood, Ignacio, and residential areas of Novato.

Apart from the basic requirement in Principle B that the collector portion of each route offers a reasonable load factor for buses, the collector portion should be so arranged that the majority of passengers may board at or near the inner end of such portion in order that average passenger travel time is minimized.

In planning new bus routes, care was taken to arrange the routes so that this passenger collection pattern would be realized. For example, passengers from Santa Venetia, who are now served by buses originating in Novato, would be collected by San Rafael-San Francisco route buses originating in Santa Venetia and calling at the San Rafael main bus stop as the last collection stop.

From a generalized route scheme, a number of alternative roads and streets were chosen for each route. These were subsequently narrowed down to a few, The final selection was made after actually testing alternative roads and streets with a 102-inch wide, 40-foot long, 53-passenger bus, provided for this purpose by Western Greyhound Lines.

The resulting pattern of routes is described in Exhibits 4 and 33.

[1]The Northwestern Pacific Railroad furnished an intensive electrified commuter service to a ferry connection to San Francisco prior to 1942.

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4.	Ross/Greenbrae	Ross Ave., Sir Francis Drake Blvd. to Hwy 101
5.	Kent/Corte Madera	College Ave., Magnolia Ave., Tamalpais Drive to Hwy. 101
6.	East Corte Madera	Paradise Dr. (at Hind Passage), Hwy. 101, East Blithdale Ave., Tower Dr., Meadow Dr., East Blithdale Ave. to Hwy. 101
7.	Belvedere/Tiburon	San Rafael Ave. (at West Shore Rd.), Beach Rd., Tiburon Blvd. to Hwy. 101
8.	Mill Valley	Mill Valley Greyhound Depot, Miller Ave., Almonte Blvd., Hwy. 1 to Hwy. 101
9.	Tam Valley	(Bolinas, Stinson Beach), Shoreline Hwy (at Ash St.) to Hwy. 101
10.	Marin City/Sausalito	Marin City Greyhound Station, Bridgeway, 2nd St., South St., to Hwy. 101

(See also Exhibit 4)

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c. Routing in Sonoma

The number of commuters from Sonoma County to San Francisco is estimated to be around 1,900 or only about 6% of the total commuters crossing the Golden Gate Bridge.

Santa Rosa is the northernmost city that generates a significant volume of commute trips to San Francisco. According to the District's questionnaire survey, an estimated 600 people commuted from Santa Rosa to San Francisco. Petaluma, the second largest city in Sonoma County after Santa Rosa, generates more commute trips to San Francisco because of its shorter distance to San Francisco. The number of commuters from Petaluma to San Francisco is estimated to be 800, or 42% of the total Sonoma commuters to San Francisco.

Due to the relatively small number of expected commute bus patrons and also to the linear distribution of commute trip origins along Highway 101, a single-route pattern was selected for application to Sonoma County.

As illustrated in Exhibit 34, the route starts in downtown Santa Rosa, then follows Highway 101 to Rohnert Park, off Highway 101, through the towns of Cotati and Penngrove and the city of Petaluma, until it rejoins Highway 101 south of Petaluma.

The Planning and Public Works Departments of Sonoma County as well as Santa Rosa kindly provided District staff with information and advice concerning the route selection.

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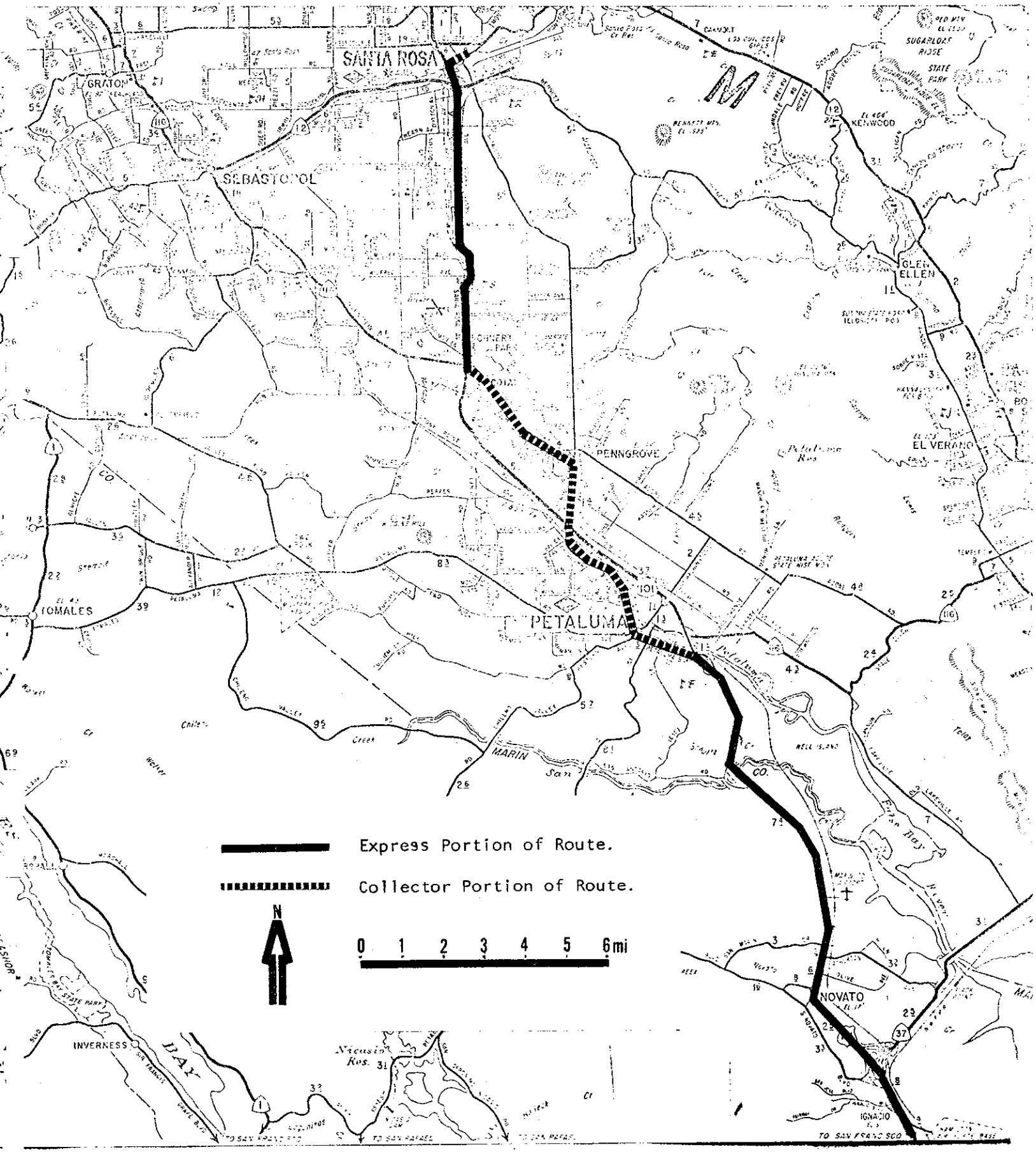
Exhibit 34

PROPOSED COMMUTER BUS ROUTES IN SONOMA COUNTY



d. Routing in San Francisco

The major concentrations of Marin commuter trip destinations in San Francisco are as follows:

Destination Area	Estimated Number Of Marin Commuters
Financial District	12,000
Civic Center & Vicinity	3,600
Presidio	1,300
California St. & Presidio Ave.	1,000
U.C. Medical Center	700
S.F. State College	600

The main objective of route design for San Francisco was to select the fastest corridors to the major destination concentrations. The problem, however, was complicated by the fact that some destination concentrations did not warrant service individually. Attempts were then made to design a routing pattern in which a single route serves more than one destination concentration. Presidio, Presidio Ave. at California St., and Civic Center were thus connected by a single route.

The destination concentration in the Financial District was large enough to warrant a separate route.

Possible service to the University of California Medical Center and San Francisco State College was carefully examined on the basis of distance, running time, patronage estimates, and bus requirements. It was concluded after the examination that a way should be sought to provide a joint service with the San Francisco Municipal Railway, whereby commuters to these destinations would be transferred to Muni buses at the Golden Gate Bridge or a nearby location. Additional work in this area is required.

After the aforementioned series of studies, a two-route system was devised for the commuter hour service: one route serving the Financial District and continuing to the Civic Center; the other route serving the Presidio, Presidio Ave., and Civic Center, and terminating in the Financial District. The overlap of the route between Financial District and Civic Center was found necessary in order to eliminate the need for a major transfer facility at the Golden Gate Bridge that would otherwise be required.

In selecting streets for the Financial District route, an analysis was made concerning the modal split change as a function of the walking distance of bus commuter at the destination end. The objective of this analysis was to determine whether the existing Embarcadero/Ferry Building route of Greyhound should be shifted in the new system to the center of the Financial District, about half a mile west of the Ferry Building Terminal.

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A regression analysis was made on the modal split of Marin commuters working in the Financial District. The result of the analysis, as shown in Exhibit 35, demonstrates that a small increase in the distance between the bus terminal and the commuter's work place greatly discourages him from taking a bus. Conversely, it suggests that a substancial increase in patronage could result if the route were shifted closer to the commuter's work place.

A hypothetical route through Montgomery Street, which is approximately the center of the Financial District, was chosen, and the regression line was applied to the condition thereof in order to measure the possible effects of the re-routing. As seen in Exhibit 36, the examination showed that a 50% increase in bus patronage could result from moving the route from the Ferry Building area to the Montgomery Street area.

Thus, routing of buses through the central portion of the Financial District was deemed to be essential for the success of the system. This view received qualified support from the Traffic Engineering staff of the San Francisco Public Works Department, who suggested the Sansome St./Battery St. pair as the optimum route.

A detailed description of the proposed routes in San Francisco is shown in Exhibits 5 and 37.

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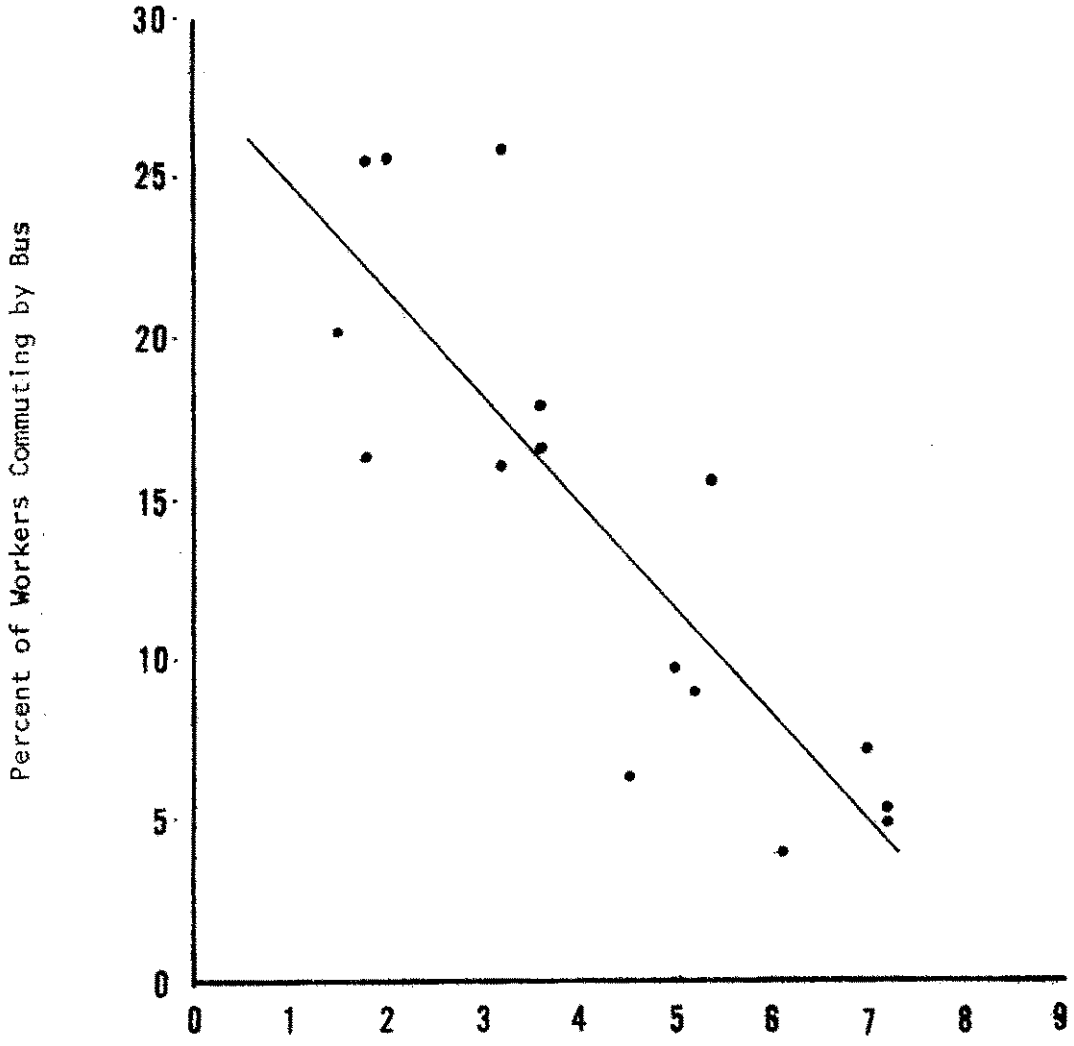
Exhibit 35

Modal Split vs. Bus Terminal to Destination Distance

Correlation coefficient = 0.85
95% Confidence interval -3.32 ± 0.84



Thousands of Feet From Bus Terminal
To Work Location

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Exhibit 36

Bus Riders, As % of Total Commuters, By S. F. Bus Route

S.F. Zone	Total Commuters %	Work Distance From (1000's ft.) Ferry	Work Distance From (1000's ft.) Montg.	% Bus (From Regression Curve) Ferry	% Bus (From Regression Curve) Montg.	% of Commuters by Bus Ferry	% of Commuters by Bus Montg.
12	3.1	7.0	2.3	5.0	20.8	0.2	0.6
13	8.1	5.2	3.1	11.1	18.0	0.9	1.5
21	20.8	3.2	0	17.8	28.4	3.7	5.9
22	10.1	1.6	1.1	23.0	24.8	2.3	2.5
23	6.7	5.0	1.3	11.7	23.9	0.8	1.6
24	8.9	3.6	0	16.5	28.4	1.5	2.5
32	3.0	7.2	3.2	4.5	17.8	0.1	0.5
51	2.1	6.1	2.5	8.1	20.0	0.2	0.4
52	2.6	4.5	1.4	13.1	23.7	0.3	0.6
392	1.7	7.2	3.2	4.5	17.6	0.1	0.3
393	3.6	5.4	1.4	10.3	23.7	0.4	0.9
394	8.2	3.6	0.5	16.5	26.8	1.4	2.2
395	8.9	1.8	2.5	22.1	20.0	2.0	1.8
396	1.5	1.8	3.8	22.1	15.7	0.3	0.2
401	4.9	3.2	0	17.8	28.4	0.7	1.4
402	5.4	2.0	1.1	21.8	24.8	1.2	1.3
	100%					16.3	24.2
					Index	100	148

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Exhibit 37

DESCRIPTION OF COMMUTER BUS ROUTES IN SAN FRANCISCO

Route Designation	Local Streets Served
Financial District	Golden Gate Bridge, Doyle Dr., Richardson Ave., Lombard St., Van Ness Ave., North Point St., The Embarcadero, Battery St., (return on Sansome St.) to Market St.
Presidio/Geary/Civic Center	Golden Gate Bridge, Lincoln Blvd., Presidio Blvd., Presidio Ave., Geary Expressway, Van Ness Ave., Golden Gate Ave. (alternatively McAllister St. for return trip) to Market St. at Sansome St.

(See also Exhibit 5)

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6. Mid-Day/Weekend Service

Beside the highly visible tide of commuter traffic that flows southward in the morning and northward in the evening over the Golden Gate Bridge, there is a random pattern of traffic within and out of Marin County during the day, in late evenings and on weekends. These trips consist mainly of shopping trips, social trips, recreational trips, business trips, work and school trips within the County, and some irregular commute trips to and from San Francisco. A bus service that caters to these miscellaneous trips is referred to in this report as the Mid-Day/ Weekend Service. The choice of this term is for the sake of convenience, for it really operates not only in mid-day but also in the morning, evening, and late night.

As long as most of these miscellaneous trips begin or end at home, the overall pattern of trip corridors should not differ much from that of commute trips. This is particularly true in Marin County, which is predominantly residential and where most communities are served by a single major road.

There are, however, some differences, too. First of all, these miscellaneous trips are extremely random in origin-destination combination, in trip direction, and in trip hour. A bus service catering to these trips should therefore be such that one can take a bus practically at any time of the day and go practically anywhere in the County and to San Francisco.

Another difference is that a major portion of these miscellaneous trips are non-essential and non-repetative trips and, therefore, their volume is determined largely by the ease or difficulty of travel by available means. In other words, where an improved public transport service is available, more trips may be generated. Viewed in this way, the Mid-Day/Weekend Service can greatly help strengthen the community integrity of the area it intensively serves.

On the aforementioned understandings and with practical considerations as to the operation of bus service, a service pattern was devised whereby buses provide frequent shuttle service in a community (or a group of communities), connecting residential areas to the center of the community. These centers are then connected to each other and finally to San Francisco by a trunk route.

At a glance this pattern resembles Principle C of suburban commute transit routing alternatives which was discussed earlier. (See Exhibit 32.) However, this Mid-Day/Weekend service route pattern is aimed to provide first of all, a frequent service within a community and between communities within the County. It is in this sense essentially an intra-county service.

The streets selected as the routes are for most part identical with the collector portions of the commute service routes. This is because the corridor pattern of miscellaneous trips is very similar to that of commute trips, and also to maintain an identity with the commute service, thereby avoiding unnecessary confusion on the part of the user.

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The trunk route of the Mid-Day/Weekend service differs slightly from the express portion of the commute routes in that the former makes local connections off Highway 101 at south Novato, Northgate Shopping Center, downtown San Rafael, Corte Madera Shopping Center, Strawberry Shopping Center and Marin City. In San Francisco, the non-commute trunk route makes a complete loop through the downtown areas, alternatively clockwise and counter-clockwise.

A time schedule was prepared that provides for an average 30-minute headway. As mentioned earlier, reasonable headway is desirable in the Mid-Day/Weekend service where a major design criterion is frequent service to meet time-wise random demands.

The routing scheme and time schedule for the Mid-Day/Weekend service are described in Exhibits 7, 8, 38A and B.

As for the patronage estimates, gross figures for the service as a whole were estimated from comparable Greyhound data even though individual route estimates were unknown. Although this procedure might be somewhat inexact, it was the only available means and was not likely to distort the total picture. Through careful monitoring, proper adjustments can be made after the operation begins.

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Exhibit 38A

Mid-Day/Weekend Marin County Service Routes

Route Designation		Route	Headway 6 A.M. - 9 P.M.
0. Marin-San Francisco		Highway 101 at South Novato Blvd. to Northgate Shopping Center to downtown San Rafael to Corte Madera Shopping Center, Strawberry Shopping Center to Marin City to San Francisco.	20 min.
1. Novato		San Marin Drive Novato Blvd. South Novato Blvd. to Highway 101	30 min.
2. Terra Linda	A.	Ignacio (Bridge Dr., Alameda de la Loma, Alameda del Prado), Highway 101, Marinwood (Miller Creek Road, Las Gallinas Avenue), Northgate Shopping Center.	30 min.
	B.	Las Ovejas Avenue, Del Granado, Manuel T. Freitas Pkwy., Northgate Shopping Center, Civic Center, North San Pedro Rd., La Brea Way.	20 min. - 30 min.
3. San Rafael	A.	Peacock Gap (Biscayne Dr.), South San Pedro Rd., 3rd Street, San Rafael Depot.	30 min.
	B.	Manor, Fairfax, Sir Francis Drake Blvd., San Rafael Depot.	30 min. - 40 min.
	C.	Canal Street (at Medway Rd.) Fairfax Road, Kerner Blvd., Bellam Blvd., Woodland Ave., B Street, San Rafael Depot.	20 min. -
4. Ross Valley/Corte Madera		San Anselmo (Ross Ave.), Sir Francis Drake Blvd., Bon Air Road, Larkspur (Magnolia Ave.), Corte Madera (Tamalpais Ave.), Corte Madera Shopping Center, East Corte Madera (Paradise Drive and Golden Hinde Passage).	30 min. - 45 min.
5. Tiburon/Mill Valley		San Rafael Ave (West Shore Road) Beach Road, Tiburon Blvd., Strawberry Shopping Center, East Blithdale, Mill Valley Depot.	20 min. - 30 min.
6. Tam Valley/Sausalito		Shoreline Highway (Ash St.), Highway 101, Marin City, Sausalito (Bridgeway).	30 min.

Headway 9:00 P.M. to 1:30 A.M. (see Also Exhibit 7.)

Trunk Route 30 minutes.
All Feeder Routes 60 minutes.

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Exhibit 38B

Mid-Day/Weekend
San Francisco Service Routes

Golden Gate Bridge, Lombard, Van Ness, North Point, Bay Street, The Embarcadero, Battery Street (or Sansome St.), Market Street, McAllister Street (or Golden Gate Ave.), Van Ness Avenue, Geary Blvd., Presidio Blvd., Lincoln Blvd., Golden Gate Bridge.

The above route is alternately run clockwise and counter-clockwise.

(See also Exhibit 8)

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B. EQUIPMENT

The major items of equipment to be purchased or leased for the proposed bus system are as follows:

Item	Quantity
Buses	106 to 186, depending on plan
Fare Collection Devices	106 to 186, depending on plan
Surveillance Cars	4
Two-way Radio System	4 radios for surveillance cars and 1 console for the central dispatching office
Garage Equipment & Tools	As required
Office Furniture & Equipment	As required

This section of the report describes in particular the recommendations on the selection of buses, fare collection devices, and two-way radio system, and design treatment of publicly-exposed equipment, facilities and materials.

As for the surveillance cars, it is not necessary to prepare specifications, since practically any production model of U.S. automobiles can meet the requirements.

Specifications for garage equipment and tools should be prepared after the final selection of buses is made.

It is also premature and unnecessary to prepare detailed recommendations for acquisition of office furniture and equipment.

1. Buses

a. Greyhound Buses

A basic choice that has to be given consideration is whether the proposed system should use a new fleet of buses or the old Greyhound buses which may be made available once the Greyhound service is displaced by the proposed system.

All of the three reports that have been written on the transit problem between Marin and San Francisco, namely, the Fanning Report, the Coverdale & Colpitts Report, and the Jenkins Report, recommended against the use of Greyhound buses, except as a transient solution, for a new commuter service.

Greyhound currently uses 95 buses for its Marin County service. These buses are drawn from a common pool of 205 buses, shared by the Marin County and Peninsula services of Greyhound.

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The aforementioned fleet of 205 buses consists of the following:

Model	Number of Buses	Seating Capacity	Year Manufactured	Age of Bus in 1969
GMC TDM-5103	37	53	1951	18
GMC TDM-4801	65	50	1954	15
GMC TDM-4515	15	45	1955	14
Mack C-49	28	51	1957	12
GMC TDM-5303	60	53	1965	4

As can be seen from the above, 117 of the 205 buses, or 57% of the total fleet, are over 14 years old. Coverdale & Colpitts in its report states that fourteen to fifteen years is a reasonable service life on Marin County routes[1], and cites that the California Public Utilities Commission adopted a 14-year life as a reasonable one for buses in the Bay Area.[2]

Furthermore, all these 205 buses are of the single-door transit type with low-back seats. Though the single-door is preferable to the double-door arrangement in suburban commute buses, the low-back transit type seats are not comfortable for long rides that are characteristic of Marin-San Francisco runs.

Western Greyhound Lines apparently practices the highest level of maintenance on the mechanical parts of buses, but due to age the appearance and interior furnishings of most buses are no longer attractive.

The poor appearance and discomfort of the buses seem to be a major cause of the indifference of many people to Greyhound service.

For the aforementioned reasons, it is advisable to avoid using Greyhound buses in the proposed bus system except, as earlier reports also indicated, as the fleet for a transitional plan (Plan I) with a definite program to replace them with new buses within a year of operation.

Even such a temporary use of Greyhound buses is not free from the risks of high maintenance costs, set-up costs (for repainting bodies), and, above all, the possible adverse effects on the public image of the new transit operation.

b. New Buses

The proposed bus system will sooner or later have to be run with a completely new fleet, and such a fleet should consist of buses that best meet the operational requirements of the proposed system.

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[1]Coverdale & Colpitts, "Report on Public Transportation in County of Marin," p. 13.

[2]Op. cit. p. 14

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Although the proposed system is comprised of a number of separate routes, the operational requirements on each route are similar, facilitating the use of a basically uniform fleet. Such a fleet has many advantages: interchangeability of buses among routes, minimum number of spare buses required, minimum inventory of replacement parts, ease of maintenance, and so on.

A minor variation may be permitted in a basically uniform fleet by including a shorter wheel-base version of the standard bus. The "shorter" bus should have parts interchangeable with the standard bus, but a shorter wheel-base, shorter body, and fewer seats. The use of such "shorter" buses may make sense on some routes, particularly those serving West Marin, where better maneuverability is desired.

Selection of the basic type of bus for the fleet must take into consideration a number of factors, including price, maintenance requirements, performance characteristics (such as acceleration, braking, and hill-climbing ability), design characteristics (such as exterior dimensions, number of seats, seat and aisle widths, number of doors, and door width), and, last but not least, aesthetics and detail finish. These as well as other significant factors concerning the available types of buses have to be examined against legal constraints, the requirements arising from transit system characteristics, financial considerations, and "market characteristics" of the potential riders.

As the initial step in narrowing the choice of bus, brief specifications for design and performance were prepared after studying the operation characteristics of the proposed system and the California Vehicle Code. Generally available types of buses were also examined so that the specifications would not become unrealistic.

The basic specifications and the reasons for setting them are as follows:

SPECIFICATIONS	REASONS
<u>Body Dimensions</u>	
Overall Length: 40' or slightly less	Maximum passenger capacity within the legal maximum length of 40 ft. (cf., California Vehicle Code, Sec. 35400)
Overall Width: 104" maximum 96" minimum	Sufficient width for four seats abreast and an aisle, within the legal maximum of 104" (cf., C.V.C. Sec, 35106)
<u>Seating</u>	
Capacity: 48-53	Maximum seating capacity within the body dimension limits, with seating comfort and ample aisle width.

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Arrangement: All transverse (forward facing)	Comfort for long trip
Design: High-back seats	Comfort for long trip
<u>Passenger Door</u>	
Number: One at front	A two-door feature is unnecessary because there will be few instances of simultaneous boarding and alighting of passengers at stops. Front positioning for better surveillance and safety.
Design: Fold-in type	Safety
Width: 27" minimum	Easy passage by a person with a briefcase or crutches.
<u>Step Height</u>	
Ground to first step: 15' maximum	Easy boarding and alighting
<u>Accessories</u>	
Air conditioner	Some 19 days a year the temperature exceeds 90° in parts of Marin. Air conditioners are becoming standard equipment on suburban buses, e.g., GMC, S8M53A.
Public address system	Better service for passengers
<u>Performance</u>	
Cruising speed: 65 mph	Expected cruising speed on the trunk route.
<u>Axle Load</u>	
Maximum gross weight on any axle: 18,000 lbs.	California Vehicle Code Sec. 35550
<u>Underframe</u>	
Underframe should be such that rail-bus conversion kit can be mounted with minor modifications on bus.	Possible use of N.W.P.R.R. right-of-way as the transit trunk route.

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Fifteen makes[1] of domestic and foreign buses were examined against the basic specifications. Among these, three models (GMC S8M-5303A, Flxible 171-CD-D8-1 and Mercedes Benz 0.302-40)[2] were found to meet the basic specifications set forth and to be readily available in this area. The particulars of the said three models are described in Exhibit 39.

Final selection of the bus should be made after consultation with transit vehicle experts who are knowledgeable regarding operational and maintenance aspects of buses. Also before the final selection, negotiations should be held with prospective manufacturers for possible improvements of the vehicle to suit the particular operational environment of Marin.

Once the Optimum Bus System, Plan II or III, is approved for implementation, the District staff in collaboration with outside experts should start negotiating with a selected number of bus manufacturers, and within a month the final recommendation on the choice of bus should be made.

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[1]D.A.F. (Netherlands), Den Oudsten & Zoner (Netherlands), Duple (U.K.), Fiat (Italy), Flxible (U.S.A.), G.M.C. (U.S.A.), Leyland (U.K.), Mercedes-Benz (Germany), Metro-Cammell-Weyman (U.K.), Nissan (Japan), O.M. (Italy), Silver Eagle (U.S.A.), Twin Coach (U.S.A.), Volvo (Sweden), and Wickham (U.K.).

[2]The opinion of the Marin County Counsel confirms that:

> "Inasmuch as the Federal Republic of Germany is a contracting party to the General Agreement on Tariffs and Trade, the Marin County Transit District may legally purchase motor buses from that country, notwithstanding contrary provisions of California law." (Memo of Douglas J. Maloney, County Counsel, to Seymour Kashin, General Manager, M.C.T.D., July 10, 1969.)

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GENERAL SPECIFICATIONS OF MERCEDES-BENZ, GMC, AND FLXIBLE SUBURBAN-TYPE BUSES

Information contained herewith is primarily based on the following catalogs:

1. "Mercedes-Benz Luxury Coach 0.302-40" published by Mercedes-Benz of North America, Inc. in April, 1968.
2. "GMC Suburbans" published by GMC Truck & Coach in January, 1969.
3. "Flxible Suburbans" published by the Flxible Co.

	MERCEDES-BENZ 0.302-40	G.M.C. S8M-5303A	FLXIBLE 171-CD-D8-1
ENGINE			
Engine Type	Mercedes Benz 0M 355 4-cycle direct injection diesel	Detroit Diesel 8V-71N 2-cycle diesel	Detroit Diesel 8V-71N 2-cycle diesel
Cylinder Configuration	6 - in - line	V8	V8
Piston Displacement	707 cu. in.	567 cu. in.	567 cu. in.
Compression Ratio	16:1	18.7:1	18.7:1
Max. Torque	640 ft. lbs/1300 rpm	770 ft. lbs/1200 rpm	770 ft. lbs/1200 rpm
Max, H.P.	255 H.P./2200 rpm	253 H.P./1800 rpm	253 H.P./1800 rpm
Engine Weight	1,820 lbs.	2,395 lbs.	2,395 lbs.
TRANSMISSION			
Standard	Mercedes-Benz 4-speed mechanical synchromesh gear box with 2-speed rear axle	GMC 4-speed mechanical constant mesh gear box	Spicer 4-speed mechanical constant mesh gear box
Gear Ratios			
4th	1.00:1	1.00:1	1.00:1
3rd	1.59:1	1.70:1	1.70:1
2rd	2.60:1	2.84:1	2.84:1
1st	4.24:1	4.84:1	4.84:1
Reverse	4.13:1	3.74:1	3.74:1
Axle Ratio	4-11 resp. 5-77	4 1/9 or 4 5/8	4 1/9 or 4 5/8
Optional		Super V (VS-2) automatic 3-speed transmission	Super V (VS-2) automatic 3-speed transmission with overdrive
ELECTRICAL SYSTEM	24V with Bosch alternator	12V with Delco-Remy generator	12V with Delco-Remy generator
SUSPENSION			
Front Suspension	2 air spring bellows 4 shock absorbers 1 leveling valve	4 air spring bellows 2 shock absorbers 1 leveling valve	4 air spring bellows 2 shock absorbers 1 leveling valve
Rear Suspension	4 air spring bellows 4 shock absorbers 2 leveling valves	4 air spring bellows 2 shock absorbers 2 leveling valves	4 air spring bellows 2 shock absorbers 2 leveling valves
Tire Size	11.00/20 Super	11.00/20	11.00/20
STEERING	Hydraulic Power Steering	Mechanical Steering	Mechanical Steering

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Exhibit 39 (Continued)

	MERCEDES BENZ 0.302-40	G.M.C. S8M-5303A	FLXIBLE 171-CD-D8-l
BRAKES			
Service Brake	Dual circuit air brake system operating on four wheels	Air brake system operating on four wheels	Air brake system operating on four wheels
Parking/Emergency Brake	Spring loaded, air powered brake acting on rear wheels	Mechanical brake acting on drive line at rear axle differential	Mechanical brake acting on rear axle
Auxiliary Brake	Exhaust brake, air operated, combined with foot brake	Optional: Jacobs's exhaust brake	Optional: Jacobs's exhaust brake
INSTRUMENTATION			
Instruments	Speedometer, odometer, dual air gauge, oil pressure gauge, fuel gauge, rev. counter, water temp. 1-day tachograph	80 mph speedometer, odometer, voltmeter, air gauge	80 mph speedometer, odometer, air gauge, fuel gauge, voltmeter
Warning Lights	Brake pressure, turn signal, high beam alternator charging control, handbrake	oil pressure, water temperature, high-beam, back-up light	stop lights, turn signal, emergency door, no generator, low air, engine hot, low-oil pressure, high beam
BODY CONSTRUCTION			
Structural Frame	Steel square tube all welded underframe and body frame	Aluminum monocoque body with steel reinforcement components	Steel I-beam all welded underframe and body frame
Anti-corrosion treatment	Base: zinc paint; Middle layer: plastic red paint; upper layer: non-hardening PVC compound	8 stage treatment to inherit corrosion zinc phospate sol. zinc chromate & enamel	Zinc chromate paint and Tectyl 121A undercoating Pontiac varnish
Exterior Panels	Stainless Steel	Aluminum	Aluminum
GENERAL DIMENSION			
Wheelbase	238"	285"	285"
Front Track	79"	79"	76.25"
Rear Track	71"	71"	71.12"
Overhang, Front	92"	82¼"	86.81"
Overhang, Rear	144"	112"	108.18"
Turning Radius			
wheels	34'6"	37'1"	37'9"
body corner		42'1"	42'9"
Ground Clearance	12.7"		
Overall Length	39'6"	40'	40'
Overall Width	96" (98.4" optional)	96" (102" optional)	96" (102"optional)
Height (unladen)	120"	122"	123"
Fuel Tank Capacity	77 gal.		95 gal. 125 gal. optional

	MERCEDES-BENZ 0.302-40	G.M.C. S8M-5303A	FLXIBLE 171-CD-D8-1
WEIGHT			
Curb Weight	Depending on config-	22,415 lbs.	22,500 lbs.
distribution, front	uration	5,935 lbs.	6,500 lbs.
distribution, rear		16,480 lbs.	16,000 lbs.
PASSENGER ACCOMODATION FEATURES			
Number of Seats	52	53	53
Seat Width	18"	18.5"	18"
Aisle Width	18"	15"	18"
Ceiling Height	76"	77"	77"
Door Width	29"	30"	30.5"
Step Height (ground to first step)	13"	13"	14"
MAINTENANCE			
Engine Oil Capacity	22 qt.		
Routine Maintenance	6000 mi. oil changes and lubrication incl. filter change, operational checks 24,000 mi. valve check 100,000 mi. general brake overhaul 120,000 mi. fuel injection adjustment, general check-up		
ACCELERATION			
Speed at end of 1¼ mi.	42 mph		
0 - 10 mph	3.6 sec.		
0 - 20 mph	8.4 sec.		
0 - 30 mph	16.4 sec.		
0 - 40 mph	28.5 sec.		
0 - 50 mph	48.7 sec.		
0 - 60 mph	75.0 sec.		
0 - 65 mph	91.0 sec.		
SPEEDS IN GEARS			
At max. b.h.p.	(2200 rpm)	(1800 rpm) 4 1/9 ratio	(2100 rpm)
4th gear	65.1 mph	66 mph	mph
3rd	40.9 mph	39 mph	mph
2nd	25.0 mph	mph	mph
1st	15.4 mph	mph	mph
At max. torque	(1300 rpm)	(1200 rpm)	(1400 rpm)
4th gear	38.4 mph	mph	mph
3rd	24.2 mph	mph	mph
2nd	14.7 mph	mph	mph
1st	9.0 mph	mph	mph
	When engaging 2-speed axle divide given data by factor 1,404		

Exhibit 39 (Continued)

	MERCEDES BENZ 0.302-40	G.M.C. S8M-5303A	FLXIBLE 171-CD-D8-1
BRAKING PERFORMANCE			
Braking distance from 60 mph to 0 mph	229.6 ft.	ft.	ft.
Parking brake, grade held	30%	%	%
FUEL CONSUMPTION			
Normal Driving	7½-9 m.p.g.	m.p.g.	m.p.g.
Cruising Range	500 mi.	mi.	mi
PRICE			
Suggested Price, including air conditioner & high-back seats. Delivery at San Rafael	$47,000 (approx.)	$42,500	$40,000
WARRANTY, Standard	24 mos/30,000 mi.	12 mos/25,000 mi.	12 mos/35,000 mi.

2. Fare Collection Device

The proposed bus system is different from most urban bus systems at least in two respects. First, up to 17 fare zones are involved in the system, while most urban bus systems operate in single-fare or two-fare zone areas. Secondly, in the proposed system a preponderance of rush-hour passengers are expected to be monthly pass holders,[1] who do not make cash-fare transactions.

Under such conditions, auditing of the accumulated cash fares at the end of a day, or even at the end of each run, would not reveal the true financial performance of the system. There is clearly a need to record in detail the movement of passengers--where they board and where they alight, whether they are monthly pass holders or cash-fare riders, etc.--in addition to monitoring cash transactions. Such information is essential not only for accurate revenue analysis of the system, but also for continuous improvement of the system through adjusting routes, time schedules and headways to changing demand. What is needed here is a fare collection device that can record detailed information on fare transactions and passenger movement without impeding the essential tasks of the driver.

Against this requirement, available fare collection devices have been examined.

There are two basic types of fare collection devices in existence: the fare box and the fare register. The fare boxes examined were manufactured by General Register Company and Johnson Fare Box Company, while the fare register examined was provided by the National Cash Register Company.

(a) Fare Box

The fare box is basically a locked vault in which passengers deposit cash fares, tokens, or, in some cases, tickets. It has an inspection window through which the driver scans the amount of fare to see whether it is correct before it drops into the vault. Some fare boxes have cyclometers (automatic counters) that register the cumulative amounts of cash and tokens deposited. The average price of fare boxes examined was $600.

The primary function of the fare box is to safeguard the revenue by receiving and storing cash fares and tokens in a tamper-proof vault that can be opened only by designated key holders. Operation of a fare box is simple: the driver scans the deposited fare, then pulls a lever to let it drop into the vault. These features are advantageous where a large proportion of passengers are cash fare riders.

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[1] On a sample weekday (12/15/65) the percentage of Greyhound commute ticket holders (equivalent of monthly pass holders under the proposed system) among the total passengers on Marin-San Francisco Ferry Terminal routes was 93%. Source: Coverdale & Colpitts Report, Exhibit XI.

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The major shortcoming of the fare box is the lack of any mechanism to record information necessary in analyzing a multi-zone operation or an operation based heavily on pass riders. The optional cyclometer, which simply indicates the cumulative amount of fares or tokens collected, hardly helps in determining how many passengers traveled from which zone to which zone, or how many pass holders utilized the bus.

In order to overcome this shortcoming, many bus operators who use fare boxes in multi-fare-zone areas issue tickets to riders who travel between two zones, and use tokens and commute tickets instead of monthly passes. However, when the number of multi-zone riders and commute ticket users increases the safeguarding and handling of tickets becomes an increasing burden to drivers.

In our proposed operation, which involves 17 fare zones and depends heavily on regular commuters, the advantages of fare boxes will be minimized and the disadvantages pronounced. As such the fare box is not an ideal fare collection device for the proposed system.

(b) Fare Register

While the fare box is essentially a cash handling and storing device, the fare register is a ticket-issuing and transaction-recording machine. The driver, upon collecting a fare from the passenger, issues him a ticket (similar to a cash register receipt) which contains comprehensive information such as date, driver's identification number, serial ticket number, amount of fare received, type of fare (e.g., cash, pass, half fare), boarding zone number, and alighting zone number. The same information is recorded on a journal tape which is locked in the device.

A detailed record of individual transactions on the journal tape, which covers the movements not only of cash-fare riders but also monthly pass holders, facilitates accurate revenue analysis of the whole system and of individual routes, zones, or runs. Also, it readily serves as the basic information for improvement of the system.

Safeguarding of revenue is achieved in the case of the fare register by checking the amount of cash brought in by the driver against the revenue record printed in the machine. Although drivers using fare registers physically handle all the cash transacted, the accounting function is somewhat simpler than with the fare box, particularly when a large number of fare zones are involved and when the same type of transaction (such as same destination and same fare) is repeated at any given stop. In the latter case, the "repeat" key will be pressed to issue the required number of tickets without the necessity of manipulating other keys. The movement of monthly pass holders can thus be recorded most rapidly, since no cash transaction is involved. Also, with the fare register, which prints tickets as required, the driver does not have to carry ready-printed tickets which are subject to loss or theft.

The unit price of the fare register examined was some $1,200.

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Maintenance costs for the fare register, as well as for the fare box, are almost negligible. Although the fare register is a considerably more complicated piece of machinery, its maintenance costs have been reported to be very low by Peerless Stages, Inc., of Oakland, which has been using NCR fare registers for some forty years.

Because of its ability to meet all the basic requirements cited earlier, the fare register is recommended as the most suitable fare collection device for the proposed bus system.

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3. Two-Way Radio System

The use of a two-way radio communication system has been investigated for possible inclusion in the proposed bus system. Such a system can be adapted to the bus system in one of two ways: (1) by installing two-way radios in surveillance cars and at the central dispatching office only, and (2) by installing the units in all buses as well as in surveillance cars and at the central office.

The first alternative would cost the District about $3,750 for capital outlay, assuming that the facilities of the Marin County Communication Center can be used for transmission purposes, while the second alternative, involving installation of radios in all buses, would cost some $230,000.

Benefits to be realized from equipping all buses with radios are as follows:

(a) Improved Scheduling Maintenance

Service disrupted by delays such as traffic jams, accidents, breakdowns, or any changing conditions can be reported promptly, giving the dispatcher control over the temporary situation. Also, full loads can be reported by drivers, allowing the dispatcher to route other units.

(b) Better Accident Handling

Drivers do not have to leave the scene to report accidents. Claims people may be quickly summoned and replacement buses dispatched if needed.

(c) Safety

The psychological effect of the presence of radio communications is a great deterrent to potential robberies, violence and vandalism. In the event of a disturbance, the driver may quickly radio for assistance or instructions.

Although the above three benefits are valuable and best obtained through the extensive use of radios, under the proposed bus system similar benefits can result from limited installation of the units in surveillance cars and at the central office. The District will be operating with new buses, and therefore the problem of breakdowns should be minimal. Also, the vast majority of buses use the Highway 101 - downtown San Francisco route as a major portion of their total route. With such a concentration of bus activity, supervisors could concentrate their surveillance on that route, where incidents would he most likely to occur. Increased efficiency and coordination between the supervisors and dispatchers facilitated by the two-way radio communication system would thus bring about most of the desired effects of a full-scale communication system.

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For the above reasons and because of the large capital saving, a two-way radio system with radios only in the surveillance cars and at the central office is recommended, at least for the initial stage of the operation. If it should become desirable later, enlargement of the communication system could be made at any time in the future without the District suffering detriment from waiting.

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4. Visual Design

In order to be successful, the proposed bus system should render a refined image congenial to its operational environment. The image of a bus system is greatly dependent upon the appearance of the system's equipment, facilities, and materials which are exposed to the public eye. Such visual design elements, including but not limited to buses, bus stop signs, information pamphlets, and advertisements, should be handled by professional designers, preferably by a single firm, in order to insure a high-quality, unified image of the system.

District staff has prepared a list of design work items for execution by design consultants, most of which should be completed before implementation of the bus service.

Visual Design Work Items

(a) Establishment of a Design Policy

--Designation of theme color(s)

--Design of a District identification mark

--Designation of letter types to be most frequently used

--General recommendation on application of these colors, mark, and types

(b) Buses

--Designation of a color scheme; lettering and/or placement of the identification mark on exterior of bus

--Color scheme and lettering for destination signs

--Color scheme and lettering for public information inside bus (excluding advertisements)

--Color and material selection for interior furnishing, within alternatives provided by bus supplier

(c) Bus Stop Signs

--Standard bus stop signs, incorporating route designation and simplified time table

(d) Standardized Roadside Shelter

--Standardized roadside shelter design according to specifications to be prepared by District

(e) Drivers' Uniform

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(f) Route Map and Timetable

--Wallet-size timetable with schematic route map, for general distribution; six to seven variations of a basic design for different service areas

(g) Tickets and Monthly Passes

--Design of type-face and letter size and arrangement of letters and symbols on ticket; designation of ink color and quality and color of ticket paper (design tasks to be performed in collaboration with manufacturers of fare registers)

--Design of monthly pass, with variation in origin/destination designation, month differentiation, holder's sex identification, serial number, etc.

(h) Office Stationery

--Letterhead, envelope and calling card design

(i) Advertising and Promotion

--Outdoor posters

--Newspaper and magazine ads

--TV ads

(j) Continuous Supervision of Designs of Renewed Timetables and Other Publications

For the purpose of estimating the fees for a contractual service as outlined above, seven design consultant firms,[1] both on the West and East Coasts, were contacted. They quoted fees averaging $30,000 for items (a) through (h) and one poster, one newspaper ad and one TV ad design, plus design supervision not exceeding 200 man hours to be performed within a year.

Based on these quotations, an expense item of $30,000 representing the initial design work was incorporated into the "Operating Expenses" of the proposed system in our financial analysis.

Once the basic decision on implementation of the system is made, a design consultant firm should be selected at the earliest possible date to work with District staff in creating an appropriate image for the new transit system.

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[1]Joseph Esherick & Assoc., San Francisco; Hisata-Marsh Industrial Design, San Francisco; Walter Landor & Assoc., San Francisco; Eva Laufer, Sausalito; Paul Rand & Assoc., Weston, Conn.; Raymond Loewy-William Snaith, Inc., New York; Wells, Rich & Greene, Inc., New York.

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C. FIXED FACILITIES

The major fixed facilities required for the proposed bus system are a bus storage lot, maintenance shop (garage), and administration building. This part of the report describes the procedure of assessing the capital expenditure for the fixed facilities.

1. Land Requirement

In general, the total land requirement and the total cost of land improvements are minimum when the bus storage lot, garage, and administration building are put together in a single site instead of several different locations. Assuming such a consolidated arrangement of fixed facilities, the land requirement for each type of facility was calculated as below.

Land Requirements

Bus Storage	820 sq. ft./bus x 200 buses =	164,000 sq. ft.
Maintenance Shop	115 ft. x 115 ft. =	13,225 sq. ft.
Administration Building	100 ft. x 100 ft. =	10,000 sq. ft.
Auto Parking	200 sq. ft./auto x 100 autos=	20,000 sq. ft.
Total		207,000 sq. ft. (4.75 acres)

A rounded figure, 5 acres, was used in subsequent computations as the total required acreage for fixed facilities.

2. Locational Considerations

In order to minimize the costs of improvement, maintenance and use of the land, a list of basic criteria for site selection was prepared.

Basic Criteria for Site Selection

(a) Relative flatness of terrain to minimize grading.

(b) Availability of power, water, sewage, and other utilities.

(c) Proximity to freeway and to N.W.P.R.R. for easy access to and from the existing and contemplated trunk routes.

(d) Central location with regard to bus system service area.

(e) Reasonable sale price or lease price, and immediate availability.

(f) Permissive zoning.

With all of these criteria in mind, and with the help of the Marin County Department of Public Works, a search of available sites was conducted. Thirteen sites in the County were thus selected, of which four, located in the Greenbrae-South San Rafael area, were found to be most promising.

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3. Capital Cost Estimate

The prices of the aforementioned four sites were slightly under $50,000 per acre at the time of investigation, and this figure was used in the capital cost estimate. Other costs, such as those for land improvement and building construction, were estimated on the basis of the current prevailing cost of each type of work in the area.

Capital Costs for Fixed Facilities[1]

Land	5 ac. x $50,000/ac.	=$ 250,000
Improvements	5 ac. x $47,800/ac.	= 239,000
Fencing & Landscaping		= 10,000
Maintenance Shop	13,225 sq.ft. x $12/sq.ft.	= 158,700
Administration Building	10,000 sq.ft. x $20/sq.ft	= 200,000
Shop Equipment		= 100,000
Sub Total		957,700
Contingencies (5%)		47,900
TOTAL		$1,005,600

The above figures were used in the financial analysis of proposed Plans II and III. The underlying assumption that all the fixed facilities mentioned here were grouped in a single site in the Greenbrae-South San Rafael area was also applied to estimation of the deadhead mileage of buses under Plans II and III.

[1]Omitted from this table, but included in the financial analysis, is the cost of erecting five bus stop shelters at strategic points at a cost of $3,000 each.

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D. ORGANIZATION AND PERSONNEL

The proposed bus system outlined in previous chapters is a substantial enterprise, ranking with the major transit enterprises in California. An operation of this magnitude will require an organization capable not only of performing the day-to-day tasks required but also able to keep the operation abreast of conditions as well as meeting future requirements. The organization must also be capable of dealing with and operating other modes in addition to buses.

It seems likely that the Golden Gate Bridge & Highway District will be requested to fund the proposed bus system, and in all likelihood to operate the same, through some form of joint powers agreement with the Transit District. The organization outlined in this section (See Exhibit 40) would be the same, with minor modification, whether it functioned under the Bridge District or the Transit District. Certain functions could be shared with the other Bridge or County departments in either case.

The basic operating organization would be responsible for the day-to-day planning and operation of the proposed bus system. These personnel would be in addition to the small number of people who have been planning the operation and whose functions would continue to be separate from the daily operation. The latter would constitute a long range planning section and would concern themselves with the design and implementation of other modes of transportation as they become feasible. Once a new mode is introduced, the responsibility for its operation would be vested with the operating organization.

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EXHIBIT 40

TRANSIT PERSONNEL

OPERATING ORGANIZATION

Position	NUMBER OF PERSONNEL Plan I	Plan II	Plan III
General Manager	1	1	1
Director of Administration & Secretary	1	1	1
Director of Personnel & Training	1	1	1
Director of Operations & Maintenance	1	1	1
Supervisor of Maintenance	0	1	1
Manager of Operations Planning	1	1	1
Manager of Claims	1	1	1
Counsel	1	1	1
Treasurer	1	1	1
Public Information Officer	1	1	1
Engineer	1	1	1
Analyst	2	2	2
Accounting	3	3	3
Clerical & Stenographic	15	16	16
Supervisor/Inspection	5	5	5
Starter	1	1	1
Dispatcher	4	4	4
Driver	143	176	212
Mechanics & Maintenance Employees	0	21	24
TOTAL	183	239	278

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E. FINANCIAL ANALYSIS

Upon development of the Optimum Bus System specifications and estimation of the patronage, the District retained a consultant firm, R.L. Banks & Associates, to perform a financial analysis of the proposed operation.

R.L. Banks & Associates subsequently estimated the capital requirements and income[1] for the three alternative operation plans, namely, Plan I, Plan II, and Plan III, for their respective first year of operation. The consultants also examined the financial implication of inclusion of the Sonoma route and of different garage and parking lot locations. Finally, they studied the possible alternative methods of funding, ownership and management.

This part of the report describes the major findings of the financial analysis of the system and their underlying premises.

1. Definition of Plans I, II, & III in Financial Context

In the financial analysis, three distinct levels of service are separately examined. Identified as PLAN I, PLAN II and PLAN III, they represent, respectively, a "low" level of service which, in terms of annual commute bus-miles, is equal to the level operated by Greyhound, a "medium" level, about 42 percent higher than Greyhound, and a "high" level which is about 78 percent above Greyhound's existing commute service.

PLAN I contemplates a system operated at the "low" level by the Transit District with buses leased from Greyhound, with maintenance provided by Greyhound under contract. All management personnel and drivers would be employees of the District. PLAN I could be put into effect within a short time following a decision to do so. For the present purpose it has been assumed that service would commence on September 1, 1969. The ensuing 12 months, through August 1970, is identified as "first year" in the exhibits.

PLAN II assumes the "medium" level of service. It assumes operation of new buses owned by the Transit District. Maintenance would be performed by District employees in a garage owned by the system. This plan could be in operation within about one year after a decision. It could be a follow-on to PLAN I or it could be the initial operation, For the present purpose it is treated as a follow-on, operating in the second year, September 1970 through August 1971.

PLAN III is an alternative to PLAN II, operating at the "high" level of service, but otherwise the same as PLAN II. It could be operated in lieu of PLAN II or could be a future step upward in service. In the present analysis it is treated as an alternative to PLAN II operating in the same time period in which PLAN II is studied.

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[1] Operation revenue less operating expenses and non-operating expenses.

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Bus-miles operated under the three plans, numbers of passengers and numbers of buses required are compared with the present Greyhound operation in Exhibit I of Chapter I.

2. Income Estimates

A summary income statement for a Marin-San Francisco service is presented in Exhibit 43A and for a Marin-Sonoma/San Francisco service in Exhibit 43E. Each plan will operate at a net loss which increases as the level of service is increased. These expenses estimates are based in large part upon Greyhound's current driver wage scales, with escalations agreed through March 1971 plus cost of living increases also provided for in the current Greyhound labor contract, estimated at 3.5% per year by R.L. Banks & Associates, Inc. Salaries of nonunion personnel are also escalated 3.5% in the second year (Plans II and III). Fares, on the other hand, are maintained in general at the present Greyhound level.

Exhibits 44A and B are more detailed income statements. Each sets forth revenues and expenses in the major categories of the uniform classification of accounts by which regulated carriers report to the Interstate Commerce Commission.

It is noted that no charter service revenues are shown in Exhibits 44A and B due to the lack of authority for such services. Charter services could provide revenues at no added cost of drivers, since the service is provided during non-commute hours when drivers are not being otherwise utilized.

Commute revenue has been obtained by applying the slightly modified Greyhound fare schedule (see Exhibits 52A and B) to estimated commute passengers.

Non-commute revenue was based on the assumption that the proposed non-commute service (i.e. Mid-Day/Weekend Service) would maintain a level of patronage per bus equal to that of Greyhound in March 1969.

The fact that the non-commute service shows a profit in the summary income statement (Exhibit 44C) should be interpreted with the following understanding.

The expenses and costs attributed to the non-commute service are those which are incurred solely as a result of that service being performed. Therefore, if a bus is purchased for the commute service but can be utilized in non-commute service, the expense attributed to non-commute service is only that resulting from the additional mileage driven.

Similarly, administrative expenses, costs of fixed facilities and other costs which are necessary for the commute service were not apportioned to the non-commute service even though they are necessary for that service also.

The operating expense listed in the detailed income statement is elaborated on in the following sections.

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Equipment Maintenance and Garage Expense, which include repairs and servicing of revenue equipment and garage overhead, is higher for Plan I than for Plans II and III. This reflects a basic assumption that during the period of Greyhound bus use, that company will maintain the fleet at cost, provided costs are computed by the method prescribed by the California Public Utilities Commission for assigning and allocating costs to Greyhound's operating subdivisions, such as its Marin County services. Plan I maintenance costs are based upon those estimated for the year ended June 30, 1967, in the most recent Greyhound rate case (CPUC Appl. No.49658). Since costs computed in this manner are based in large part upon allocations of costs incurred in common with other portions of Greyhound operations, there is always a chance that they are overstated. Maintenance costs of Plans II and III, on the other hand, are based on the mechanical staff which will be employed solely for the Marin Transit System buses. Staff size is consistent with the size of the projected operation, and wages estimated at Greyhound rates, projected upward over time as with driver scales.

Transportation expense is dominated by drivers' wages, which, as indicated, are based on Greyhound notes. Also included are such items as fuel, oil, uniforms and supervisors salaries.

Traffic & Advertising includes such items as public relations, staff salaries, advertising and timetables. It was estimated from the experience of A.C.Transit and other operating agencies.

Insurance & Safety expense is difficult to estimate for an operation with no experience record. The estimates shown are based upon coverage common to other similar bus operations and are pegged at premium rates thought to be conservatively high. Rates may be subject to renegotiation after the first year of experience.

Administative & General expenses are based primarily upon salaries of officials and general staff personnel. (See table of organization in Exhibit 40.) Salary levels are based upon those paid by Alameda-Contra Costa Transit District and upon salaries for comparable jobs in the Marin County Government.

Depreciation under Plans II and III is much higher than Plan I, reflecting transit system ownership of its buses, garage and administrative building.

Amortization consists principally of write-off of some of the expenses to be incurred prior to commencement of operation. It is higher under Plan I than under Plans II and III because the entire cost of painting Greyhound's buses in Marin's colors is changed to the single year of Plan I operation.

Operating Taxes & Licenses are dominated by funds required for the Federal Insurance Contribution Act but also include State Unemployment Insurance, motor fuel taxes and other lesser miscellaneous taxes.

Operating Rents, shown only for Plan I, relate to the parking lots in Marin County where Greyhound overnights its buses near the beginning of commute routes. For Plans II and III it has been assumed that Marin's buses will be parked at its garage, tentatively located near Greenbrae.

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It has been assumed, that Greyhound, which will benefit from release from its franchise obligation, will make its buses available for one year for maintenance cost only.

Interest on long-term debt is a major expense item in Plans II and III but does not appear in Plan I due to the fact that buses, buildings, and land are not purchased under that plan. The estimates assume financing through general obligation bonds of the County at 5 percent interest. It is most unlikely that bonds could be sold at this rate, the County's legal limit, in the present market. Recent tax-free government issues have commanded rates in the vicinity of 5.8 percent. Whether the market will remain so high until mid 1970 when the assumed bonds would be issued is a matter for speculation.

3. Timing of Cash Outlay

While the Income Statements show the expected results of each of the operating PLANS, PLAN I in the first year (September 1969-August 1970) and PLANS II and III in the second year (September 1970-August 1971), they do not fully disclose the cash requirements of the projected system. Exhibit 45 sets forth the timing of all outlays, capital and operating. It sets out the start-up costs which would be incurred prior to commencement of operation, assumed for the present purpose to be during July and August 1969. The Exhibit assigns two kinds of costs to the year September 1969 through August 1970: 1) the net loss of cash from PLAN I operations, and 2) start-up costs peculiar to PLAN II, which would be incurred concurrently with operation of PLAN I. Exhibit 45 does not treat PLAN III.

The net loss (cash basis) of operating PLAN II is charged to the year September 1970 through August 1971.

4. Source and Application of Funds

The expenditures in Exhibit 45 are brought together in Exhibit 46 with revenues from system operation and funds from outside sources, in a conventional statement of source and application of funds. This statement discloses the total need for funds, from the beginning of the pre-operating period through the second year of system operation. It assumes PLAN I for the first year and PLAN II for the second.

The statement(Exhibit 46)starts with the $300,000 existing reserve of the District as the intial working capital. Necessary staff salaries and other pre-operating expenses, including cash register fare boxes to be installed in Greyhound buses, exceed available funds during the start-up period by some $39,000.

The maximum outlay of funds occurs during the first year of operation, when a little more than $1 million is invested in real estate and $5.6 million in buses for PLAN II. These expenditures are financed, in Exhibit 46 by a hypothetical bond issue of $6.7 million. However, other demands, principally loss on operation of PLAN I, exceed the indicated sources of funds, with the net result that available funds fall $11,900 short of the need.

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In the second year the greatest need for funds is to offset the $1 million loss (after bond interest expense of $335,000, Exhibit 44A) and to begin to retire bonds at the rate of $447,000 a year (based on 15-year issue). Available funds fall $697,000 short of the need.

By the end of the second year, the cumulative short-fall of funds is estimated at $748,000. This is the measure of the transit system's need from external sources, over and above the hypothetical bond issue, the Marin Transit District Tax proceeds and its present reserve.

An alternative situation is outlined in Exhibit 47, a statement of source and application of funds which is the same as that in Exhibit 46 except that it rests upon the assumption of a Federal grant for two-thirds of the required $6.7 million investment in property. This assumption that the Government will provide $4.4 million is not unreasonable; there is no apparent reason why the projected operation would not qualify, although there are, of course, many demands for available funds. Under this assumption the amount to he raised by the hypothetical County bond issue is reduced to $2.3 million. This decreases the system's loss by reducing interest expense, and it reduces the amount needed for bond redemption in the second year. The net result is to reduce the system's unfilled need for funds through the second year from $748,000 (Exhibit 46) to an estimated $211,000 (Exhibit 47). This highlights the very substantial effect of debt service upon cash flow.

A third statement of source and application of funds is shown in Exhibit 48. It is the same as the other two, except that it portrays a situation where there is no need to borrow from external sources. It assumes that after a Federal grant, the local share of financing comes from existing reserves. Exhibit 48 indicates that with system losses in the second year of operation reduced to $717,000 by the elimination of interest on debt and with relief from the need to retire debt, the operation shows an increase in working capital, $84,500, in its second year. With no bond retirement, there is a cumulative increase of $71,000 in working capital after two years of operation.

5. Costs of Alternative Financing Methods

The range of financing cost by alternative methods is examined in Exhibit 49. For convenience of illustration, the needed amount is set at an even $6 million instead of the $6.7 million need foreseen for PLAN II.

The first method is that assumed in Exhibit 46, where the needed funds are raised by a County bond issue. Cost of interest and retirement of principal in the first year, assuming a 12-year issue, is $800,000; for the entire period it is $8,040,000.

If Federal funds are available to cover two-thirds of the cost, the 12-year cost on the books of the transit system is reduced to $2,680,000, and if existing reserves are available for the local share, there is no cost to the transit system.

At the other end of the cost spectrum, equipment leasing is shown to be the most costly method of finance. While it requires no initial outlay, $6 million worth of buses would cost the system $864,000 in the first year and an estimated

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$10,368,000 over the life of the equipment. The implicit interest rate is twice the level of the county borrowing rate. This illustration was adapted from an estimate obtained by the Golden Gate Bridge and Highway District from a major leasing company.

Financing by the first three methods shown in Exhibit 49 is predominant in the transit industry. Other methods are sometimes employed, but they are the exception rather than the rule. Financing by equipment trusts or by conditional sales have been employed by some. The cost of these methods falls within the range between leasing and general obligation bods. Revenue bonds are less frequently employed, and are not worth considering for a system which will operate at a deficit.

6. Joint Ownership of Transit System, Marin Transit District and Golden Gate Bridge and Highway District

Two alternatives to Marin Transit District ownership and operation of the transit system are: 1) ownership by the Bridge District and 2) joint ownership.

If the Bridge District were to undertake the project by itself, it is not likely that at any chosen level of operations the financial results would be substantially different from those projected in Exhibit 44A. Where the Consultant's have estimated a loss of $1.1 million for Plan II in 1970-1971 the Bridge District has estimated annual losses ranging between $900,000 and $1.7 million under alternative assumptions as to service, fares, and financing.[1]

There may be some opportunity for economy by combining some of the transit system overhead with the existing Bridge District staff. Conceivably some of the engineering and accounting staffs, for example, could be shared. But the assumption that this kind of opportunity is large is to assume that the present Bridge District staff is not fully utilized -- that it has "excess capacity" for employment in transit matters, which does not seem reasonable.

The area where Bridge District costs could be less is that of financing, where the District's existing reserves could significantly raduce the transit system's capital costs, as illustrated in Exhibits 46, 47 and 48. These benefits would, of course, also be available to a jointly held transit operation.

7. Garage and Parking Lot Location

A special analysis was made to estimate the effect on costs of having the garage and bus storage lot centrally located, as compared with the Greyhound arrangement of a garage in San Francisco and overnight parking lots in Marin County near ends of commute runs. Exhibit 50 sets forth the differences in bus miles and costs and in driver pay costs which were found. Operation from the Greenbrae garage at the Plan I level of service is estimated to cost $139,000 a year -- $71,000 in bus maintenance and fuel and $68,000 in driver pay -- more than operation patterned after that of Greyhound. In view of the fact that the excess driver cost of a centrally located garage is incurred before the morning commute runs and after the evening commute runs, a system employing route-end night storage lots and a central garage should be considered.

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[1]Golden Gate Bridge and Highway District projection of estimated financial condition to June 30th, 1978 with proposed bus rapid transit in operation.March 25, 1969.

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8. Sonoma Service

Exhibits 43C and D are summary income statements showing revenue and incremental expenses of operating to and from Santa Rosa. The estimates are based upon Greyhound's level of service and patronage.

For Plan I, the annualized Greyhound figures were increased by 3% to allow for traffic growth to the year September 1969-August 1970. These estimates were further increased by 3% for Plans II and III. Revenue per passenger was estimated according to the proposed one-way fares for non-rush hour and weekend passengers. Revenue from rush hour passengers was estimated at 75% of the one-way fares.

Bus miles and driver hours were based on an assumption of overnight parking in Santa Rosa.

9. Greyhound Operation Under Contract

Exhibit 51 contains estimates of costs of the Marin County operation (excluding Sonoma) on the assumption that Plan I was operated by Greyhound under contract to the Transit District. It compares the cost on this basis with that estimated in Exhibit 44A for operation of Plan I by the District. The Greyhound contract cost is developed first on the assumption that existing Greyhound buses would be employed and second on an assumption that Marin County would buy new buses and turn them over to Greyhound for operation.

It is assumed that with a contract operation Marin Transit District would take full responsibility for prescribing routes and schedules, for conducting continuing market research and surveillance so as to keep schedules and routes in tune with the market, and for advertising and promotion. The cost of a small Transit District staff to handle this work is included.

It is estimated in Exhibit 51 that if Greyhound were to operate its present buses the net cost to Marin would be $403,000 in the first year. Greyhound would retain all operating revenues. This compares with a cost of $279,000 if the Transit District operated the system itself. The principal element accounting for the difference in these estimates is the Greyhound management fee, estimated at $160,000.

The fee is based on 6 percent of revenues which approximates a reasonable level of return in the transit industry. Presumably this return would provide adequately for return to stockholders and, together with other cash flow, would keep the operation in a posture to finance new equipment.

For the column indicating Greyhound operation of Greyhound buses, there would be no rental payment for Greyhound's buses. This assumption, which was acceptable in the context of Plan I -- a transitional operation pending replacement of Greyhound's buses - is not reasonable for a permanent arrangement. The low figure for depreciation, $16,000, is not adequate to insure equipment replacement in the style the Transit District would require.

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Exhibit 51 also contains an estimate of cost to Marin Transit District on the assumption that the District would buy new buses and turn them over to Greyhound for operation under contract. The estimated cost of this alternative, at Plan I level of operations, is $726,000. For this alternative, the management fee is estimated at only 3 percent of revenues, since Greyhound would not have any investment in equipment.

A third alternative, not shown in Exhibit 51 might be to contract with Greyhound with a requirement that it upgrade its bus fleet. In this event the cost to the Transit District would fall somewhere between the $403,000 and the $726,000 shown in the Exhibit, depending upon the degree of equipment improvement.

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Exhibit 41

CAPITAL REQUIREMENTS
(PROPOSED MARIN-SAN FRANCISCO OPERATION)

	Estimated Life (Years)	ALTERNATIVE LEVELS OF SERVICE Plan I (low)	Plan II (medium)	Plan III (high)
		(000 omitted)		
Acquisition of Land		$ 0	$ 250	$ 250
Improvements to Land	40	0	249	249
Garage	40	0	159	159
Administration Building	40	0	200	200
Contingency Allowance[1]		0	73	73
Garage Equipment	8	0	100	100
Buses	12	0	5,610	7,055
Fare Boxes	25	121	151	190
Shelters	15	0	15	15
Automobiles	4	8	8	8
Office Furniture	10	24	24	24
Office Equipment	5	20	20	20
Two-Way Radios	5	4	4	4
		$177	$6,863	$8,347

[1]Land Improvements, Buildings and Interest During Construction.

Source: R. L. Banks & Associates, Inc., Working Papers.

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Exhibit 42

CAPITAL REQUIREMENTS

(PROPOSED MARIN/SONOMA-SAN FRANCISCO OPERATION)

		ALTERNATIVE LEVELS OF SERVICE		
	EST. LIFE	PLAN I	PLAN II	PLAN III
			(000 omitted)	
Improvements to Land	40	$ 0	$249	$249
Garage	40	0	159	159
Administration building	40	0	200	200
Contingency Allowance[1]		0	73	73
Garage Equip.	8	0	100	100
Buses	12	0	6,460	7,905
Fare Boxes	25	144	174	213
Shelters	15	0	15	15
Automobiles	4	8	8	8
Office Furniture	10	24	24	24
Office Equip.	5	20	20	20
Two-Way Radios	5	4	4	4
		$200	$7,486	$8,970

[1]Land Improvement, Building & Interest during construction.

Source: R. L. Banks & Associates, Inc., Working Papers.

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Exhibit 43A

SUMMARY INCOME STATEMENT - PROPOSED BUS OPERATION
(MARIN-SAN FRANCISCO)

	ALTERNATIVE LEVELS OF SERVICE		
	[1]Plan I (low)	[2]Plan II (medium)	[2]Plan III (high)
	(000 omitted)		
Total Operating Revenues	$ 2,669	$ 3,290	$ 3,924
Total Operating Expenses	2,948	4,007	4,700
Total Operating Income (Loss)	(279)	(717)	(776)
Non Operating Income (Expense)	-	(335)	(405)
NET INCOME (LOSS)	$ (279)	$ (1,052)	$ (1,181)

Exhibit 43B

ANALYSIS OF INCOME STATEMENT - PROPOSED BUS OPERATION
(MARIN-SAN FRANCISCO)

Total Operating Revenues	$ 2,669	$ 3,290	$ 3,924
Total Operating Expenses	2,948	4,007	4,700
LESS: Depreciation & Amortization	65	540	665
Direct Operating Expenses	2,883	3,467	4,035
NET OPERATING INCOME (LOSS) (Line 1 minus Line 4)	$ (214)	$ (177)	$(111)
Interest on Long Term Debt, Depreciation & Amortization (Public Subsidy)	$ 65	$ 875	$ 1,070

[1]Fiscal year September 1969-August 1970.

[2]Fiscal year September 1970-August 1971.

Source: R. L. Banks 9 Associates, Inc., Working Papers.

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Exhibit 43C

SUMMARY INCOME STATEMENT
(SONOMA-SAN FRANCISCO)

	ALTERNATIVE LEVELS OF SERVICE		
	Plan I	Plan II	Plan III
	(000 omitted)		
Total Operating Revenues	$ 647	$ 666	$ 666
Total Operating Expenses	461	485	485
Total Operating Income (Loss)	$ 186	$ 181	$ 181
Non Operating Income (Expense)		(43)	(43)
NET INCOME (LOSS)	$ 186	138	138

Exhibit 43D

ANALYSIS OF INCOME STATEMENT
(SONOMA - SAN FRANCISCO)

Total Operating Revenues	$ 647	$ 666	$ 666
Total Operating Expenses	461	485	485
LESS: Depreciation & Amortization	1	72	72
DIRECT OPERATING EXPENSES	$ 460	$ 413	$ 413
NET OPERATING INCOME (LOSS)	187	253	253
Interest on Long Term Debt, Depreciation & Amortization (Public Subsidy)	1	114	114

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Exhibit 43E

SUMMARY INCOME STATEMENT
(MARIN/SONOMA-SAN FRANCISCO)

	ALTERNATIVE LEVELS OF SERVICE		
	PLAN I	PLAN II	PLAN III
	(000 omitted)		
Total Operating Revenues	$ 3,315	$ 3,956	$ 4,590
Total Operating Expenses	3,409	4,492	5,185
Total Operating Income (Loss)	(94)	(536)	(595)
Non Operating Income (Expense)		(378)	(448)
NET INCOME (LOSS)	(94)	(914)	(1,043)

Exhibit 43F

ANALYSIS OF INCOME STATEMENT
(MARIN/SONOMA-SAN FRANCISCO)

Total Operating Revenues	$ 3,315	$ 3,956	$ 4,590
Total Operating Expenses	3,409	4,492	5,185
LESS: Depreciation & Amortization	66	611	736
Direct Operating Expenses	$ 3,343	$ 3,881	$ 4,449
NET OPERATING INCOME (LOSS)	(28)	75	141
Interest on Long Term Debt, Depreciation & Amortization (Public Subsidy)	66	989	1,184

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Exhibit 44A

DETAILED INCOME STATEMENT
(PROPOSED MARIN-SAN FRANCISCO OPERATION)

	ALTERNATIVE LEVELS OF SERVICE		
OPERATING REVENUES:	[1]Plan I (low)	[2]Plan II (medium)	[2]Plan III (high)
Passenger:			
Commute	$1,430,206	$2,010,400	$2,638,047
Non Commute	1,220,000	1,257,000	1,257,000
TOTAL	2,650,206	3,267,400	3,895,047
Charter & Express	-	-	-
Advertising	18,550	23,100	29,050
TOTAL OPERATING REVENUE	$ 2,668,756	$ 3,290,500	$ 3,924,097
OPERATING EXPENSES:			
Equipment, Maintenance & Garage	$ 492,177	$ 364,921	$ 403,202
Transportation	1,665,551	2,250,157	2,688,138
Traffic and Advertising	77,303	87,351	96,766
Insurance and Safety	123,275	150,837	168,665
Administrative & General	428,750	508,638	554,838
Depreciation	14,095	512,801	635,271
Amortization	50,430	26,827	30,055
Operating Taxes & Licenses	88,300	105,660	122,977
Operating Rents	8,280	-	-
TOTAL OPERATING EXPENSE	$ 2,948,161	$ 4,007,192	$ 4,699,912
OPERATING INCOME (LOSS)	$ (279,405)	$ (716,692)	$ (775,815)
NON OPERATING INCOME (EXPENSE)			
Interest on Long Term Debt	$ -	$ (335,000)	$ (405,000)
NET INCOME (LOSS)	$ (279,405)	$(1,051,692)	$(1,180,815)

[1]Assumed Timing: September 1, 1969 - August 31, 1970.
[2]Assumed Timing: September 1, 1970 - August 31, 1971.

Source: R. L. Banks & Associates, Inc., Working Papers

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Exhibit 44B

Detailed Income Statement-Proposed
Marin/Sonoma-S. F. Operation

	ALTERNATIVE LEVELS OF SERVICE		
OPERATING REVENUES	Plan I	Plan II	Plan III
Passenger:			
Commute	1,706,940	2,295,436	2,923,083
Non Commute	1,589,779	1,637,872	1,637,872
TOTAL	3,297,719	3,933,308	4,569,955
Charter & Express	- -	- -	- -
Advertising	18,550	23,100	29,050
TOTAL OPERATING REVENUE	3,315,269	3,956,408	4,590,005
OPERATING EXPENSES			
Equipment, Maintenance & Garage	599,441	403,535	441,816
Transportation	1,964,499	2,566,476	3,004,457
Traffic & Advertising	77,303	87,351	96,766
Insurance & Safety	133,975	161,537	179,365
Administrative & General	458,009	542,610	588,810
Depreciation	15,009	584,548	707,018
Amortization	50,430	26,827	30,055
Operating Taxes & Licenses	102,362	119,722	137,039
Operating Rents	8,280	- -	- -
TOTAL OPERATING EXPENSE	3,409,308	4,492,606	5,185,326
OPERATING INCOME (LOSS)	(94,039)	(536,198)	(595,321)
NON OPERATING INCOME (EXPENSE) Interest on Long Term Debt	- -	(377,500)	(447,500)
NET INCOME (LOSS)	(94,039)	(913,698)	(1,042,821)

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Exhibit 44C

Summary Income Statement
Showing Commute Separate From Non-Commute
(Marin/San Francisco)

	Service Plans		
	I	II	III
Total Operating Revenues			
Commute	1,445,956	2,030,700	2,664,297
Non-Commute	1,222,800	1,259,800	1,259,800
Total	2,668,756	3,290,500	3,924,097
Total Operating Expenses			
Commute	2,004,697	3,100,784	3,798,453
Non-Commute	943,482	906,408	901,459
Total	2,948,161	4,007,192	4,699,912
Total Operating Income (Loss)			
Commute	(558,723)	(1,070,084)	(1,134,156)
Non-Commute	279,318	353,392	358,341
Total	(279,405)	(716,692)	(775,815)
Non-Operating Income (Expense)			
Commute	----	(301,000)	(371,000)
Non-Commute	----	(34,000)	(34,000)
Total	----	(335,000)	(405,000)
Net Income (Loss)			
Commute	(558,723)	(1,371,084)	(1,505,156)
Non-Commute	279,318	319,392	324,341
Total	(279,405)	(1,051,692)	(1,180,815)

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Exhibit 45

Timing of Expenditures
Optimum Bus System
Phased Development,
Plan I Followed By Plan II

	July & August 1969	Sept. 1969 - August 1970	Sept. 1970 - August 1971
Start-up costs (July & August 1969)			
Expenses charged to start-up period:			
Staff salaries and expenses	$ 36,890		
Driver training, wages	21,264		
Recruiting expenses	5,700		
Office rent	5,600		
Printing	1,000		
Bus stop signs	20,000		
Destination signs for buses	17,000		
(Sub-total)	(107,454)		
Expenses capitalized, depreciated in later periods:			
Furniture and office equipment	44,000		
Fare boxes	121,122		
Supervisors' cars	8,400		
Radios	3,750		
(Sub-total)	(177,272)		
Expenses capitalized, amortized in later periods:			
Driver training expense (excl. wages)	10,736		
Greyhound bus preparation (paint, fare boxes)	27,560		
Design of visual identification system	30,000		
Design of cost-finding system	15,000		
Driver uniforms	14,300		
(Sub-total)	(97,596)		
(Sub-total, all start-up costs)	(382,322)		

Source: R. L. Banks & Associates

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Exhibit 45 (Continued)

	July & August 1969	Sept. 1969 - August 1970	Sept. 1970 - August 1971
First year operation, Plan I (Sept. '69-Aug. '70)			
Net loss		$279,405	
Add back depreciation and amortization		(64,525)	
Cash loss		214,880	
Preparation for Plan II (Expenses are incurred while Plan I is in operation but are not included in profit and loss estimate for Plan I)			
Expenses not capitalized:			
Driver training wages		12,330	
Mechanics wages during training		12,000	
Move to administration building		400	
(Sub-total)		(24,730)	
Land		250,000	
Expenses capitalized, depreciated in later periods:			
Improvement to land		249,000	
Garage and equipment		258,700	
Administration building		200,000	
Contingencies on real estate		47,900	
Interest during construction		25,100	
Bus Purchase		5,610,000	
Fare boxes for added buses		29,700	
Shelters		15,000	
(Sub-total)		(6,435,400)	
Expenses capitalized, amortized in later periods:			
Bus selection		3,000	
Driver training expenses (excluding wages)		5,570	
Uniforms for added drivers		3,300	
(Sub-total)		(11,870)	
(Sub-total, Preparation for Plan II)		(6,722,000)	
Second Year Operation, Plan II (Sept. '70-Aug. '71)			
Net loss			1,051,683
Add back depreciation and amortization			(539,628)
Cash loss			512,055
Total Cash Expense	$382,322	$6,936,880	$512,055

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Exhibit 46

STATEMENT OF SOURCE AND DISPOSITION OF FUNDS
OPTIMUM BUS SYSTEM BOND FINANCING
July 1, 1969 through August 30, 1971

PLAN I FOLLOWED BY PLAN II

	July and Aug. '69	Sep. 1, '69 through Aug. 30, '70	Sep. 1, '70 through Aug. 30, '71
WORKING CAPITAL AT BEGINNING OF PERIOD	$ 300,000[1]	$ (38,655)	$ (50,535)
ADDITIONS DURING PERIOD			
Net earnings (loss)[2]	(107,454)	(279,405)	(1,051,683)
Depreciation and amortization	0	64,525	(539,190)
County property tax[3]	43,667	262,000	262,000
Sale of 5% general obligation bonds[4]	0	6,700,000	0
Total Additions (Negative)	(63,787)	6,747,120	(250,493)
USES DURING PERIOD			
Purchase of property and equipment:			
Real property	0	1,045,700	0
Revenue equipment	148,682	5,639,700	0
Other capitalized projects	126,186	11,870	0
Plan II start-up exp. not capitalized	0	24,730	0
Redemption of general obligation bonds	0	37,000	447,000
Total Uses	274,868	6,759,000	447,000
NET INCREASE (DECREASE) DURING PERIOD	(338,655)	(11,880)	(697,493)
WORKING CAPITAL AT END OF PERIOD (NEGATIVE)[5]	(38,655)	(50,535)	(748,028)

[1]Marin Transit District reserve, June 30, 1969, $300,009.66, per 1968-1969 Final Budget.

[2]Figure for July & August 1969 represents all pre-operating expenses not capitalized. Figure for Sept. 69 - Aug. 70 is loss on operation of Plan I; figure for Sept. 1970 - Aug. 1971 is loss on operation of Plan II.

[3]Marin Transit District tax @ 5¢ per $100 valuation, 1969-70 estimate.

[4]At current interest rate levels, this is probably not a realistic assumption, but County limit is 5%.

[5]Indicated additional cash requirement.

SOURCE: R. L. Banks & Associates, Inc.

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Exhibit 47

STATEMENT OF SOURCE AND DISPOSITION OF FUNDS
OPTIMUM BUS SYSTEM BOND FINANCING, WITH FEDERAL GRANT
July 1, 1969 through August 30, 1971

PLAN I FOLLOWED BY PLAN II

	July and Aug. '69	Sep. 1, '69 through Aug. 30, '70	Sep. 1, '70 through Aug. 30, '71
WORKING CAPITAL AT BEGINNING OF PERIOD	$ 300,000[1]	$ (38,655)	$ (26,535)
ADDITIONS DURING PERIOD			
Net earnings (Loss)[2]	(107,454)	(279,405)	(831,683)
Depreciation and amortization	0	64,525	539,190
County property tax[3]	43,667	262,000	262,000
Sale of 5% general obligation bonds[4]	0	2,300,000	0
Federal grant[4]	0	4,400,000	0
TOTAL ADDITIONS (NEGATIVE)	$ (63,787)	6,747,120	(30,493)
USES DURING PERIOD			
Purchase property and equipment:			
Real property	0	1,045,700	0
Revenue equipment	148,682	5,639,700	0
Other capitalized projects	126,186	11,870	0
Plan II start-up expense not capitalized	0	24,730	0
Redemption of general obligation bonds	0	13,000	154,000
TOTAL USES	274,868	6,735,000	154,000
NET INCREASE (DECREASE) DURING PERIOD	(338,655)	12,120	(184,493)
WORKING CAPITAL AT END OF PERIOD (NEGATIVE)[5]	(38,655)	(26,535)	(211,028)

[1]Marin Transit District reserve, June 30, 1969, $300,009.66.

[2]Figure for July & August 1969 represents all pre-operating expenses not capitalized. Figure for Sept. 69 - Aug. 70 is loss on operation of Plan I; figure for Sept. 70 - Aug. 71 is loss on operation of Plan II.

[3]Marin Transit District tax @ 5¢/$100 valuation, 1969-70 estimate.

[4]Assumes 2/3 participation by Federal Government under UMTA.

[5]Indicates additional cash requirement.

SOURCE: R. L. Banks & Associates, Inc.

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Exhibit 48

STATEMENT OF SOURCE AND DISPOSITION OF FUNDS
OPTIMUM BUS SYSTEM
GOLDEN GATE BRIDGE AND HIGHWAY DISTRICT RESERVES, WITH FEDERAL GRANT
July 1, 1969 through August 30, 1971

PLAN I FOLLOWED BY PLAN II

	July and Aug. '69	Sep. 1, '69 through Aug. 30, '70	Sep. 1, '70 through Aug. 30, '71
WORKING CAPITAL AT BEGINNING OF PERIOD	$ 300,000[1]	$ (38,655)	$ (13,535)
ADDITIONS DURING PERIOD			
Net earnings (loss)[2]	(107,454)	(279,405)	(716,683)
Depreciation and amortization	0	64,525	(539,190)
County property tax[3]	43,667	262,000	262,000
Golden Gate Bridge & Highway District[4]	0	2,300,000	0
Federal grant[4]	0	4,400,000	0
TOTAL ADDITIONS (NEGATIVE)	(63,787)	6,747,120	84,507
USES DURING PERIOD			
Purchase property and equipment:			
Real property	0	1,045,700	0
Revenue equipment	148,682	5,639,700	0
Other capitalized projects	126,186	11,870	0
Plan II start-up expense not capitalized	0	24,730	0
Retirement of long term debt	0	0	0
TOTAL USES	274,868	6,722,000	0
NET INCREASE (DECREASE) DURING PERIOD	(338,665)	25,120	84,507
WORKING CAPITAL AT END OF PERIOD (NEGATIVE)[5]	(38,655)	(13,535)	70,972

[1]Marin Transit District reserve, June 30, 1969, $300,009.66.

[2]Figure for July & August 1969 represents all pre-operating expenses not capitalized. Figure for Sept. 69 - Aug. 70 is loss on operation of Plan I; figure for Sept. 70 - Aug. 71 is loss on operation of Plan II.

[3]Marin Transit District tax @5¢/$100 valuation, 1969-70 estimate.

[4]Assumes 2/3 participation by Federal Government under UMTA.

[5]Indicates additional cash requirement.

SOURCE: R. L. Banks & Associates, Inc.

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Exhibit 49

COSTS OF ALTERNATIVE FINANCING METHODS

Method	Amount to be Financed	Approx. Rate of Interest	First Year Debt Service[1]			Total Cost[1]			
			Interest	Prin.	Total	Initial	Interest	Principal	Total
General Obligation Bonds, Marin County	6,000,000[2]	5 %[3]	300,000	500,000	800,000	90,000	1,950,000	6,000,000	8,040,000
Combination, Gen'l Obl.Bonds	2,000,000	5 %	100,000	166,667	266,667	30,000	650,000	2,000,000	2,680,000
and Federal grant	4,000,000	-	-	-	-	-	-	-	-
Combination, GGB&HD	2,000,000[4]	-	-	-	-	-	-	-	-
reserves & Federal grant	4,000,000	-	-	-	-	-	-	-	-
Lease	0	10-1/8%[5]	-	-	864,000	-	-	-	10,368,000

[1]Assumes 12-year amortization.

[2]Cost of 132 buses required for Plan II level of service.

[3]Assumes 5% (the Marin County legal limit) will be adequate in the 1970 money market.

[4]Although no cost would appear on transit system books, funding agency would incur loss of earnings or other benefits from alternative uses of these funds.

[5]Est. obtained by the Golden Gate Bridge & Highway District From a major leasing company.

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Exhibit 50

Bus Operating Cost Comparison
Central Garage (Greenbrae)
vs.
Greyhound Garage and Parking Lots
Plan I

	Greenbrae Garage And Lot	Greyhound Garage And Parking Lots	Excess Greenbrae Over Greyhound
Bus Miles			
Revenue	3,254,000	3,254,000	----------
Non-Revenue			
From and to Night Storage[1]	415,000	154,000	261,000
From and to Maintenance Facility Between Morning and Afternoon Commute Hours	292,000	70,000	222,000
Other	163,000	163,000	----------
Total Bus Miles	4,124,000	3,641,000	483,000
Bus Operating Costs @ 14.64/mile	$ 604,000	$ 533,000	$ 71,000
Bus Driver Costs[1]	1,459,000	1,390,000	68,000
Total	$2,063,000	$1,923,000	$ 139,000

[1]All excess driver pay is associated with bus movements which extends driver elasped time.

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Exhibit 51

Estimated Cost of Marin Service
Under Contract to Greyhound
(Excludes Sonoma)
Plan I Level of Service

		Greyhound Contract	
	Plan I[a]	Greyhound Buses	MTD New Buses
Total Operating Revenue	$2,668,756	$2,668,756	$2,668,756
Operating Expense			
Equipment, Maintenance & Garage	492,177	492,177	349,000[b]
Transportation	1,665,551	1,665,551	1,665,551
Station	---	---[c]	---[c]
Traffic & Advertising	77,303	---[d]	---[d]
Insurance & Safety	123,275	60,000[e]	60,000[e]
Administration & General	428,750	300,000[e]	300,000[e]
Depreciation	14,095	16,000[e]	---
Amortization	50,430	41,850[f]	14,290[g]
Operating Taxes & License	88,300	200,000[e]	200,000[e]
Operating Rents	8,280	8,280	8,280
Total Operating Expense	2,948,161	2,783,858	2,597,121
Net Operating Income (Loss)	(279,405)	(115,102)	71,635
Expense to Marin Transit District			
Contractors operating deficit (Profit)	---	115,102	(71,635)
Contractor's fee	---	160,125[h]	80,000[i]
Bond retirement (equal to depreciation of buses)	---	---	370,000
Traffic & Advertising	---	77,300[d]	77,300[d]
Routes & Schedules	---	50,000[j]	50,000[j]
Interest on bonds	---	---	220,000[k]
Total MTD Expense	$ 279,405	$ 402,527	$ 725,665

NOTE: See footnotes next page.

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Notes to Exhibit 51.

a. From Exhibit 44A.

b. Assumes maintenance labor and materials for new buses at 1/2 the cost per bus mile as for Greyhound's existing fleet.

c. Marin plan involves no stations.

d. Traffic and advertising expense borne directly by Transit District. See below.

e. Estimated on basis of Greyhound's actual costs. Twelve months ended June 30, 1967,and projected 1968 costs in CPUC 49658.

f. Includes bus paint job, visual design and driver uniforms.

g. Includes visual design and driver uniforms.

h. Six percent of revenues.

I. Three percent of revenues; contractor has no responsibility for providing buses.

j. Cost of a small market research and scheduling group.

k. $4.4 million @ 5%.

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EXHIBIT 52A

PRESENT MARIN COUNTY FARE STRUCTURE
GREYHOUND LINES

ZONE NUMBER

Zone No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.35																	
2	.60 8.35	.35																
3	.75 11.45	.45 7.30	.35															
4	.90 12.50	.50 8.35	.45 7.30	.35														
5	.95 13.55	.60 9.40	.60 8.35	.45 7.30	.35													
6	1.05 14.60	.75 10.40	.75 9.40	.55 9.40	.45	.35												
7	1.55 17.70	1.05	1.00	.85	.75	.55	.35											
8	1.70 20.80	1.30	1.25	1.15	1.05	.75	.45	.35										
9	1.95 23.95	1.60	1.55	1.40	1.20	1.00	.80	.45	.35									
10	.75 11.45	.35	.35	.50	.65	.85	1.05	1.45	1.70	.35								
11	.80 12.50	.45	.45	.60	.75	.90	1.25	1.55	1.85	.35	.35							
12	.95 14.60	.55	.50	.80	.90	1.10	1.45	1.70	1.95	.50	.45	.35						
13	1.25 17.70	.85	.80	1.05	1.25	1.45	1.70	2.05	2.25	.70	.65	.55	.35					
14	1.10 14.60	.75	.70	.35	.70	.85	1.20	1.50	1.75	.80	.90	1.05	1.25	.35				
15	1.30 15.60	.95	.85	.65	.90	1.05	1.40	1.70	1.95	.95	1.05	1.20	1.50	.45	.35			
16	1.55 20.80	1.10	1.05	.80	1.15	1.30	1.65	1.95	2.20	1.15	1.25	1.45	1.70	.60	.45	.35		
17	1.75 21.85	1.30	1.15	1.00	1.40	1.45	1.80	2.10	2.30	1.40	1.50	1.70	1.90	.70	.60	.45	.35	
18	.90 12.50	.50	.45	.55 8.35	.55 9.40	.70 11.45	1.05	1.40	1.60	.50	.55	.70	.95	.85	1.00	1.20	1.40	.35

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EXHIBIT 52B

PROPOSED MARIN COUNTY FARE STRUCTURE

ZONE NUMBER

Zone No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1																	
2	.60 16.70	.35															
3	.70 22.90	.35	.35														
4	.85 25.00	.45	.45	.35													
5	1.00 29.20	.70	.70	.50	.35												
6	1.50 35.40	1.00	.95	.80	.50	.35											
7	1.65 41.60	1.25	1.20	1.10	.70	.45	.35										
8	1.90 47.90	1.55	1.50	1.35	.95	.75	.45	.35									
9	.70 22.90	.35	.35	.45	.80	1.00	1.40	1.65	.35								
10	.75 25.00	.45	.45	.55	.85	1.20	1.50	1.80	.35	.35							
11	.90 29.20	.50	.45	.75	1.05	1.40	1.65	1.90	.45	.45	.35						
12	1.20 35.40	.80	.75	1.00	1.40	1.65	2.00	2.20	.65	.60	.50	.35					
13	1.00 29.20	.70	.65	.35	.80	1.15	1.45	1.70	.75	.85	1.00	1.20	.35				
14	1.25 31.20	.90	.80	.60	1.00	1.35	1.65	1.90	.90	1.00	1.15	1.45	.45	.35			
15	1.50 41.60	1.05	1.00	.75	1.25	1.60	1.90	2.15	1.10	1.20	1.40	1.65	.55	.45	.35		
16	1.70 43.70	1.25	1.10	.95	1.40	1.75	2.05	2.25	1.35	1.45	1.65	1.85	.65	.60	.45	.35	
17	.85 25.00	.45	.35	.55	.65	1.00	1.35	1.55	.45	.50	.85	.90	.80	.95	1.10	1.35	.35

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F. IMPLEMENTATION

Once a decision is made that the District go into bus operation independently or jointly with another agency, some preparatory steps will have to be taken immediately. The required preparation differs slightly depending upon which Plan is to be implemented. These requirements are itemized below according to the Plan of operation.

Work Item	Plan I	Plans II & III
I. Design Work		
A. Cost-Finding System	X	X
B. Bus Schedule Finalization	X	X
C. Visual Identification		
1. Bus Paint Scheme	X	X
2. Bus Stop Sign Design	X	X
3. Time-Table Design	X	X
4. Bus Stop Shelter Design	X	X
5. Promotion	X	X
6. Driver's Uniform Design	X	X
D. Final Specifications for New Buses	-	X
E. Construction Plans for Garage & Administration Building	-	X
II. Equipment & Facility Preparation		
A. Bus Purchase	-	X
B. Bus Preparation	X	X
C. Drivers' Uniform Purchase	X	X
D. Fare Register Purchase and Installation	X	X
E. Service Vehicle Purchase	X	X
F. Two-Way Radio Purchase and Installation	X	X
G. Bus Stop Shelter Construction	X	X
H. Bus Stop Sign Purchase and Installation	X	X
I. Bus Parking Lot Selection	X	X
J. Land Purchase	-	X
K. Garage and Administration Facilities Construction	-	X
III. Organization		
A. Staff Recruitment	X	X
B. Driver Training	X	X

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The cost of the aforementioned pre-operational steps is included in the financial statements in this report.

Most of the work items can be accomplished within about three months after the basic decision is made. This time-span constitutes the lead-time required for operation of Plan I.

The lead-time for implementation of Plan II or III will be determined by the delivery time of new buses, which is expected to be six to nine months. Some work items such as construction of administration building would take more than the bus delivery time, but these delays should not hold up the implementation of the system.

Any contract entered into for the purchase of buses to implement Plans II or III should contain an option for the delivery of a specified number of additional buses in the event that patronage exceeds the initial estimates. This provision is necessary as these estimates are conservative and any failure to match capacity with demand on the new system during its initial period of operation could damage the positive image which might otherwise be created.

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CHAPTER IV

EFFECTS OF THE SYSTEM

If implemented, the propsed bus system will bring about a wide range of effects beyond alleviation of traffic congestion. Psychological effects of having convenient and dependable public transport means available, the effects of improved mobility on the choice of jobs, etc. are all real but difficult to assess accurately. In this chapter, therefore, only some of the easily measurable effects of the proposed system are discussed.

The proposed bus system, when implemented, will be accessible to most Marin residents. Even assuming a quarter-mile as the maximum walking distance, it will be accessible on foot to 55% of Marin residents. This is an increase of about 77% over the corresponding figure of the existing Greyhound service. (See Exhibit 53)

The effect the system will have on Marin's transportation corridors will depend on which bus "Plan" is chosen and how well Marin's residents respond by using the system. Even with such vague parameters, after making some reasonable assumptions, an indication of the impact which the system might have can be determined.

To do this, the following procedure was followed:

1. Major-corridor a.m. peak-hour vehicular commuter traffic was obtained from directional hourly vehicle counts which are maintained by the Marin County Department of Public Works Traffic Engineering.

2. Major corridor a.m. peak-hour bus commuters was obtained from Greyhound bus passenger statistics.

3. The commute direction vehicle counts were multiplied by 1.65 to obtain commuters per vehicle. (Occupancy factor from Transit District survey.)

4. The number of commuters by bus and auto were summed to give present total commuters by corridor in the peak direction during the peak a.m. commute. From this total were subtracted the estimates of patronage for Bus Plans II and III.

5. The remaining commuters were divided by 1.65 to convert them to vehicle counts and the change expressed as a percent decrease in vehicular traffic.

The results of this procedure are tabulated below:

	% Decrease	
Corridor	Plan II	Plan III
So. San Pedro Road	15	25
Red Hill Ave./Fourth St.	6	12
Sir Francis Drake Blvd./Center Blvd.	7	10
Sir Francis Drake Blvd. (Ross, Greenbrae)	0	8
College Ave,/Tamalpais Ave.	0	0
Tiburon Blvd.	25	40
Miller Ave. (Mill Valley)	5	13
Alexander Ave. (Sausalito)	20	20

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The accumulation of the above reductions plus that on corridors which were not enumerated are a measure of the effect the system will have on the Freeway 101 congestion. To present a more real picture of this effect, it has been extrapolated to 1975, thereby reflecting the effect over a probable time of occurance. The results are graphically presented as Exhibits 54 and 9.

It is pointed out that the above reductions of vehicular traffic are not necessarily to be realized. It is likely instead that as the vehicular traffic starts to decrease during the peak hour, commuters who presently commute at a different time in order to avoid congestion will change to the peak hour. Therefore, any alleviation of that congestion will result in a switching of commute times to fill the gap. The result then should be a shortening of the peak period of congestion.

The effect will not be as dramatic when observed in San Francisco because of the large volumes of traffic existing on those streets. The following table illustrates this fact by comparing transit vehicles and patrons originating from Marin with all others entering the city limits of San Francisco.

A.M. Peak Period
Counts of Vehicles & Commuters Entering S. F.

	Vehicles		People	
	No.	Percent	No.	Percent
Mass Transit[1]	1,000	0.8	38,000	16.0
Non-Transit[1]	129,000	99.2	198,000	84.0
Total (All Modes)[1]	130,000	100.0	236,000	100.0
Marin Contribution by Mass Transit to Total				
Greyhound (Marin)[2]	96	0.07	3,800	1.6
Optimum Bus Plan I	93	0.07	4,500	1.9
Optimum Bus Plan II	131	0.10	6,100	2.6
Optimum Bus Plan III	165	0.13	8,000	3.4

[1]Estimated from State Division of Highways daily figures.

[2]Greyhound Passenger Statistics - 1968

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The impact of the Optimum Bus System can be shown, nevertheless, to be positive with respect to relieving the vehicular congestion in San Francisco. The following chart (Exhibit 55) demonstrates that when the Optimum Bus System, Plan III, is in operation, there would very probably be some 2,600 fewer Marin commuter vehicles entering the city during the morning commute period. This amounts to a decrease in vehicles of over 15 percent.

Therefore, it is demonstrated that the Optimum Bus System proposed herein can help alleviate the existing commuter traffic congestion on Highway 101 and on local streets of Marin and San Francisco. Furthermore, if properly implemented, it could absorb most of the incremental commute traffic for some years to come. These effects will be the result of the growth in transit patronage, which, in turn, is the expected outcome of improved service.

The bus system as well as the bus itself is a well-tested means of public transportation, and there are few unknown factors involved. The Optimum Bus System can be implemented almost immediately, and itssperformance and operation costs are predicted with confidence. However, commitment to the bus system does not exclude the District from adapting newer and better systems of public transit. The Optimum Bus System is flexible not only in adjusting itself to new route patterns and new time schedules, but also in harmonizing itself with any new mode of public transit that may become available. The ultimate flexibility of the bus system is continually demonstrated by the easy resell of buses.

One of the "new" modes of transit that was studied recently is ferry. A water transportation study, which was included in the District's 1968-69 Work Program, was conducted by a consultant firm. The findings of this feasibility study are reviewed in the last chapter of this report, and the relationship of the Optimum Bus System to the proposed ferry system is therein examined.

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Exhibit 53

Comparison of Coverage by Optimum Bus System
vs.
Present Greyhound System

Locality	Housing Units Within 1/4 Mile of Bus Route: Greyhound	Housing Units Within 1/4 Mile of Bus Route: Optimum Bus
Sausalito/Marin City	3,300	3,300
Tam Valley	100	1,000
Mill Valley	2,750	2,750
Tiburon/Belvedere	3,100	3,100
East Corte Madera/Alto	50	1,250
Kentfield/Corte Madera	2,350	2,350
Greenbrae	2,050	2,050
Ross	550	550
San Rafael	2,700	5,300
So. San Pedro	---	1,300
Fairfax/Sleepy Hollow/Manor/ San Anselmo	2,500	5,000
Santa Venetia	---	1,150
Terra Linda	100	2,500
Lucas Valley	150	800
Ignacio	100	800
Novato	300	2,400
TOTAL	20,100	35,600
% of County Total 65,000 Housing Units	31%	55%

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Exhibit 54

Modal Split of Peak Hour Commuters (7-8 a.m.)
By Plan and Year

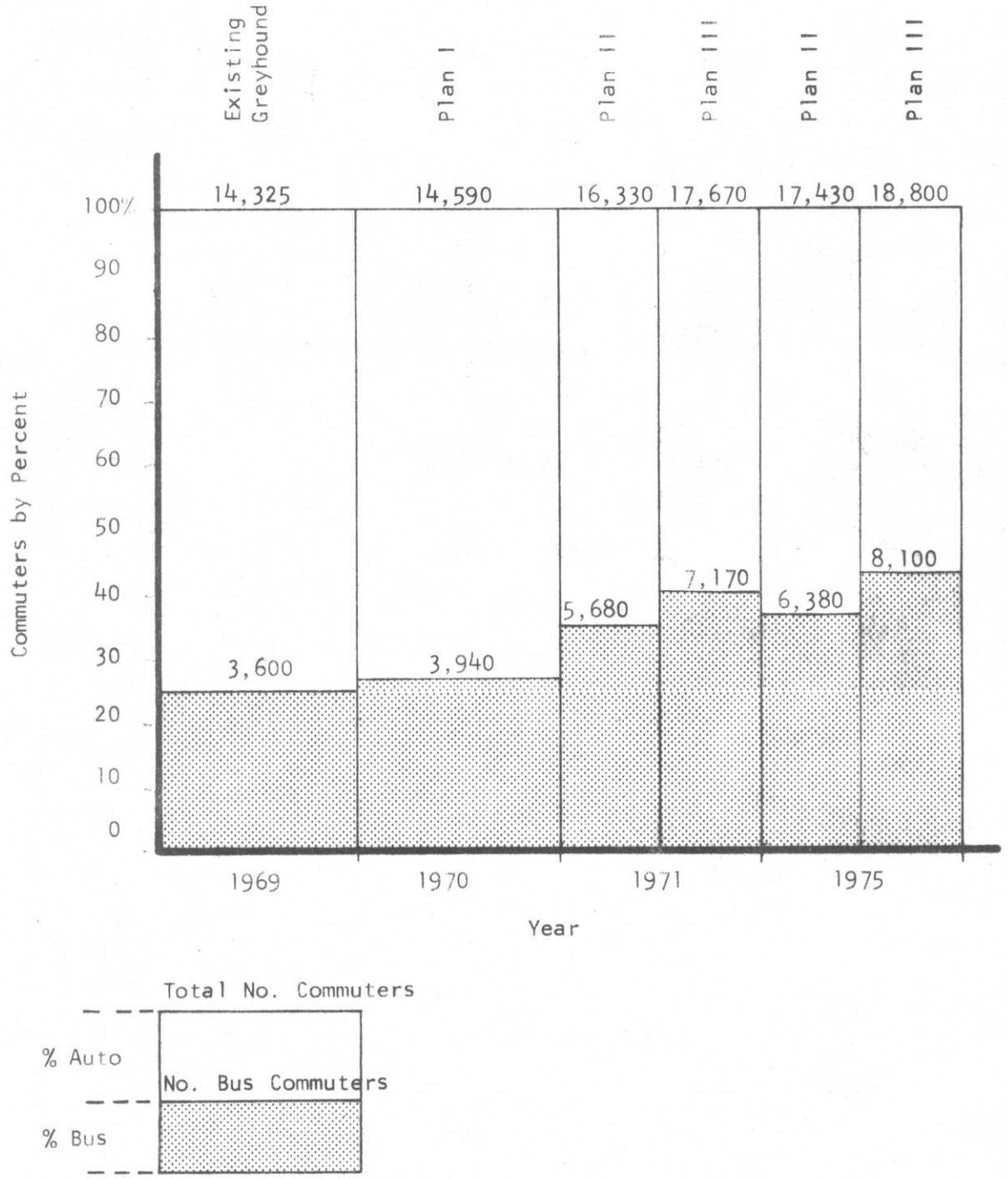

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Exhibit 55

Impact of Improved Marin Bus Service
On Vehicles and Commuters Entering San Francisco
(A.M. Peak Period)

	Vehicles		People	
	No.	Index	No.	Index
Present Marin-S.F. Traffic				
Mass Transit	96	0.6	3,700	12.3
Non-Transit	15,940	99.4	26,300	87.7
Total (All Modes)	16,036	100.0	30,000	100.0
Proposed Bus System Marin-S.F.				
Non-Transit	15,450	96.4	25,500	85.0
Optimum Bus Plan I	93	0.6	4,500	15.0
Non-Transit	14,480	90.3	23,900	79.7
Optimum Bus Plan II	131	0.8	6,100	20.3
Non-Transit	13,330	83.1	22,000	73.3
Optimum Bus Plan III	165	1.0	8,000	16.7

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CHAPTER V

REVIEW OF WATER TRANSPORTATION STUDY

A San Francisco-Marin Water Transportation Study Committee was appointed by the City and County of San Francisco and the Marin County Transit District under the terms of a Joint Exercise of Powers Agreement. The Committee engaged Arthur D. Little, Inc. to undertake a study to determine the feasibility of initiating a water transportation system between San Francisco and Marin County. Consultant rendered its report to the Committee during July 1969.[1]

The Arthur D. Little report concludes that "a modern, technologically advanced system of ferries, with proper, closely coordinated feeder services at each end, can substantially reduce the present peak hour congestion of the Golden Gate Bridge 'corridor' by diverting a significant number of automobiles from it." They then conclude that "it would be feasible to institute such a system."

The report raises many questions in addition to those which it attempts to answer. For example, conclusions drawn from the consultant's survey indicate that many present commute bus riders would switch to a modern ferry system. No question was asked concerning the desire of the respondent if an alternative modern bus system was available. In other words, the choice was between the present bus service and a hypothetical ferry service. Additional work will have to be done in this area in order to determine what effect a modern bus system would have on commuter choice.

More serious perhaps, are the qustions relating to present water transportation technology. Page 56 of consultant's report quotes from a letter from Morris Guralnick Associates, Inc., a firm of naval architects associated with it in this report:

> "Based on our studies to date, we recommend catamaran type vessels, driven by diesel engines through controllable pitch propellers. This type of vessel will generate minimum wake, provide ample deck area with minimum stability problems, and permit outstanding maneuverability characteristics which is vital to the success of this service. A normal speed of about 21 knots and a capability of operating at 23 knots on occasion will be required to maintain the desired schedule. To be sure of maintaining these speeds with reasonable economy, the hulls will have to be long and widely spaced. We have conservatively selected a length of 330 feet and an overall beam of 100 feet. The length of the deckhouse will be much shorter."

---

[1] "Feasibility Study of San Francisco-Marin Ferry System," Arthur D. Little, Inc., July, 1969.

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In connection with the employment of hydrofoil vessels for the proposed service, consultant states on page 58:

> "The lack of available information on hydrofoils makes it extremely critical that any use of such vessels be preceded by engineering tests to determine the ability of such craft to meet the critical criteria of dependability and safety. If ADL were seeking to maximize the conservative nature of its report we would exclude consideration of any vessels other than displacement hull craft because more technologically advanced vessels cannot yet be proven to be absolutely reliable. However, the market demand requirements previously discussed (emphasis supplied) suggest that the systems design effort should not exclude the possibility of more advanced vessels."

The Guralnick report to A. D. Little states:

> "Hydrofoils have demonstrated a limited ability to provide a practical means of passenger transport at speeds of 30-40 knots.
>
> "Hydrofoils are limited in the number of passengers they can carry. The largest one in the world is the EXPRESSAN launched May 1968 in Norway with a capacity of 240 passengers....
>
> "Most of the presently successful hydrofoils can carry an average of about 100 passengers and operate on runs of about 20 to over 100 miles in length....
>
> "The U.S. Department of Commerce concludes that their best use is in the 30 to 200 mile range."

The A. D. Little report also deals with surface effect vessels (air cushioned vehicles [ACV]) and indicates that "We did not undertake any more detailed evaluation of any ACV prototype though this could be done in the system design and implementation phase of a ferry boat program should a manufacturer present the relevant data."

It is obvious from the findings in the A.D. Little study that the institution of a ferry system between San Francisco and Marin which will meet the criteria needed for success would require considerable technical investigation and prototype testing. No advanced vessel designs are now commercially available which will meet the criteria under which the study was made. Furthermore, the cost data which was available to consultant by which it made its economic analysis are probably subject to sharp upward revision. For example, consultant assumes the cost of 15 hydrofoil vessels (250 passengers each) at $600,000 or a total of $9,000,000. The cost per vessel is estimated at $1,615,000 (250 passenger, PT-150) or $24,225,000 in another report.[1] Still another source states that the cost per vessel could actually reach $4,000,000.

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[1] "Richmond Manhattan Marine Transportation Study", The Stanwick Corporation, November 29, 1968.

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The institution of a ferry system will require a prolonged period of evaluation leading to the design and testing of vessels. This suggests that San Francisco join with the Marin County Transit District and the Golden Gate Bridge and Highway District in the creation of a technical committee charged with responsibility for carrying on the work begun by the San Francisco-Marin Water Transportation Study Committee. The magnitude of investment required to successfully operate a ferry system permits no shortcuts. The A. D. Little report confirms this conclusion.

Nowhere does the report document any reasons why the "Optimum Bus System" cannot be implemented immediately. The new bus system should in no way prejudice the later implementation of a water transportation system as bus routes can be revised to serve the proposed ferry terminals and services adjusted according to changed traffic demands. Furthermore, the proposed bus system should provide immediate relief from present commuter travel congestion and restore commuter confidence in public transportation.

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CAPITAL REQUIREMENTS

PROPOSED

ALTERNATIVE FERRY SYSTEMS

ITEM	DISPLACEMENT HULL	HYDROFOIL	AIR CUSHION VEHICLE
Vessels *	$19,200,000	$ 9,600,000	$24,000,000
Marin Terminal (s)	10,000,000	10,000,000	10,000,000
San Francisco Terminal	2,000,000	800,000	800,000
System Design & Development	1,000,000	1,000,000	1,000,000
Land & Access Roads	2,000,000]		
Feeder Buses	1,225,000]	5,150,000	3,750,000
Dredging	700,000]		
Total	$36,125,000	$26,550,000	$39,550,000

* Individual vessel cost estimates:

Displacement Hull	4@	$ 4,800,000
Hydrofoil	15@	600,000
Air Cushion Vehicle	4@	6,000,000

Source: Arthur D. Little, Inc.

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MINIMUM VESSEL CRITERIA

1. They must be capable of operating dependably and maintain schedules under fog and other weather conditions which occur in the bay.

2. They must be capable of operating dependably at night to permit trips past peak commute hours.

3. They must operate dependably given the fact that logs and other flotsam are frequently in the bay.

4. They must be capable of avoiding small boats.

5. They must he able to operate economically on relatively short runs.

6. They must present no navigational hazards.

7. Maintenance down time must not be excessive.

8. They must not produce noise pollution problems for the residents and workers located near terminals.

9. The internal facilities of the vessel must be commodious with no noise irritation for passengers.

10. The ride must be smooth and comfortable.

Source: "Feasibility Study of San Francisco-Marin Ferry System"; Arthur D. Little, Inc. pp. 55-56.

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SAN FRANCISCO-MARIN WATER TRANSPORTATION STUDY COMMITTEE

SAN FRANCISCO MEMBERS	MARIN COUNTY MEMBERS
Hon. Jack Morrison, Co-Chairman	Thomas T. Storer, Esq., Co-Chairman
Hon. William C. Blake	Seymour Kashin, Secretary
Louis Goldblatt	Harlan Soeten
Stephan C. Leonoudakis, Esq.	
Hon. James Mailliard	
Orris W. Willard	

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APPENDIX

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Appendix 1

Projected Commuter Traffic Volumes
by Mode and Alternative Transit Plan

YEAR	Total Commuters	Bus Riders G.H.	Plan I	Plan II	Plan III	Auto Commuters	No. Autos (1.65/Auto)	Difference In No. of Autos
1960	18,500	3,575				14,925	9,045	
1968	30,000	3,700				26,300	15,940	
1970	32,000	3,800				28,200	17,100	0
			4,700			27,300	16,500	600
1971	33,000	3,800				29,200	17,700	0
				6,500		26,500	16,100	1,600
					8,500	24,500	14,800	2,900
1975	37,000	4,000				33,000	20,000	0
				7,300		29,700	18,000	2,000
					9,600	27,400	16,600	3,400

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Appendix 2

Projected Peak Hour Commuter Traffic Volumes and Modal Split
(7 a.m. - 8 a.m. on Golden Gate Bridge)

Year	Bus Plan	Total Commuters	Auto No.	Auto %	Bus No.	Bus %	No. of Autos	No. of Buses	Total Vehicles
1969	WGL	14,325	10,725	75	3,600	25	6,500	80	6,580
1970	I	14,590	10,650	73	3,937	27	6,450	82	6,532
1971	II	16,330	10,650	65	5,680	35	6,450	118	6,568
	III	17,670	10,500	59	7,170	41	6,350	150	6,500
1975	II	17,430	11,050	63	6,380	37	6,700	133	6,833
	III	18,800	10,700	57	8,100	43	6,500	169	6,669

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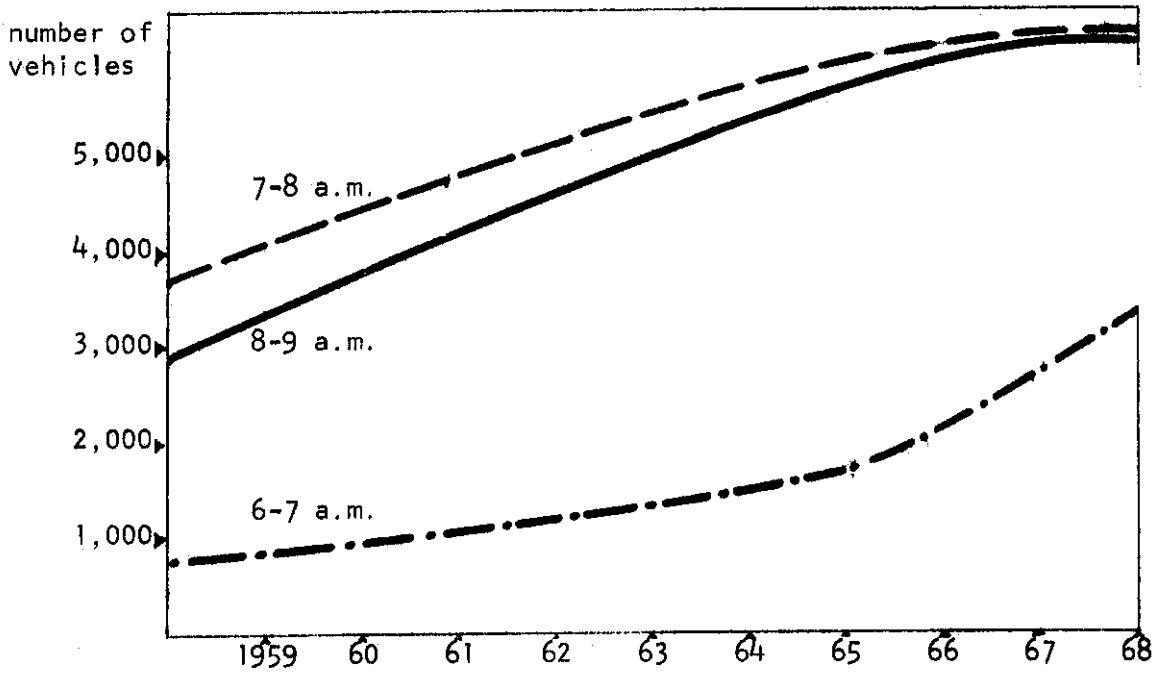
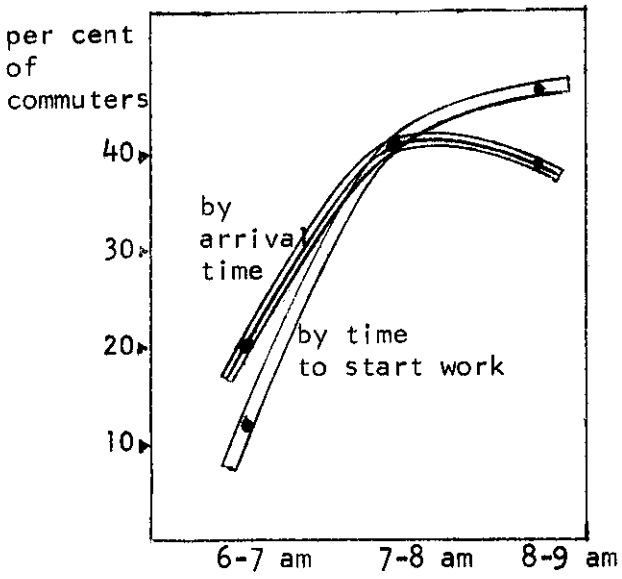
Appendix 3 COMMUTER TRAFFIC GROWTH TREND, AT GOLDEN GATE BRIDGE, A.M., 1958-1968.



Appendix 4 DISCREPANCY BETWEEN TIME OF TRAVEL AND TIME TO START WORK. (Percent of Commuters, by Arrival Time and by time to start work) 1968.



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Appendix 5

Comparison of Present Greyhound Operation
With Proposed Public Operation
Marin/Sonoma-San Francisco

		MARIN TRANSIT		
	Greyhound	Plan I	Plan II	Plan III
Revenue Bus Miles:				
Commute	1,495,376	1,499,988	1,917,048	2,284,464
(Index)	(100)	(100)	(128)	(153)
Non Commute	1,660,716	2,718,668	2,718,668	2,718,668
(Index)	(100)	(164)	(164)	(164)
TOTAL	3,156,092	4,218,656	4,635,716	5,003,132
(Index)	(100)	(134)	(147)	(159)
Passengers:				
Commute	2,288,782	2,570,770	3,509,507	4,546,235
(Index)	(100)	(112)	(153)	(199)
Non Commute	1,753,102	2,186,761	2,252,365	2,252,365
(Index)	(100)	(125)	(128)	(128)
TOTAL	4,041,884	4,757,531	5,761,872	6,798,600
(Index)	(100)	(118)	(143)	(168)
BUSES REQUIRED	123	126	152	186
(Index)	(100)	(102)	(124)	(151)

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Appendix 6

SUMMARY OF DAILY PASSENGER ESTIMATES
FOR PROPOSED PUBLIC OPERATION BY DAY OF WEEK
AND TYPE OF SERVICE (MARIN-SAN FRANCISCO)

	WEEKDAY				SAT/SUN/HOL			
	WGL*	PLAN I	PLAN II	PLAN III	WGL	PLAN I	PLAN II	PLAN III
Commute	7,480	9,430	13,132	17,246				
Non Commute	3,978	5,366	5,527	5,527				
TOTAL	11,458	14,796	18,659	22,773	4,419	5,168	5,322	5,322

Appendix 7

SUMMARY OF DAILY PASSENGER ESTIMATES FOR
PROPOSED PUBLIC OPERATION BY DAY OF WEEK
AND TYPE OF SERVICE (MARIN/SONOMA-SAN FRANCISCO)

	WEEKDAY				SAT/SUN/HOL			
	WGL	PLAN I	PLAN II	PLAN III	WGL	PLAN I	PLAN II	PLAN III
Commute	8,251	10,201	13,927	18,041				
Non Commute	4,749	6,137	6,322	6,322				
TOTAL	13,000	16,338	20,249	24,363	4,967	5,716	5,886	5,886

*Western Greyhound Lines

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Appendix 8

Marin/San Francisco Service
Detailed Commute/Non-Commute
Income Statement

	I	II	III
Operating Revenues			
Passenger			
Commute	1,430,206	2,010,400	2,638,047
Non-Commute	1,220,000	1,257,000	1,257,000
Total	2,650,206	3,267,400	3,895,047
Advertising			
Commute	15,750	20,300	26,250
Non-Commute	2,800	2,800	2,800
Total	18,550	23,100	29,050
Total Operating Revenue			
Commute	1,445,956	2,030,700	2,664,297
Non-Commute	1,222,800	1,259,800	1,259,800
Total	2,668,756	3,290,500	3,924,097
Operating Expenses			
Equipment, Maintenance & Garage			
Commute	184,566	188,299	229,019
Non-Commute	307,611	176,622	174,183
Total	492,177	364,921	403,202
Transportation			
Commute	1,145,587	1,694,251	2,132,367
Non-Commute	519,964	555,906	555,771
Total	1,665,551	2,250,157	2,688,138
Traffic & Advertising			
Commute	41,744	53,721	65,511
Non-Commute	35,559	33,630	31,255
Total	77,303	87,351	96,766

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Appendix 8 (Continued)

	I	II	III
Insurance & Safety			
Commute	123,275	150,837	168,665
Non-Commute	-------	-------	-------
Total	123,275	150,837	168,665
Administrative & General			
Commute	378,240	454,772	500,972
Non-Commute (Welfare Expenses)	50,510	53,866	53,866
Total	428,750	508,638	554,838
Depreciation			
Commute	13,327	455,593	578,063
Non-Commute (Buses & Fare Boxes)	768	57,208	57,208
Total	14,095	512,801	635,271
Amoritization			
Commute	50,430	26,827	30,055
Non-Commute	-------	-------	-------
Total	50,430	26,827	30,055
Operating Taxes & Licenses			
Commute	59,230	76,484	93,801
Non-Commute	29,070	29,176	29,176
Total	88,300	105,660	122,977
Operating Rents			
Commute	8,280	------	------
Non-Commute	------	------	------
Total	8,280	------	------

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Appendix 8 (Continued)

	I	II	III
Total Operating Expense			
Commute	2,004,679	3,100,784	3,798,453
Non-Commute	943,482	906,408	901,459
Total	2,948,161	4,007,192	4,699,912
Operating Income (Loss)			
Commute	(558,723)	(1,070,084)	(1,134,156)
Non-Commute	279,318	353,392	358,341
Total	(279,405)	(716,692)	(775,815)
Non-Operating Income (Expense)			
Interest On Long Term Debt			
Commute	-----	(301,000)	(371,000)
Non-Commute	-----	(34,000)	(34,000)
Total	-----	(335,000)	(405,000)
Net Income (Loss)			
Commute	(558,723)	(1,371,084)	(1,505,156)
Non-Commute	279,318	319,392	324,341
Total	(279,405)	(1,051,692)	(1,180,815)

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Appendix 9

Morning Commute Patronage Estimate
by
Origin and Plan

Origin	Passengers Plan I	Plan II	Plan III
Novato	316	481	610
Ignacio	314	518	637
Terra Linda	419	653	861
Santa Venetia	94	152	212
Peacock Gap	111	196	308
Sleepy Hollow	203	229	342
Manor	111	370	286
Fairfax	386	251	452
Canal	111	112	236
Ross Valley/Greenbrae	321	468	620
Kentfield/Corte Madera	369	522	676
East Corte Madera/Alto	103	271	321
Belvedere/Tiburon	696	847	1,067
Mill Valley	469	537	780
Tam Valley	159	317	430
Marin City/Sausalito	533	642	785
Total	4,715	6,566	8,623

Note- The above estimates were obtained by multiplying the base year estimates (September,1968) by the following factors. Plan 1-- 1,045, Plans II, III-- 1.076 This was done to obtain figures representative of the year of probable bus operation.

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Appendix 10

November 1968 Survey Response Summary

Summary For All Modes

Mode	No. Commuters	
	Responded	Total
Auto	16,403 (56%)	29,161 (100%)
Bus	1,958 (52%)	3,800 (100%)
Ferry	215 (86%)	250 (100%)
	18,576 (56%)	33,211 (100%)

Survey Responses by Bus Mode

Total Responses by Bus Mode = 1,958

Daily Bus Commuters (7:00 a.m. - 9:00 a.m.) = 3,800 (Greyhound Passenger Statistics - 5-68, 10-68)

Expansion Factor = 3,800/1,958 = 1.94

Survey Response by Ferry Mode

Total Responses by Ferry Mode 215

Daily Ferry Commuters 250 (actual count - Nov. 1968)

Expansion Factor $\frac{250}{215} = 1.16$

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Appendix 10 (Continued)

Survey Response Summary Continued

Survey Responses by Auto Mode

1. No. Responses by Auto Occupancy

Auto Occupancy	1	2	3	4	5	6	7	8	9	Total
Respondents	6,034	2,381	858	290	209	90	21	12	5	9,900
%	61%	24%	8.7%	/---------- 6.3%----------/						100%

II. No. Commuters by Auto Occupancy

Auto Occupancy	1	2	3	4	5	6	7	8	9	Total
Respondents	6,034	4,762	2,574	1,160	1,045	540	147	96	45	16,403
%	37%	29%	16%	/---------- 18%----------/						100%

III. Auto Occupancy Rate

$$\frac{16{,}403 \text{ auto commuters}}{9{,}900 \text{ autos}} = 1.657$$

IV. Adjustment Factor

Total autos crossing G. G. Bridge (6:00 a.m. - 9:40 a.m.) = 17,600

17,600 x 1.657 = 29,161 total auto commuters

$$\frac{29{,}161 \text{ total auto commuters}}{16{,}403 \text{ responding auto commuters}} = 1.778 \text{ adjustment factor (commuters)}^{1}$$

$$\frac{29{,}161 \text{ total auto commuters}}{9{,}900 \text{ responses (cards)}} = 2.946 \text{ adjustment factor (returned cards)}^{1}$$

[1]Adjustment factor for commuters takes into account that a returned card may represent more than one commuter.

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Appendix 11

TIME PROFILE TOTALS BETWEEN 8:00 & 9:09 (Raw Data)

	Destination						
Origin	S03	S04	S05	S09	S14	S16	TOTAL
M1	84	34	36	1	1	23	179
M2	50	42	20	1	1	8	122
M4	31	7	6	1	1	8	54
M5	62	18	7	0	2	11	100
M6	159	66	34	13	0	24	296
M8	279	115	127	12	8	34	575
M13	169	46	33	6	5	40	299
M14	51	22	12	5	4	16	110
M15	37	19	17	1	3	6	83
M18	21	10	7	0	3	3	44
M20	56	42	28	3	9	6	144
M22	16	8	21	0	3	1	49
M23	22	11	6	2	0	4	45
M25	86	48	16	7	7	3	167
M27	36	13	10	0	2	6	67
M29	274	127	56	19	12	29	517
M30	157	59	58	7	7	21	309
M31	71	39	23	7	2	21	163
M32	416	182	86	34	15	44	777
M34	52	34	14	7	1	2	110
M35	149	87	57	21	11	15	340
M38	138	74	59	12	15	24	322
M41	280	96	46	25	27	39	513
M42	27	30	9	1	0	8	75
M43	41	22	14	2	4	6	89
M44	34	11	7	0	1	5	58
TOTAL	2,798	1,262	809	187	144	407	5,607

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Appendix 12

TIME PROFILE TOTALS (24 Hour Raw Data)

	Destination						
Origin	S03	S04	S05	S09	S14	S16	TOTAL
M1	116	44	65	3	1	45	274
M2	66	48	26	3	2	47	192
M4	38	7	14	1	1	16	77
M5	71	20	12	0	2	19	124
M6	204	80	53	14	1	51	403
M8	349	145	145	20	10	93	762
M13	222	57	50	8	5	52	394
M14	67	26	20	5	4	47	169
M15	42	28	18	3	8	33	132
M18	29	14	10	0	4	5	62
M20	81	53	31	4	11	20	200
M22	34	17	25	0	3	1	80
M23	33	13	7	3	1	6	63
M25	99	60	31	13	7	12	222
M27	38	17	12	0	3	6	76
M29	352	159	76	21	15	60	683
M30	237	94	88	10	14	57	500
M31	109	48	42	8	2	41	250
M32	529	206	113	44	17	118	1,027
M34	71	42	14	7	4	8	146
M35	191	100	75	33	15	36	450
M38	162	80	74	17	23	50	406
M41	323	118	69	32	34	77	653
M42	35	38	17	3	3	28	124
M43	46	26	23	2	4	33	134
M44	57	11	8	0	8	19	103
TOTAL	3,601	1,551	1,118	254	202	980	7,706

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Appendix 13

Modal Split Analysis No. 1
Raw Data Summary

Survey Responses (Unadjusted)

Mill Valley to Ferry Terminal Area

By Mode & Autos per Household (7:10 a.m. - 9:09 a.m.)

Autos/H.H.	Bus	Auto	Total
1	55 (36%)	98 (64%)	153 (100%)
2	20 (16%)	107 (84%)	127 (100%)
3-8	2 (10%)	17 (90%)	19 (100%)
0	11 (85%)	2 (15%)	13 (100%)
	88 (28%)	224 (72%)	312 (100%)
		80[1]	80[1]
	88 (22%)	304 (78%)	392 (100%)
			63[2]
			455

[1]Commented that auto was required in job.

[2]Commuted at other times.

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Appendix 14

Modal Split Analysis No. 1
Bus Passenger Statistics

Mill Valley Greyhound Lines Passenger Statistics (10/1-7/68)

Schedule #	Passengers
7005	35
7007	40
7025	44
7009	44
7013	40
7015	43
7027	43
7017	58
7019	45
7021	45
7023	27
TOTAL	464

88 = No. survey responses of bus riders from Mill Valley to Ferry Terminal Area.

120 = No. survey responses of all bus riders from Mill Valley.

$464 \times \frac{88}{120} = 340$ adjusted Mill Valley to Ferry Passengers.

$\frac{340}{88} = 3.864$ adjustment factor.

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Appendix 15

Modal Split Analysis No. 2
Expanded Data

S. F. Zone	Bus Mode (f_b = 12.60)	All Modes (f_t = 2.64)	% by Bus	Distance From Ferry Terminal
12	38	531	7.2	7,000 ft.
13	113	1,249	9.0	5,200
21	517	3,202	16.1	3,200
22	315	1,555	20.3	1,600
23	101	1,032	9.8	5,000
24	227	1,360	16.7	3,600
32	25	462	5.4	7,200
51	13	327	4.0	6,100
52	25	393	6.4	4,500
392	13	264	4.9	7,200
393	88	560	15.7	5,400
394	227	1,265	17.9	3,600
395	352	1,375	25.6	1,800
396	38	232	16.4	1,800
401	189	758	25.9	3,200
402	214	834	25.7	2,000

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Appendix 16

Modal Split Analysis No. 2
Expansion Factors

Bus Expansion Factor

Total Bus Riders = 3,800

Bus Commuters riding to Ferry Terminal = 71.3% of total[1]

71.3% x 3,800 - 2,709

Regression Sample Size = 215

F_b = expansion factor = $\frac{2,709}{215}$ = 12.60

Total Commuter Expansion Factor

Bus Commuters riding to Ferry Terminal and working in Financial District

From Regression Sample - 187/215 = 87%

Expansion to total responses = 87% x 71.3% x 1,958 bus commuter responses = 1,215

Expansion to Bus Commuters = 1,215 x 1.94 commuters per bus response = 2,357

Ferry Riders working in Financial District

203 survey responses x 1.16 commuters per response = 235

Auto Commuters working in Financial District

Total Commuter Responses	-	Bus Responses	-	Ferry Responses	=	Auto Responses
5,208		1,215		203		3,790

3,790 auto responses x 1.657 commuters per auto x 1.778 commuters per response = 11,166 Commuters

Total Commuters (all modes) = 11,166 auto + 235 ferry + 2,357 bus = 13,758

F_t = Expansion factor = 13,758/5,208 = 2.64

[1]Greyhound Passenger Statistics - July 1968

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Appendix 17

Modal Split Analysis No. 2
Raw Data

San Francisco Zone	Commuters by Bus	Total Commuters (from Survey Listing Program Report)	% By Bus	Zone Distance from Ferry Terminal (thousands of feet)
12	3	201	1.49	3.9
13	9	473	1.90	2.9
21	41	1,213	3.38	1.8
22	25	589	4.24	.9
23	8	391	2.05	2.8
24	18	515	3.50	2.0
32	2	175	1.14	4.0
51	1	124	0.81	3.4
52	2	149	1.34	2.5
392	1	100	1.00	4.0
393	7	212	3.30	3.0
394	18	479	3.76	2.0
395	28	521	5.37	1.0
396	3	88	3.41	1.0
401	15	287	5.23	1.8
402	17	316	5.38	1.1
Others	16	2,211	--	--
TOTAL	215	8,044		

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Notes for Exhibits 52A and 52B

(Pages 126 and 127.)

The numbers shown in the pyramid scale are the fares now in effect on Greyhound Lines (Exhibit 52A) and proposed for the new bus system (Exhibit 52B). Where two amounts are shown between the same zonal pair, the first or lesser number is the one-way fare, the second or larger number is the price of the twenty-ride ticket (Exhibit 52A) or a proposed calendar month, unlimited ride commutation ticket (Exhibit 52B). The proposed monthly ticket would be available for direct purchase or by mail. Round-trip single fares are 180% of the one-way fares shown in the two exhibits.

The boundaries of the zones shown in Exhibits 52A and 52B are as follows:

Zone Number Shown in Exhibit 52A	Zone Boundaries	Zone Number Shown in Exhibit 52B
1	San Francisco	1
2	Marin Bridgehead Fort Baker Gate Sausalito Marin City Manzanita	2
3	Tamalpais Jct. Tamalpais Valley Almonte High School Locust Avenue Park Avenue Mill Valley Alto Tiburon Wye Corte Madera Road Greenbrae Corte Madera Baltimore Avenue Larkspur	3
4	Greenbrae Oaks Bon Air Laurel Grove Avenue California Park Escalle Murray Park Kentfield Kentfield Corners Ross	4

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Zone Number Shown in Exhibit 52A	Zone Boundaries	Zone Number Shown in Exhibit 52B
4 (Continued)	Bolinas Avenue San Anselmo Highland West End San Rafael Saunders Avenue San Anselmo Avenue Pastori Avenue Fairfax Manor	4
5	Terra Linda St. Vincent School (Marinwood)	4
6	Hamilton Field Jct. (Bolling Rd.) Ignacio Novato	5
7	Burdell San Antonio Road Sonoma-Marin County Line Petaluma	6
8	Willow Beade Inn Ely Road Jct. Penn Grove Cotati	7
9	Wilfred Todd Road Bellevue Avenue Santa Roas	8
10	Dias Ranch Muir Woods Jct.	9
11	Ridge Avenue Alpine Lodge Anne Lane Mountain Home	10

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Zone Number Shown in Exhibit 52A	Zone Boundaries	Zone Number Shown in Exhibit 52B
12	Boot Jack Muir Beach Jct. Stinson Beach	11
13	Bolinas	12
14	Woodacre Woodacre Lodge San Geronimo	13
15	Forest Knolls Lagunitas Bettini Camp Berkeley Camp Taylor Taylorville	14
16	Jewell Tocolona Olema Point Reyes Station	15
17	Inverness	16
18	Greenwood Beach Tiburon Belvedere	17

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