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Different Modes of Demand Responsive
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ABSTRACT

The Orange County Transit District (OCTD) has operated a community service transit program in the City of Orange, California since May of 1975. Because of an adverse court ruling and a subsequent successful appeal, this service underwent four modal changes. These four modes provide a unique opportunity for comparison. In order of implementation, they were: a demand-responsive Dial-A-Bus, a three-loop fixed route bus system, a two-loop fixed route bus system, and a demand-responsive Dial-A-Taxi system.

Five performance indicators were used for the comparison, and the two demand-responsive systems were found more efficient and effective than the fixed route systems. The Dial-A-Taxi system, during its first three months of operation, compared very favorably to Dial-A-Bus. In addition, the Dial-A-Taxi system continues to show monthly improvements on each indicator.

There may be limited transferability of the information gained in this study, but the data suggests that Dial-A-Taxi can be very efficient and effective in serving cities or suburban areas with population densities of 5000 or less per square mile.

The Orange County Transit District (OCTD) has as one of its goals the development of an extensive community service program.* This program is used to supplement the basic OCTD fixed route bus system (one mile grid spacing and 30 minute headways) in areas where transit dependency is greatest. The community service is always associated with a city or area for name identification and takes one of these forms: Dial-A-Bus, Dial-A-Taxi, or an intensive fixed route loop system. The Dial-A-Taxi mode may involve the use of some buses in areas where heavy peak hour traffic merits the use of larger vehicles.

The community service program that was developed in the City of Orange presents a rare and unique case for study. The original service provided utilization of the Dial-A-Bus mode. A court decision terminated the Dial-A-Bus (1), and a three-loop fixed route system was inaugurated. Later the three loop system was converted into a two loop system. A higher court reversal of the original ruling enabled the OCTD to reinstate demand response services (2), and the decision was made to replace the fixed route service with Dial-A-Taxi service. The four key dates to remember are the service date changes. They are as follows:

June 2, 1975	Dial-A-Bus commenced
July 6, 1976	Community Fixed Route Service (CFR) replaced Dial-A-Bus
January 2, 1977	CFR changed from three loops to two loops
July 6, 1977	CFR changed to Dial-A-Taxi

This paper describes the results of a study comparing the passenger response and operating costs of the four different modes of community service in the City of Orange.

* The planning department of the OCTD was instrumental in providing the data necessary to complete this report.

It should be obvious that direct comparisons of cost and performance data for different modes or for different areas may have little validity and require careful interpretation, but it is believed that there are performance indicators that at least facilitate comparisons. In the case of the City of Orange the geographical area and the population served remain a constant. The first three modes used were all operated by the same contractor and utilized the same type of vehicles.

ORANGE COUNTY TRANSIT DISTRICT

Orange County, California is one of the fastest growing metropolitan areas in the United States. In 1960, its population, assessed valuation, and taxable sales stood at 704,000, \$1,142,000,000, and \$759,000,000 respectively. By 1970, the figures had risen to 1,420,000, \$3,534,000,000, and \$2,819,000,000; and the 1976 figures are 1,729,294, \$8,525,901,232, and \$6,965,894,000 respectively (3).

Throughout the first three years of this period, Orange County residents had to rely almost exclusively upon the automobile as a mode of urban travel. The lack of high density development, the extensive network of wide streets and arterials, and the extensive network of freeway interconnections with other Southern California areas resulted in and from this complete dependence on the automobile.

In 1971, however, the Orange County Transit District (OCTD) was formed for the purpose of providing cost-effective public transportation to county residents. Its task was not easy. There were two dominant obstacles. One was the unusually strong attachment of Southern Californians to their automobiles--brought about in large measure by the ease with which great distances can be traversed at relatively low costs; the other was the travel pattern of county residents--diverse and diffused in both space and time.

To compete with the automobile in this environment of diffused travel patterns, OCTD developed innovative concepts. The goal of OCTD became a well balanced, integrated transportation system comprised of a number of community or local area bus or taxi systems which serve intracommunity travel needs, while simultaneously serving as collection and distribution of subsystems for an extensive county-wide network of bus routes designed to facilitate intercommunity travel. In the future, this integrated county-wide system will, in turn, serve as a collection and distribution subsystem for the regional transportation system of the Los Angeles Basin.

As the first step of the innovative process that could serve the needs of those without access to an automobile and yet compete with the automobile, OCTD inaugurated a pilot Dial-A-Ride service in the City of La Habra, California in February, 1973.

OCTD has since expanded its community service into Orange, Buena Park and Westminster (Fixed Route Services), and Fullerton (Dial-A-Taxi), and expanded the La Habra service into Brea. Three other community services are expected to go into operation before July 1, 1978.

CITY OF ORANGE

The City of Orange, the first city selected for community service after the pilot project, is located in the center of Orange County, approximately 26 miles south of Los Angeles. On the edge of Southern California's coastal plain, Orange is situated at the foot of the Santa Ana Mountains, with both the Santa Ana River and Santiago Creek running through the city (4). It covers 16.8 square miles with a total population of 83,900 (5) and a population density of 4994 per square mile. One-fourth of the population is under 15 years of age, whereas the elderly, another major transit dependent group, constitute approximately seven percent of the population (6). Recreational opportunities

abound. Within the City of Orange are six city parks, three public pools, and miles of horse and bike trails.

A wide variety of housing opportunities, ranging from low cost apartments to expensive condominiums, are available in the City of Orange. Typical costs for housing range from \$35,000 to \$200,000. Major trip attractions for residents include two regional shopping centers and a total of 1,350 retail establishments. Educational facilities include Chapman College within the city, and three major universities located in the surrounding area. The city also contains four major hospitals including the University of California Medical Center, as well as seven medical labs, and seven convalescent homes.

The main industrial area is located on the western edge of the city and covers approximately 1,230 acres. This is divided into 120 acres of M-1 zoning and 1,110 acres of M-2 zoning. Major industries include those concerned with transportation, machinery/metal products, plastic, rubber, fibre products, building materials, and chemicals.

Industry provides employment for 27,068 in the City of Orange, and the mean income is \$14,317/year. Thirty-seven percent of the nonagricultural wage and salary employment is involved in manufacturing, 11% of which is devoted to aerospace. Another 25% are employed in trade, 19% in services, and 16% in government. Seventy percent of the work force commutes over five miles to their place of employment, with 38% commuting over ten miles. Fifty-seven percent of the families have two or more automobiles, and only 6% of the families do not have an automobile (7).

Orange County is typified by two types of cities. The first type is the completely new city that has rapidly grown in the areas previously used for agriculture. The City of Orange is typical of the second type, i.e. an existing

small city with a definite community and cultural center, rapidly expanding with new development around the older center. This second type of city generally provides a more consolidated destination area, and such cities are more responsive to demand-responsive trip consolidations.

COMMUNITY SERVICE MODES

As a result of the success of the pioneer demand-responsive Dial-A-Ride in La Habra, the Board of Directors of the Orange County Transit District (OCTD) decided to expand its local community service program. The Board developed a three-tiered policy to be used for the selection of cities to receive the service. The first tier involved an objective scoring system based on the following demographics: number of persons over 65, number of persons 14 to 16, existing fixed route service, and number of low income families. This system identified the top eight communities on the eligibility list.

The second facet of the policy was the determination that cities on the eligibility list who were willing to pay one-third of the operating deficit would be considered for immediate implementation. (This policy was changed on February 1, 1976, and cities were no longer required to share in the cost). The third phase of the policy dealt with modal selection. Community Fixed-Route and Dial-A-Bus were the two alternatives.

The City of Orange was in the top three on the primary eligibility list, and the Orange City Council committed the city to paying one-third of the operating deficit. Dial-A-Bus was selected as the operational mode, and on June 2, 1975 the Orange Dial-A-Ride (DAB) began operating in the southern half of the city; fourteen days later operations expanded into the northern half of the city.

DIAL-A-RIDE OPERATIONS (DAB) JUNE 2, 1975 to JULY 5, 1976

OCTD contracted with Dial-A-Ride Management, Inc. to manage and operate the DAB system (8). Services of DAR Management, Inc. included: the employment and supervision of all personnel including drivers; the operation of a driver training program for additional personnel after the initial training period; supervision over the maintenance and repair of equipment used in the system; preparation of budgets and financial reports; and the clerical, statistical, and bookkeeping services as required so that the systems operations may be compared with the performance of other transit operators.

Although DAR Management, Inc. advised OCTD on matters of importance and made recommendations when appropriate, final authority rested with OCTD. Maintenance, accounting, and personnel procedures had to comply with OCTD guidelines. In addition, service standards including wait-time and rest-time minimums were determined by OCTD and were reviewed by both OCTD and DAR Management, Inc.

The maximum yearly total cost to OCTD, including a fixed fee and two incentive fees, was not to exceed \$518,815. The first incentive fee was computed as follows: seven cents (\$.07) per revenue and transfer passenger carried by the DAB per month. The second incentive fee was an additional increase per passenger if over 320,000 passengers were carried in the first year of operation. All fares collected were revenue for OCTD.

Operating on a many-to-many basis, the DAB was in service Monday through Saturday from 7:00 a.m. to 7:00 p.m. (9). Seventeen 19 passenger Transcoach vehicles provided residents with service to anywhere within the city boundaries for a \$.50 fare. Residents could obtain this service, which combined the door-to-door conveniences of a taxi ride with the economies of bus service, through a phone call to the OCTD control center. The average response time

was 30 minutes, although wait time during the peak-hour periods averaged 60 minutes. This was in contrast to a planned response time of 20 minutes and illustrated that there were problems with the system.

Subscription service which enabled a passenger to call the control center and request to be picked up at a certain time each day was also available and accounted for 2 percent of all passengers(10). This type of operation provided a convenient way to commute between residence and place of employment if both were within the City of Orange.

When the dispatcher at the control center received a call requesting transportation, the customer information regarding location, number of riders, and desired pickup time was combined with information regarding vehicle positions, tentative routes, and trip characteristics of other passengers (11). Using preplanned scheduling and dispatching procedures, the dispatcher, utilizing radio, assigned a vehicle to pick-up a customer. The customer was provided with an estimated pick-up time.

A large metal-back map and magnetic pieces were used to simplify the manual procedure. "The magnetic pieces hold trip tickets containing the customer trip date - different pieces indicating origins and destinations. When a trip was assigned, colored markers corresponding to the vehicle were placed on both pieces"(11). These markers also were pointed in the direction of the vehicle's next stop and assisted in tracing out the tentative routes. When a "mini-bus" arrived at a stop, the driver notified the dispatcher, who updated the mini-bus position on the map, and in turn, notified the driver of the next stop. The map represented quite accurately the true state of the system; vehicle position, customers on board, and customers waiting were indicated. Given a full view of the system the control staff was in a good position to alter tentative routes as necessary to accomodate new trip requests.

COMMUNITY SERVICE FIXED ROUTE OPERATIONS (CS) JULY 6, 1976 to JULY 5, 1977

As a result of litigation by taxi companies, the DAB was discontinued, and community fixed route service was then implemented in July, 1976 (12). An extensive analysis of DAB trip tickets was completed by OCTD staff, and a three loop system was designed. These routes were designed to continue to provide service to those patrons utilizing DAB. Service operated Monday through Friday, 6:00 a.m. to 9:00 p.m. on 30 minute headways. Saturday service operated on 60 minute headways from 9:00 a.m. to 6:00 p.m. The contract with Dial-A-Ride Management, Inc. was retained with a few minor amendments added. Maximum total cost to OCTD remained at \$518,815 (8).

Starting in July, 1976, three Community Service (CS) routes utilizing a total of seventeen 19-seat Transcoach vehicles were operating. An evaluation by OCTD revealed that the CS was not as productive as other fixed-route bus operations and did not come close to the policy standards established by the Board. In January, 1977 the existing three routes were replaced with two new CS routes, and as a result of the changes, eight vehicles operated an average of 23,000 revenue vehicle miles per month (12). The attempt was made to link the two new CS routes to major trip attractions whenever possible. Feeder distribution to the regular fixed route bus service was also a factor in scheduling. The end result for many patrons was long travel times for relatively short direct distance traveled.

The replacement of the three CS routes with two new CS routes was made when marketing analyses revealed that patrons prefer to walk out of their neighborhood (1-3 blocks) to the major arterials for the trade-off benefits of faster travel time (12). In other words, residents were willing to sacrifice convenience (closer service) for reduced travel time. Because CS routes deeply penetrated many neighborhoods, travel time increased to the point where ridership was discouraged.

The change from a three-route system to a two-route system was also a Board policy decision to cut total costs. The appellate court decision had been rendered in OCTD's favor, and preliminary planning had started immediately to reinstate a demand-responsive system in Orange. The Board decided to reduce the community fixed route service during the interim period and to do minimal advertising. Total costs were greatly decreased, but the individual indicators reflect the high per passenger costs.

DIAL-A-TAXI OPERATIONS (DAT) JULY 6, 1977 to PRESENT

On July 6, 1977 a new DAR consisting of taxicabs and Transcoach buses replaced the CS operations in the City of Orange. This new DAR system included Orange and Orange Park Acres as well as the City of Villa Park, a community of 7,200 people, which was not included in the original DAR service area. Since Villa Park is surrounded by the City of Orange, DAT can effectively serve Villa Park without significantly increasing operations costs (13).

Service is provided by a contractor and consists of 12 vehicles - seven 7-passenger sedans provided by the contractor and five 19-passenger Transcoach buses provided by OCTD (14). The Yellow Cab Co. of North Orange County operates and maintains all vehicles and is responsible for hiring and supervising all personnel including drivers, dispatchers, supervisors, and maintenance employees. These services are provided on a cost-plus-fee basis. OCTD monitors the efficiency of the operation to assure that the transit district service standards, safety, courtesy, and maintenance are followed. In addition OCTD provides uniforms and conducts initial training for all drivers. According to the officials involved, this new service concept is a "step forward in public agency relationships with private industries" (14).

A unique feature of the contract is that the contractor keeps all passenger revenue. This is an incentive feature for the operator, and he becomes a

real partner in the drive for increasing patronage. The advantage to the district is the ability to plan for a fixed cost for service. Increases in patronage are reflected in the district performance statistics by decreasing costs per passenger carried.

PERFORMANCE ANALYSIS

Research into performance evaluation generally concludes that direct comparison of Demand Response (DR) and Fixed Route (FR) service using performance indicators is not proper because of basic differences in service. Such differences as vehicle size, access to vehicles, and the fact that one service is demand activated while the other provides continuous service over specific routes result in statistics which are inherently different (15).

However, in the case of the City of Orange, the fact that these two services were offered in much the same area during successive time periods makes some comparison possible. Vehicle size was identical for the DAB and CFR vehicles, and this aids in the comparison. In addition, the DAB and CFR services had the same administrative structure, and consequently there was very little difference in overhead expense between the two types of service.

The indicators used in this analysis are: net cost per vehicle service hours, percent population served, revenue passengers per service area population, passengers per vehicle service hour, and net cost per passenger. In order to prepare these indicators, certain basic operating and financial statistics are utilized (16). These included the monthly totals for patronage, net cost, and vehicle service hours.

DAB: During the thirteen month operational period of the initial DAB, 195,663 passengers utilized the service. The total net cost was \$640,782, which provided 44,980 vehicle service hours.

CFR (3 Routes): Passenger activity amounted to 43,388 passengers and the net cost totaled \$375,301; 20,842 vehicle service hours were recorded.

CFR (2 Routes): As a result of the reduction from three fixed routes to two fixed routes, the vehicle service hours declined to 7,924 and total passengers declined to 20,470. Net costs also fell to \$194,587.

DAT: After only three months in operation, passenger activity has amounted to 26,583 passengers. This involved 5,409 vehicle service hours of operation at a total net cost figure of \$369,806 (Table 1).

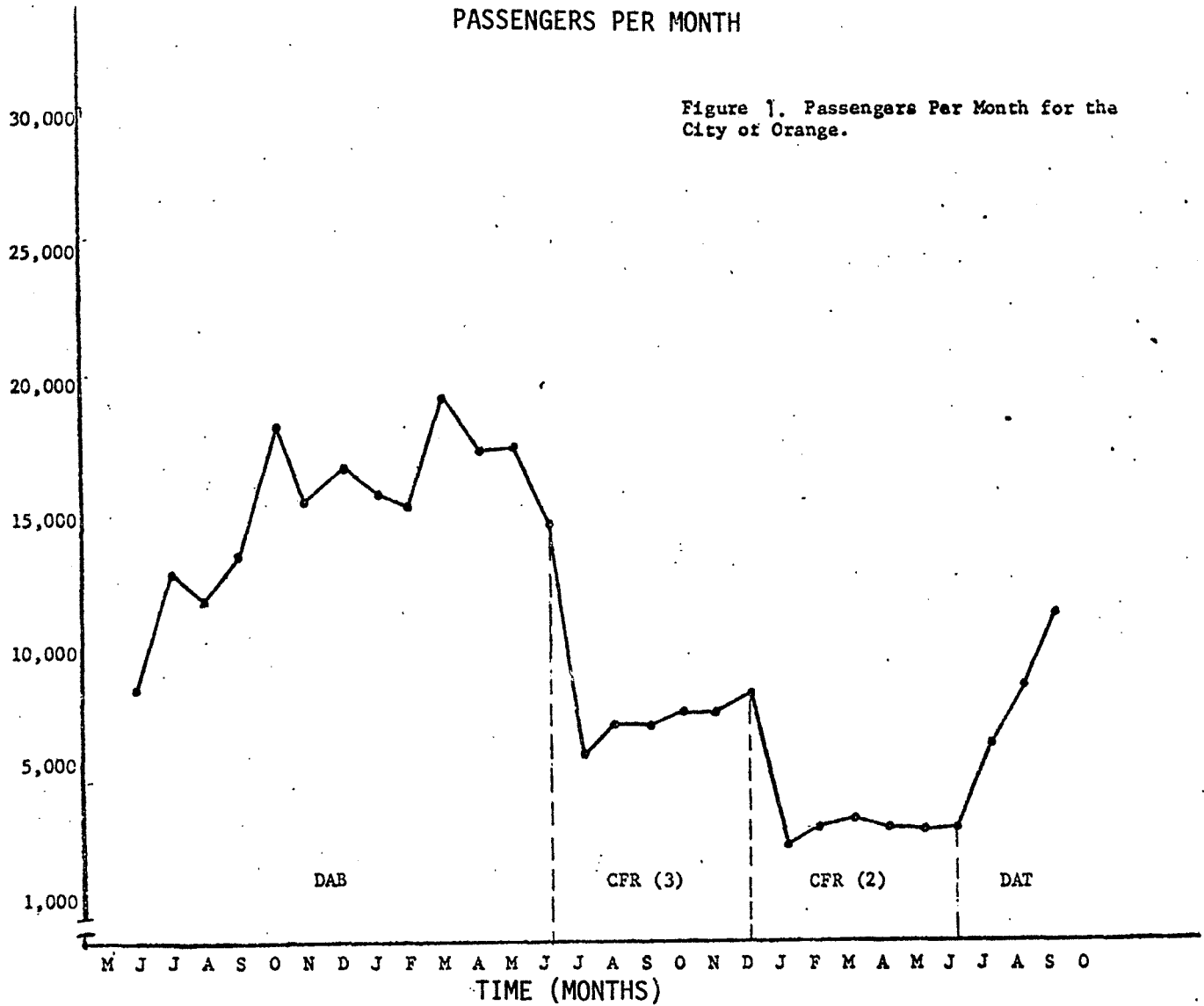
Table 1. Operating and Financial Statistics: City of Orange

System	Total Passengers	Total Vehicle Service Hours	Total Net Cost	Total Months In Operation
DAB	195,663	44,980	\$640,782	13 months
CFR (3)	43,388	20,842	\$375,301	6 months
CFR (2)	20,470	7,924	\$194,587	6 months
DAT	26,583	5,409	\$ 69,806	3 months

Before comparing the performance indicators, it is informative to look at the monthly averages of patronage, vehicle service hours, and net cost. Although these statistics cannot be exactly compared with each other, they give a general picture of the four systems over time.

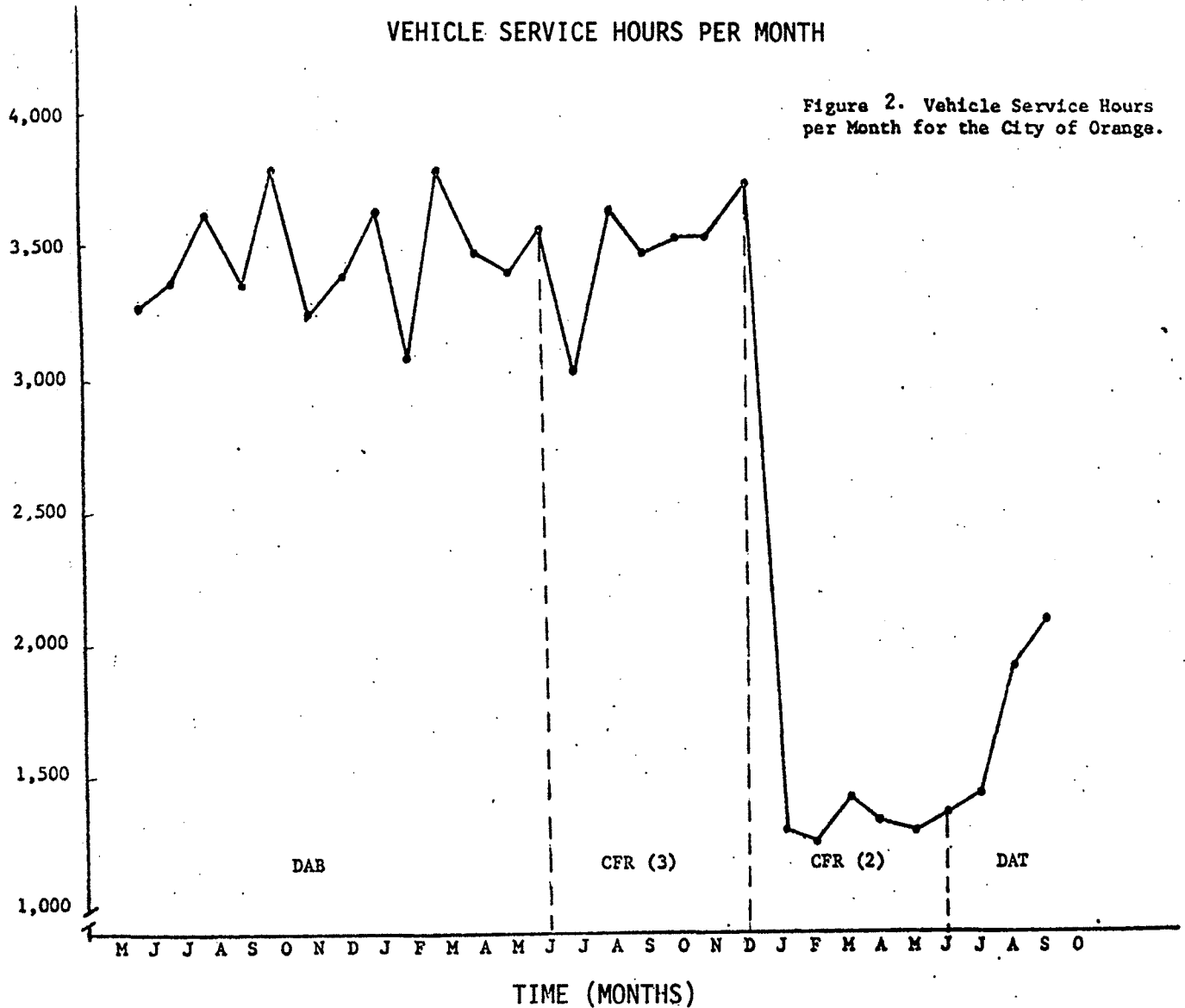
PASSENGERS PER MONTH: The DAB had a average passenger/month figure of 15,051 with a peak month (March, 1976) figure of 19,200. When the first CFR service was implemented the average fell to 7,231 passengers/month. This is a decrease of over 50%. During the CFR peak month (December, 1976) 8,100 passengers were carried. When CFR (3) was replaced by CFR (2) the average fell to a low 3,412 passengers/month. During this period, patronage remained

relatively stable with no real peak month. After only three months in service the average figure for the DAT is 8,861 passengers/month and is rising each month. The latest month (September, 1977) shows 10,100 passengers were carried. Month-by-month passenger totals are shown on Figure 1.



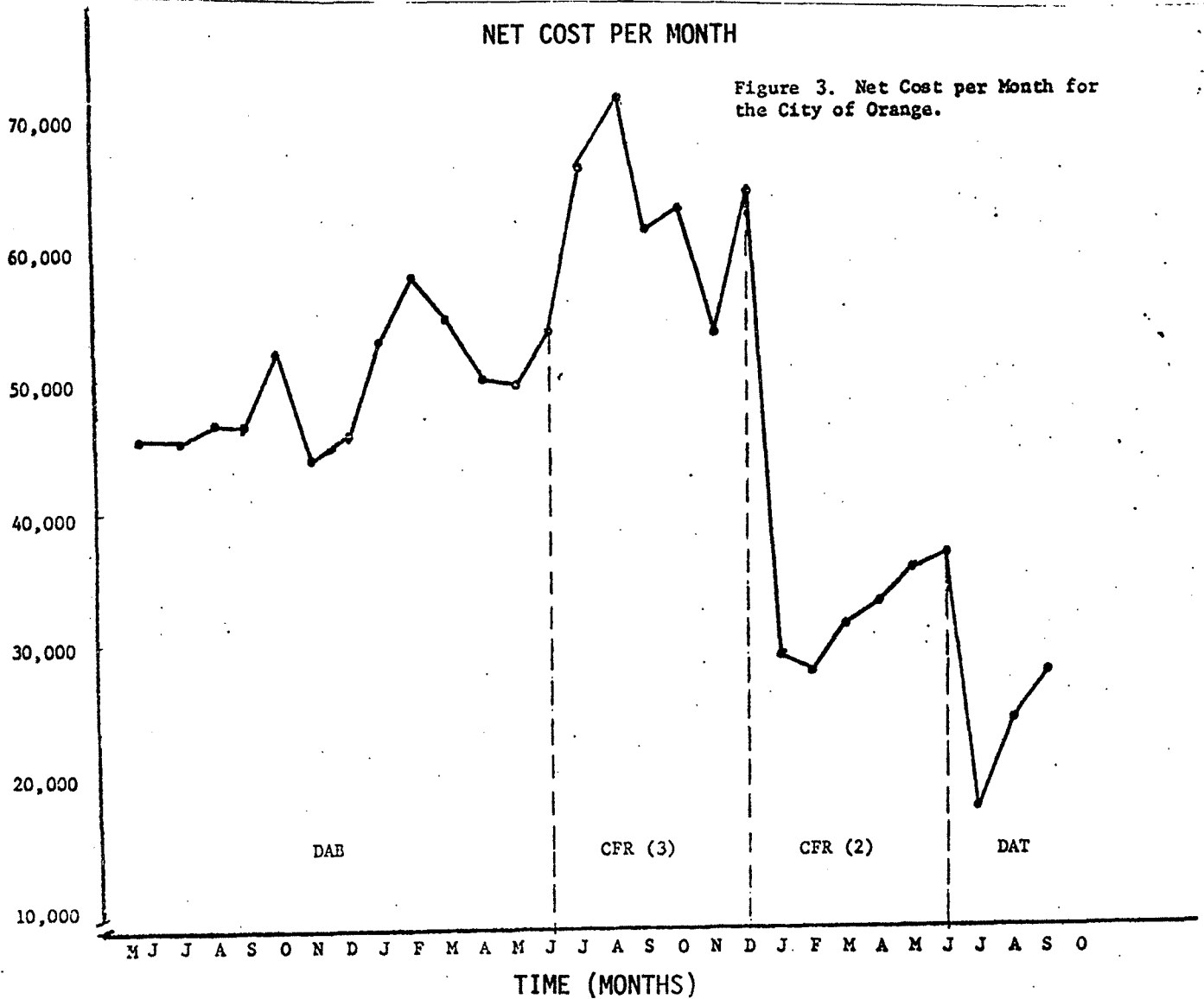
VEHICLE SERVICE HOURS PER MONTH: This is a measure of total units of service produced during a certain period of time (in this case, a month), thus it follows that a higher figure means that more service was provided. Looking at Figure 2 we can see that the DAB and CFR (3) provided nearly the same amount of service. The implementation in January of CFR (2), how-

ever, resulted in a 62% reduction in service. After three months of operation the current DAT provides approximately 482 hours per month of service more than the previous CFR (2) operation (Figure 2). Although these figures tell us how much service was provided they do not tell how much of the provided service was utilized.



NET COST PER MONTH: This is a measure of net inputs per unit of time (a month). A lower cost indicates either a more efficient system or a lower level of provided service (i.e. total service hours). The largest net cost per month value (\$62,550) was recorded for the first CFR services; the next

largest net cost value was for the DAB (\$49,290). The two lowest figures are for the CFR (2) at \$32,431, and the DAT at \$23,268. The net cost per month figure for the new DAT is a reduction of 53% from the first DAB and a reduction of 63% from the first CFR service. Monthly net cost figures are summarized in Figure 3.



PERFORMANCE INDICATORS

The performance indicators used in evaluating and comparing transit systems in general as well as the four modes used in the City of Orange may be categorized as those evaluating efficiency and those evaluating effec-

tiveness. "Efficiency concerns the process by which services are produced, particularly through the relationship of inputs to produced output; that is, it concerns 'doing things right'" (15). "Effectiveness is concerned with the service which is actually provided: its accessibility to the area residents, and its correspondence to the transportation requirements of the particular area" (17). It is concerned with "doing the right things."

The specific indicators used in this report were selected to minimize the effects of modal differences. They include net cost per vehicle service hour, percent population served, revenue passengers per service area population, passengers per vehicle service hours, and net cost per passenger. Interpretation of the measures may differ somewhat by the service mode, and these differences must be considered when making comparisons. Comparisons are described below and are shown on Table 2.

Table 2. Performance Indicators for the Four Orange Systems

Performance Indicator	DAB	CFR (3)	CFR (2)	DAT
Net Cost Per Vehicle Service Hour	\$14.25	\$18.01	\$24.56	\$12.90
Percent Population Served	100%	86%	48%	100%
Monthly Revenue Passenger Per Service Area Population	.18	.09	.04	.10/.13 ^a
Passengers Per Vehicle Service Hour	4.35	2.08	2.58	4.91
Net Cost Per Passenger	\$ 3.27	\$ 8.65	\$ 9.51	\$ 2.62

^aThe latter value was computed using patronage for just the month of September.

NET COST PER VEHICLE SERVICE HOUR: This indicator is an efficiency measure of the net inputs per unit of service produced. A low value is favorable on this indicator. The initial DAB had a net cost per vehicle service hour figure of \$14.25. With the CFR (3) implementation, this increased to \$18.01 and with CFR (2), reached \$24.56. This is in contrast to the \$12.90 net cost per vehicle service hour figure for the current DAT, or a reduction of nearly 50%. We can see that although the original DAB provided more service, the new DAT is more efficient in terms of net cost per vehicle service hours. To determine service utilization, other performance indicators which evaluate effectiveness must be examined.

PERCENT OF POPULATION SERVED: High values on this effectiveness indicator are favorable, but it must be remembered that Demand Response (DR) Systems, by definition, present service to 100% of the residential population of the area they serve. The 100% score for DR systems is given without consideration for the hours of operation or planned response times. In the fixed route systems, residential population within one-quarter of a mile of the route is considered to be served. DAB and DAT each score 100% on this indicator, CFR (3) scores 86%, and CFR (2) scores 48%.

REVENUE PASSENGERS PER SERVICE AREA POPULATION: This effectiveness indicator has more meaning than the percent of population served because actual service utilization is involved. High values are favorable. Monthly averages for each of the four modes were used but two values are presented for DAT. This second value shown is the third month value and is used because of the short period of record for DAT. The DAB value is .18, the three month average for DAT is .10, and the third month value is .13. This compares to .09 for CFR (3) and the very low .04 for CFR (2).

PASSENGERS PER VEHICLE SERVICE HOUR: This is an effectiveness measure of system patronage per unit of service with high values being most favorable.

In the DAB, passenger per vehicle service hour was 4.35. The measure decreased to 2.08 under CFR (3) and improved only slightly to 2.58 when CFR (2) was implemented. Passengers per vehicle service hour for the current DAT is 4.91, which is almost a 90% increase over the first CFR service.

NET COST PER PASSENGER: This is an effectiveness indicator of net inputs per trip within the system; thus a low cost figure is favorable. This is really an overall performance measure combining efficiency (net operating costs) with the system's effectiveness (passengers). Usually systems with low passenger volumes, by virtue of their service characteristics (demand responsive), will have correspondingly higher costs per passenger. Systems with high ridership and short trip lengths will have low costs per passenger. Contrary to usual prediction, it can be seen on Table 2 that both CFR systems have much higher net cost per passenger figures (\$8.65 and \$9.51 respectively), and that the current DAT records the lowest or most favorable value.

All effectiveness indicators showed that the two DAR systems were more effective than the CFR systems.

SYSTEM-WIDE COMPARISON: Table 3 presents data for 1977, for the OCTD fixed route system and four of its community service operations. These data were selected for appropriate months in order to show and compare the representativeness of Orange indicators.

DAB: When comparing the Orange DAB to La Habra/Brea's DAB, the differences of efficiency are not great. The net cost per vehicle service hour figure for Orange is \$1.00 per vehicle service hour less than La Habra's but is of little efficiency significance because of vehicle and personnel variables.

The effectiveness indicators tend to favor the La Habra DAB. The passengers per vehicle service hour value for the Orange system was 2.45 passengers per vehicle service hour lower than the La Habra value and indicates

Table 3. System-wide Table: Comparison of Orange Service with Other Services

Performance Indicator	DAB Oct., 1975		CFR Oct., 1976		CFR April, 1977		DAT Sept., 1977		Reg. F.R. Sept., 1977
	La Habra	Orange	Westminster Buena Park	Orange CFR(3)	Westminster Buena Park	Orange CFR(2)	Fullerton	Orange	Countywide ^a
Net Cost/ VSH	\$14.64	\$13.54	\$12.00 \$11.26	\$17.52	\$17.12 \$ 9.58	\$25.36	\$12.89	\$13.47	\$28.85
Pass/ VSH	7.17	4.72	5.87 3.38	2.16	7.15 5.44	2.69	4.68	5.43	23.04
Net Cost/ Pass	\$ 2.04	\$ 2.87	\$ 2.04 \$ 3.33	\$ 8.10	\$ 2.39 \$ 1.76	\$ 9.43	\$ 2.76	\$ 2.48	\$ 1.23

^aValues are based on Budget and allocation model estimates. Statistics include regular fixed route plus park and ride services. Park and ride accounts for 1% of total cost and 1% of total passengers.

that La Habra's system was utilized at a higher rate than the Orange system. Net cost per passenger is also lower for the La Habra system by about \$.80.

CFR (3): Comparing CFR (3) to either Buena Park or Westminster's CFR system easily points out both the inefficiency and ineffectiveness of the Orange CFR (3). Net cost per vehicle service hour for the Orange system is higher than both the other two CFR systems and exceeds the Buena Park figure by \$5.12 per vehicle service hour.

CFR (2): With the implementation of the Orange CFR (2), the situation did not improve. Net cost per vehicle service hour increased to \$25.36 which is two and a half times as large as the Buena Park figure and surpassed the Westminster figure by \$7.24 per vehicle service hour. An inefficient system was replaced by an even more inefficient system. Total net cost per month did decrease due to the drastic reduction in vehicle service hours.

Passenger per vehicle service hours did show a slight favorable increase but still remains substantially behind the other two CFR systems. The net cost per passenger value increased, indicating that although total net cost decreased with the service reduction, passenger utilization decreased even more. In an attempt to cut cost, OCTD had lost a substantial number of passengers.

DAT: Comparing the Orange DAT to the Fullerton DAT for the month of April, reveals that after three months of operation, Orange is very close to Fullerton in all categories. The net cost per vehicle service hour for Orange is \$13.47 as compared to a net cost per vehicle service hour for Fullerton of \$12.89. The effectiveness measure, passengers per vehicle service hour, shows that Orange (5.43) is higher than Fullerton (4.61). Net cost per passenger for Orange is \$2.48, and for Fullerton, it is \$2.76.

Figures for the system-wide route bus and park-and-ride service are also included to facilitate comparisons.

RIDERSHIP SURVEY

In August, 1977 a ridership survey of all DAT patrons was conducted by OCTD. All riders calling in for service, both at Orange and Fullerton were asked the single question "How did you make this trip before DAT?" Responses are tabulated on Tables 4 and 5.

The most surprising result in the case of Orange was the extremely small number of people that had previously used OCTD Easyrider (CFR (3) and CFR (2)). It appears that the patrons for the two types of services come from two different populations. Fullerton did not have a prior community service.

As expected, the availability of DAT did not have much impact on automobile drivers, but 16.5% of Fullerton trips and 18.3% of Orange trips had previously been made as passengers in someone else's automobile.

The impact on trips made by OCTD fixed route system is comparable to the reduction in automobile trips. Approximately one-third of the patrons indicated they had used some other means, e.g. walking or bicycles, for their previous trip making.

In Fullerton 27% of the patrons and in Orange 13.2% of the patrons indicated that they had not made the trip before. This may indicate that this service is playing an important social function by allowing senior citizens and other transit dependents to participate in recreational and educational activities.

TABLE 4. SURVEY RESULTS ORANGE, AUGUST 1977

	<u>6:00 A.M.- 9:00 A.M.</u>	<u>9:00 A.M.- 3:00 P.M.</u>	<u>3:00 P.M.- 7:00 P.M.</u>	<u>TOTAL</u>
Auto Driver	1.8%	4.3%	0.6%	6.7%
Auto Passenger	6.1	7.3	4.9	18.3%
OCTD fixed-route	5.5	13.3	1.2	20.0%
OCTD EasyRider	2.4	1.2	0.0	3.6%
Did not make trip before	1.8	8.4	3.0	13.2%
Other (walk, bicycle)	7.9	20.0	6.1	34.0%
No response	<u>0.0</u>	<u>1.2</u>	<u>3.0</u>	<u>4.2%</u>
TOTAL	25.5%	55.7%	18.8%	100.0%

Response to question "How did you make this trip before DAT?"

TABLE 5. SURVEY RESULTS FULLERTON, AUGUST 1977

	<u>6:00 A.M.- 9:00 A.M.</u>	<u>9:00 A.M.- 3:00 P.M.</u>	<u>3:00 P.M.- 7:00 P.M.</u>	<u>TOTAL</u>
Auto Driver	3.1%	1.1%	0.0%	5.2%
Auto Passenger	7.3	8.1	1.1	16.5%
OCTD fixed-route	2.3	11.5	2.3	16.1%
OCTD EasyRider	0.0	0.0	0.0	0.0%
Did not make trip before	6.5	11.9	8.8	27.2%
Other (walk, bicycle)	8.5	22.5	3.5	34.5%
No response	<u>0.4</u>	<u>1.1</u>	<u>0.0</u>	<u>1.5%</u>
TOTAL	28.1%	56.2%	15.7%	100.0%

Response to question "How did you make this trip before DAT?"

SUMMARY

This study does not produce any conclusions that are directly transferable to other cities or areas. Many factors like population density, street patterns, and population characteristics, should be considered when determining whether or not a community transit service is required and what mode of service would be most efficient and effective.

DAT, after three months, appears to be the best choice for community service in Orange County suburban cities in areas when the population density is 5000 per square mile or less. The DAT as implemented in Orange and Fullerton utilizes some small buses during the peak hours, and this provides for higher performance in the important passengers per vehicle service hour and net cost per passengers indicators. It is not an "all taxicab" system.

DAT has gained wide acceptance in the community of Orange. It is strongly supported by the City Council, Chamber of Commerce, service and social organizations, and the local newspaper. Letters and comments to the OCTD by patrons and relatives of patrons have been highly favorable, and the complaint level has been lower than that of any other OCTD service.

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