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Shared-Ride Taximeters: State-of-the-Art and Future Potential

Final Report
May 1982

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16. Abstract

A shared-ride taximeter is a means of calculating passenger fares for shared-, group, or exclusive-ride taxi service. This report describes shared-ride taximeter equipment and operating issues and then identifies the state-of-the-art and the future potential for shared-ride taximeter services. Data were collected as the evaluation contractor to the jointly sponsored U.S. and California Department of Transportation's demonstration project to test shared-ride taximeter services, from U.S. and foreign taximeter manufacturers and from related shared-ride taxi research. General conclusions, specific equipment findings, and future recommendations are identified.

This study identified the following major findings: 1) the taxi industry is currently facing significant regulatory, ridership, productivity, and economic changes; 2) no U.S. shared-ride taxi operators use shared-ride taximeters; 3) the barriers to implementing shared-ride taxi services are institutional, regulatory, and technological; 4) there is no documented experience with shared-ride taximeters manufactured in the U.S.; and 5) there are a few examples of foreign shared-ride taximeter services, and there appears to be interest for other applications. In general, this report reflects the view that technological opportunities may be available for solving shared-ride meter requirements. This report provides a bibliography related to Shared-Ride Taxi Services.

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PREFACE

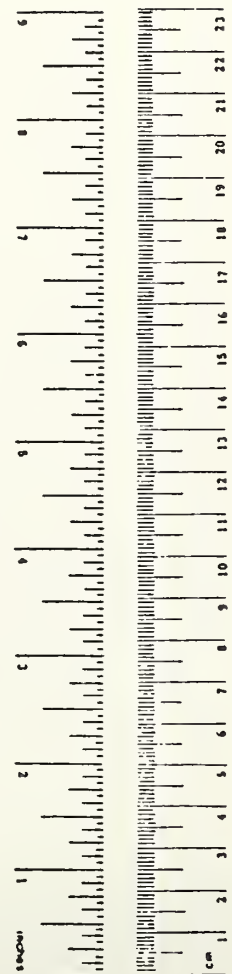
This report was prepared by SYSTAN, Inc. under contract to the U.S. Department of Transportation, Transportation Systems Center under Contract No. DOT-TSC-1416. The author wishes to thank several individuals for their assistance on this study and report. In particular, Dr. Roy E. Lave of SYSTAN, Inc. made several contributions to the study and to the content and structure of the report. Robert Casey of the Transportation Systems Center, U.S. Department of Transportation monitored the evaluation and study. James Bautz, Paul Fish and Lawrence Bruno of the Urban Mass Transportation reviewed and helped direct the project.

Charles E. Zell, Chief, Office of Transit Systems Research at CALTRANS, California Department of Transportation, coordinated and monitored the demonstration project in California and supplied background material and timely reports on the project. Byron Stutes of Valley Cab and Limousine Service, Patrick Linnington, of San Luis Transportation and Nick DiNapoli of Minicars, Inc. provided first-hand information on the equipment. The taximeter manufacturers who responded to the author's request for equipment data also provided useful information for this report and helped to clarify the possibilities for shared-ride taximeter services.

METRIC CONVERSION FACTORS

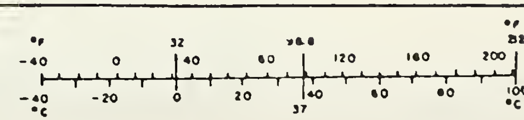
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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EXECUTIVE SUMMARY

This report examines shared-ride taximeter equipment, services and use. A shared-ride taximeter is a means of calculating passenger fares for shared-, group or exclusive-ride taxi service. Taximeter fares usually consist of an initial drop charge and a per-mile charge with a surcharge often added for time delays. Taxi passenger fares are thus a function of the total distance travelled and the total time elapsed. The major shared-ride taximeter issue is the amount of taxi diversion required to pickup or discharge additional passengers versus the taxis' charges for each passenger's trip. Related to this issue are the obstacles to taximeter fare calculation.

This report is based on the activities and findings of the evaluation contractor to the U.S. Department of Transportation, Transportation Systems Center. The U.S. Department of Transportation, Urban Mass Transportation Administration and the California Department of Transportation jointly sponsored a demonstration project to test shared-ride taximeters in operation between 1978 and 1980. Throughout this demonstration period, the shared-ride taximeter equipment never operated reliably and in 1980 the project was terminated. The focus of the evaluation changed and the contractor then sent questionnaires to U.S. and foreign taximeter manufacturers and investigated studies related to shared-ride taxi equipment and use. These efforts were conducted to identify the state-of-the-art and the future potential for shared-ride taximeter services, equipment and use.

This study identifed the following major findings:

- The taxi industry is currently facing significant regulatory, ridership, productivity and economic changes. Most taxi operators only offer exclusive or group-ride services. Most operators use conventional taximeters to calculate passenger fares.

- No U.S. shared-ride taxi operators use shared-ride taximeters. All identified U.S. shared-ride taxi operators use zonal, grid, flat or pre-determined computer charges to calculate passenger fares.

- The barriers to implementing shared-ride taxi services are institutional, regulatory and technological. Taxicab operators have not collectively identified their requirements for shared-ride taximeter equipment. The research and development in the taximeter industry has also been sparse and taxicab operators are reluctant to use unproven technology.

- There is no documented experience with shared-ride taximeters manufactured in the United States. One Canadian taximeter manufacturer developed a prototype shared-ride model, but decided not to produce them until a more favorable local regulatory environment exists in the United States. One taximeter manufacturer in New Zealand has developed and produced a reportedly reliable shared-ride taximeter.

- There are a few examples of foreign shared-ride taximeter services and there appears to be interest for other foreign applications. Some U.S. taxicab operators appear to be interested in shared-ride taxi services and in testing shared-ride taximeters.

1. INTRODUCTION

1.1 WHAT IS A SHARED-RIDE TAXIMETER?

A shared-ride taximeter is a means of calculating passenger fares for shared-, group or exclusive-ride taxi service. Shared-ride taxi (SRT) service is private door-to-door transportation for two or more passengers travelling between different origins and/or destinations. A shared-ride meter can also be used for group-ride taxi (GRT) service, when two or more passengers travel together between a common origin and destination, or for exclusive-ride taxi (ERT) service, when a single passenger boards and occupies the taxi alone. Shared, exclusive or group-ride services are typically requested by telephone or street hail, with group- and exclusive-riding involving a single request for service.

Shared-ride taximeter fares usually consist of a drop charge and a per-mile fee. A "live-clock" can be added to charge for time delayed in traffic or for additional waiting time delays. Since taximeter fares are a function of both the total distance travelled and the total time elapsed during the trip, depending on where individual passengers want to go, how far these requests cause the taxi to detour, what time of day the trip is made and what current traffic conditions are like, the travel distance and time will vary. Consequently, the same trip taken on different occasions may cost different amounts.

The tradeoff is between the taxi diversion and the taxi charges. A major issue is the amount of diversion required to pickup or discharge additional passengers, in terms of the travel time and fare costs, taxi passengers will tolerate. Shared-ride taxi services must always charge lower out-of-pocket costs than exclusive-ride taxi services for the same trip. Theoretically, each time an additional passenger is picked up the rate should be lowered, because each passenger's total fare is related to the amount of route deviation and time required to make the trip. This assumes that each additional SRT passenger receives correspondingly lower levels of service, as measured by longer ride times, more wait time for pick-ups and drop-offs, and less personalized service.

In some cities, such as Davenport, Iowa and New York, group riding fares do not vary with the size of the group; a group of five passengers can make the identical trip as a single passenger for the same total price. Alternatively, some cities charge each group passenger the full trip fare and some cities add incremental charges for each additional passenger.

1.2 WHY SHARE A RIDE?

Most taxi operators have traditionally provided exclusive-ride service. Although most taxis can carry five, and in larger vehicles seven or eight passengers, most taxis carry only one passenger. Surveys conducted during the mid-70's indicate the average number of passengers per taxi trip is approximately 1.5.[1]

In recent years however, the taxi industry has begun to change. This is because escalating inflation, fuel, and operating costs, regulatory resistance to fare changes, and the growing number of public transit and paratransit services, are pressures decreasing taxicab ridership, reducing operator efficiencies and diminishing taxicab operator profits. As a result, taxicab operators are seeking ways to attract new riders, improve productivities and achieve profits. The most straightforward answer is to lower passenger fares, increase the use of existing vehicles and increase total revenues. One way of achieving these objectives may be shared-ride taxi services.

A recent study conducted by the U.S. Department of Transportation found that switching from exclusive-ride to shared-ride services can increase vehicle productivities from 2-3 passengers per vehicle-hour to 4-6 passengers per vehicle-hour. This can increase operator profitability by 50 cents per hour, for about a 7.5 percent increase in revenues. Under the tested scenarios, overall ridership was also projected to increase. The major disadvantage in converting to SRT however, was the reduced level of service, as measured by increases in passenger wait times, ride times, and the variability and uncertainty of service.[2]

It should, however, be noted that just because a shared-ride option is available, unless there is a demand for such services, and the service quality and fares can be set so users perceive this as an option that is to their advantage, simply implementing shared-riding will not increase ridership or overall productivities. Similarly unless the supply, the level of services and the costs of SRT are perceived by operators as being to their advantage, vehicle productivities and operator revenues will not increase. For example, in the Community Transit Demonstration project in Rochester, New York, although the private paratransit operator was offered direct financial payments if vehicle productivities rose above a certain level, the private operator did not attract additional passengers nor achieve vehicle productivities significantly higher than the public paratransit operator, where no incentive payments were offered. As a result, few additional payments were actually made. Even though total revenues could be marginally

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[1] Gorman Gilbert, et.al. Establishing Innovative Taxicab Services: A Guidebook, University of North Carolina, Chapel Hill, NC, August, 1979 (UMTA Report No. UMTA-NC-11-0005).

[2] Tom Carberry, "DOT Completes Shared-Ride Study," Taxicab Management, August, 1979, p. 10-26.

increased, payments were not seen as enough of an incentive to encourage shared-ride coordination and matching efforts.

Although the scope of this taximeter study was quite limited, the author conducted some preliminary research into determining where the operator and passenger supply, demand, cost and fare trade-offs might be. It should be noted that other investigations into these related issues of supply (i.e., the number of vehicles, hours of service and level of services), demand (i.e., overall ridership, origin and destination travel patterns, time of travel, and type of users), costs (i.e., labor, maintenance, equipment and total operations), and fare levels (i.e., degree of elasticity in relation to ridership) have begun.[3] In the area of shared-riding, however, much more study will be needed to determine appropriate fare levels and charges to make shared-riding appeal to both travellers and taxicab operators.

Even though there may be many positive SRT user and system benefits, prior attempts to offer shared-ride or innovative taxi services have often been thwarted by local institutional or regulatory constraints. The U.S. Department of Transportation is currently conducting a major study of the impacts of taxicab deregulation in San Diego, Portland and Seattle. Most of the taxicab institutional or regulatory issues have been fairly well documented in the paratransit literature and are in the areas of:

1. Fare levels and calculation;

2. Entry restrictions;

3. Financial responsibility; and

4. Operation and service standards.

Some of the most frequently mentioned barriers concerning shared-ride taxi fare levels and calculations are cited below.

"Uncertainties about how an equitable fare structure can be assumed is often a deterrent to shared-ride experimentation."[4] Innovations in taxi operations have also been hampered by "the lack of fare calculating and display systems that could satisfactorily address problems associated with shared-ride services."[5] "This unfulfilled potential also

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[3] Carradino and Schimpeler; Douglas; Fravel and Gilbert; Korhauser, et.al.; Manski; MacLean and Segal; Tung and Baumann (ed).

[4] Multisystems, Inc. Taxis, the Public and Paratransit: A Coordination Primer, Prepared for the International Taxicab Association, August, 1978, p. 67.

[5] Tung Au and Dwight Baumann, Ride Shared Vehicle Paratransit System, Carnegie-Mellon University, Pittsburgh, PA, July 1977, p. 1.

results in part from attitudes of skepticism toward technological innovations within the taxi industry."[6] Taxicab operators feel they cannot afford to risk a new idea, where the rewards are uncertain. Taxicab operators reiterated these shared-ride fare calculation problems at the 1980 Taxicab Innovation Conference.

> "Shared-riding is simply a matter of determining the origin and destination and matching these units into a same direction trip. The complications are the fare determination for the individual units within the shared mode."[7]

This is a circular dilemma, because "institutional and regulatory constraints have also inhibited paratransit-related technological developments, since a viable market for large scale production does not exist."[8] Despite these obstacles, shared-ride taxi services do exist.

1.3 WHERE ARE SHARED-RIDING AND TAXIMETERS USED?

Shared-riding is being used both formally and informally in a wide variety of taxicab operations. In 1979, SYSTAN, Inc. identified over 28 different general market and seven target market shared-ride taxi operations in the United States.[9] Some examples of general market SRT include: Little Rock, Arkansas; El Cajon, California; Westport, Connecticut; Davenport, Iowa; St. Bernard Parish, Louisiana; Boston, Massachusetts (Logan Airport); Hicksville, New York; Xenia, Ohio; Pittsburgh, Pennsylvania; Arlington, Virginia; Washington, D.C.; and Madison, Wisconsin.

None of these systems use shared-ride taximeters. Each of these operations, except for Pittsburgh, uses either a flat fee, a zonal rate or a modified grid structure to calculate passenger fares. Pittsburgh uses a more sophisticated computer controlled shared-ride fare

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[6] Dwight Baumann, et.al., "Automation of Paratransit Fare Computation and Dispatching," Demand Responsive Transportation Systems and Other Paratransit Services: TRR #608, Washington, D.C.: TRB, 1976, p. 93.

[7] Jerry Wilson, "Let's Get Serious," Presented at the National Taxicab Innovations Conference, kansas City, Missouri, May 1980.

[8] Au, Ride Shared Vehicle, p. 1.

[9] J.W. Billheimer, et.al., Paratransit Handbook: A Guide to Paratransit Implementation, U.S. Department of Transportation, Washington, D.C., January 1979.

calculation method.[10] Exhibit 1 identifies the major characteristics of each of these five major taxi fare calculation options.

Although no SRT operators use shared-ride meters, the predominant fare system in the taxicab industry is the meter fare. In 1975, 71% of U.S. taxi operators reported using taximeters either entirely or in combination with another fare scheme and 47.2% reported using only meters.[11] In California, 95.7% of the operators reported using meters.[12]

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[10] The Pittsburgh system is part of an experimental Ride-Shared Vehicle Paratransit (RSVP) project conducted by Carnegie-Mellon University. A Time/Distance (TD) File developed by the Southwest Pennsylvania Regional Planning Commission is used to calculate zone-to-zone time and distance data. All street addresses in the taxicab service area were coded into an Address/Coordinate (AC) File. Shared-ride and exclusive-ride tariffs were then filed, based on time and distance parameters. Combining the TD, AC and tariff files, the computer system can calculate time and distance for a trip between specific origins and destinations, as well as the fare for each rider.

Drivers must call each pick-up into a dispatcher, who calculates and transmits the fare and the level of service data to the taxicab by radio and on an electronic taximeter display. The computer also records these data for accounting purposes. The three major components of the RSVP system are:

1) a communication interface which includes all circuits for radio-meter interface;

2) a numeric display which allows four digits of fare information, two digits of estimated travel time and one digit for seat or passenger identification; and

3) metering circuitry, which simulates a conventional taximeter, to provide back-up fare calculation capabilities in case of computer failure.

For more detailed information on this system, see Au and Baumann References.

[11] J.D. Wells and the International Taxicab Association, An Analysis of Taxicab Operating Characteristics, U.S. Department of Transportation, Washington, D.C., 1975.

[12] K. Busath, "Characteristics of the California Taxicab Industry," Sacramento, California Taxicab Owners Association, 1975.

EXHIBIT 1 – FARE OPTIONS

OPTIONS	DESCRIPTION/ DEFINITION	WHEN IS FARE COLLECTED?	HOW TO USE	ADVANTAGES	DISADVANTAGES	EXAMPLES
Flat Fare	All passengers pay same amount for trip anywhere in service area.	–Upon entering vehicle.	–Small service areas. –Relatively uniform trip distances. –TM services.	–Easy to install and administer. –Easy for riders to use. –Minimize accounting and stop time. –Rider knows cost before trip begins. –No capital equipment required.	–Recipients of Federal Grants must offer ½ fare to elderly & handicapped. –Inequitable. –Encourages long, yet discourages short-distance riders. –No traffic or wait-time factor.	El Cajon, CA La Mesa, CA
Zonal Fare	Incremental fare increases as rider crosses designated zone boundaries	–After completion of trip.	–Relate boundaries to break points in passenger volumes, trip characteristics, natural boundaries or route configurations. –Overlapping/flexible borders may eliminate short trips costing 2-zone fares. –Keep number of zones to minimum. –Can add shared-ride rate differential. –Can add peak/off-peak differential.	–Low-cost service for short trips. –Different amounts charged for different trip lengths. –2-zone structure easy to install/administer. –No capital equipment required. –Rider can know costs before trip begins. –Incentive for driver to take shortest and fastest route.	–Creates anomalies near zone boundaries. –Multi-zones confusing for passengers. –Usually no traffic or wait time factor. –Little accountability between driver & owner – potential for driver theft, if not owner-operator.	Madison, WI Washington, D.C. Hicksville, NY
Grid Fare	Similar to zonal; Incremental fare increases as rider crosses contiguous sub-areas.	–After completion of trip.	–Divide jurisdiction into approximately ¼ sq. mile grid network with boundaries in middle of streets. –Count smallest number of contiguous sub-areas for direct travel between origin and destination. –Can add shared-ride rate differential. –Can add peak/off-peak differential.	–More equitable than conventional zonal fares. –No capital equipment required. –Rider can know costs before trip begins. –Incentive for driver to take shortest and fastest route.	–Confusing for passengers, especially strangers. –No implicit wait time factor. –Little accountability between driver & owner; potential for driver theft if not owner-operator.	Little Rock, AR Montgomery, AL San Diego, CA
Taximeter Fare	Passengers pay according to distance travelled.	–After completion of trip.	–Base on direct point-to-point distance when detours are necessary for shared-ride. –Supplement with flag-drop and/or live clock charge. –Popular taxi structure. –Extra charges or features available.	–Most equitable. –Other features can be added (e.g., flag drop/live clock). –Rider sees total fare charged. –Accountability between driver & owner. –Records fares and management data. –Most precise.	–More complex calculation. –Higher potential cost-automated equipment required. –Rider does not know costs until trip is completed. –Encourages driver to take circuitous or congested routing, especially for strangers.	Canberra, Australia Darwin, Australia
Computer Fares	Advance calculation of fares based on urban time-distance data base.	–Upon entering vehicle, or –After completion of trip.	–Develop Time/Distance file based on estimated zone-to-zone travel distance and travel time. –Develop Address/Coordinate file based on all street addresses in service area. –Combine T/D file and A/C file for specific passenger trip requests. –Can add peak/off-peak differential.	–Combines time & distance costs. –SR trip fare would never exceed ER trip fare for same trip. –Rider knows cost & estimated LOS before trip begins. –Management data.	–More complex calculation. –Highest capital & operating cost. –Not actual traffic or wait time factor. –Back-up system needed.	Pittsburgh, PA

Source: Adapted from SYSTAN, Inc. *Paratransit Handbook: A Guide to Paratransit Implementation,* 1979; Taximeter Manufacturers Records; Baumann, *Ride Shared Vehicle Paratransit System,* 1977.

These "conventional" taximeters can only register one fare. This makes shared-riding for most taxicab operators who must use a taximeter almost impossible. (To circumvent this problem yet still realize the benefits of shared-riding, some conventional meter operators simply turn off their taximeters and negotiate fares in advance with each party where this is legal, or the laws can be ignored.) In order to encourage shared-riding among taximeter operators, the California Department of Transportation (CALTRANS) decided to conduct an innovative study of shared-ride taximeters in revenue service.

2. REVIEW OF STUDY

The Shared-Ride Taximeter Study evolved through four basic phases. These include the:

1. Original Recommendations;

2. Revised Demonstration;

3. Frustrated Attempts at Service; and

4. State-of-the-Art.

The following subsections detail the major activities in each of these phases.

2.1 ORIGINAL RECOMMENDATIONS

This Shared-Ride Taximeter Study was originally a demonstration project sponsored by the California Department of Transportation (CALTRANS) in 1978. CALTRANS' interest evolved from a study of taxicab business failures in California, which recommended "activating shared-ride taxicab systems" and the computerization of operating and financial data."[13] CALTRANS wanted to test and evaluate two different shared-ride taximeters in three separate California taxicab operations. The shared-ride taximeters were being developed by the Bruider Corporation and the Viking Taximeter Company ("Executive" model). For comparison, CALTRANS would then conduct a zonal fare shared-ride system demonstration.

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[13] Davidson, J.H. and R. Gaylen. Taxicab Business Failures in California, 1972-1976. Sacramento, California: California Department of Transportation, Division of Mass Transportation, November 1977.

2.2 REVISED DEMONSTRATION

Unfortunately, the Bruider Corporation had problems developing their new equipment. Thus, CALTRANS only received eight Executive shared-ride taximeters from the Viking Taximeter Company. Exhibit 2 highlights the advertised features of the Viking Executive.

The feature that distinguished the Executive meter from conventional meters was its advertised ability to record up to six different charge rates. These fares could be for concurrent trips having up to six different origin-destinations. But, only shared trips requiring small deviations in order to pick-up or discharge passengers could be equitably handled by the Executive meter since charges were based on mileage and time, as in a conventional meter. Naturally, customers will only accept fares inflated by large deviations (mileage or time) from their desired route if the basic rate is sufficiently low so that the total fare is lower than for exclusive ride service.

An additional feature of the meter was its ability to collect, store and generate management data. The data could be directly accessed by the driver, if desired, to serve both the driver-owner or driver-employee structures. Data could also be stored in the meter in a machine readable format, making it readily available for subsequent data processing.

With the meter constraint on route deviations in mind, CALTRANS selected the service between the Santa Barbara airport and the CBD and several beach communities as the first demonstration site. In January, 1979 CALTRANS entered into an agreement with Valley Cab and Limousine Service, Inc. in Santa Barbara to:

- provide six shared-ride taximeters (and two spare meters);
- pay for taximeter installation and removal costs (up to $600);
- cover data collection costs ($100/month); and
- provide nominal marketing services.

The total contract was for $3,000 and the meters were to be tested in revenue service for a six-month period.

SYSTAN, Inc., under contract to the Transportation Systems Center, U.S. Department of Transportation, then worked with CALTRANS to develop a demonstration evaluation plan.[14] The evaluation plan identified the major demonstration objectives; listed the evaluation issues and questions to address; and outlined a data collection plan required to address these questions. The evaluation questions included:

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[14] Lave, Roy, "Memorandum on the Special Evaluation of CALTRANS Taxi Meter Project," SYSTAN, Inc., June 1979.

EXHIBIT 2

The **executive** *-all you ever wanted in a taximeter*

- The most versatile meter ever made
- Has simple push-button operation
- Up to six rates
- Up to six fares
- Shared ride computations automatically
- Rate change parts cost less than $25

but never thought possible

- Are the meters easily installed?
- Does the meter work accurately?
- How do shared-ride fares compare to exclusive-ride fares and to zonal fares for the same trip?
- How significant are the shared-ride savings?
- How much of the potential savings are lost in diversion costs?
- Are there non-cost reasons users give for sharing costs?
- Does the shared-ride option have the potential to change travel behavior?
- What happens to drivers' income?
- Is the meter easy for the drivers to use?
- Do the drivers like the shared-ride option and the meter?
- Do dispatchers like the shared-ride option?
- What happens to the operators' income?
- Do the operators like the shared-ride option?

2.3 FRUSTRATED ATTEMPTS AT SERVICE

During the Spring of 1979, two meters were delivered to Valley Cab and Limousine Service in Santa Barbara for pre-demonstration testing. In September, the City and County of Santa Barbara approved the following shared-ride taxi rate structure.

SHARED RIDE TAXI RATE STRUCTURE
(Effective September 1, 1979)

	Flag Drop	Charge Per Mile	Charge Per Hour Waiting Time	% Discount
Single Ride	$1.20	$1.00	$11.00	---
2nd Passenger	1.20	.80	8.80	20%
3rd Passenger	1.20	.60	6.60	40%
4th Passenger	1.20	.50	5.50	50%
5th Passenger	1.20	.40	4.40	60%
6th Passenger	1.20	.30	3.30	70%

CALTRANS then forwarded the rest of the meters and new electronic chips to Santa Barbara.

Soon thereafter, Valley Cab reported the meters were not operating reliably and CALTRANS returned all eight meters to the manufacturer for repair or replacement. By the last week in February, 1980, CALTRANS had received and forwarded two repaired meters to Santa Barbara. Another California taxicab operator, San Luis Transportation Company of San Luis Obispo, was also interested in testing the taximeters. In March, CALTRANS sent two meters to San Luis Obispo and three more meters to Santa Barbara.

Viking provided only minimal installation instructions (see Appendix A) and Valley Cab encountered several problems installing their first meter. The local taxicab operators also had difficulty understanding the manufacturer's instructions for operating the meters (see Appendix B). CALTRANS thus developed step-by-step instructions for drivers on "How to Charge a Shared-Ride Fare" and "How to Charge for a Group Ride" (see Exhibit 3). CALTRANS also prepared an information flyer on metered shared-riding for potential customers. Exhibit 4 contain these CALTRANS instructions.

On April 7, 1980, the first shared-ride taximeter vehicle began revenue service in Santa Barbara. Almost immediately, equipment problems arose. Valley Cab tried to substitute the first meter with the other shared-ride meters, but none of the meters would maintain reliable operation. The Viking Taximeter Company would not respond to the operators' complaints concerning these malfunctions.

Valley Cab then traced some of the problems to faulty batteries and loose cables and plugs. They recharged the batteries and soldered the connections together. Despite these efforts, meter problems persisted. Valley Cab finally returned the inoperable taximeters to CALTRANS.

San Luis Transportation decided to simulate potential trips to test their two taximeters. They noted that if they cleared Fare #3, Fare #2 might also accidentally be cleared with no recourse for resetting the meter. Their drivers also had difficulty comprehending the shared-ride system and felt the meter was too complicated to use. The City of San Luis Obispo also saw potential problems, since passengers would not know the fare before entering the cab. San Luis Transportation thus decided not to participate in the demonstration and returned their two taximeters to CALTRANS.

In December, 1980 CALTRANS wrote to Viking Taximeter Company to request the circuit diagrams, parts list and other technical specifications on the meters, in hopes of understanding why they never worked. CALTRANS also loaned one of the meters to MINICARS, Inc. of Santa Barbara, for their electronics people to analyze. MINICARS is currently developing an Accessible Taxicab Vehicle, under contract to the U.S. Department of Transportation.

EXHIBIT 3

HOW TO CHARGE FOR A SHARED RIDE FARE

1. Have several pads of fare receipts marked Fare #1, Fare #2, etc.

2. When each person enters the cab give them a blank receipt with their fare number on it and explain this is to reduce any confusion as to which fare applies to which passenger.

3. Press first (left side) button to "START" the fare for each passenger when they have boarded the cab.

4. When loading or discharging passengers press the fifth button "TIME" to turn time off. Check the indicator light at top right side of the meter to tell if time is on or off. Turn time on when you resume your trip by pressing the time button again. If you do not anticipate any traffic delays enroute, you can leave the time off and turn it on only when you are in a congested area.

5. When you are ready to discharge a passenger verify his Fare number. If the meter is not showing his Fare number under Fare, (top center of meter) press the third button "FARE" to advance the Fare number to the number for the passenger. When the correct Fare number is showing, record the fare. You have only 10 seconds before the Fare number will advance automatically. If it does, press the "FARE" button again to the desired fare.

   After the fare is recorded, press the fourth button "CLEAR" which will clear the meter for that fare. *Be careful.* If the fare number has automatically advanced, you will clear the wrong fare.

6. Complete passenger's Fare receipt if he so desires.

7. Complete entries in driver's manifest.

NOTE: The Shared Ride fare will be in cents rather than 10¢'s as in all other meters. You should have adequate small change in case the passenger asks for exact change. You should consider mentioning that Shared Ride is a real bargain for each passenger and that they request a Shared Ride cab for future trips.

HOW TO CHARGE FOR A GROUP RIDE

1. Every member of the group must board and depart at the same location.

2. The regular rate (Rate #1 on the meter) will be used.

3. Collecting the fare can be done by collecting the total fare from one person who would in turn collect from the other passengers. This is the simplest for the driver but requires the passengers to make their own change. This will discourage Group Riding. The fare for each passenger is the total fare divided by the number of passengers. The fare will be to the nearest penny. You should carry adequate small change and each passenger should be treated with the same consideration and courtesy as any other passenger. You should consider mentioning to the passengers that Group Ride saved each of them 2/3rd of the fare (3 in group) or, 3/4th of the fare (4 in group), etc. This may increase your tip.

EXHIBIT 4

REDUCED FARES

In these times of inflation, high gasoline prices and never ending taxes we are pleased to offer you lower taxi rates.

SHARED RIDE

This taxi is equipped with a new type of taxi meter for Shared Ride use. If you are willing to share this cab with one or more persons going your way we charge you and the other passengers a lower rate.

Here is how it works:

With just one passenger in the cab our regular rates are charged. The rate lowers as the number in the cab increases. Each passenger pays $1.20 for the first one-tenth mile which represents our overhead, standby, etc. charges. Then the following mileage charge is added.

1 person	$1.00 per mile.
2 persons	80¢ each per mile; a 20% savings.
3 persons	60¢ each per mile; a 40% savings.
4 persons	50¢ each per mile; a 50% savings.
5 persons	40¢ each per mile; a 60% savings.
6 persons	30¢ each per mile; a 70% savings.

How much can you save? Here are some examples for trips from the airport.

- To downtown stopping at the Peppertree Motel to drop off 2 passengers – your fare $8.90 shared ride – save $2.10 or 19%. If by yourself to downtown – your fare $11.00.
- To Miramar Hotel stopping at the Ambassador to drop off one passenger and the Biltmore to drop off 2 passengers – your fare $9.90 shared ride – save 37%. If by yourself directly to the Miramar – your fare $15.60.
- To San Ysidro Guest Ranch stopping at the Biltmore and Miramar to drop off one passenger each – your fare $12.50 shared ride – save 27%. If by yourself directly to San Ysidro Guest Ranch – your fare $17.10.

GROUP RIDE

Sometimes Group Riding may save you more. This is when up to 4 persons in the cab starts and ends at the same place and the regular fare is divided between each person. Here are some examples:

Airport to downtown 3 persons – total fare $11.00 or $3.67 per person.

Airport to Miramar Hotel 4 persons total fare $15.60 or $3.90 per person.

Airport to Biltmore Hotel 3 persons total fare $11.30 or $3.77 per person.

We are sorry, but Shared and Group Riding cannot be done at the same time.

Everybody saves on Shared and Group Riding. You save money. We save gasoline. Everybody has cleaner air and reduced congestion.

Based on Valley Cab's experiences and insights, MINICARS' electronics' analyses and CALTRANS suggestions on ways to improve the Viking Executive Taximeter, it is recommended that future shared-ride taximeters:

- Adopt more (e.g. 8) fare positions for use in Dial-A-Ride and larger services. This could be designed as an optional feature, since there are advantages to keeping the meter small and shared-ride operators report average vehicle productivities in the 5-6 passengers per vehicle-hour range.

- Design a printer feature, so that receipts can be issued to customers and fares can be tabulated for each driver's shift. This feature will also be valuable for management information purposes.

- Eliminate driver's ability to reset or tamper with the recorded fare and the ability of the memory to be cleared if the meter is disconnected. One suggestion is to require "Print" to be pushed before "Clear" so that no records could be lost through accidental pushing of "Clear."

- Simplify the driver operating requirements, with a single switch for the flag drop, one "PRINT" button, one "ADVANCE" button, and one "CLEAR" button. Also, develop easily understandable operating instructions for the taxicab drivers.

- Protect the electronics and printer from environmental factors. A remote under-dash installation in a shielded metal case is suggested.

- Eliminate the large battery requirements by replacing the taximeters' mechanical movements with electronic equipment. The demonstrations' equipment failures were often traced to faulty batteries and cable connections.

- Provide light shielding on the fare readout and mount on the dash for easy passenger view.

- Redesign the Vacant/Hired indication, such that "Hired" is only shown when no more passengers can be picked-up. For exclusive ride passengers, "Hired" would be shown when only one rider is in the vehicle.

- Rename "Fare" to reflect individual passenger's identification number and "Rate" to reflect the number of persons in the vehicle, or to actually show the rate per unit.

As outlined in the CALTRANS-Valley Cab and Limousine Service contract, the taxicab operator would collect operating and financial data, and submit monthly progress reports and a final report to CALTRANS. But, the persistent taximeter equipment problems resulted in no shared-ride taximeter data and Valley Cab did not submit any reports to CALTRANS. Since SYSTAN's Final Evaluation Report was to be based on the operator's data and reports and these did not exist, SYSTAN proposed an alternative shared-ride taximeter study.

2.4 STATE-OF-THE-ART REVIEW

In October, 1980 the International Taxicab Association (ITA) held their Annual Convention and Trade Show. Several of the Convention Exhibitors were taximeter manufacturers and a few were advertising shared-ride taximeter capabilities. In 1978, when this demonstration was initiated, no other shared-ride taximeter manufacturers were identified, other than Bruider or Viking. Realizing the market had changed, SYSTAN thus proposed that TSC and UMTA change the focus of this study:

- to identify the current state-of-the-art in shared-ride taximeter equipment;
- to identify any existing shared-ride taximeter operations; and
- to project the future potential for shared-ride taximeters.

The scope of the study was agreed to be limited. SYSTAN, Inc. sent letters to five taximeter manufacturers, who were identified through the ITA Convention displays, from Taxicab Management advertisements and through discussions with taximeter manufacturers. A list of the contacted manufacturers is included in Appendix C.[15] Each manufacturer was asked to explain the ability of their taximeter to compute shared-rides; the current use of their taximeters in U.S. and foreign shared-ride systems; and taxicab operator contacts for any shared-ride systems operating in the United States.

Two taximeter manufacturers responded, Centrodyne, Inc. of Canada and Electronic Innovations Limited of New Zealand.

Centrodyne, Inc. is the parent company of Centrodyne Corporation of America, which manufactures, sells and services taximeters exclusively for the U.S. market. All research, development and engineering is conducted in Canada and in 1979, after encouragement from Dick Hunt, then President of ITA, Centrodyne developed a prototype shared-ride meter. This "Silent 500" meter could calculate up to four separate rates and fares based on individual pick-ups and drop-offs.

As passengers boarded or alighted and the driver activated or deactivated the number of fares the meter would automatically switch to the appropriate rate. These rates would be programmable and would

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[15] Although the Argo Taximeter company was not identified at this time, they are currently marketing a shared-ride taximeter.

generally comprise a 15 percent reduction in time and mileage per additional passenger. After conducting prototype testing, Centrodyne decided not to produce the shared-ride meter "until such time as there is a general consensus as to shared-ride regulations at the State/Municipal level throughout the U.S.A." Centrodyne maintains this same position today.[16]

Electronic Innovations Limited has developed the Novax 80, a shared-ride taximeter that can calculate up to five separate fares at preprogrammed discounted rates. Similar to the Executive, the Novax 80 collects, stores and retrieves management data and the Novax also has a printer option, which can be used to provide passengers with hard-copy receipts or to print management records.

The Novax also calculates rides on a distance and time basis, with an option for four different flag and drop charges and eight different distance and time rates. Similar to the other shared-ride taximeters examined in this report, riders should therefore be travelling from (or to) one common point (e.g. airport) so that large pick-up (or drop-off) deviations are not required on both ends of the trip. Depending on the total length of the shared-ride trip, Electronic Innovations estimates the average taxicab operator collection area could be a half-mile radius, without severe adverse impacts on the level and cost of service to the users or operators.

Some additional Novax 80 features include: an Automatic Tariff Change, so that after a preset distance, time, fare or number of drops, a different fare rate can be activated, to compensate for deadheading, peak hour or other additional operator costs; a Total Fare option, which adds together the fare plus any extras; the Automatic Return to Vacant feature, which prevents leaving the taximeter in the Hired mode after the last passenger has disembarked; and the Running Total Inhibitor, which prevents the running total from being added to the memory if a customer does not appear, after the driver has arrived at the pick-up point, received acknowledgement and flagged the meter. Exhibit 5 compares the reported basic features of the three shared-ride taximeters identified to date.

The Electronic Innovations model, the Novax 80, has only been commercially available to the taxi industry for a little over a year. Two Australian taxi operators are currently using these shared-ride taximeters (Darwin Radio Taxis in Darwin and Aerial Taxis in Canberra), and in Melbourne, Australia shared-ride taxi service is now being tested. In Perth, Australia taxi operators have requested a change in local legislation to permit shared-riding and in Singapore shared-ride

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[16] Lee, H.A., Executive Vice-President, Letter in response to SYSTAN, Inc. inquiry, Centrodyne, Inc. Montreal, Quebec, February, 1981.

EXHIBIT 5 — SHARED RIDE TAXIMETER FEATURES

FEATURES	VIKING EXECUTIVE	ELECTRONIC INNOVATIONS NOVAX 80	CENTRODYNE, Inc. SILENT 500
NUMBER OF RATES/FARES	6	5	4
BASED ON	Distance & Time	4 flagfalls/drop values 8 waiting times 8 distance rates } or any combination	Distance Alone/Distance & Time Any Increments
ACCURACY	Distance: 2.5 feet Time: .005%	Better than .5%	N/A
POWER	Battery	Electronic — 3 Amp Fuse	Electronic Stand-by Battery
CALIBRATION	Miles or Kilometers	Miles or Kilometers	Miles
WARRANTY	One Year	One Year	One Year
EXTERNAL INDICATORS	Hired Vacant	Not for Hire Vacant Hired 1 Hired 2 Hired 3 Hired 4	Hired Vacant
MANAGEMENT DATA	Fares ($), Extras ($) Units, Trips Miles, Paid Miles Fare & Extras ($), Number of Extras	Fares ($), Extras Units, Trips Miles, Paid Miles Waiting Time	Fares ($), Extras ($) Trips Miles, Paid Miles
INSTALLATION	• Sketch Diagram included; • Reported "easy" — but problems documented.	• Mounting screws included; • Reported small enough to fit into, or mount onto dash.	N/A
EXTRA FEATURES	• Day of Week • AM/PM • Hours/Minutes	• Hard-copy printer (receipts, data) • Automatic Tariff Change • Total Fare • Automatic Return to Vacant • Running Total Inhibitor	N/A

N/A = Information Not Available.

taximeter services will soon be tried.[17]

No existing shared-ride taximeter operations have been identified in the United States. However, in Honolulu, Hawaii, A&M Enterprises operates a taxi fleet and rents taximeters to independent taxi operators. A&M has recently purchased the Novax 80 shared-ride taximeters and is now testing the equipment. They are reported to be operating reliably. Since the Honolulu International Airport is located approximately 10 miles from Waikiki Beach, this would be an ideal site for testing the shared-ride taximeter concept. Unfortunately, shared-riding is not currently permitted in Honolulu and there are strict taxicab regulatory controls for pick-ups at the Honolulu Airport.

There also seems to be some interest in shared-ride taximeters in Southern California. The city of San Diego has recently decided to allow taxicabs to set their own rates. Although San Diego has a zonal fare system, there appears to be some interest in running unofficial tests of shared-ride meters. Valley Cab and Limousine Service of Santa Barbara, the CALTRANS taximeter demonstration operator, is also still interested in testing the shared-ride taximeter concept. If a reliable and easily understandable meter was available, the San Luis Obispo operator might also be interested.

Another site might also be the Logan Airport in Boston, Massachusetts. Currently, a "Share-A-Cab" zonal fare system is in effect. A limited number of cabs could be equipped with shared-ride taximeters to compare the two fare calculation options.

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[17] North, Brian E., President, Letter in response to SYSTAN, Inc. inquiry, Electronic Innovations Limited, Auckland, New Zealand, December, 1980.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 GENERAL FINDINGS

This Shared-Ride Taximeter Study identified the following major findings based on the demonstration project, and the shared-ride taximeter state-of-the-art review.

- In spite of the fact that the taxi industry is currently facing significant regulatory, ridership, productivity and economic changes, the vast majority of taxi operators continue to offer exclusive or group-ride services and use conventional taximeters to calculate passenger fares.

- No shared-ride taxi operators use taximeters to calculate passenger fares in the United States. All identified shared-ride taxi operators in the U.S. use zonal, grid or flat fares. One operator uses a computer to calculate passenger fares.

- Many of the barriers to implementing shared-ride taxi services are institutional, regulatory as well as technological. As a group, taxicab operators have not identified their requirements for shared-ride taximeter equipment. At the same time, the research and development in the taximeter industry has been sparse and taxicab operators are reluctant to use unproven technology.

- There are no proven reliable shared-ride taximeters currently manufactured in the United States. However, several American taximeter companies advertise shared-ride capabilities. One Canadian taximeter manufacturer developed a prototype shared-ride unit in 1979, but decided not to produce them until a more favorable local taxicab regulatory environment exists in the U.S. And one taximeter manufacturer in New Zealand has developed and produced a reportedly reliable shared-ride taximeter.

- A few examples of formal shared-ride taximeter services were identified in other countries and there appears to be some interest for other foreign applications.

- There also appears to be some interest, on the part of U.S. taxicab operators, in shared-ride taxi services and in testing shared-ride taximeters.

3.2 EQUIPMENT FINDINGS

Based on the demonstration participants' experiences and observations, some specific shared-ride taximeter equipment features might include:

- Adopting a printer feature, so receipts can be issued to passengers, fares can be tabulated for each driver's shift and hard-copy reports can be printed for management;

- Eliminating large battery requirements by replacing mechanical parts with electronic equipment;

- Providing light, non-glare and easily readable fare readouts, mounted in a predominant position for passenger view;

- Protecting supplementary electronics and printer from environmental factors. A remote under-dash installation in a shielded case is suggested;

- Redesigning "Vacant/Hired" Indicator, so that potential shared-ride passengers can differentiate among "Not for Hire," "Vacant," and "Available for 1," "Available for 2," "Available for 3," etc;

- Renaming "Fare" to reflect individual passenger's identification number and "Rate" to reflect the actual rate based on the number of passengers per vehicle;

- Eliminating driver's ability to reset or tamper with meter calculations, memory or equipment; and

- Simplifying driver operating requirements and instructions for use.

3.3 GENERAL OUTLOOK AND RECOMMENDATIONS

Based on these findings, what does the future look like for shared-ride taximeters? In the long-run, taximeter technology and equipment innovations will likely improve significantly. During the past few years, there has been a tremendous boom in the electronics industry and the electronic taximeter industry. Current electronic taximeter equipment is considerably more reliable than the previous mechanical models and the reliability of future models is also expected to increase.

In the short run, it is therefore recommended that the existing shared-ride taximeters be tested and compared with alternative shared-ride calculation options. Shared-ride operations using flat fares, zonal fares, computer calculated fares and taximeter fares should be monitored and evaluated for their impacts on users, drivers and operators. A comparative evaluation should shed new light on these methods for calculating shared-ride fares and ideally identify the preferred and/or best method.

In addition, further research needs to be conducted to determine the level of fares, the differential fares charged per passenger and the amount of diversion that can be tolerated in shared-ride taximeter services. Actual shared-ride taximeter case studies, charging different fare levels may be able to compare how passengers value travel, ride, wait, personalized services and fare charges for SRT. In conventional transit, the level of service has generally been shown to be a more important factor than fares in determining ridership. These results should then be disseminated to interested taxicab operators, taximeter manufacturers, local taxicab regulatory agencies and public authorities. This type of information might be useful for resolving future shared-ride fare calculation questions and decisions.

In general, this report reflects the view that technological opportunities may be available for solving shared-ride meter requirements. Furthermore, some operators (e.g. Santa Barbara, Honolulu) are interested in testing shared-ride taximeters in revenue service. However, the existing state of the art and operational experiences are too limited to determine whether these meters can operate reliably and actually meet taxicab operator and rider needs.

If a pilot study or shared-ride taximeter demonstration project is developed, issues that should be considered include:

- The local legal, institutional and regulatory environment. Potential barriers to implementing innovative fare calculation and shared-ride taxi service should be identified early and either eliminated or another site selected. Ideally, the city should be receptive to testing innovative techniques.

- The different type of shared-ride incentives that have been tried (e.g. taxicab deregulation, direct payments, etc.) and their impacts on fares, demand, vehicle productivity, level of services, overall operator efficiencies and revenues. These results can then be used for comparison.

- The elasticity between ridership and fares as well as the trade-offs between the level of services and the user and operator costs for shared-ride services. Shared-ride taximeter service and fares must be implemented so that operators receive sufficient revenues to encourage use of shared-riding and shared-ride users are guaranteed sufficient fare savings to encourage them to use the service. To be attractive, shared-ride users should always be charged lower fares than exclusive-ride users making the same trip.

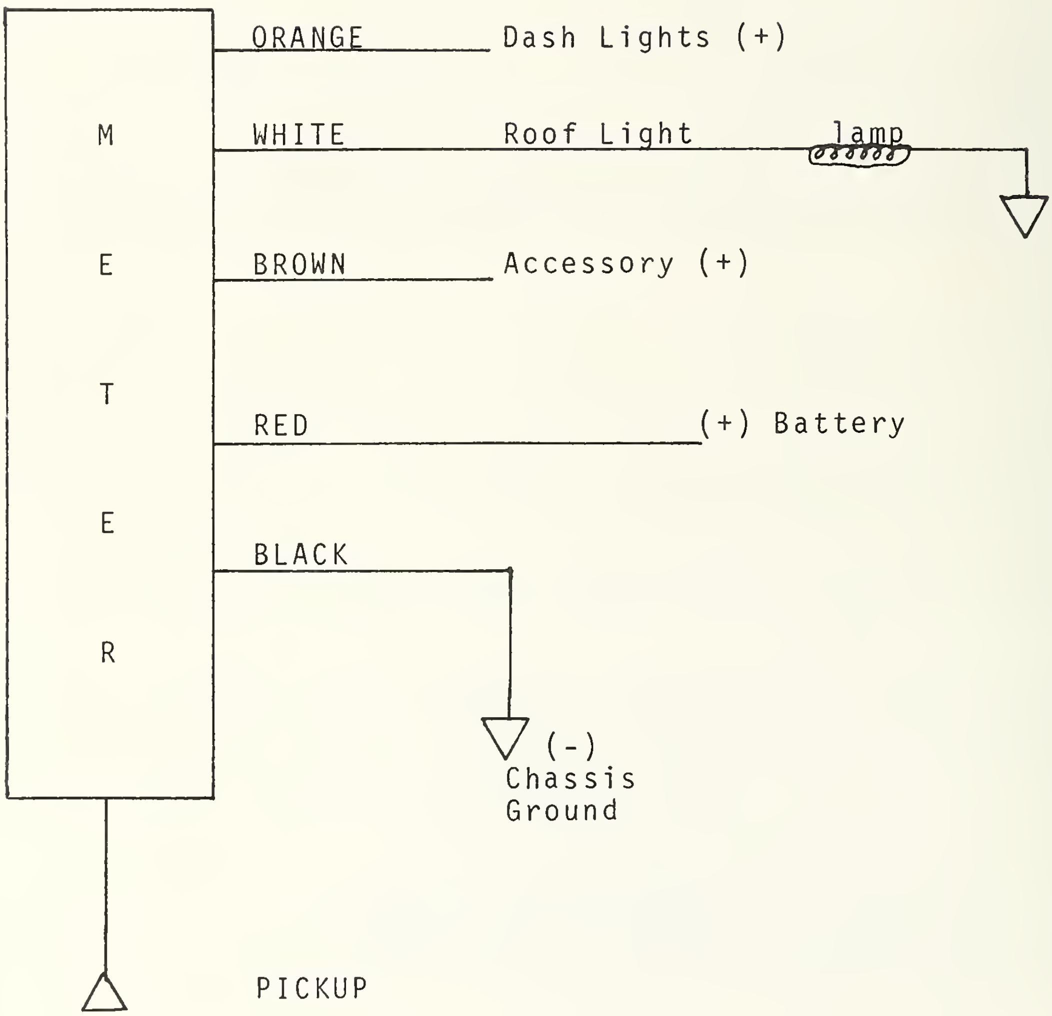
- The importance of marketing to make the public aware of the fares and service options available. Potential passengers may want to know what the average costs are in terms of the total fare and what the level of services are in terms of approximate wait time and ride time. This type of information is important for passengers deciding between exclusive and shared-ride services.

- The demand for travel, and the modal split between major activity centers (e.g. airport, downtown, etc.) and during peak travel periods. Demand should be sufficient to allow matching of riders between areas. Shared-ride services might be initially limited to certain times or portions of a metropolitan area where sufficient demand would be generated.

- The relationship between private shared-ride taxi services and publicly subsidized transit services. Since there are real sensitivities in the quality of services, costs and fare levels that taxicabs and buses can charge, comparative tests in cities with and without alternative transit options might be considered. Differences in the number of passengers switching from bus, exclusive-ride taxi services and automobile could also be compared.

APPENDIX A

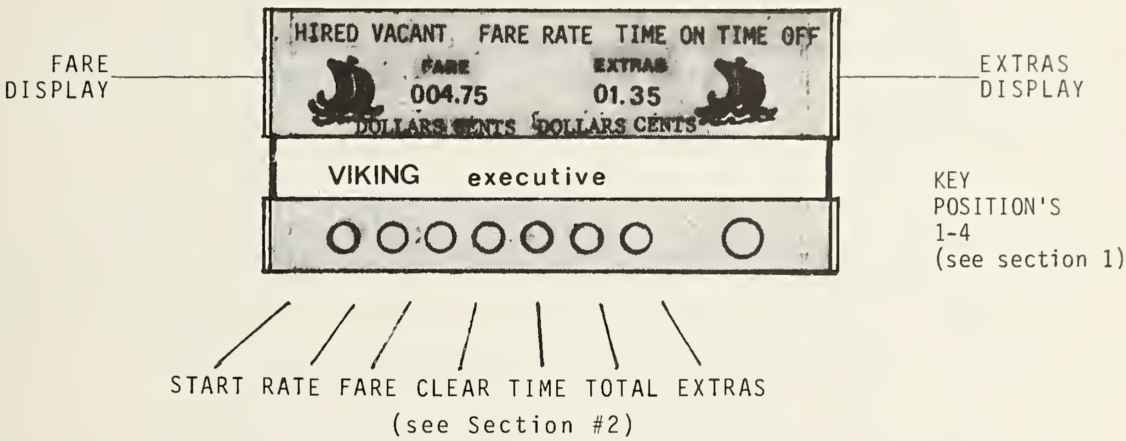
INSTALLATION OF EXECUTIVE



APPENDIX B

EXECUTIVE OPERATOR'S MANUAL #1

FARE'S 1-6 ________________ ________________ RATE'S 1-6



DEFINITION OF KEY POSITIONS
(FOR SINGLE FARE/SINGLE RATE METER)

SECTION #1

KEY POSITION #1
With key in this position the meter is in operating mode.
Management totals are available whenever cab is vacant, and vacant light is on (see SECTION #5)

KEY POSITION #2
Master System Clear; clears all totals and time to zero (see SECTION #2-D). Depress CLEAR (red) button to obtain this.

KEY POSITION #3
Management Position; to read management reports.
Also used to set internal clock and calendar (see SECTION #4).

KEY POSITION #4
With key in this position the meter is also in an operating mode (same as Position #1, above), management totals are locked out and can only be accessed by moving key to Position #1 or #3.

DEFINITION OF BUTTONS

SECTION #2

Meter is in: Operating mode, key position #1 or #4.

START (Green button)

This button when pressed, will cause meter to enter fare.

RATE
This button does not have to be used with a single fare/single rate meter.

FARE
This button does not have to be used with a single fare/single rate meter.

CLEAR (Red button)
Pressing this button clears FARE and EXTRAS from display when driver discharges passenger.
(When key is in Position #2, this button acts as a master clear of all memory as well as display, see SECTION #1, - Key Position #2.)

TIME
This button changes TIME ON to TIME OFF, when pressed, or visa versa. The meter will do this only when its in an operating mode (key Positions #1 and #4) and when the HIRED light is on.
When meter is vacant, this button when pressed will display the correct time of Day. This will only work when key Positions #1 or #4 is in operation (see SECTION #1 - Key Position #1, #3, #4.)

TOTALS
This button adds extras to the fare when pressed for a total fare, when pressed again, it will bring back the display to normal. This is done before pressing CLEAR button to show passenger's total fare. (For further use see SECTION #5).

EXTRAS
When pressed this button will display an extra charge on the display, each additional time this button is pressed another EXTRA (of the same denomination) charge is added to the display.

TO START A NEW METER

SECTION #3

After the meter has been installed:

A) Start car
B) Insert key into lock and then turn to Position #2.
C) Press CLEAR button and release.
D) Note that meter display will show: FARE 1 RATE 1
E) Turn day to Position #1 or #4 and remove key from lock.
F) It is suggested that the car should run for approximately 10 minutes or more to recharge the internal battery in the meter. The purpose of recharging the battery is to retain the memory of the fare even if the meter is removed from the car.
At this point the meter is ready to be used.
G) Press START button and Fare 1/Rate 1 will start.

APPENDIX B (cont.)

TO SET TIME OF DAY

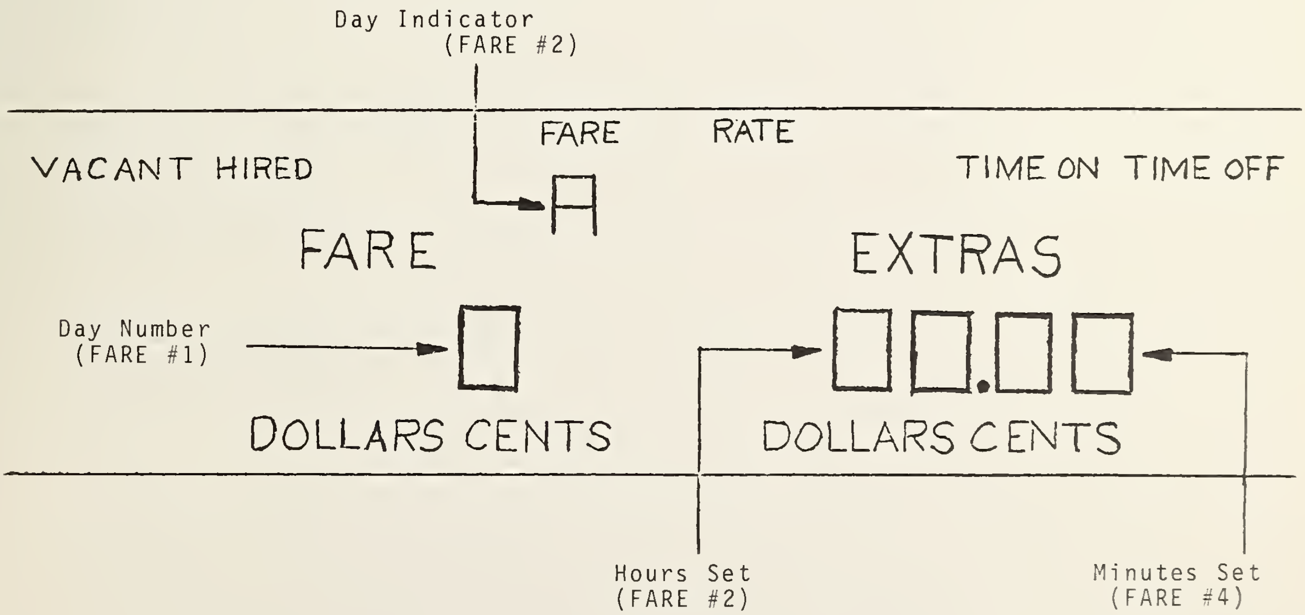
SECTION #4

Time of day and day of week are available on demand whenever the meter is in a operating mode and cab is vacant.

To set the time, the key lock must be in Position #3 and the following procedure must be used:

A) Select the appropriate item to be changed by pressing the FARE button. See table below for appropriate fare number.
B) Display time by pressing the TIME button.
C) Advance the item selected by pressing the CLEAR button.
D) To update the time, press the FARE button until you reach the item to be corrected.

FARE #	ITEMS TO BE UPDATED:							
1		Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
	Day Number	1	2	3	4	5	6	7
2	A.M. or P.M.: Change only if necessary, because a change from P.M. to A.M. will also advance Day Number and you will have to reset Day Number in FARE #1 position.							
3	Hours can be set							
4	Minutes can be set.							



APPENDIX B (cont.)

MANAGEMENT TOTALS

SECTION #5

Management totals are available only when the meter is vacant.

A) In Position #1 they are always available, but only when meter is vacant.

B) In Position #4 they are never available, but may be make available by moving the key to Position #1. (The reason for Position #4 is so that your drivers may not read the totals during the shift; totals can only be read when drivers check in at night and you unlock the meter.)

* * * The key is removable ONLY in Positions #1 and #4. * * *

Depression of the Totals button causes totals to be shown in the FARE and EXTRAS area as follows:

FARE #	FARE DISPLAY	EXTRAS DISPLAY
1	Total Fare	Total Extras
2	Total Units	Total Trips
3	Total Miles	Total Paid Miles
4	Total of Fare and Extras	Total Number of Extras

APPENDIX C

TAXIMETER MANUFACTURERS CONTACTED

Mr. Frank J. Hart
Martin Meters
203 Brunswick Street
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Victoria 3065, Australia

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Bruider Instrument Corporation
14 Seminary Avenue
Hopewell, NJ 08525

APPENDIX D

REPORT OF INVENTIONS

The work performed under this evaluation study did not result in new inventions. However, the work performed under this contract indicates that a number of innovations and improvements are currently being developed. These include:

Shared-ride taximeters; and
Computer calculated shared-ride fares.

Both of these developments are outlined in the report.

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