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PROJECT EVALUATION PROGRAM

for

PERFORMANCE STANDARDS FOR RIDESHARING PROJECTS

By

Donald A. Maxwell
Harry C. Petersen
Richard L. Petersen

The Texas A&M University System
Texas Transportation Institute
College Station, Texas 77843

713/845-9879

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PREFACE

This report is one of a series produced for the Federal Highway Administration under a research study entitled: Performance Standards for Ridesharing Projects. The published reports in the series are:

1. Project Evaluation Program.
2. Project Evaluation Workbook.

The first report is basically a reference manual that describes the evaluation approach. The final report is a how-to manual containing the necessary forms and a step-by-step procedure for conducting an evaluation.

These reports were developed by the Texas Transportation Institute on behalf of the Texas A&M Research Foundation for the Transportation Management and Ridesharing Programs Branch of the Federal Highway Administration. Donald A. Maxwell (Principal Investigator) and Harry C. Petersen developed and co-authored the evaluation approach. James Collins was the technical representative for the Federal Highway Administration and Ms. Julie Emig was the contract coordinator for the Research Foundation.

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The opinion are those of the author's and do not necessarily reflect the official views of any of the above individuals or organizations.

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I. INTRODUCTION

There is an almost universal agreement among its supporters that ridesharing is a very cost-effective way to increase highway capacity, abate pollution, save energy, and reduce parking demand. In fact there is a large body of research that supports this contention. For example, Frederick L. Wagner in the FHWA/UMTA report TSM - Measures of Effectiveness demonstrates that regionwide ridesharing projects can be expected to cost an average of 2¢ per vehicle miles traveled (VMT) reduced as compared to 40¢ for expansion of an existing transit system and $8.40 for add-a-lane type exclusive high occupancy vehicle (HOV) lanes. In spite of the fact that ridesharing has enjoyed a large measure of enthusiasm at the federal level, this has not carried down to local funding agencies for one reason or another.

As the federal (FHWA/UMTA/DOE/EPA) dollar commitment to ridesharing wanes, the slack must be picked up by state and local funds. Thus, for many program managers, the ability to prove the cost-effectiveness of their programs is not just a matter of pride, but of survival. This means that for ridesharing to flourish in a competitive atmosphere, the program managers must arm themselves to compete with other Transportation Improvement Program (TIP) measures for funds.

The primary emphasis in this report is the implementation of techniques to produce the numbers required to "prove your case" in the reports developed for program evaluation (and program defense) purposes; for example, the reports required by funding agencies and/or presentation to City Councils and the like. Because of the localized nature of the reporting system, development of the wording and format of these specialized reports and presentations will be an individual matter and thus outside the scope of this report.

This Introduction section outlines ridesharing evaluation needs. The following three sections describe the evaluation techniques. The second section describes the overall evaluation approach and the rationale behind its development. The third describes "how to work through the numbers". The fourth addresses the problem of implementation. Finally, there are a number of appendices. Appendix A contains a "typical" example evaluation; B, an evaluation of the Texas Vanpool Project; and C, the development of the evaluation percentiles.

There is a growing body of opinion that "hard numbers" are needed for ridesharing to prove its case. The question is: what kind of evidence do we need? Do we use easy-to-capture financial data, off-the-shelf models, and national averages, or do we design elaborate data collection systems, research every parameter, and make each evaluation system totally unique? And finally how do we organize the information to our best advantage?

First, the data must be timely. It is necessary to recognize that evaluation is a continuous process, not a one-shot effort conducted just before budget time. The evaluation should be a part of the administrative process and data collection should take place on a regular and continuous basis. For example, the program manager should be able to answer questions concerning the results of the program within a matter of hours or even minutes, and should not be required to wait for the results from a new study. The program manager should have up-to-date numbers "in his hip pocket" at all times.

Second, the numbers must be localized. Every ridesharing program has several unique features, which are usually a function of the local situation. One of the fears of many successful project managers is that any

evaluation system or set of performance standards will force the project into a standard mold. They feel that this will reduce their effectiveness by eliminating the local personality. Any proposed evaluation method should avoid forcing ridesharing programs to conform to a nationwide plan.

Third, there is a need to evaluate ridesharing internally as well as externally at several levels (program level, local, state and federal). The evaluation procedure uses the following four phases to address these areas of concern:

1. Service: How well does the areawide ridesharing project do its job as seen by the program manager? Do the employees perform effectively?
2. Mode: How cost-effective is the program with regards to actually forming pools and putting vehicles into service? How much does a carpool cost?
3. Transportation: How cost-effective is the program in reducing Vehicle Miles Traveled (VMT) and Vehicle Trips (VT)? That is, how much is a carpool worth?
4. Comparative: How does a carpool compare with other T.I.P. measures on a cost-effectiveness basis?

Performance standards used in this guide emphasize the first three phases. This report also provides a tie to the Comparative Standards Guide, which describes how to compute VMT & VT reductions for various transportation improvement measures. Once this multi-phase evaluation system is in place, the methodology can be used to determine the cost-effectiveness at the various levels.

Fourth, there is a feeling that, since the ridesharing agency is usually the custodian of all regional ridesharing results, regardless of whether or not the agency was the major motivator. This report takes into account

the need to maintain the regional totals of pools and ridesharing participants. The technique keeps the credited results separated from the overall regional totals for evaluation purposes.

Finally, both the evaluation and data collection process must be conceived as useful and easy to use in order for implementation to occur. It must also fit unobtrusively into the program's administrative processes and not consume an inappropriate amount of project resources.

II. OVERALL EVALUATION APPROACH

This section of the report describes the "why" of the evaluation process and how it evolved. It examines the problem from different points of perspective:

- Looking from the transportation objectives back toward the relevant services. (Figure 1)
- Looking from the services (and data collection) toward the transportation objective. (Figure 2)
- Looking at the process from a temporal point-of-view. (Figure 3)

The next section gives the details of "how-to-do" a full evaluation.

The Evaluation Objectives

From the transportation planning perspective, the end product of the evaluation is a comparison of the cost-effectiveness of ridesharing to other types of transportation improvement measures. The usual objectives of transportation improvement measures which are used for comparison purposes are:

- Pollution abatement expected as a result of project implementation;
- Fuel savings resulting from implementation;
- Increases in (people carrying) capacity resulting from implementation;
- Reductions in parking demand resulting from implementation; and
- Dollars saved by the users of the services and/or facilities.

One or more of these objectives are usually included in any project implementation plan.

Very often these objectives can not be measured directly, but various surrogates are used instead. The most common surrogates are:

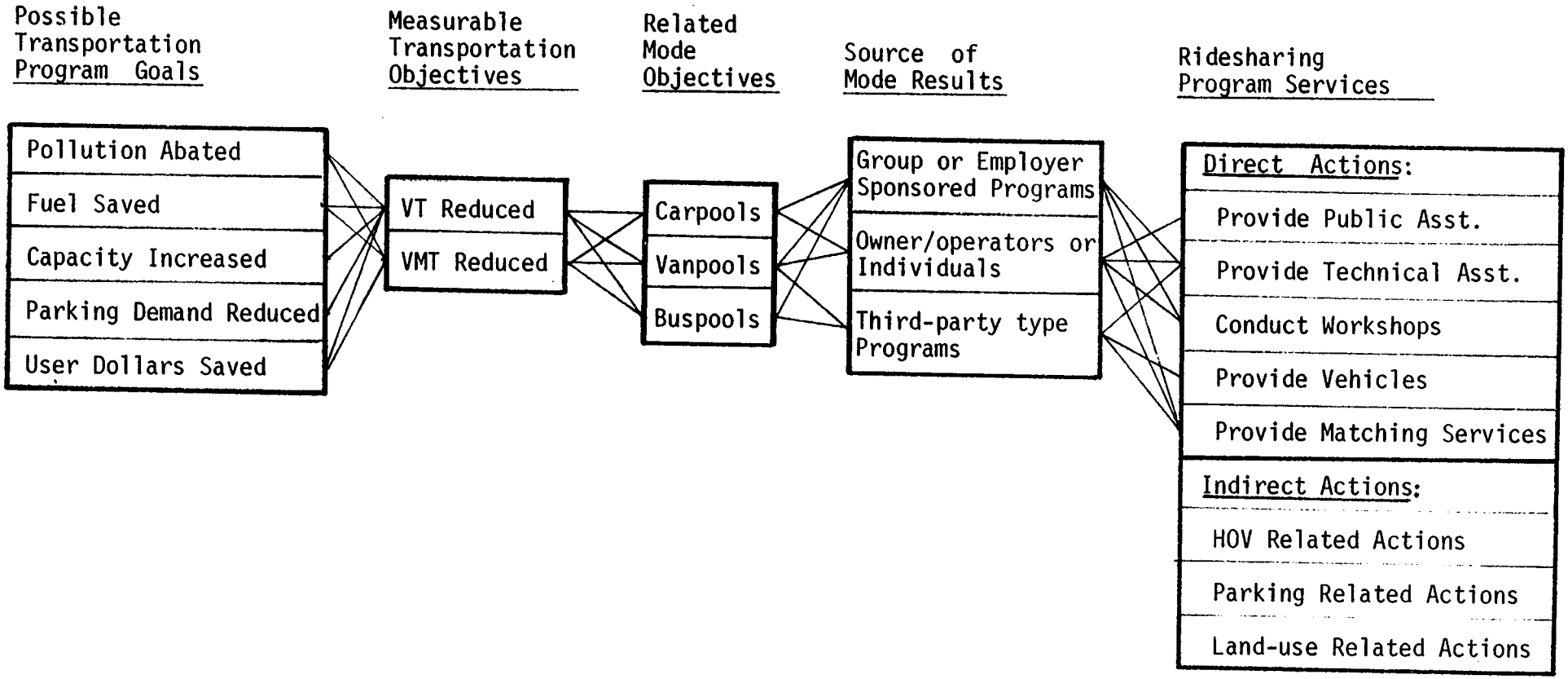

Figure 1 - - RELATIONSHIP BETWEEN GOALS AND SERVICES

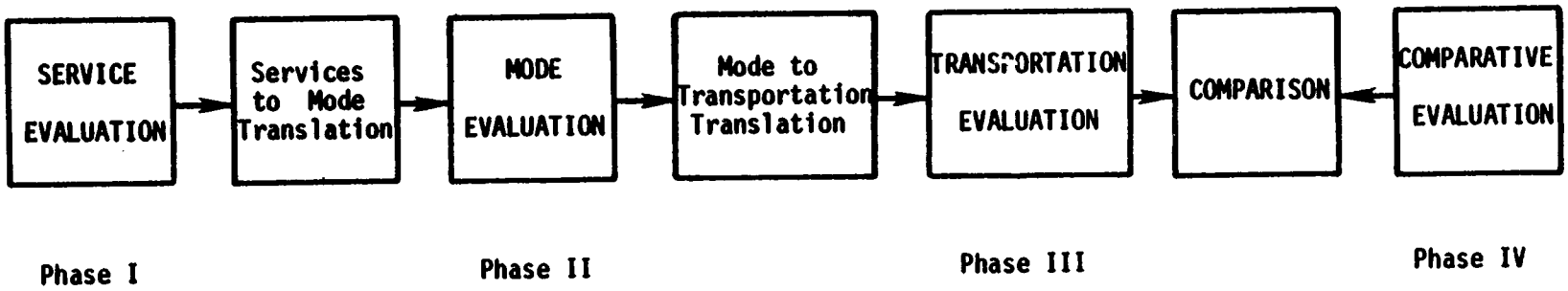

Figure 2 -- OVERALL EVALUATION FRAMEWORK

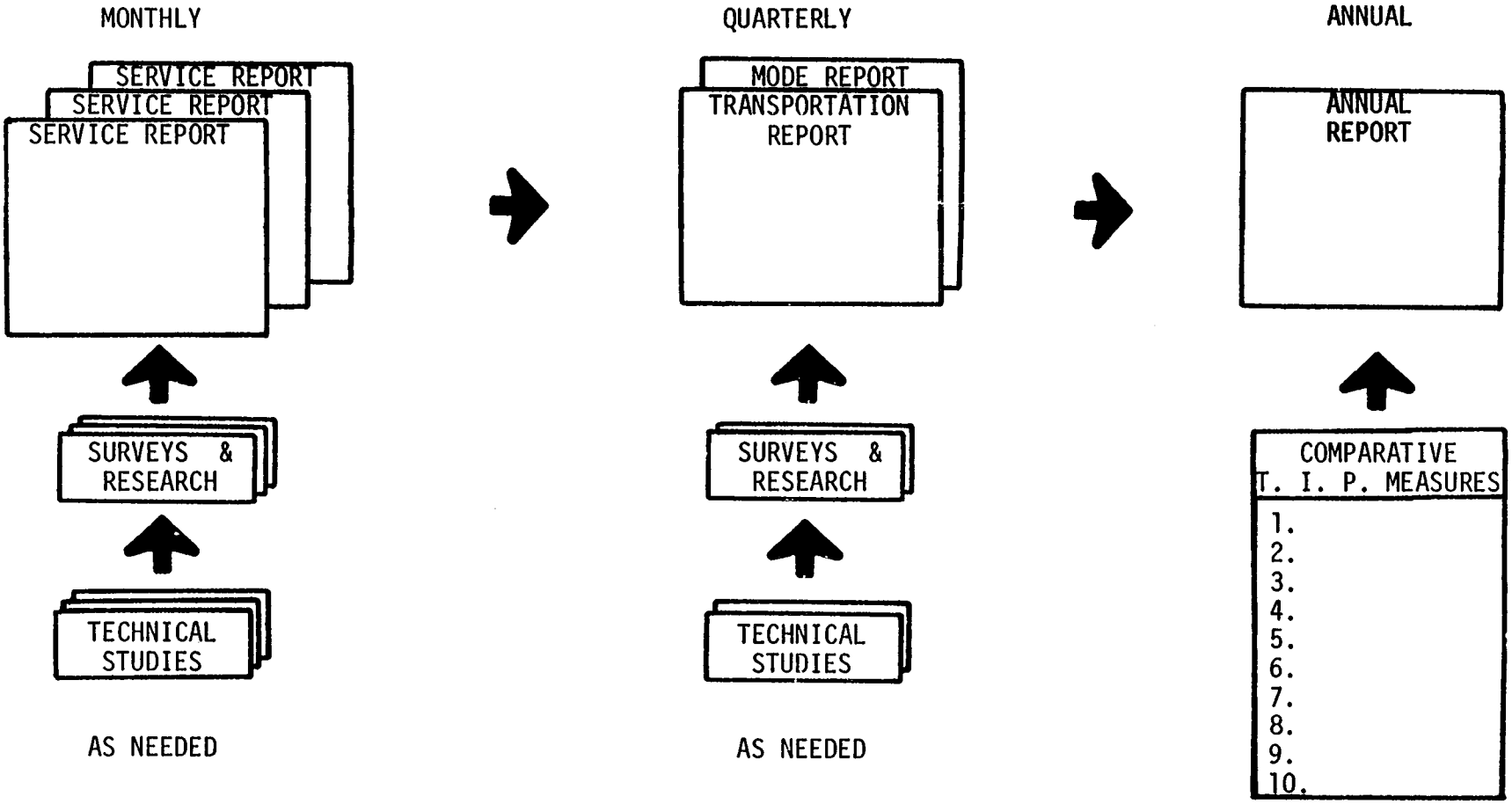

Figure 3 - - EVALUATION SCHEDULE

- Vehicle Miles Traveled (VMT) reduction resulting from the project.
- Vehicle Trips (VT) reduction resulting from the project.
- Vehicle Hours Traveled (VHT) reduction resulting from the project.

Reduction in pollution, fuel saved, etc. can be calculated in terms of VMT and VT alone, so VHT need not be considered. (VHT resulting from ridesharing would also be very difficult to determine directly). Thus, reductions in VMT and VT are the measures of effectiveness used in this project with respect to transportation objectives.

In ridesharing, reductions in VMT and VT (and hence the achievement of the transportation objectives) result from increases in numbers of carpools, vanpools, and buspools. These in turn become the corresponding project mode objectives. They can be measured in terms of vehicles (pools) or passengers, since one converts easily to the other. Thus, the measures of mode results are:

- Carpool passengers (or carpools) resulting from the project.
- Vanpool passengers (or vanpools) resulting from the project.
- Buspool passengers (or buspools) resulting from the project.

Mode results come from three sources. This may seem to be an over-simplification, but they are defined in such a way that they contain all sources.

- Group or Employer Programs. This includes the classical employer programs, the employer/driver programs, and other programs sponsored and/or controlled by any similar group. Carpools, vanpools, and buspools all result from these types of programs.
- Individuals or Owner/Operators. This includes carpools and vanpools that result from individual action (with or without the areawide Ridesharing agency's help).

Third Party Programs. This source includes vanpools provided by the usual third-party arrangement and also buspools provided by the transit agency.

The question now is: How cost-effective are each of the actions of the ridesharing agency which cause pools to be put on the road from these sources? To answer this question, the evaluation process must provide for identification and counting of these actions.

This report groups these actions into two general classes: those that directly cause ridesharing to increase and those that indirectly cause ridesharing to increase. The direct actions (or services) are those traditionally associated with ridesharing. From a nationwide perspective these services appear to be rather standard. For example, carpool matching can be accomplished in a variety of ways (at least six major variations), some more successful than others. No matter what kind of matching technique is used, drivers and riders still must be found. The variation from program to program comes from the mix of services provided, because no agency provides the full array of possible services.

The direct actions fall into the following general classes:

A. Matching services: finding drivers/riders for vanpools, riders for park-and-pool, etc.

B. Workshops: meetings designed to "turn people on" to ridesharing.

C. Specific technical assistance: program design, development of handouts, consulting with employers.

D. Vehicle provision: providing vehicles for use by pools.

These services can either be conducted in the field or in-office. The effects of these actions can be measured directly. The calculation of the cost-effectiveness of these is a straightforward process.

Indirect actions (or services) have only emerged in the past several years as a means to stimulate ridesharing. They tend to be highly program-specific. This group includes things like:

A. Increasing public awareness: public presentations, erection of signs, public service announcements, material distribution, etc.

B. Increasing relative attractiveness of ridesharing: preferential treatment (high occupancy vehicle lanes, HOV parking, access ramp) and vehicle restriction: auto restricted zones, parking, zoning.

C. Providing transit services: transit schedules, park-and-ride lots.

It is very difficult to determine the effectiveness of these types of actions, because the increases in ridesharing are hard to determine.

The basic difficulty is that it is almost impossible to count pools that are not formed as a direct result of program action. Carpools form, break up, and reform without the knowledge of the agency. Owner/operator vanpools tend to remain "invisible" for a number of reasons. Bus pools are highly visible and are easier to count; however, new bus passengers may be difficult to count.

The Evaluation Process

The evaluation process consists of four evaluation modules: Service, Mode, Transportation, and Comparative. The process begins with the service evaluation module and moves from left to right, until all modules have been completed. Each module consists of one or more steps. The following discussion describes only the Service, Mode, and Transportation modules. The comparative module is the subject of another report.

The Service Module (I) consists of two steps. The first involves the collection of service data, that is, services provided and their costs (for

example, four workshops were held at a cost of $1500 each). The second step evaluates the results in comparison with a set of recommended performance standards (for example, $500 to $3500 per workshop).

The Mode Module (II) consists of three steps. The first translates the service results into mode results. For example, a program may find that 1000 matchlists translate into 250 three-person carpools with an average former automobile occupancy of 1.75 persons per vehicle. The second is a summary of the mode results (how many direct, non-program, and credited carpools, vanpools, and buspools) and the cost associated with each mode. The third step is a comparison of the cost-effectiveness of these mode results with a set of performance standards.

The Transportation Module (III) also consists of three steps. The first is a translation of mode results into transportation results, such as the VMT and VT reduction which results from a shift of commuter trips from private automobile into the three modes. The second step is a summary of these transportation results and their costs. The third step is an evaluation of the cost-effectiveness of these results compared with a set of performance standards.

The Comparative Module (IV) consists of two steps. The first step involves the determination of VMT and VT reduction resulting from the implementation of one of the ten specific Transportation Improvement Program (TIP) measures selected for this study. The second step is a comparison of the cost effectiveness of the TIP measure with the results expected from an alternative, comparable ridesharing project.

It should be noted that the evaluation process can be implemented either in parts, or as a whole. For example, the first mode can be bypassed

if the mode totals are already known. An entire module can be disregarded so that, for example, only carpool programs need to be examined. The comparative analysis can be eliminated in its entirety if not needed.

The process also works backward as well as forward. For example, suppose a certain VMT reduction is required in a particular corridor, and a vanpool program has been suggested as the most cost-effective way to achieve the desired results. Since the required reduction in VMT is known, the number of vans required to achieve this result can be determined by reversing the mode-to-transportation translation. Then, based upon the services-to-mode translation model, the evaluator can work backward to determine the required number of workshops and contacts to achieve the desired shift into vans. This reverse process can be also used for program planning and budgeting.

The Evaluation Schedule

It is customary for accounting to be on a monthly cycle, reporting on a quarterly cycle, budgeting on a yearly cycle. Requests for technical information occur frequently, independent of any regular cycle. In order to institutionalize the evaluation process it needs to be tied to the regular accounting/reporting/budgeting cycle. In addition, the process must respond to the above irregular requests for information. The following is a recommended sequence for working through the evaluation modules (see Figure 3).

The Service Module (I) should be worked through every month. This is especially true of the results components. It is important at this stage that services rendered be matched to the appropriate costs on a regular and

systematic basis. If this can not be accomplished directly because of the local agency accounting conventions, then estimates should be made according to a specific set of rules. This will allow for in-house evaluation on a regular basis.

The Mode Module (II) should be worked through every quarter. This can be accomplished by translating the previous quarter's service results data (a three month total) into a quarterly mode result summary. These mode results can then be translated into a quarterly summary. A mode and transportation evaluation can be done at this point for in-house monitoring purposes. A summary report of ridesharing results (similar to the Texas Vanpool Census, Appendix D) can be prepared for outside consumption.

Experience shows that the mode results and evaluation are very important public relation tools. The published results should be kept as current as possible for use in presentations and in responding to inquiries. Remember to base costs on funded dollars, excluding "in-kind" contributions. The annual report should contain the accumulated results of the four quarterly summaries. Costs versus mode and transportation results should be highlighted and service results down-played.

Smaller programs will probably use the "national" factors and averages provided in this report to determine results and make conversions for evaluation. The larger programs (that is, those with the most resources) will want to conduct their own surveys and technical studies to obtain their own unique local translation factors for the evaluation process. These studies can be conducted as staff time is available. (Using college students to conduct those studies as part of their co-op program or as part of a degree requirement has proven to be part of a low cost method of obtaining good results. Several programs have recommended this approach).

III. EVALUATION PROCEDURE

This section describes the steps to be taken by a ridesharing program when conducting an evaluation. Rapid, fairly accurate calculations, summaries, evaluations, and performance comparisons with other ridesharing programs can be made by using pre-prepared tables based upon "national" averages. This series of procedures, with necessary tables, will be presented in this section (see Figure 2 for procedural flowchart). It must be emphasized, however, that the tables and statistics are based upon a small sample collected prior to June of 1982. The numbers can be refined when a larger, more recent sample is generated. The shortened procedures and tables of this section have been pre-derived from the beta distribution; Appendix C presents the full procedures for use with updated data, for those who desire to develop their own updated numbers.

The procedure summarizes and evaluates each phase in turn. Data is first collected, or translated (mathematically derived) from the preceding phase, for the time period over which the program is to be evaluated (such as one quarter or one year). The total program budget for the evaluation period is apportioned or divided among the variables to be evaluated for each phase in turn, and the cost-effectiveness ratio is calculated in dollars per unit of evaluation variable, which summarizes the results. Beta statistics are then used for evaluation of the ratios by percentile comparisons with ratios of other ridesharing programs. (This shortened procedure uses pre-calculated tables, based on the 1982 sample to determine the percentile rankings of the ratios).

Percentile rankings of transportation results can be compared with percentile rankings of other Transportation Improvement Projects, using

the final comparison table. Thus, a program manager can compete for budgeted funds on a rational, results-oriented basis.

Budget Adjustments

All ridesharing programs do not have the same funding sources, available outside resources, or goals. Thus, they cannot be directly compared without adjusting the budgets to make them equivalent. The necessary steps in the budget adjustment are determined by the nature of the evaluation:

First, does the funding agency require the program to provide matching funds or in-kind services? If so, two evaluations will be necessary. For internal control, the program coordinator should include the total value of all matching and in-kind contributions to evaluate program performance based on total resources. On the other hand, for comparisons with other TIP measures and evaluations of the performance per dollar contributed by the funding agency, the contributed and in-kind budget share should be subtracted, so the evaluation is based entirely on results per funded dollar. In-kind contributions which should be subtracted for external comparisons include volunteers' time, donated computer use, donated advertising, employer or civic organization contributions, etc. Multiple funding sources should all be included, however; local government funds contributions should not be subtracted, for example.

Second, does the program provide a substantial amount of actual transit services (vans, buses, paratransit, transit schedules) in addition to ridesharing assistance? If so, these transit services should be evaluated separately from the ridesharing services, and the overall pro-

gram percentiles should be separated into the overall ridesharing assistance percentile and overall transit services percentile (as shown in the first example evaluation). Otherwise, efficiencies of the ridesharing assistance portion of the program will be obscured by the more costly transit services. This separation should be clearly maintained throughout all reporting procedures, to prevent for example, elimination of matchlist funding due to the unrelated high cost of paratransit for the handicapped in specially-equipped program vans.

Finally, are some services only incidental to the program goals? These incidental services should be clearly identified in all reports, as they may prove to be much less cost-effective than the other services, and may reflect badly on the entire program unless separately identified. They still should be included in the procedures, however. See example evaluation #1 for application of these principles.

Service Results--Phase 1

The total program budget for the evaluation period must be apportioned or divided over the services performed for which hard numbers exist. The actual percentage amounts spent for each service should be apportioned, when data is available, as follows:

(A) The budget should always be apportioned first to specific services directly affecting ridesharing (matchlists, workshops, specific technical assistance, providing pool vehicles, etc.). Some funding agencies will require certain specific services to be included in the evaluation.

(B) Specific services which indirectly affect ridesharing (public awareness presentations, increasing relative attractiveness of ridesharing, etc.) should have budget assignments where specific records make this possible, even though it is usually not possible to directly translate these services into mode results. (In a few cases it might be possible to directly translate some of these normally "indirect" services into mode results. These services should then be reassigned to the "direct" category).

(C) In many cases not all the budget will have been apportioned in steps A and B; and an "uncertain" portion of the budget will remain due to overlap of services, general overhead requirements, record keeping, and other causes. This budget should be apportioned to services by estimate, where possible.

(D) Any remaining budget following estimation should be divided fairly evenly among the remaining, as yet unbudgeted services. First, strike off all services which are very rarely or never performed by the program, leaving both direct and indirect services which are sometimes performed but difficult to budget. Then divide the uncertain budget items evenly among the remaining services but adjusting this apportionment according to common sense, if necessary. The apportioned budget percents for Phase I must total one hundred percent. These percents are converted to decimals and are then entered in the Program Results Form's first column.

(E) The total program cost for the evaluation period is entered in each row of the second column (or, to save entering the total many times, enter the total budget in the first row and use a vertical down arrow through the remaining rows).

(F) Multiplying columns one and two, for each service evaluation variable, results in an estimate of dollars spent for each service, which is recorded in the third column of the Program Results form.

(G) The numbers of units of each service performed are entered in the fourth column. Dividing the third column by the fourth column (for each service which can be counted), gives ratios of cost per service unit, which are entered in the fifth column for services which were not counted, such as some indirect services. If the ratio can not be calculated, insert a dash. This completes the summary of results portion of the evaluation of Phase I.

The results formulas are:

(Apportioned Budget Percent)x(Total Program Cost) = ($ Per Service)

$$\frac{(\$ \text{ Per Service})}{(\text{Number of Service Units})} = \text{Ratio of \$ Per Service Unit}$$

(H) When using the shortened method of evaluation to determine the percentile rank of each service as compared with other programs across the nation, each newly calculated program ratio's numerical relative location is found in the corresponding row of the percentile table. The decile (range of ten percentile points) ranking is read at the top of the table, and entered in the overall Program Percentiles Form. This percentile (decile) value gives an immediate comparison with other programs. For example, if your program's ratio lies within the 70th percentile (decile) column for matchlists produced, this means that your

cost per matchlist is lower (better) than the cost for at least 70% (but less than 80%) of other ridesharing programs. Enter these percentiles in the first column of the Overall Program Percentiles form. Those services with no ratios can not be ranked. The simplest approach is to assume average, 50 percentile performance.

(I) To calculate the overall Phase I percentile, enter the same apportioned budget percents in the second column of the Overall Program Percentiles form as was entered in the first column of the Program Results form.

(J) Multiply each evaluation variable percentile in column one by the respective apportioned budget percent in column two to determine the adjusted percentile for each evaluation variable, and record these adjusted percentiles in the third column of the Overall Program Percentiles form.

(K) Sum all adjusted percentiles in column 3 for Phase I evaluation variables to calculate the overall Phase I percentile. (See Phase I of the example evaluation in Appendix A). If transit services are provided also, remember to separate these from traditional ridesharing services.

Services-to-Mode Translation

If both numbers of service units (meetings, matchlists, etc.) and numbers of mode results (vanpools, carpools, passengers, etc.) are available, these actual numbers should be used, and the proportional constants calculated for use in the services-to-mode translation model for your specific program. If these actual numbers are not al'

available, "national averages" for the proportional constants can be used to approximate mode results from direct service units, by following the services-to-mode translation model procedure, which assumes a direct, linear relationship between services and mode results:

(A) Divide the number of units of each Phase I direct service evaluation variable by the conversion factors in Table 1 to estimate new carpool passengers and vanpool passengers resulting from each service.

(B) Add all new carpool passengers and separately add all new vanpool passengers which were estimated. (It is assumed that the rideshare program can locate and count all buspool passengers). If some of the actual mode numbers are available, use them instead; the conversion factors are extremely generalized and not as accurate as hard numbers.

Working backward from mode results to service results requires estimation of the number of carpool, vanpool, and buspool passengers which resulted from each Phase I service, then simply multiplying each service category portion by the respective conversion factor to estimate number of service units for each mode. For example, assuming 3,000 new carpool passengers are desired:

The 3,000 carpool passengers will form an estimated
(3000 passengers)/(2.85 passengers per pool) = 1071 carpools.
(1071 carpools)x(19.1 matchlists per carpool = 20,456 matchlists required for 3,000 new carpoolers.

While it is not possible to translate accurately from indirect services to carpool, buspool, and vanpool riders, the ridesharing program

Table 1. Services to Mode Conversion Factors

Phase I Services Directly Affecting Ridesharing	Number of Services per Pool (Use conversion numbers in text to estimate pool riders). CARPOOLS	VANPOOLS	BUSPOOLS*
A. Matching Services			
1. Matchlists Produced	19.1	*	
2. Call-in Services	15.9	*	
3. Registrations Processed	15.0	*	
B. Workshops Conducted	0.2	0.25	
C. Technical Assistance			
1. Publications Distributed	22	20	
2. In-office Assistance	12.0	4.6	
3. In-Field Assistance	1.5	1.0	
D. Providing Vans and/or Buses	Does not Apply	1	1
E. Other			

Services Indirectly Affecting Ridesharing

* Not enough data available for estimate.

must still be credited with estimated pools formed as a result of these indirect services. The following assumptions make this estimation possible:

- For every carpool formed as a result of direct services, at least one additional "non-program" carpool will be formed at least partially due to indirect program services.
- Few additional "indirect" vanpools will be formed, and essentially no "indirect" buspools.
- The program will have provided over 75% of the inducement to form "indirect" pools.
- While some pools would continue through the years once formed, approximately 50% of existing pools would fold each year without continued program assistance.

It should be emphasized that these are estimates made from a very small and incomplete sample, and may not represent the local situation.

The following translation steps follow from the above assumptions:

(C) Add 50% of all continuing (longer than one year) carpool, vanpool, buspool passengers to the new pool passengers calculated in part (B) reflecting the poolers who would have stopped pooling without program services. This is the number of poolers which can be directly credited to program services. The remaining 50% of the old pool passengers are considered to be "non-program", as it is assumed that they would have continued to pool regardless of direct program services.

(D) To the above "non-program" continuing carpool passengers, add a number equal to the "program" new carpool passengers. Add only 10% of the "program" new vanpool passengers to the "non-program" continuing

vanpool passengers. Do not add any additional buspool passengers to "non-program" buspool passengers. This step estimates the total nonprogram pool passengers, based on the above assumptions.

(E) Assuming only 75% of the inducement for "non-program" pools came from the ridesharing program's services, multiply each mode's "non-program" total passengers by 0.75 and add this to the "program" passengers calculated in part (B). Enter these totals (program passengers plus 75% of non-program passengers for each mode) in Column #4 of the Program Results form. (If the number of pools have been counted instead of passengers, use the relationships in the Mode Results section to convert to numbers of passengers to enter in the form).

Directly credited car, van, or buspool passengers = (new pool passengers)+(0.5)x(continuing pool passengers)
Non-program carpool passengers = (new carpool passengers)+(0.5)x(continuing carpool passengers)
Non-program vanpool passengers = (0.1)x(new vanpool passengers)+(0.5)x(continuing vanpool passengers)
Non-program buspool passengers = (0.5)x(continuing buspool passengers)
Total program car, van, or buspool passengers = directly credited passengers + (0.75)x(Non-program passengers)

Mode Results -- Phase II

Mode results are given in terms of passengers, rather than pools, as these are more meaningful evaluation numbers. Within Phase II, a rough calculation of carpools, vanpools, and buspools can be made using the following general relationships:

One carpool = 2.85 carpool passengers (average)
One vanpool = 11.2 vanpool passengers (average)
One Buspool = 36.5 buspool passengers plus one driver (average)
(The driver is also considered a passenger for carpool and vanpools, but NOT for buspools).

If the results of the mode evaluation are in pools, rather than passengers, use the above conversion figures to estimate passengers.

The ratios and percentiles are calculated in a similar manner to that of Phase I, but with a somewhat different method of apportioning the budget. If the actual budget percents are known for each mode, these percents should be used. Otherwise, apportion the budget in direct proportion to passengers (if there were 2,000 credited carpool passengers and 500 credited vanpool passengers (2500 total), apportion (2000/2500) x (100%) = 80% of the budget total to carpool passengers, and the remaining 20% to vanpool passengers). Notice that 100% of the budget is again apportioned in Phase II, reflecting the fact that services result in pool passengers.

To evaluate Phase II Mode Results, (A) enter the apportioned percent in column one of the Program Results form, and (B) enter the total budget in column two. (C) Multiply columns one and two together, and enter the results in dollars per mode in column three. (D) Divide dollars in column three by numbers of poolers in column four (from the translation model or direct count), and record the resulting ratio of dollars per pooler in column 5. This is the summary of results for Phase II.

(E) Using the percentile table, find the percentile (decile) for dollars per passenger for each mode, and record these percentiles in the first column of the Overall Program Percentiles form. (F) Copy the apportioned mode budget percents (from column one of the Program Results form) into column two of the Overall Program Percentile form, (G) multiply column one by column two, and record these adjusted percentiles i

column three. (H) Total the Phase II adjusted percentiles in column three to calculate the overall Phase II percentile. (See Phase II of the example evaluation).

Mode to Transportation Translation

Phase III, Transportation Results, is composed of two parts. The first part evaluates transportation results in terms of reductions of Vehicle Miles Traveled (VMT) and Vehicle Trips (VT). The second part internally estimates pollution reduction and fuel, cost, and parking savings. The Mode-to-Transportation Translation model thus converts mode results only into VMT and VT.

(A) While a more accurate and detailed translation is given in Appendix C, a general, simplified translation can be made by multiplying the conversion factors per month (in the following table), times the number of credited poolers for VT; and multiplying those results by your best estimate of average daily single round trip distance in miles for VMT.

Mode	Average Pool Vehicle Occupancy	One-Way Vehicle Trips Saved* Per Pooler Per 21.67/day Month
Carpool	2.85 poolers	18.75
Vanpool	11.2 poolers	26.3
Buspool	36.5 poolers	28.1

* Assuming former automobile average occupancy was 1.5 commuters per vehicle. Multiply VT by 1.5 to estimate single-occupancy vehicle trips saved.

For example, to calculate savings in VT and VMT brought about by 3,000 vanpoolers, with 50 miles average round trip length, first multiply:

(3,000 vanpoolers) x (26.3 VT per vanpooler per month) = 78,900 VT/month

Notice that the conversion factor already accounts for vehicle trips made by the vans, based on average occupancy. This factor is also included for carpools and buspools.

To convert vehicle trips per month saved into Vehicle Miles Traveled per month, the program evaluator must calculate or estimate the average one-way pool vehicle trip distance. In this example, 50 miles round trip distance is equivalent to 25 miles one way. Then, multiply VT times average trip length:

(78,900 VT/month) x (25 miles/VT) = 1,972,500 VMT/month

Multiply monthly results by three for quarterly results, and by twelve for annual results. These results are then entered into the fourth column of the Program Results form.

Transportation Results--Phase III

This phase consists of two parts. First, Vehicle Trips (VT) reduced and reduction of Vehicle Miles Traveled (VMT) are determined directly by the Mode to Transportation Translation model, or by a direct survey. The other transportation results are derived from reductions in VT and VMT by multiplying by the following (1982) conversion factors:

Energy Use Reduction = (VMT reduced/month) x (0.0583 gallons/VMT)
Air Pollution Abatement (Tons) = (VMT reduced/month) x (0.00015 tons/VMT)
Commuter Cost Reduction = (VMT reduced/month) x (0.0583) x (cost/gallon)
Parking Space Demand Reduction = (VT reduced/month) x (0.023 space/VT/month)

NOTE: Except for parking spaces per VT per month, the above conversion factors will vary with average automobile fuel economy and pollution, and with fuel costs. Commuter parking, insurance, purchase capital, and maintenance costs are not included in the above cost reduction conversion as they are assumed to approximately equal the vanpool cost share.

Calculate the transportation results as above, and enter them (along with reductions in VT and VMT) in the fourth column of the Program Results form.

While the percentile calculations proceed in a similar manner to Phases I and II, the budget is apportioned according to the relative importance of each desired result. The problem is that different cities may attach different relative importances to the results, making direct accurate comparisons impossible. Also, different TIP measures which are to be compared may have different relative importances, which must be matched by the ridesharing results if a meaningful comparison between TIP measures is to result. Therefore, the following "national average" budget percents should be used when evaluating the percentile rankings, while other TIP budget percents may be used when comparing TIP measures (in which case, the differences should be clearly labeled):

Energy Use Reduction	25%
Air Pollution Abatement	25%
Commuter Travel Cost Reduction	20%
Traffic Congestion Reduction (VMT related)	10%
Parking Demand Reduction (VT related)	10%
Improved Commuter Mobility (VMT related)	10%
	100%

As the last three items (Traffic Congestion Reduction, Parking Demand Reduction, and Improved Commuter Mobility) usually cannot be easily measured or separated, it is recommended that all three can be combined under the general headings of VMT & VT (Vehicle Miles Traveled and Vehicle Trips) reduction, with 20% of budget for VMT reduction and 10% for VT reduction.

Following the same basic procedure from Phase I, (A & B) enter the apportioned percents in column one of the Program Results form, and (C) enter the total budget in column two. (D) Multiply columns one and two together, and enter the results in dollars per result in column three. (E) Divide dollars in column three by the results value in column four, and record the resulting ratio of dollars per result unit in column 5. This is the summary of transportation results for Phase III.

(F) Using the percentile table, find the percentile (decile) for each transportation result, and record these percentiles in the first column of the Overall Program Percentiles form. (G) Copy the apportioned budget percents (from column one of the Program Results form) into column two of the Overall Program Percentile form, (H) multiply column one by column two, and record these adjusted percentiles in column three. (I) Total the Phase III adjusted percentiles in column three to calculate the overall Phase III percentile. (See Phase III of the example evaluation).

Comparisons with Other TIP Measures

The Phase III ratios from the Program Results form (adjusted for budget percentages when necessary, as explained in the preceeding section) can now be directly compared with other proposed Transportation Improvement Project (TIP) measures for cost-effectiveness. It is important to remember that "in-kind" contributions not be included in these costs, as the comparison should be based on results per funding agency dollar if a fair comparison is to result. Table 2 gives the cost per

Table 2. Summary of Projects Ranked by Approximate Cost Per VMT Reduced

PROJECT	CLASS	Cost Per VMT Reduced		
		Low	High	Average
Transit Free Fare Zone in CBD of Major Urban City--Off-Peak Only	A-Reduce Demand	$ .01	$ .01	$ .01
Park-and-Pool Lot in Rural Area	A-Reduce Demand	$ .02	$ .02	$ .02
Park-and-Pool Lot in Urban Area	A-Reduce Demand	$ .02	$ .03	$ .03
Priority Entry Ramp on an Urban Freeway	D-Enhance Supply and Reduce Demand	$ .06	$ .09	$ .08
Combination Park-and-Ride with Express Transit and Park-and-Pool Facility for Urban Commuters -- Distance from Primary Destination: 15 miles	A-Reduce Demand	$ .11	$ .13	$ .12
Designation of an Exclusive HOV Lane on an Urban Arterial	C-Degrade Supply and Reduce Demand	$ .12	$ .15	$ .14

Table 2 (cont). Summary of Projects Ranked by Approximate Cost Per VMT Reduced

PROJECT	CLASS	Cost Per VMT Reduced		
		Low	High	Average
Combination Park-and-Ride with Express Transit and Park-and-Pool Facility for Urban Commuters - Distance for Primary Destination: 7.5 miles	A-Reduce Demand	$ .14	$ .17	$ .16
Park-and-Ride Facility with Express Transit to serve Urban Commuters	A-Reduce Demand	$ .17	$ .37	$ .26
Transit Free Zone in CBD of Major Urban City---All Day Free Service	A-Reduce Demand	$ .44	$ .56	$ .50
Concurrent Flow HOV Lane on an Urban Freeway---Level-of-Service "E" Condition	D-Enhance Supply and Reduce Demand	$ .84	$1.04	$ .94
Reversible Flow Median HOV Lane on an Urban Freeway	D-Enhance Supply and Reduce Demand	$ .83	$1.45	$1.12
Concurrent Flow HOV Lane on an Urban Freeway---Level-of-Service "D" Condition	D-Enhance Supply and Reduce Demand	$1.19	$1.43	$1.31

Table 2 (cont). Summary of Projects Ranked by Approximate Cost Per VMT Reduced

PROJECT	CLASS	Cost Per VMT Reduced		
		Low	High	Average
Implementation of a Contra-Flow HOV Lane on an Urban Freeway	C-Degrade Supply and Reduce Demand	$1.28	$1.85	$1.55
Expansion of existing transit system	B-Enhance Supply			$0.40
Add-a-lane exclusive HOV lane	D-Enhance Supply and Reduce Demand			$8.40

VMT of various TIP measures. To estimate cost per VT, multiply the cost per VMT by your estimate of average one-way distance (one-half of round trip distance). For example:

Average cost per VMT of a priority entry ramp (from Table) = $ 0.09

Estimate of average round-trip distance = 40 miles (= 20 miles one way).

Average cost per VT of priority entry ramp:

($ 0.09) x (20) = $1.80 per VT reduced.

In most cases, ridesharing assistance (not including actual provision of vehicles or transportation) will emerge as the most cost-effective TIP measure.

PROGRAM RESULTS

Evaluation Variable
Phase I

Services Directly Affecting Ridesharing	APPORTIONED BUDGET % x	TOTAL PROGRAM COST =	$ PER SERVICE	÷ NUMBER =	RATIO
A. Matching Services					
1. Matchlists Produced					
2. Call-in Services					
3. Registrations Processed					
B. Workshops Conducted					
C. Technical Assistance					
1. Publications Distributed					
2. In-office Assistance					
3. In-Field Assistance					
D. Providing Vans and/or Buses					
E. Other					

Services Indirectly Affecting Ridesharing					
A. Increasing Public Awareness					
1. Media Presentations					
2. Signs and Billboards					
3. Public Presentations					
B. Increasing Relative Attractiveness of Ridesharing					
1. HOV Special Lanes					
2. HOV Special Parking & Land Use Related					
3. HOV Tax Breaks					
4. HOV Contest & Awards					
5. Alternate Work Schedule					
6. Promoting Work Schedule					
C. Providing Transit Services					
1. Call-in Schedules					
2. Schedule Coordination					
3. Providing and/or Operating Park-and-Ride Lots					
4. Paratransit					
D. Other Indirect Services					

Phase II

	APPORTIONED BUDGET % x	TOTAL PROGRAM COST =	$ PER SERVICE	÷ NUMBER =	RATIO
1. Dollars/Carpool Passenger					
2. Dollars/Vanpool Passenger					
3. Dollars/Buspool Passenger					
4. (Dollars/Carpool)					**
5. (Dollars/Vanpool)					**
6. (Dollars/Buspool)					**
	100%				

Phase III

1. Dollars/VMT Reduced					
2. Dollars/VT Reduced					
3. Dollars/Gallon of Fuel Saved					
4. Dollars/Tons of Pollution Abated					
5. Dollars/Commuter Dollar Saved					
6. Dollars/Parking Space Demand Reduction					
	100%				

**Note: Apportion budget to dollars per pool passenger, not dollars per pool, when calculating ratio.

PERCENTILE TABLE

Evaluation Variable

Percentile Services Directly Affecting Ridesharing	10	20	30	40	50	60	70	80	90
					RATIO				
A. Matching Services	--	--	--	--	--	--	--	--	--
1. Matchlists Produced	6.37	5.96	5.67	5.43	5.20	4.97	4.72	4.43	4.03
2. Call-in Services	1.82	1.64	1.52	1.41	1.32	1.21	1.11	0.99	0.81
3. Registrations Processed	3.00	2.81	2.67	2.56	2.45	2.34	2.23	2.09	1.90
B. Workshops Conducted	2283	2100	1967	1854	1750	1646	1533	1400	1217
C. Technical Assistance	--	--	--	--	--	--	--	--	--
1. Publications Distributed	2.12	1.91	1.77	1.65	1.54	1.43	1.31	1.16	0.97
2. In-office Assistance	22	19	16	14	12	10	8	5	1
3. In-Field Assistance	611	541	491	448	408	369	326	275	205
D. Providing Vans and/or Buses	1447	1376	1324	1280	1240	1200	1156	1104	1033
E. Other	--	--	--	--	--	--	--	--	--

Services Indirectly Affecting Ridesharing

A. Increasing Public Awareness									
1. Media Presentations									
2. Signs and Billboards									
3. Public Presentations									
B. Increasing Relative Attractiveness of Ridesharing									
1. HOV Special Lanes									
2. HOV Special Parking & Land Use Related									
3. HOV Tax Breaks									
4. HOV Contest & Awards									
5. Alternate Work Schedule									
6. Promoting Work Schedules									
C. Providing Transit Services									
1. Call-in Schedules									
2. Schedule Coordination									
3. Providing and/or Operating Park-and-Ride Lots									
4. Paratransit									
D. Other Indirect Services									

	10	20	30	40	50	60	70	80	90
Phase II					R A T I O				
1. Dollars/Carpool Passenger	40	37	34	32	30	29	27	24	21
2. Dollars/Vanpool Passenger	18	16	15	14	13	12	11	10	8
3. Dollars/Buspool Passenger	--	--	--	--	--	--	--	--	--
Phase III									
1. Dollars/VMT Reduced	.027	.024	.022	.020	.018	.017	.015	.013	.010
2. Dollars/VT Reduced	0.58	0.53	0.50	0.47	0.45	0.42	0.40	0.36	0.32
3. Dollars/Gallon of Fuel Saved	.058	.052	.047	.044	.041	.037	.033	.029	.023
4. Dollars/Tons of Pollution Abated	834	688	581	492	409	326	236	130	-0-
5. Dollars/Commuter Dollar Saved	.045	.040	.036	.034	.032	.028	.025	.022	.018
6. Dollars/Parking Space Demand Reduction	1.16	1.06	1.00	0.95	0.90	0.84	0.80	0.72	0.64

z	+1.28	+0.84	+0.52	+0.25	0.00	-0.25	-0.52	-0.84	-1.28
%	10	20	30	40	50	60	70	80	90

Table: z to % Relationship

OVERALL PROGRAM PERCENTILES

Evaluation Variable

Phase I Services Directly Affecting Ridesharing	PERCENTILE x	APPORTIONED BUDGET % =	ADJUSTED PERCENTILE
A. Matching Services			
1. Matchlists Produced			
2. Call-in Services			
3. Registrations Processed			
B. Workshops Conducted			
C. Technical Assistance			
1. Publications Distributed			
2. In-office Assistance			
3. In-Field Assistance			
D. Providing Vans and/or Buses			
E. Other			

Services Indirectly Affecting Ridesharing			
A. Increasing Public Awareness			
1. Media Presentations			
2. Signs and Billboards			
3. Public Presentations			
B. Increasing Relative Attractiveness of Ridesharing			
1. HOV Special Lanes			
2. HOV Special Parking & Land Use Related			
3. HOV Tax Breaks			
4. HOV Contest & Awards			
5. Alternate Work Schedule			
6. Promoting Work Schedules			
C. Providing Transit Services			
1. Call-in Schedules			
2. Schedule Coordination			
3. Providing and/or Operating Park-and-Ride Lots			
4. Paratransit			
D. Other Indirect Services		+	+
		100%	

Sum of adjusted Phase I percentiles equals Overall Phase I Percentile [ ]

Phase II

	PERCENTILE x	APPORTIONED BUDGET % =	ADJUSTED PERCENTILE
1. Dollars/Carpool Passenger			
2. Dollars/Vanpool Passenger			
3. Dollars/Buspool Passenger			
		100%	

Sum of adjusted Phase II percentiles equals overall Phase II percentile [ ]

Phase III

1. Dollars/VMT Reduced			
2. Dollars/VT Reduced			
3. Dollars/Gallon of Fuel Saved			
4. Dollars/Tons of Pollution Abated			
5. Dollars/Commuters Dollars Saved			
6. Dollars/Parking Space Demand Reduction		+	+
		100%	

Sum of adjusted Phase III percentiles equals overall Phase III percentile [ ]

$$\text{Program Percentile} = \frac{\text{Phase I \%} + \text{Phase II \%} + \text{Phase III \%}}{3} = [\ ]$$

IV. IMPLEMENTATION SUMMARY

As the title implies this report describes a highly structured procedure for conducting a ridesharing evaluation program. The procedure provides for a results oriented, cost-effectiveness evaluation. The technique provides a tool for the project staff to: monitor internal performance; compare project results with other ridesharing projects; and use in combination with the Comparative Standards Guide to demonstrate the cost-effectiveness of ridesharing in reducing VMT.

The recommended plan for implementing this technique is to: first, impelement what you can immediately, using the "national" data provided in the example problems; and then, work toward a later full and localized evaluation. This transition includes the following steps:

1. Identify the incompatabilities between the accounting system and the evaluation parameters. At this time you can take steps to iron out the problems to ease later evaluations.

2. Identify those translation models where you wish to enrich the model with local data in place of national averages. At this time you should perform the necessary surveys to accomplish what you want. (This is a area where some research is needed).

3. Program the timing of your annual evaluation effort to culminate just before budget time, so that you have current figures to present. The process is so simple (once you have the parameters in hand) that you can do another evaluation for the final report.

In order to localize the evaluation, the staff must conduct studies to establish a more accurate set of translation variables. A cost-effective technique for gathering the data and writing the reports is to use co-op or graduate students from a local college of engineering or planning to assist project staff. It goes without saying that you should closely monitor the work so that it serves project purposes as well as those of the students.

The above implementation plan assumes that the program staff has some background in cost-accounting, statistics and transportation engineering. This knowledge is required to accomplish the cost allocation; estimate "local" values for parameters; understand the scoring technique and deal with the comparative analysis. The following appendices are intended to serve as implementation models to help guide people through the process.

The second implementation assumption is that 2-3 years of experience will result in a national data base with large enough samples to develop more accurate percentile curves and refine the service categories. This will allow researchers to reach conclusions as to the effectiveness of the various ridesharing program implementation strategies. (At present, the data base is so small that it is impossible to tell whether or not a "success" is due to an efficient project staff, the local situation, or marketing techniques).

The review and trial implementation of the Project Evaluation Program and the Comparative Standards Guide revealed that the two documents needed to be supplemented with a workbook. The resulting Project Evaluation Workbook provides more guidance in the areas of cost allocation, computational details, and cost-effectiveness comparisons between ridesharing and other transportation improvement measures than does this reference manual.

APPENDIX A

A TYPICAL PROGRAM EVALUATION

TYPICAL EXAMPLE EVALUATION

The Metro Ridesharing Program (a hypothetical program) is funded by the Federal Government ($110,000) and the State ($50,000); the program is required to develop 20% matching or "in-kind" assistance. Annual assistance is provided by $20,000 worth of no-cost television and radio advertising donated by local broadcasters, $5,000 worth of computer time donated by a local insurance company, and $15,000 worth of office space, equipment, and supplies provided by a Metro downtown business association.

Their mission is to promote increased participation in all three modes of ridesharing through matching services (matchlists), public awareness, workshops, and technical assistance, as well as to promote use of public transit by answering telephone requests for information about the Metro bus schedules and fares. They do not provide any vehicles. The state funding agency, which funds other ridesharing programs also, considers numbers of new ridesharing matchlist registrants to be a measure of program effectiveness (which tends to distort the effectiveness of the program, resulting in wholesale company registration drives which clog the records with people who will never rideshare, but simply bowed to employer pressure to register). There is a possibility that the Federal funds will be cut back. The State is considering adding lanes to a leg of the expressway system to increase capacity. It is hoped that this will improve commuter traffic flow in and out of the central business district. Thus, the comparative evaluation becomes especially important, as the Metro Ridesharing Program must demonstrate cost-effectiveness to compete for funds.

This past quarter, it is estimated that approximately one-third of the Program funded budget was spent on registering 3,255 new ridesharing candidates, and sending a matchlist to each, plus processing 47 matchlist requests by previous registrants. Television and radio "spots" worth $5,000 were broadcast, 4,000 ridesharing leaflets costing 25¢ each were picked up at shopping centers and bus stops; 10 employer/employee workshops were held at an estimated cost of $1,500 each to recruit matchlist registrants (including information packets), $1,400 worth of computer time was donated. The program director attended a ridesharing conference at a cost of $500. Twenty employers requested technical assistance (some on-site, some off-site) about carpools and vanpools, and one employer started two buspools. There are known vanpools, all but two are part of 15 employer-sponsored programs; 20 are new pools. The 150 rideshare registrants requested advice and literature about vanpooling, and two potential third-party vanpool suppliers asked for advice. A new slide show (copied from the Texas A&M program) cost $100. One researcher from a local university spent three days and $200 worth of computer time gathering data. Finally, approximately 6,000 requests for Metro bus transit information were handled at an estimated cost of 50¢ per request (based on the workers' time plus overhead).

This hypothetical program will be evaluated on the next few pages. Notice that the numbers and letters in the evaluation of Phase I correspond to the numbered and lettered steps in the procedure portion of this paper. Also, some of the assumptions made in the budget division procedures may differ from those which would be made by a different evaluator. This is not a problem, provided that the assumptions are written out. (Evaluate <u>your</u> program based on <u>your</u> assumptions).

BUDGET ADJUSTMENTS

1. As 20% matching or "in-kind" services are required and provided, two evaluations should be performed. The first evaluation (to be used for internal control, and not to be published) should include the matching services, with a quarterly budget of $50,000. (This "internal" evaluation is not included here, as it will essentially duplicate the second evaluation. Any differences in procedure will be noted). The second evaluation eliminates matching or "in-kind" services, to allow the funding agencies to accurately evaluate results per funded dollar. Thus, the total budget for the quarter is $40,000, the sum of Federal and State Funds, but the text of the report, and also the letter of transmittal, will clearly state that "The budget includes only Federal and State Funds; the value of contributed services is not a direct program expense, and is therefore not included".
2. As transit services (phone-in bus schedule assistance) are provided, they should be carried through the evaluation and identified separately.
3. The university researcher's data gathering is incidental to the program. Although the costs will be included under other Indirect Services (Part D), the text of the final report will note that "Assistance to a university researcher in gathering ridesharing data consumed $200 worth of contributed computer time and $120 worth of budgeted employee time, although he was not charged for these services. This expense reduced overall program efficency

slightly". Depending on incidental expenses, the word "slightly" might be changed to "significantly" or even "greatly", in which case yet another evaluation eliminating the incidental expenses might be justified to show the true cost-effectiveness of the program. In this case, $120.00 is only 0.3% of the quarterly funded budget, and will not require this re-evaluation.

PHASE I--EVALUATION

(A & B) Hard dollar costs based on records or approximations exist for only a few service variables, which allows combination of Phase I Evaluation Steps A and B. These variables are assigned directly as follows:

Program Service	Evaluation Variable	$ amount	
Workshops Conducted	Direct-Workshops Conducted	(10)($1500)	=$15,000
Distribution of Leaflets	Indirect-Public Presentations	(4000)($25)	= $1,000
Call-in Transit Aid	Indirect-Call-in-Schedules	(6000)($50)	= $3,000
Attend Conference	Other Indirect		= 500
Assist Researcher	Other Indirect		= 120
Slide Show Copy	Other Indirect		= 100
			$19,720

NOTE: Internal evaluation (including donated services) would have included $5,000 donated broadcasts under "media presentations" and $200.00 computer time under "Other Indirect".

(C) Less than half of the budget has been apportioned in the previous steps. It is possible to make the following estimates:

13,333.00 (One-third of $40,000) can be apportioned to registrants processed plus matchlists produced. As each registrant also received a matchlist, one-half of the cost can be assigned to regis-

tration (processing) and the remainder to matchlist production (printout, stuffing envelopes, mailing, etc., as well as computer operation), as registration input takes only a little more time than matchlist request verification. Thus, $6,666.50 can be assigned to 3,255 (Direct) Registrations Processed, and the remaining $6,666.50 can be assigned to 3,302 (Direct) Matchlists Produced.

The two potential third-party vanpool suppliers both visited the office, took up one employee-day each, and received approximately $10.00 worth of literature each. Thus, approximately $100 can be assigned to (Direct) Other.

NOTE: For internal evaluation, $1,200 computer time plus approximately $1,250 (one-third of $15,000/4) of donated office space & supplies would have been added to the $13,333 for registrations plus match lists.

(D) Following the above steps, $6,847 remains. This is apportioned to the remaining services after striking off the following services: Providing vans and/or buses (none are provided by the program), media presentations (donated, not paid by funding agency), signs & billboards (no new signs produced), Public Presentations (none were made this quarter), Increasing Relative Attractiveness of Ridesharing (no major efforts made this quarter), schedule coordination (this is done by Metro bus employees), providing and/ or operating Park-and-Ride Lots, and paratransit. The money is first evenly apportioned to the remaining services:

			First Apportionment	Readjusted
Direct:	A2.	Call-in Services	$1711.75	$2000
	C1.	Publications Distributed	$1711.75	$ 847
	C2.	In-Office Assistance	$1711.75	$2000
	C3.	In-Field Assistance	$1711.75	$2000

NOTE: No budget is apportioned to general categories such as "A. Matching Services", due to the fact that the sub-categories are used.

One common-sense readjustment is necessary, as less than $1711.75 worth of publications was distributed in conjunction with other assistance. So only $847 is arbitrarily reassigned to publications, and $2000 to the remaining categories.

The percents for each are calculated by dividing each dollar assignment by $40,000 and multiplying by 100%. For example:

Workshops Conducted: (15,000/40,000) x (100%) = 37.5%

These percents are entered into the first column of the Program Results Form.

(E) The $40,000 funded budget is entered in each row of the second column.

(F) Multiplying columns one and two should result in the dollar values originally assigned above, with some unimportant round-off error possible. This allows double-checking the assignments. Write the dollars per service in the third column. For example:

Workshops Conducted: (37.5%) x ($40,000) = $15,000

(G) The ratios on the Program Results Form were calculated by dividing the dollar values in the third column by the corresponding numbers in the

fourth column (where numbers were available. Otherwise, dashes were inserted). For example:

Workshops Conducted: ($15,000)/(10) = $1500 per workshop

NOTE: In the case of "workshops conducted", the ratio of dollars per workshop was already known, and could have been entered directly. This tactic would have complicated budget assignments to "softer" budgeted services, however, and would not have resulted in percentage apportionments.

(H) The percentile (decile) rank of each calculated service ratio is located in the Percentiles Table (circled in this example evaluation) and the percentile is read at the top (see arrows for workshops conducted). These percentiles are entered in the first column of the Overall Program Percentiles Form. For those services which had no ratios, 50% was inserted in the first column.

(I) The same budget apportioned percents were entered in column two. For example, 37.5% was entered for "Workshops Conducted".

(J) Each percentile in column one was multiplied by the apportioned budget percent in column two, and the results entered in column three. For example:

Workshops Conducted: (70) x (37.5%) = 26.25

(K) The adjusted percentiles in column three were summed to give an overall program percentile of 69. Then, as bus transit schedule assistance is not a true ridesharing activity, the transit schedule adjusted percentile was subtracted from the overall program percentile, and the difference was

divided by the quantity (one minus the budget percent apportioned to transit services). The result is the overall program service performance percentile less transit services, which is a more accurate appraisal of ridesharing performance:

(Overall Percentile - Transit Percentile)/(1 - the Transit budget %) = rideshare percentile

$$(69 - 3.75)/(1 - 0.075) = 70.5$$

Due to the fact that exact ratios could not be determined for a number of services (call-in, publications, in-office in-field assistance, and others) and percentile ranking is not available for indirect services, the 50th percentile was used. This tends to shift the overall rank towards average (50th percentile). The weighted percentile for ranked and counted services (matchlists, registrations, and workshops) is 75.16.

SERVICE TO MODE TRANSLATION

As the number of old and new vanpools and new buspools are known, they need not be translated. Carpools are estimated from registrations and workshops as follows. (As each registration results in a matchlist, they should not both be counted separately):

A2.	Registrations	3255/15.0	217
B.	Workshops	10/0.2	+ 50
		Total Direct Carpools	267 carpools

Based on 70.5% of the total budget.

Other Direct Services amounted to 17.4% of the total budget, but could not be counted. One crude way of estimating pools is proportional:

(17.4/70.8)x(267) = 60 more carpools

for a total of 333 new carpools estimated. In the absense of other data, assume the same number of old carpools.

Finally, Directly Credited, Non-program, and Total Program pools are estimated as follows:

- Direct Carpools = 333 + (0.5)x(333) = 500 pools
  (500 pools)x(2.85 poolers) = 1425 carpoolers
- Direct Vanpools = 20 + (0.5)x(60) = 50 pools
  (50 pools)x(11.2 poolers) = 560 vanpoolers
- Direct Buspools = 2; (2 pools)x(36.5 poolers) = 73 buspoolers.
- Non-program Carpools = (333 new pools)x(2.85 passengers) + (0.5)x (333 old pools)x(2.87 passengers) = 1424 carpoolers
- Non-program Vanpools = (20 new pools)x(11.2 passengers) + (0.1)x(60 old pools)x(11.2 passengers) = 291 Vanpoolers
- Non-program Buspoolers = 0 (new programs only)
- Total Program Carpoolers = (1425) + (0.75)(1425) = 2493 carpoolers
- Total Program Vanpoolers = (560) + (0.75)(291) = 778 vanpoolers
- Total Program Buspools = 73

These results are entered in column 4 of the Program Results form.

MODE RESULTS - PHASE II

As budget breakdown by mode is not known, costs are apportioned by proportion of poolers in each mode, adjusted to eliminate the 7.5% for transit services.

(92.5%)x(2493 carpoolers)/(3344 total poolers) = .69
(92.5%)x(778 vanpoolers)/(3344 total poolers) = .215
(92.5%)x(73 buspoolers)/(3344 total poolers) = .02

These are entered in column 1 of the Program Results form, and the $40,000 budget is entered in column 2; the product is entered in column 3. Dividing dollars per mode in column 3 by the number of poolers in column 4 gives the ratios, which are entered into column 5. For example:

(0.69)x($40,000) = $27,600 for carpoolers
($27,600)/(2493 poolers) = $11.07 per carpooler.

(Notice that budget apportionment proportional to number of poolers results in approximately the same cost per pooler for each mode. This warps the following percentile evaluations, making carpool results appear more cost-effective, and other modes less. Thus, we can see a need to separate budgets by mode where possible.)

A ratio of 11:07 is in the 90th percentile for carpools, and in the 60th percentile for vanpools. As no percentile exists for buspools, use 50% (average).

As the apportioned budget percents in the Program Results form were multiplied by 92.5% (100% - 7.5% transit services) to separate out transit service costs, these percents no longer total 100%, which is necessary to calculate the Overall Phase II percentile. Thus each apportioned budget percent in the Program Results form must now be divided by 92.5% before multiplying times the mode percentiles. The total of the (double) adjusted percentiles equals 82, the Overall Phase II percentile.

MODE TO TRANSPORTATION TRANSLATION

As no exact count exists, "national averages" are used to estimate VT and VMT savings due to the program. VT is calculated first for each mode

and then added to calculate vehicle trips saved due to the program:

(2493 carpoolers)x(18.75 VT/mo) = 46,744 VT
(778 vanpoolers)x(26.3 VT/mo) = 20,461 VT
(73 buspoolers)x(28.1 VT/mo) = 2,051 VT

As the estimated average one-way commuting trip is 20 miles:

(69,256 VT)x(20 miles) = 1,385,120 VMT saved per month due to the program. These are entered in the fourth column of the Program Results form (for evaluation based on monthly budget).

TRANSPORTATION RESULTS - PHASE III

The VT and VMT calculated above are used to calculate monthly transportation results, as follows:

(1,385,120 VMT)x(0.053 gal/VMT) = 73,411 gallons fuel saved
(1,385,120 VMT)x(0.00015 tons/VMT) = 208 tons pollution abated
(1,385,120 VMT)x(0.053 gal/VMT)x($1.30/gal) = $95,435 saved
(69,256 VT)x(0.023 space/VT/month) = 1593 spaces

These are entered in column four of the Program Results form (for monthly evaluation).

The "national" budget percents are apportioned in column 1, but (as in Phase II) each percent must first be multiplied by 92.5% (100%-7.5% transit services) to eliminate the effect of non-ridesharing transit services.

As parking demand reduction is important, this is evaluated instead of VMT reduction (they are approximately proportional). Parking demand reduction is in total (daily) number of spaces.

The next step is critical. Approximately the same number of poolers ride every day, every month, every quarter, every year (not time dependent). But the transportation results in VT, VMT, and their derivatives are in units per month. Thus the quarterly budget of $40,000 must be divided by three to give the monthly budget of $13,333.33 which is entered into column 2 of the Program Results form. The ratios are calculated as before, and located in the Percentiles Table. Percentiles are entered in the first column of the Overall Program Percentiles form.

Once again, the apportioned budget percents less transit services must be adjusted to total 100%, by dividing by 92.5%. The adjusted percentiles are calculated and added, totalling 67, the overall Phase III percentile.

The three phase percentiles are averaged to give an Overall Program Percentile of 75.

COMPARISONS

The percentiles allow comparisons with other ridesharing programs. The Metro Ridesharing Program is performing better than 75% of nationwide programs overall; all phases are better than at least two-thirds of other programs.

Compared with other TIP and land-use measures, the ridesharing program is doing very well. Over 5 VMT are reduced per $0.01 of funding, versus $8.40 per single VMT reduced by High Occupancy Vehicle Add-a-Lane. Furthermore, if lanes are added without restricting them to HOV's, VMT will probably be increased, resulting in increased downtown congestion, pollution, energy use, and parking space demand.

(The program spends only 77 cents per month per parking space reduction).

Mode and Service results are quarterly, while transportation results are monthly. The transportation results can be tripled to make them quarterly. Quarterly results can be quadrupled to render annual results for reports to various agencies.

The numbers and comparisons have been produced which demonstrate that the program is efficient compared with other programs, and extremely efficient compared with other Transportation Improvement Measures. Some record-keeping adjustments (such as separating mode expenses) will aid the next evaluation. A survey to estimate the actual number of carpoolers and actual transportation results would help Metro "Tune up" the translation models to fit the local situation. Now it is up to the program manager to use the information gathered to sustain or increase funding, and then write the reports.

Program Results

Evaluation Variable
Phase I

Services Directly Affecting Ridesharing	APPORTIONED BUDGET % x	TOTAL PROGRAM COST =	$ PER SERVICE	÷ NUMBER =	RATIO
A. Matching Services	----	---	---	---	---
1. Matchlists Produced	16.7%	40,000	6666.50	3302	2.02
2. Call-in Services	5%	40,000	2,000	---	---
3. Registrations Processed	16.7%	40,000	6666.50	3255	2.05
B. Workshops Conducted	37.5%	40,000	15,000	10	1,500
C. Technical Assistance	----	---	---	---	---
1. Publications Distributed	2.1%	40,000	847	---	---
2. In-office Assistance	5%	40,000	2,000	---	---
3. In-field Assistance	5%	40,000	2,000	---	---
D. Providing Vans and/or Buses	----	---	---	---	---
E. Other	0.3%	40,000	100	2	50

Services Indirectly Affecting Ridesharing

A. Increasing Public Awareness	----	---	---	---	---
----------	----------	--------	-------	------	-----
----------	----------	--------	-------	------	-----
3. Public Presentations	2.5%	40,000	1,000	4,000	0.25
----------	----------	--------	-------	------	-----
----------	----------	--------	-------	------	-----
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----------	----------	--------	-------	------	-----
----------	----------	--------	-------	------	-----
----------	----------	--------	-------	------	-----
C. Providing Transit Services--------	----------	--------	-------	------	-----
1. Call-in Schedules----------	7.5%	40,000	3,000	6,000	0.50
----------	----------	--------	-------	------	-----
----------	----------	--------	-------	------	-----
D. Other Indirect Services----------	1.8%		720		
	100%		40,000		

Phase II

	APPORTIONED BUDGET % x	TOTAL PROGRAM COST =	$ PER SERVICE	÷ NUMBER =	RATIO
1. Dollars/Carpool Passenger	0.69	40,000	27,600	2,493	11.07
2. Dollars/Vanpool Passenger	0.215	40,000	8,600	778	11.05
3. Dollars/Buspool Passenger	0.025	40,000	800	73	10.69
4. (Dollars/Carpool)					**
5. (Dollars/Vanpool)					**
6. (Dollars/Buspool)					**
TOTALS	92.5%				

Phase III

1. Dollars/VMT Reduced		13,333.33	2467	1,385,120	.0018
2. Dollars/VT Reduced	0*	13,333.33	---	69,256	---
3. Dollars/Gallon of Fuel Saved	.23	13,333.33	3067	73,411	.042
4. Dollars/Tons of Pollution Abated	.23	13,333.33	3067	208	14.74
5. Dollars/Commuter Dollar Saved	.185	13,333.33	2467	45,435	.026
6. Dollars/Parking Space Demand Reduction	.092	13,333.33	1227	1593	0.77
TOTALS	92.5%				

**NOTE: Apportion budget to dollars per pool passenger, not dollars per pool, when calculating ratio.

Overall Program Percentiles

Evaluation Variable

	PERCENTILE x	APPORTIONED BUDGET % =	ADJUSTED PERCENTILE
Phase I Services Directly Affecting Ridesharing			
A. Matching Services	---	---	---
1. Matchlists Produced	90	16.7%	1.5
2. Call-in Services	(50)	5%	2.5
3. Registrations Processed	80	16.7%	13
B. Workshops Conducted	70	37.5%	26
C. Technical Assistance	---	---	---
1. Publications Distributed	(50)	2.1%	1
2. In-office Assistance	(50)	5%	2.5
3. In-Field Assistance	(50)	5%	2.5
D. Providing Vans and/or Buses	---	---	---
E. Other	(50)	0.3%	0.1
Services Indirectly Affecting Ridesharing			
A. Increasing Public Awareness	---	---	---
1. Media Presentations	---	---	---
2. Signs and Billboards	---	---	---
3. Public Presentations	(50)	2.5%	1.25
B. Increasing Relative Attractiveness of Ridesharing	---	---	---
1. HOV Special Lanes	---	---	---
2. HOV Special Parking & Land Use Related	---	---	---
3. HOV Tax Breaks	---	---	---
4. HOV Contest & Awards	---	---	---
5. Alternate Work Schedule	---	---	---
6. Promoting Work Schedules	---	---	---
C. Providing Transit Services	---	---	---
1. Call-in Schedules	(50)	7.5%	3.75
2. Schedule Coordination	---	---	---
3. Providing and/or Operating Park-and-Ride Lots	---	---	---
4. Paratransit	---	---	---
D. Other Indirect Services	(50)	+ 1.8%	+ 1
		100%	

Sum of adjusted Phase I percentiles equals Overall Phase I Percentile [69]

Phase II

	PERCENTILE x	APPORTIONED BUDGET % =	ADJUSTED PERCENTILE
1. Dollars/Carpool Passenger	90	.69/92.5%	67
2. Dollars/Vanpool Passenger	60	.215/92.5%	14
3. Dollars/Buspool Passenger	50	.02/92.5%	1
		100%	

Sum of adjusted Phase II percentiles equals overall Phase II percentile [82]

Phase III

1. Dollars/VMT Reduced	90	.185/92.5%	18
2. Dollars/VT Reduced	---	---	---
3. Dollars/Gallon of Fuel Saved	40	.23/92.5%	10
4. Dollars/Tons of Pollution Abated	80	.23/92.5%	20
5. Dollars/Commuters Dollars Saved	60	.185/92.5%	12
6. Dollars/Parking Space Demand Reduction	70	+.092/92.5%	+ 7
		100%	

Sum of adjusted Phase III percentiles equals overall Phase III percentile [67]

$$\text{Program Percentile} = \frac{\text{Phase I \%}\ [70.5] + \text{Phase II \%}\ [82] + \text{Phase III \%}\ [67]}{3} = [73]$$

APPENDIX B

TEXAS VANPOOL PROGRAM EVALUATION

TEXAS VANPOOL PROGRAM EVALUATION

The Texas Ridesharing program (an actual program) has been underway since January 1978. During that time 2425 employer sponsored vanpools and 75 owner-operator vanpools have been added to the vanpool fleet. The total costs of this effort, both the Texas Energy and Natural Resources Advisory Council (TENRAC) and the Texas Transportation Institute (TTI) share, has amounted to $350,000. The level of effort has averaged a 60% program coordinator at TENRAC, a 40% time Project Manager, a 50% time graduate student and 50% time technical/secretarial support. Travel, materials, printing, slide show development, etc. have been included in these costs.

Program services, both in amount and type, have varied widely over this period. The first year, 1978, was spent in development of printed materials, coordination with local agencies, and "setting the stage". About 20 meetings were held in 1978. The second year, 80 workshops/meetings were held, because the rate of growth of vanpooling had begun to decline in Texas. In 1981, twelve meetings/workshops were held; attention switched to development of new written material and "selling" approaches, preparation of legislation, and a fruitless attempt at a public agency vanpool program. During this entire period the staff provided free "over-the-shoulder" technical assistance whenever requested, usually by phone.

From the beginning of the project, the program manager placed a great deal of emphasis upon "counting vans", documenting their existence, and taking credit for every van that actually rolled in Texas. This could be considered "mode results". Based upon graduate student research projects these mode results were translated to transportation results. The program's primary motivation continues to be a serious effort to meet the energy conser-

vation targets (which were met since 1980), set under the Texas Energy Conservation Program. Our second objective is to compete for funds under the State Energy Conservation Program and ultimately transfer the project to the State Department of Transportation.

COST ALLOCATION

While developing the 1982 work program, it was decided to establish a more detailed goal structure, and to try to separate the dollars in the budget according to services. The program's accounting system does not allow this to be done directly, so an additional system was devised to factor the funds according to services provided. An explanation of the way the program will fit into the evaluation system follows. (Incidentally, the goal for 1982 is to establish a net of 12 new programs.)

SERVICE

The average annual budget should be allocated as follows:

12 workshops/meetings with	@ $1000 each potential	$12,000 vanpoolers
Research for the Vanpool Census, etc.		6,000
8 Liason and "show the flag" meetings with NAVPO, etc. (in-field).	@ $375 each	3,000
4 Technical meetings	@ $1250 each	5,000
4 Printing of the Vanpool Census (500 copies plus 500 newsletters per printing)	@ $1000 each printing	4,000
4 Technical reports (Two graduate students plus project manager)	@ $5000 each	20,000
"Over the Shoulder" Assistance as requested (in-office: 1250 requests, estimated)		10,000
TOTAL BUDGET		$60,000

(Due to the unique academic orientation of the program, 51.7% of the budget-vanpool research and technical meetings and reports - must be included under other Indirect Services.)

MODE

In spite of the fact that the project provides staff assistance to the four major state carpool agencies, the program only takes credit for vanpools. (This somewhat eliminates the bias introduced by the university accounting system which also makes it convenient to support a part-time staff.) The project does carry a firm 30% overhead rate (of all direct costs) and a 25% fringe benefits package.

TRANSPORTATION

The primary interests are fuel savings and the net dollar savings to the users. VMT reductions and passenger miles of service are also computed.

COST RATIOS

Evaluating the typical annual budget, the total $60,000 budget was assigned to each phase in turn, and apportioned as follows:

SERVICE

	Number	Estimated Apportioned Budget %	$	Ratio
B. Workshops Conducted	12	20%	12,000	$1000/ea
C1. Publication Distributed	4000	6.6%	4,000	1.00/ea
C2. In-office Assistance	--	16.7%	10,000	---
C3. In-field Assistance	8	5%	3,000	375/ea
D. Indirect Other (Technical Research)	--	51.7%	31,000	---
No activity in other service areas				
MODE (only vanpools considered)				
2. Dollars/Vanpool Passenger	26,470	100	60,000	2.27/ea

TRANSPORTATION

1.	Dollars/VMT Reduced	55,904,114 VMT	20	12,000	0.22/VMT
2.	Dollars/Gallon Saved	3,440,000 gallons	25	15,000	0.004/gal
3.	Dollars/Tons of Pollution	8,246 tons	25	15,000	1.82/ton
4.	Dollars/Commuter Dollar Saved	4,472,000	20	12,000	0.003/$
5.	Dollars/Parking Space Demand Reduction	6,892	10	6,000	0.87/space

The program uses a computerized evaluation system which counts or estimates all factors except actual numbers of vanpoolers (some formulas differ from those in the guide). Thus, the actual numbers were used above except for the numbers of vanpoolers, which were derived from the number of vanpools:

(564 new vanpools)x(11.2 vanpoolers each) = 6317 new vanpoolers

(2008 old vanpools)x(11.2 vanpoolers each) = 22,490 old vanpoolers

Calculation of total credited poolers follows:

Directly credited = 6317 new poolers + (0.5)x(22,490 old pools)
= 17,562 poolers

Non-Program poolers = (0.1)(6317 new pools) + (0.5)x(22,490 old pools)
= 11,877 poolers

Program poolers = 17,562 direct + (0.75)(11,877) = 26,470 poolers

PERCENTILE SCORES

The ratios were entered into the Percentiles Table, and the percentile determined. (As no percentiles are possible for "Other" 50th percentile was entered in the Overall Percentile form.) For example, In-field assistance

row C3 of the table. The vertical column shows that this is within the 50th (to 59th) percentile range; cost-effectiveness is better than at least 50% of the comparable services.

When the calculation of service percentiles was finished and entered in the Overall Program Percentile form, the module percentiles were calculated by multiplying the budget percent times the percentile for each standard, and adding all the "adjusted" percentiles within that module. For example, Module I-Service:

Service #	Percentile	x	Budget %	= "Adjusted" Percentiles
B	50		20	10
C1	80		6.6	5.28
C2	(50)		16.7	8.35
C3	50		5	2.5
D	(50)		51.7	25.85
	Total = Module I Percentile		=	51.98

Example, Module II-Mode:

As only one mode (vanpooling) was involved, the 90th percentile is the "total adjusted" percentile.

Example, Module III-Transportation:

Results #	Percentile	x	Budget %*	= "Adjusted" Percentiles
1-VMT	90		20	18
2-VT	---		---	--- (not used)
3-FUEL	90		.25	22.5
4-POLLUTION	80		.25	20
5-$/COMMUTER	90		20	18
6-$/PARKING	90		10	9
	Total = Module III Percentile		=	87.5

*NOTE: The percentage of the total of budget actually apportioned to all of Module III services was 60%. The budget percent apportioned to categories not measured should not be included in Module percentile "adjustment" calculations.

$$\text{Average Program Percentile} = \frac{52 + 90 + 87.5}{3} = 76.5$$

The nature and goals of the program should be used when interpreting percentile rankings. The TTI Program in this example does not provide vans or regular individual pooler assistance. On the other hand, they put a great deal of effort into technical meeting and publication. Therefore, the program manager cannot cheer excessively over his high ratings in new vanpool formation, nor need he bemoan his average ratings in services. These results will derive from the nature of the program. On the other hand, the Mode percentile of 90 and the overall program percentile of 76.5 shows that his program is doing well.

Program Results

Evaluation Variable
Phase I

Services Directly Affecting Ridesharing	APPORTIONED BUDGET % x	TOTAL PROGRAM COST =	$ PER SERVICE	÷ NUMBER =	RATIO
A. Matching Services	---	---	---	---	---
1. Matchlists Produced	0	60,000	0	0	0
2. Call-in Services	0	60,000	0	0	0
3. Registrations Processed	0	60,000	0	0	0
B. Workshops Conducted	.20	60,000	12,000	12	1000
C. Technical Assistance	---	---	---	---	---
1. Publications Distributed	.066	60,000	4,000	4000	1.00
2. In-office Assistance	.167	60,000	10,000	---	---
3. In-field Assistance	.05	60,000	3,000	12	375
D. Providing Vans and/or Buses	0	60,000	0	0	0
E. Other					

Services Indirectly Affecting Ridesharing

A. Increasing Public Awareness					
1. Media Presentations					
2. Signs and Billboards					
3. Public Presentations					
B. Increasing Relative Attractiveness of Ridesharing					
1. HOV Special Lanes					
2. HOV Special Parking & Land Use Related					
3. HOV Tax Breaks					
4. HOV Contest & Awards					
5. Alternate Work Schedule					
6. Promoting Work Schedule					
C. Providing Transit Services					
1. Call-in Schedules					
2. Schedule Coordination					
3. Providing and/or Operating Park-and-Ride Lots					
4. Paratransit					
D. Other Indirect Services	.517	60,000	31,000	---	---
TOTALS	100%		60,000		

Phase II

	APPORTIONED BUDGET % x	TOTAL PROGRAM COST =	$ PER SERVICE	÷ NUMBER =	RATIO
1. Dollars/Carpool Passenger					
2. Dollars/Vanpool Passenger	1.00	60,000	60,000	26,470	2.27
3. Dollars/Buspool Passenger					
4. (Dollars/Carpool)					**
5. (Dollars/Vanpool)					**
6. (Dollars/Buspool)					**
TOTAL	100%				

Phase III

1. Dollars/VMT Reduced	.20	60,000	12,000	55.9M	0.22
2. Dollars/VT Reduced	---	60,000	---	---	---
3. Dollars/Gallon of Fuel Saved	.25	60,000	15,000	3.44M	.004
4. Dollars/Tons of Pollution Abated	.25	60,000	15,000	8,246	1.82
5. Dollars/Commuter Dollar Saved	.20	60,000	12,000	4.47M	.003
6. Dollars/Parking Space Demand Reduction	.10	60,000	6,000	20,362	.29
TOTAL	100%				

M = 1,000,000

**NOTE: Apportion budget to dollars per pool passenger, not dollars per pool, when calculating ratio.

Adjusted Program Percentile Scores

Evaluation Variable

Phase I Services Directly Affecting Ridesharing	PERCENTILE x	APPORTIONED BUDGET % =	ADJUSTED PERCENTILE
A. Matching Services			
1. Matchlists Produced			
2. Call-in Services			
3. Registrations Processed			
B. Workshops Conducted	50	.20	10
C. Technical Assistance			
1. Publications Distributed	80	.066	5.28
2. In-office Assistance	(50)	.167	8.35
3. In-field Assistance	50	.05	2.5
D. Providing Vans and/or Buses			
E. Other			
Services Indirectly Affecting Ridesharing			
A. Increasing Public Awareness			
1. Media Presentations			
2. Signs and Billboards			
3. Public Presentations			
B. Increasing Relative Attractiveness of Ridesharing			
1. HOV Special Lanes			
2. HOV Special Parking & Land Use Related			
3. HOV Tax Breaks			
4. HOV Contest & Awards			
5. Alternate Work Schedule			
6. Promoting Work Schedules			
C. Providing Transit Services			
1. Call-in Schedules			
2. Schedule Coordination			
3. Providing and/or Operating Park-and-Ride Lots			
4. Paratransit			
D. Other Indirect Services	(50)	+ .517	+ 25.85
		100%	

Sum of adjusted Phase I percentiles equals Overall Phase I Percentile [52]

Phase II

	PERCENTILE x	APPORTIONED BUDGET % =	ADJUSTED PERCENTILE
1. Dollars/Carpool Passenger			
2. Dollars/Vanpool Passenger	90	100	90
3. Dollars/Buspool Passenger			
		100%	

Sum of adjusted Phase II percentiles equals overall Phase II percentile: 90

Phase III

1. Dollars/VMT Reduced	90	.20	18
2. Dollars/VT Reduced	---	---	---
3. Dollars/Gallon of Fuel Saved	90	.25	22.5
4. Dollars/Tons of Pollution Abated	80	.25	20
5. Dollars/Commuters Dollars Saved	90	.20	18
6. Dollars/Parking Space Demand Reduction	90	.10 +	9 +
		100%	

Sum of adjusted Phase III percentiles equals overall Phase III percentile: 87.5

$$\text{Program Percentile} = \frac{\text{Phase I \%}\ 52 + \text{Phase II \%}\ 90 + \text{Phase III \%}\ 87.5}{3} = 76.5$$

APPENDIX C

DEVELOPMENT OF PERCENTILES

DEVELOPMENT OF PERCENTILES

The percentile evaluation technique used in this report is similar to the SAT (Scholastic Achievement Test) results used to evaluate the scholastic achievement of high school students. The test results are also used as a basis for college admission, awarding scholarships, and rating the adequacy of local education programs. The SAT not only enjoys wide-spread acceptance but the probability distribution functions (PDF's) that form the basis for the "scores" are well supported by a long history of large samples.

The calculation of these percentiles (or decile or quartiles) requires three items (see Figure A):

- The mean: The mean is a measure of central tendency or the expected value of a parameter.
- The variance: The variance is a measure of scatter of data about the mean; the standard deviation is the square-root of the variance.
- The probability distribution function: The PDF is the curve or model that describes the probability of a specific value (or range) of a variable. The poisson is used to model traffic, the binomial is used to model floods, etc.

Unfortunately, the means, variances, and probability distribution functions of the suggested ridesharing evaluation parameters are not yet established with any degree of certainty. A careful analysis of ridesharing project annual and/or evaluation reports resulted in sufficient data to estimate the mean of the parameters. For example, the average occupancy of a Texas van is 11.1, the average vehicle occupancy during the morning work trip in Houston is 1.41. Estimates of the variance are much less reliable because of the lack of data. The shape of the distribution function is "pure guess work" in most cases.

There are a number of reliable techniques to deal with this problem. (Lack of reliable data is a universal complaint among researchers.) The ones used in this report were developed to deal with "space problems" during research for NASA and found their way into scheduling (PERT) calculations in the construction industry. There are other more sophisticated techniques (Bayesian Estimation, for example, but they are too complex for this report).

The mean of an unknown distribution can be calculated from the following expression:

$$\bar{X} = \frac{LO + 4MP + HI}{6}$$

where:

$\bar{X}$: The estimated mean of the population;

LO: The lowest reasonable value that you could expect the parameter to have;

HI: The highest expected value of the parameter; and

MP: The most probable value the parameter is likely to assume.

This calculation results in the weighted average of these three estimates.

The standard deviation (the square root of the variance) can be estimated from:

$$S = \frac{HI - LO}{6}$$

where:

S: The estimated standard deviation of the parameter.

HI & LO: The same values as used in the calculation of the mean.

The probability distribution commonly used with these parameters is the Beta distribution with q = r = 3. In this analysis, the normal distribution is used to approximate the Beta between the natural-process-limits of plus or minus three standard deviations from the mean (see Figure B). This technique uses the range as the measure of scatter about the mean. (This is where the "6" comes from in the expression for estimating the standard deviation.) These natural process-limits enclose 99.6% of the normal curve and exclude the -.2% in each tail of the normal distribution.

The next step is to divide the curve into 10 equal areas (see Figure C). These divisions along the horizontal axis are spaced such that you have an equal probability of falling between any of the divisions. These are the generalized decile boundaries used in the analysis.

To determine the decile associated with a particular parameter, you must calculate the Z value as follows:

$$Z = \frac{R - \bar{X}}{S}$$

where:

Z: The "decile" pointer to the general decile curve.

R: The cost-effectiveness ratio calculated from your data.

X: The mean value of the cost-effectiveness ratio calculated from the analysis sample.

S: The estimated standard deviation of the cost-effectivness ratio.

The above explanation outlines the process used to develop the deciles used in the evaluation. To ease the calculation burden for the program manager, this report uses specific (precalculated) decile boundaries for each parameter.

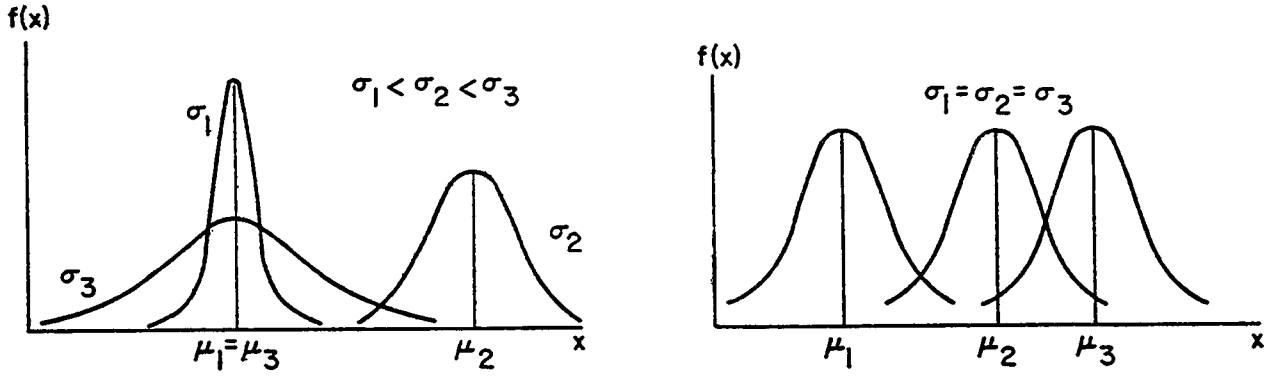

Figure A: The Normal PDF for Various Means (μ) and Variances (σ)

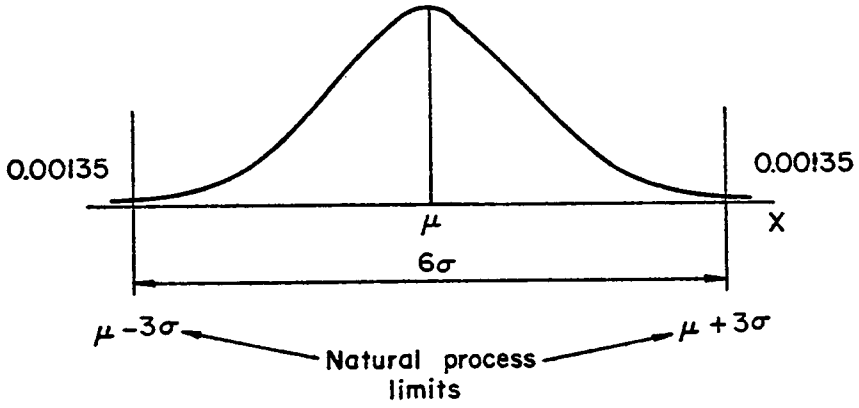

Figure B: Natural Process Limits for $\mu \pm 3\sigma$

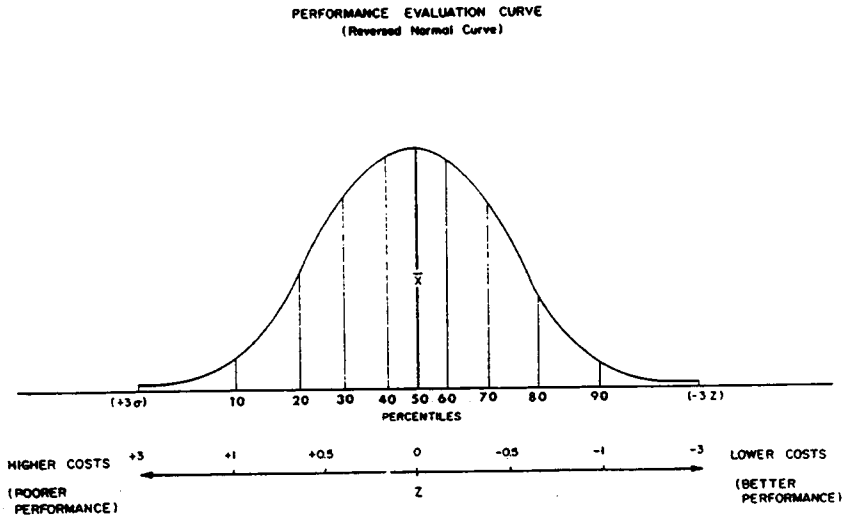

Figure C: Percent Areas Under the Normal Curve

Percentile Table

Evaluation Variable

Percentile Services Directly Affecting Ridesharing	10	20	30	40	50	60	70	80	90
				R A T I O					
A. Matching Services	--	--	--	--	--	--	--	--	--
1. Matchlists Produced	6.37	5.96	5.67	5.43	5.20	4.97	4.72	4.43	4.03
2. Call-in Services	1.82	1.64	1.52	1.41	1.32	1.21	1.11	0.99	0.81
3. Registrations Processed	3.00	2.81	2.67	2.56	2.45	2.34	2.23	2.09	1.90
B. Workshops Conducted (1533>1500>1400)	2283	2100	1967	1854	1750	1646	1533	1500	1400
C. Technical Assistance	--	--	--	--	--	--	--	--	--
1. Publications Distributed	2.12	1.91	1.77	1.65	1.54	1.43	1.31	1.16	0.97
2. In-office Assistance	22	19	16	14	12	10	8	5	1
3. In-Field Assistance	611	541	491	448	408	369	326	275	205
D. Providing Vans and/or Buses	1447	1376	1324	1280	1240	1200	1156	1104	1033
E. Other	--	--	--	--	--	--	--	--	--

Services Indirectly Affecting Ridesharing

A. Increasing Public Awareness									
1. Media Presentations									
2. Signs and Billboards									
3. Public Presentations									
B. Increasing Relative Attractiveness of Ridesharing									
1. HOV Special Lanes									
2. HOV Special Parking & Land Use Related									
3. HOV Tax Breaks									
4. HOV Contest & Awards									
5. Alternate Work Schedule									
6. Promoting Work Schedules									
C. Providing Transit Services									
1. Call-in Schedules									
2. Schedule Coordination									
3. Providing and/or Operating Park-and-Ride Lots									
4. Paratransit									
D. Other Indirect Services									

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