

San Francisco Joint Institutional TSM Program Evaluation

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The San Francisco joint institutional transportation systems management (TSM) program began out of conflict in the mid 1970s between institutions, who thought they needed to grow to survive, and neighborhood groups, who thought they had to defend their neighborhoods against the negative impacts of growth. One of the main impacts of growth was traffic congestion and lack of on-street parking. With the sponsorship of the San Francisco Department of City Planning, the joint institutional TSM program was started in 1979. Fourteen major hospitals, colleges, and a private employer were asked to participate in the program; all agreed. A four-phase program was developed for planning, training, implementation, and evaluation. The Urban Mass Transportation Administration granted \$163 000 to support the program. Evaluation, based on a 1980 resurvey of employees and analysis of broker and institutional efforts, showed outstanding results. Single-occupant automobile use decreased from 57 to 49 percent from 1979 to 1980. During this same period, ridesharing increased from 17 to 22 percent. This paper presents the results of the evaluation of the program conducted following the first year of program implementation.

The San Francisco joint institutional transportation systems management (TSM) program began out of conflict in the mid-1970s between institutions, who thought they had to grow to survive, and neighborhood groups, who thought they had to defend their neighborhoods against the negative impacts of growth. One of the main impacts of growth was in transportation--traffic congestion and lack of on-street parking.

As a result of this conflict in San Francisco, an institutional master plan requirement was passed by the City Board of Supervisors. Also, growth at the University of California at San Francisco (UCSF) resulted in legal challenges by its neighbors. UCSF met its transportation challenge by developing and implementing a TSM plan, designed to make more efficient use of present transportation resources and lower the number of single-occupant automobile trips. As a result of analysis of the institutional master plan submissions and the efforts of UCSF, the San Francisco Department of City Planning organized a series of joint meetings with other institutions in San Francisco to discuss common transportation problems and solutions. Out of this effort the joint institutional TSM program was started.

Fourteen major hospitals, colleges, and a private employer were asked to participate in the program; all agreed. The criteria for participation were based on (a) location in a neighborhood area, (b) perception of conflict with neighbors about traffic, and (c) institution had to be of significant size.

A grant application was prepared and approved for \$163 000 in funding from the Urban Mass Transportation Administration (UMTA). A four-phase program was developed for planning, training, implementation, and evaluation. Planning efforts included the development by consultants of a separate TSM plan for each institution and an overall planning report. Training of the employer-designated transportation brokers was accomplished through a 10-week, half-day per week training class. Implementation was the responsibility of each of the individual institutions, assisted by an organization the brokers set up, the Joint Institutional Transportation Brokers Association (JITBA). Evaluation, based on resurvey of employees and analysis of broker and institutional efforts, showed outstanding results.

In general, the participating institutions were located in San Francisco neighborhoods rather than the downtown area. The implications of this include difficult transit access, lack of parking, spillover

effects on the streets and adjacent neighborhoods, unusual work schedules, the perception of being out of scale with the neighborhoods, and considerable political and legal opposition to further growth. In a city where only 20 percent of downtown workers drive alone to work, 57 percent of the employees of the 12 institutions who participated in the total program drove alone to work in 1979 prior to the start of the TSM program.

The findings of the effectiveness of joint institutional TSM plans instituted at 12 institutions (universities, medical centers, and a private insurance company) in San Francisco from October 1979 through October 1980 were significant. (Some of the results exclude two institutions, Children's Hospital and the University of California, San Francisco, who evaluated their TSM programs separately from the overall joint institutional program.)

1. Employment at the institutions showed minor change. Overall, the 12 institutions employed 23 170 in 1979 and 23 830 in 1980; an increase of 3 percent.

2. Generally, the distribution of employees by geographic area remained consistent between 1979 and 1980. Collectively, nearly 14 000 employees of the 12 institutions (58 percent) lived in San Francisco in both 1979 and 1980. The remaining 9000 employees were almost evenly divided among East Bay communities, North Bay communities, and the Peninsula.

3. The institutions, although experiencing normal job turnover and employment fluctuations, had a labor force that remained fairly constant in its residual distribution; thus, changes in residence were of minor importance as a motivation for employee changes in transportation patterns.

4. The effect of the TSM program on reducing employee reliance on the automobile from 1979 to 1980 was significant. At the 12 institutions, use of single-occupant automobiles declined, on an average, from 57 to 49 percent. Overall, the number of single-occupant drivers was reduced from 13 100 to 11 650.

5. The decline in the use of single-occupant automobiles was accompanied by significant increases in the number of employees who shared rides, which increased from 17 to 22 percent. In 1979, 4050 shared rides; by 1980 the number had increased to 5200.

6. Use of transit as a means of commuting to work also showed gains. In 1979, 16 percent of the employees (approximately 3750) used public transit; by 1980, transit use increased to 18 percent, or 4250 employees.

7. Changes occurred in other transportation modes, including walking and bicycling. In 1979, 10 percent of the employees (2300) walked or bicycled to work; in 1980, 11 percent or nearly 2700 did so.

8. Considerable annual employee turnover occurred at the institutions--approximately 12 percent at the universities and 19 percent at the medical centers.

9. Although it was anticipated that the individual institutional transportation brokers would be able to devote a large percentage of their work time to TSM activities, in actuality, this did not occur. Brokers spent an average of 18 percent of the their time in TSM activities, or approximately 7-8 h/week.

10. Nearly one out of four of the new employees (persons employed less than one year) changed their mode of transportation between 1979 and 1980. Among the employees who had worked from 1 to 10 years, approximately one out of five changed their mode of transportation. Among employees who had worked 11 or more years, approximately one out of nine changed transportation modes.

11. More than 6 out of 10 employees indicated that they were aware of their employer's transportation programs. At only two institutions did fewer than one-half of the employees indicate that they were aware of the employer's program.

12. More than one-third of the employees who responded to the transportation resurvey asked for additional transportation information and provided their name and work phone number on the survey form to receive more information.

13. According to the resurvey, an untapped market of employees who were not only ready to change transportation modes but who were also willing to consider changing immediately, existed. For example, 30 percent of all employees who currently drive alone to work said they would be willing to consider changing to a carpool, 20 percent to vanpools, and 16 percent to public transit. However, 51 percent of the single-occupant automobile drivers indicated no interest in or willingness to consider changing transportation modes.

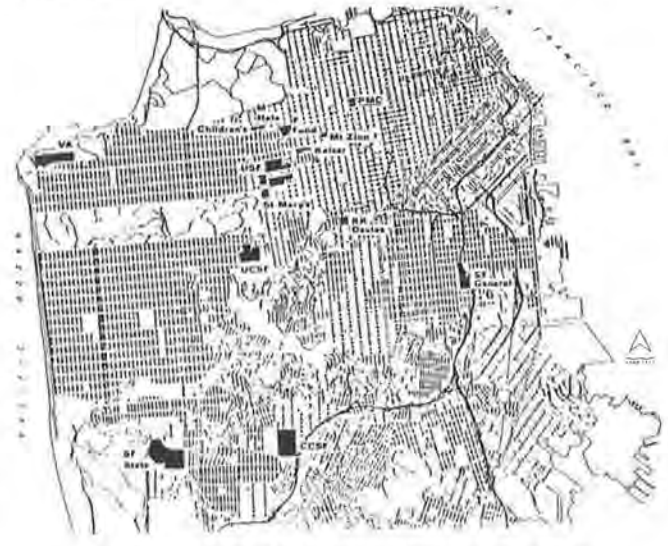
14. One of the most visible and tangible results of the TSM program was the spontaneous formation of JITBA. The effectiveness of JITBA's collective voice was demonstrated in legislation enacted to provide preferential on-street parking for carpools; in proposed San Francisco Municipal Railway (Muni), San Mateo County Transit District (SamTrans), and Golden Gate transit improvements; and in providing mutual support for the institutional brokers' activities.

In summary, the joint TSM programs were the first of their kind in the nation and a test case for potential application to other cities throughout the country. Although the programs have been effective, the reasons for the significant results in reducing employee reliance on the single-occupant automobile are difficult to pinpoint. However, a number of factors were at work. First, the institutions had comprehensive plans for encouraging employees to reduce reliance on the single-occupant automobile; second, the cost of commuting by automobile increased as gasoline prices rose to approximately \$1.35/gal by fall 1980; third, parking management programs were implemented at many of the institutions, including preferential parking for carpools, and greater restrictions were placed on obtaining parking stickers for existing parking; fourth, the institutions themselves made transportation management a high priority and publicized it through new and existing employee-orientation sessions and through newsletters, transportation fairs, and other forms of publicity and marketing to the employees; fifth, each institution had an appointed transportation broker on whom employees could call for transportation information and also who served to encourage commute alternatives to the employees. Thus, a combination of timing, resources, alternatives, and priorities led to the impressive TSM gains.

EXISTING CONDITIONS

The San Francisco Department of City Planning and a consortium of 14 major institutions [see Figure 1 (1)] located in neighborhood districts participated

Figure 1. Location of San Francisco joint institutional TSM program institutions.



SOURCE: "Final Report of the San Francisco Joint Institutional Transportation Systems Management Study," DeJoy, Cather, et al., October 1979, page 7.

in the San Francisco joint institutional TSM program, which began in 1979:

1. Children's Hospital,
2. Kaiser Permanent Medical Center,
3. Marshal Hale Memorial Hospital,
4. Mt. Zion Hospital and Medical Center,
5. Pacific Medical Center,
6. Ralph K. Davies Medical Center,
7. San Francisco General Hospital,
8. St. Mary's Hospital and Medical Center,
9. Veteran's Administration Hospital,
10. Fireman's Fund Home Offices,
11. City College of San Francisco (CCSF),
12. San Francisco State University (SF State),
13. University of California, San Francisco (UCSF), and
14. University of San Francisco (USF).

The objectives of the TSM program were to reduce automobile parking and traffic impacts at each institution by means of low capital cost measures, such as ridesharing, public and private transit services, parking management, and marketing incentives, and to achieve greater impact through cooperative efforts with the other participating institutions. The primary goal was to reduce the number of single-occupant automobile commute trips to work (2). The first step in development of the program was to gain a clear understanding of the nature of each institution, the transportation system that serves it, and existing transportation use by institutional employees and visitors. This was needed not only for identifying potential for TSM improvements but also to provide before data for postimplementation evaluation.

At all but two institutions, the single-occupant automobile was the predominant means of commuting by employees in 1980. In most cases, public transit, particularly Muni, was the second most frequently reported means of commute.

Residence Locations

The nature of transportation services available to employees was dependent on residence location. In

1979, nearly 60 percent of the employees lived within San Francisco. The greatest use of single-occupant automobiles for commuting was by employees who live outside the city, particularly on the San Francisco Peninsula. This reflects the lengthy and difficult transit access from these outlying points.

Parking

Although all institutions provide some employee or visitor parking, the number of spaces provided and policies on their use vary widely. In general, the university campuses have the greatest numbers of parking spaces on-site; this is consistent with their comparatively large site populations.

At all institutions, on-site parking was observed or reported to be heavily used during the peak periods, and parking frequently spilled over onto neighboring streets. The amount of spillover varied greatly, depending on the net deficiency of on-site parking and availability of transportation alternatives.

Public Transit and Ridesharing

The San Francisco Bay Area has an extensive public transit network. However, the institutions in the program shared a common problem of being located away from the downtown focal point of local and regional transit service. As a result, although all of them have at least one transit route that provides direct service, connections to some areas of the city and to some regional transit systems are inconvenient and time consuming.

Carpools operated at all of the institutions, but the degree to which carpooling was encouraged varied considerably. Vanpools operated at three of the institutions. Buspools operated only at two institutions.

Recommended TSM Efforts

The planning effort resulted in plans for all of the participating institutions and an overall final planning report (1).

The recommendations focused on the following activities:

1. Ridesharing--internal carpools, internal and joint vanpools, new buspool service, in-house matching services, and preferred on-site parking;
2. Parking management--priority and free or low rates for registered pools, higher all-day rates, no additional on-site parking, and cooperation with neighborhood parking programs;
3. Transit--sale of monthly transit passes, transit information availability, and work with transit operators for improved service;
4. Marketing--information available, transportation bulletin boards, new employee orientation, and flextime;
5. Administration--designation of the transportation broker, joint coordination, employee transportation committees, and program monitoring and evaluation; and
6. Traffic operations--various low-cost operational improvements.

In addition, specific numerical goals for modal shifts were developed for each institution. These were based on a combination of present habits, surveyed employee interest, and site conditions. All of the goals were ambitious and were meant to be implemented and met over several years.

PROGRAM IMPLEMENTATION AND EVALUATION

Program implementation began in late 1979 with the

completion of a transportation brokers' training class and the publication of the individual TSM reports. Basically, the implementation involved initiation and continuation of proposed TSM actions. The actions included activities that required immediate action, short-range plans, or long-range plans.

Immediate-action plans included ridesharing promotions and the marketing of transit efforts, coordination among the various institutions to promote carpools and vanpools, improvements in parking management, and the creation of employee transportation committees. Short-range program elements depended on other agency resources, particularly the public transit districts, including Muni, SamTrans, and the Golden Gate Bridge District. Individually and collectively the institutions were asked to take immediate action in requesting and lobbying for transit improvements, although transit improvements were not expected until the second or third year of the program. The short-range proposals included modifications of transit routes in the Muni five-year plan, Muni reverse express service to the institutions from the AC Transit Trans Bay Terminal and Bay Area Rapid Transit (BART), and rerouting of the Golden Gate transit service onto Geary Boulevard. Other short-range activities included recommendations for off-street preferential parking for carpools, and implementation of a Muni shuttle service to link the outer Mission District of San Francisco with some of the institutions.

Long-range plans, basically those that would occur between the third and fifth year of the program, related primarily to new transit services, such as the new Muni Route 33 and other suggested transit improvements. Although it will take several years to implement all the TSM plans fully and to accomplish the TSM goals, much of the ground work was to be accomplished during the first year.

The program evaluation phase included both program monitoring and evaluation. At the outset of the TSM program, the city reserved funds to evaluate program effects after approximately one year of implementation. The firm of Ira Fink and Associates of Berkeley, in association with David Bradwell and Associates of San Francisco, was selected by the city in Fall 1980 to conduct the evaluation of the effectiveness of the TSM plans at each institution (3).

The steps involved in the TSM program evaluation included first, a resurvey, in October 1980, of employee transportation patterns at 10 of the participating institutions (UCSF and Children's Hospital conducted employee surveys separately, the Ralph K. Davies Medical Center and the San Francisco General Hospital dropped out of the joint institutional program and were not included in the resurvey or evaluation). Interviews were conducted with the institutional brokers at each of the participating institutions. A review was made of all recommended TSM programs at each institution to document those that were accomplished in 1980 and those that were not accomplished. Meetings were held between the consultant, the transportation broker, and his or her immediate administrative supervisor to review the progress of the TSM program at each institution and to discuss the results of the employee transportation surveys. Final evaluation reports were prepared for each of the 10 institutions and an overall evaluation summary, including the other two institutions, was also prepared.

JOINT INSTITUTIONAL TSM MODE SPLIT GOALS

The primary purpose of the TSM program was to reduce reliance on the single-occupant automobile as a mode of transportation from home to work. At the start

of the TSM program, the single-occupant automobile was the predominant means of commuting by employees at all institutions except for Fireman's Fund and UCSF. At most institutions between 51 and 66 percent of the employees arrived in single-occupant automobiles. Overall, an average of 57 percent of the employees drove to work in single-occupant automobiles in 1979. This is shown in Table 1.

The effect of the TSM program in reducing employee reliance on the automobile during 1980 was significant. As shown in Table 1, use of single-occupant automobiles declined to an average of 49 percent. In other words, whereas in 1979, 6 out of 10 employees drove to work, in 1980 only 5 out of 10 did so. Overall, the number of single-occupant drivers was reduced from 13 100 to 11 650.

The hoped for decline in the use of the single-occupant automobile was accompanied by significant increases in the number of employees who shared rides. In 1979, 17 percent of the employees (4050) shared rides; by 1980, the percentage who shared rides had increased 22 percent and the number increased to 5200. In other words, in 1979 one out of six employees shared rides; in 1980, more than one out of five did so.

Use of transit as a means of commuting to work also showed gains. In 1979, 16 percent of the employees (3750) used public transit; by 1980 this had increased to 18 percent, or more than 4250 employees. In addition, increases occurred in other transportation modes, including walking and bicycling. In 1979, 10 percent of the employees (2300) walked or bicycled to work; in 1980, 11 percent (2700) did so.

Overall, the effect of the TSM program in reducing employee reliance on the single-occupant automobile was impressive. Automobile use, as measured by the percentage of employees who drove to work at each of the institutions, showed a significant decline. As illustrated in Table 2 (1, p. 27), many

of the institutions reached the TSM target transportation goals suggested in the 1979 institutional plans. These goals, set separately for each of the institutions, were based on the factors of existing transportation patterns, availability of institutional resources to change these patterns, alternative means of transportation to the institutions, institutional parking policies, and anticipated improvements in transit services that serve the institutions. The 1980 data in Table 2 were from the employee transportation survey conducted by Ira Fink and Associates and David Bradwell and Associates in October 1980.

Because of the considerable annual turnover of employees at these institutions (approximately 12 percent for the universities and 19 percent for the medical centers), TSM marketing activities that led to reduced use of automobiles must continue uninterrupted. If not, employees may revert to earlier forms of transportation behavior. Thus, to maintain the impressive TSM gains requires continuing work, because of the ease with which employees can shift from one commute alternative to another. Once an employee learns to commute to work with an alternative other than the single-occupant automobile, the probability is high that the employee will not revert to single-occupant automobile use if continued emphasis is placed on commute alternatives.

PERCENTAGE OF EMPLOYEES WHO CHANGED TRANSPORTATION MODES

There are two measures of employee changes of transportation modes. The first is a measure of the change of mode by the years of service at the institution; the second is the change of mode by type of transportation. These measures are based on the more-extensive evaluation at 10 of the 12 institutions conducted by Ira Fink and Associates and David Bradwell and Associates.

Table 1. Primary modes of employee transportation.

Year	Drive Alone		Shared Ride		Public Transit		Walk or Bicycle		Total
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	
1979	13 105	57	4030	17	3740	16	2295	10	23 170
1980	11 640	49	5215	22	4265	18	2710	11	23 830
Difference	-1 465		+1185		+525		+415		+660

Table 2. Progress made by 1980 in reaching transportation mode goals set forth in 1979 TSM plans at joint TSM institutions.

Institution	Drive Alone (%)			Shared Ride (%)			Public Transit (%)			Other ^a		
	1979	Goal	1980	1979	Goal	1980	1979	Goal	1980	1979	Goal	1980
Kaiser Permanent Medical Center	58	38	57	24	37	18	10	17	17	8	8	8
Marshal Hale Memorial Hospital	56	30	45	15	30	21	20	31	21	9	9	9
Mt. Zion Hospital	65	42	49	5	21	18	25	32	25	5	5	8
Pacific Medical Center	52	34	45	14	28	18	23	27	25	11	11	12
St. Mary's Hospital	56	39	52	17	31	20	19	22	18	8	8	10
Veteran's Administration Hospital	66	59	47	14	19	27	7	9	17	13	13	9
Fireman's Fund Insurance	42	26	33	39	52	45	15	18	18	4	4	4
CCSF	86	81	68	2	6	13	10	11	15	2	2	4
SF State	63	55	57	13	20	17	16	17	16	8	8	10
USF	53	30	42	17	17	18	19	27	24	11	26	16
Avg	60		51	16		21		16		8		9
Children's Hospital	59		45	15		23		16		10		10
UCSF	46		44	22		25		16		14		17
Avg	57		49	17		22		16		18		11

^aIncludes walking and riding.

One of the basic tenets of the Joint Institutional TSM plans was the introduction of employee orientation programs for new employees to alert the employees to transportation or commute alternatives on their trip from home to work. As shown in the table below, turnover of employees is considerable.

No. of Years of Employment	Avg (%)
<1	16
1-2	22
3-5	13
6-10	20
>11	29

The effectiveness of the TSM programs is shown in the table below. Nearly one out of four of the new employees changed their mode of transportation between 1979 and 1980. Among the employees who had worked from 1 to 10 years, approximately one out of five changed their mode of transportation. Among employees who had worked 11 or more years, approximately one of nine changed their mode.

No. of Years of Employment	Changed Transportation Mode (Avg %)
<1	24
1-2	21
3-5	19
6-10	20
>11	11
Avg	18

The new employee, who, at the time of employment, can be induced to change his or her mode of transportation, offers the greatest single opportunity for long-term improvement in commute alternatives to the institution. However, since the longer-term employees represent five out of six employees at the institutions, existing employees need also to change transportation modes and, once they have changed from a single-occupant automobile mode, to stay in the alternative mode.

In view of the turnover among employees and that many employees change places of residence during the year, some employees will change to driving to work. However, this amount of change was minimal. Of the employees who reported driving alone to work in 1980, 13 percent (one of seven) indicated that they had changed to this mode of transportation. This resulted in approximately 1100 added drivers. This potential increase was offset by a reduction of 2700 employees who changed to other modes with the net result of 1300 fewer cars being driven to work at the TSM institutions.

Among those who rideshared, 30 percent indicated that they had changed to this mode of transportation within the past year. At those institutions that have aggressive ridesharing programs, the results were most impressive: 37 percent of the ridesharers at both Mt. Zion and at Fireman's Fund indicated that they had changed to this mode in 1980.

Of the more than 3300 ridesharers, the 30 percent change meant that more than 1000 employees became ridesharers in 1980. As a result of the increase in ridesharing, the percentage of ridesharers at all institutions increased from 16 percent in 1979 to 21 percent in 1980.

Gains were also made in percentage increases in the number of employees who changed to public transit. An estimated 60 public transit users changed from public transit to another mode of transportation, and 615 changed to using public transit. Overall, the net gain was 555 transit users. At individual institutions transit use increased between 20 and 70 percent. Overall, the percentage of all

employees who use transit increased from 2600 (16 percent) to 3100 (19 percent).

Finally, some employees chose either to walk or bicycle to work instead of driving or using transit. Gains were made at 9 of the 10 institutions in this regard. Overall, an estimated 20 employees changed from walking or bicycling to some other mode of transportation, and more than 270 changed from some other mode to walking or bicycling. In sum, the number of walkers or cyclists increased from slightly more than 1200 (8 percent) to nearly 1500 (9 percent) between 1979 and 1980.

As the above data indicate, employees, regardless of the length of time on the job, were willing to change to alternate modes of transportation. Of the nearly 16 300 employees at the 10 institutions, more than 3000 of the employees, or nearly 20 percent, indicated that they had changed their mode of transportation between 1979 and 1980. These modal shifts clearly favored alternatives to the single-occupant automobile.

EMPLOYEE AWARENESS OF EMPLOYER'S TRANSPORTATION PROGRAMS

One of the key components of the TSM plans was to set forth marketing strategies to inform new and existing employees about their transportation alternatives for commuting to work. All institutions had such programs written into their work plans. However, implementation of the marketing strategies was easier at some institutions than others because of the variation in the ease with which the institutional administrations could communicate with the employees. At some institutions weekly, biweekly, or monthly newsletters are distributed in house. At others, such as Kaiser Permanent Medical Center, the employee newsletter is a regional newsletter distributed to all Kaiser employees throughout the Bay Area. At some institutions, such as City College, which has a large part-time faculty who are on campus infrequently and for short periods of time, it is difficult to communicate with them or to establish mechanisms for them to work out commute alternatives.

Notwithstanding the above, and as shown in the table below, in 1980 more than 6 out of 10 of the employees were aware of their employer's transportation programs. At three of the institutions, Marshal Hale Memorial Hospital, Veterans Administration Medical Center, and Fireman's Fund Home Office, more than 85 percent of the employees were aware of the transportation programs or received information about them. At only two institutions, Mt. Zion and City College of San Francisco, did fewer than one-half of the employees indicate that they were aware of the employer's transportation programs.

Employee Awareness of Transportation Programs	No.	Avg (%)
Aware	10 116	62
Not aware	6 154	38
Total	16 270	
Want transportation information	5 792	36

With so many of the employees indicating that they were aware of the programs, one would expect them to be fully informed about their transportation alternatives. However, more than one-third of the employees who responded to the survey asked for additional transportation information and provided both their name and work phone number to receive it.

Moreover, that employees asked for additional information indicates that, although significant gains

Table 3. Employee willingness to consider changing to another transportation mode among car drivers only at joint TSM institutions, 1980.

Institution	Willingness to Change Mode								Car Drivers	Total ^a
	Carpool		Vanpool		Public Transit		No Interest or Response			
	No.	Percent	No.	Percent	No.	Percent	No.	Percent		
Kaiser	278	26	203	19	171	16	599	56	1070	1465
Marshal Hale	49	27	41	23	25	14	86	48	180	264
Mt. Zion	378	35	259	24	119	11	529	49	1080	1619
Pacific Medical Center	238	34	147	21	84	12	364	52	700	994
St. Mary's	299	34	202	23	106	12	378	43	880	1267
Veteran's	159	23	113	17	68	10	401	59	680	790
Fireman's Fund	156	38	111	27	49	12	226	55	410	632
City College	347	34	204	20	204	20	643	63	1020	1653
SF State	510	28	364	20	400	22	801	44	1820	2621
USF	127	27	61	13	75	16	207	44	470	546
Total	2521	30	1705	21	1301	16	4234	51	8310	11851

Note: The responses from employees interested in changing to shuttles or buspools have been excluded from the above table. These results are contained in the individual institution's final TSM evaluation report.

^aTotal responses exceed the number of car drivers because some of the drivers indicated a willingness to consider changing to more than one other mode of transportation.

have been made in the past year, there is still an existing untapped market of employees who are not only ready to change transportation modes but are also willing to consider it immediately.

For example, based on an employee transportation survey (October 1980) conducted by Ira Fink and Associates and David Bradwell and Associates, 30 percent of all employees who currently drive to work alone would be willing to consider changing to a carpool (see Table 3). This level of interest was consistent among all institutions, even at institutions that have a high percentage of ridesharers, such as Fireman's Fund. At Fireman's Fund, 45 percent of employees currently share rides, yet 38 percent of the car drivers indicated that they would be willing to consider a carpool alternative.

Interest in vanpools was also apparent, but not as high as in carpools. Overall, more than one out of five employees who drove to work alone indicated that they would be willing to consider changing to a vanpool. Again, the level of interest was consistent among all 10 institutions.

Interest in public transit did not fare as well. Among current automobile drivers, only one out of six said they would be willing to consider changing from driving the automobile to using public transit. The highest level of interest was expressed among employees at the universities--City College of San Francisco, San Francisco State University, and the University of San Francisco. In each of these cases between 16 and 22 percent of car drivers said they would be willing to consider changing to public transportation modes.

At the medical centers the level of interest in changing to public transit was somewhat lower, which is understandable because of the variation in employee starting times, especially among the nursing staff. Also, many of the shifts start or end the work period in nondaylight hours. In conversations with the transportation brokers and their administrators, employees' concerns about public transit were less related to convenience and schedule and more related to their personal safety both en route to work and between the transit stop and their place of employment.

Of interest is that, of all of the single-occupant automobile drivers, about one-half indicated no interest in or willingness to consider changing transportation modes. Thus, of the more than 8300 single-occupant automobile drivers, the most apparent market is for about 4100 to be willing to consider changing and actually changing to a different transportation mode.

JITBA

The unique JITBA organization was formed by the institutional brokers on the completion of their broker training in mid-1979. JITBA has provided an important ingredient that the individual institutions could not accomplish on their own--the ability to provide a single voice for transportation and transit improvements to agencies that provide transportation and transit services. For example, JITBA and its members sponsored and wrote new legislation for the City of San Francisco to allow for preferential parking for carpools in designated areas around institutions. The members appeared before the various committees of the Board of Supervisors, bird-dogged the legislation, and now share both in the glory of its effectuation and the benefits of its implementation, which started in January 1981 (4).

Similarly, the brokers association and its representatives have appeared before Muni, SamTrans, and the Golden Gate Bridge District. In all three cases, transit improvements resulted. One such improvement is the Muni reverse-express-bus service from the downtown AC Transit and BART terminals to the institutions. Service began on a pilot basis in April 1981; 3000 of the employees who live in the East Bay could avail themselves of this service.

The SamTrans system has indicated interest in providing express-bus service from the Peninsula to the institutions and is currently conducting a survey of institutional interest in such a route. At present 3700 of the joint institutional employees live on the Peninsula. The Golden Gate Bridge District, with support from JITBA, has prepared a position paper on providing service by its buses along Geary Boulevard in San Francisco. Such service would be of considerable interest to the institutions in that more than 3200 of the employees of the JITBA institutions live in the North Bay area and are now served by the Golden Gate Bridge District transit system. This spontaneously formed organization has been one of the most visible and tangible results of the TSM program.

It was anticipated at the outset of the program that the transportation brokers would be able to devote a large percentage of their time to the TSM activities. In actuality, this has not occurred. Many of the brokers have other primary responsibilities at their institutions, including serving as security officers, managers of the parking systems, or directors of internal transportation programs.

As a result, the brokers themselves report spending as little as 5 percent of their time in the TSM activities to as much as one-third of their time. This is shown in the table below:

Distribution of Broker's Time	Avg (%)	Hours per Week
TSM program	18	7.3
Parking management	18	7.3
Police or safety	32	13.0
In-house transportation	16	6.2
Other	16	6.2

On average, the brokers spend about 18 percent of their time in TSM activities, or approximately 7-8 h/week.

HOW THIS PROGRAM DIFFERS FROM OTHERS

The joint institutional TSM program has a number of positive and negative features. On the negative side, it deals with institutions whose irregular working hours made ridesharing particularly difficult. Also, the program is a collection of sites bound together by function rather than proximity. On the positive side, the program has the benefit of a number of vital factors:

1. A clear and thorough four-part program,
2. Specific numerical goals for modal split at each institution,
3. Designation and training of the transportation brokers,
4. On-going broker organization,
5. A comprehensive approach to the problem rather than piecemeal focus on one or two elements,
6. Low cost,
7. The gasoline crisis of 1979,
8. Clear political pressures on the institutions,
9. Clear political and employee payoffs for the institution, and
10. A consensus on clearly effective strategies.

Each of the pieces of the program was vital in its own way. The planning effort gives each institution a detailed list of solutions to their particular problems. The training of the brokers clearly fixes responsibility at each institution on a particular person, and that person was brought up to the state of the art. The continuing brokers association provides a professional forum, joint problem solving, mutual support system, and joint measuring stick. The implementation term was long enough (one year) to provide results but still left time to catch up to the long-term schedule. The evaluation was very clear; there was an obligation to progress toward the specific, numerical goals set in the initial plans. Everyone knew the evaluation was coming, and they had to produce. All participants produced a lowered rate of single-occupant drivers. By 1980, eight institutions produced a drive-alone rate under 50 percent compared with two in 1979.

One of the most telling results was that one of the most promising institutions, in terms of location and potential, produced the least. The transportation broker was replaced, the new broker's responsibility was upgraded to a middle-management level, and the new person went through subsequent training courses and developed an aggressive, improved plan of attack for that particular institution.

The brokers association, in recognition for its results, received the San Francisco Bay Area Transportation Commission's grand award for 1980 for "significant efforts...in support of public transit."

Although the gasoline shortage, which came during this program, certainly heightened everyone's awareness of the costs and perils of commuting alone, this factor cannot be given primary credit. The results of the program varied widely from institution to institution, not in any specific pattern other than the amount of time, energy, and thought put in by the broker. Less promising locations did better than more promising ones in a number of cases.

The program served to reinforce two conclusions. First, personalized service is the key to maximum success. Shifts away from driving alone to work are the result of personal decisions to make a change in travel habits; the more a broker deals on a personal, individual basis, the more likely he or she will get results. Second, results do not come dramatically but are accumulated over time. All of the commute alternative success stories across the country, such as the Tennessee Valley Authority and 3M Company, are the results of years of accumulated effort. The joint institutional program accumulated 8 percent change in the first full year of effort, and will likely accumulate more over the next several years, despite the difficulty of dealing with hospital and college work shifts and locations.

A coordinated, multifaceted program is more likely to succeed than a TSM program focused on a single strategy. Programs fixed on just vanpools or parking management did not produce the results, for instance, that the overall approach does.

A major result was the clarification of TSM as an employer strategy and a clarification of just what strategies seem to be effective. The most-effective strategies included the following:

1. Transit--on-site sale of monthly commuter passes, availability of route maps and schedules, and personal trip planning;
2. Ridesharing--personal assistance in getting carpools and vanpools together and maintaining them; free or reduced-rate, reserved on-site parking; and joint ridesharing where a pool cannot be formed on-site;
3. Parking management--preference for ridesharing vehicles, increased rates for single-occupant automobiles, and limitations on increasing the number of available parking spaces;
4. Marketing--new employee orientation, transportation day, transportation bulletin boards, and continual use of in-house newsletter to promote program; and
5. Administration--coordinate all activities, emphasize on the personal touch, and regular recycle of all activities, especially marketing, parking enforcement, ridesharing drives.

A very business like approach was taken to the situation. Because the whole enterprise was taken seriously, it worked. In sum, the six-part approach is an essential--specific goal-setting, a mix of governmental carrots and sticks, institutions that can see the political and employee benefits, a clear, personalized set of various TSM strategies, a mutual support group of brokers with consulting or professional assistance through the implementation period, and an evaluation they have to answer to. Each area around the country has differences in situation, cooperation, and public opinion; however, the joint institutional formula can be applied.

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Reducing Work Trip Length Through Home Mortgage Subsidy Incentives

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This paper presents research in progress at Princeton University that examines the potential of geographically restricted mortgage subsidies to encourage people to live closer to work and thus reduce work trip travel and automobile-related energy consumption and air pollution. A preliminary analysis is made of the effect of a mortgage-subsidy program at Princeton University. The Princeton plan offers a 1.5 percent mortgage subsidy to eligible employees of Princeton who buy a home within an 8-mile radius of campus. Preliminary analysis indicates that the mortgage subsidy has produced significant reductions in work trip travel in comparison with employee work trips of similar employers in the Princeton area. Implementation of mortgage subsidies in the private sector is also investigated. We propose that the U.S. Environmental Protection Agency's emissions offset policy can provide industry with a financial incentive for implementing geographically restricted mortgage-subsidy programs. This policy is proposed as a means of increasing an industry's flexibility in meeting pollution regulations. It also provides the benefit of significant energy conservation.

This paper reports preliminary results of research in progress at Princeton University that examines the potential of geographically restricted mortgage subsidies to reduce vehicle miles of travel (VMT) in urban areas. At Princeton, mortgage subsidies are available to eligible employees who are willing to live within a specified distance of the work place. This research examines the effect of the Princeton University mortgage-subsidy program in reducing the length of employee work trips. Work trip comparisons are made between employees at Princeton and employees of three other major employers in the area.

At this point in the research the data are highly aggregated. This limitation is currently being overcome by collecting data via a detailed questionnaire. However, the preliminary analysis suggests that the Princeton plan has been effective in reducing Princeton employees' work trip VMT significantly.

This paper presents the benefits of a geographically restricted mortgage loan policy and the theoretical support for such a policy. The initial empirical results of the Princeton plan are given. We propose that the U.S. Environmental Protection Agency's (EPA) regulatory policies be used as incentives to induce participation of the private sector in providing geographically restricted mortgage-subsidy programs.

PROBLEM DEFINITION

The problems of excessive energy consumption and air pollution emerged during the last decade as major facets of the urban transportation problem. Automobile

travel is a major contributor to both energy consumption and air pollution. Automobile travel accounts for about 40 percent of the U.S. consumption of oil, two-thirds of which is consumed in urban areas (1). Pollutant emissions from mobile sources produced 75 percent of the ambient carbon monoxide (CO), 55 percent of the ambient hydrocarbons (HC), and 50 percent of the ambient nitrogen oxides (NO_x) in urban areas in 1973. Reduction in these levels of energy consumption and air pollution has been mandated by legislation such as the 1975 Energy Policy and Conservation Act and the Clean Air Act of 1970, as amended. However, large-scale solutions by the public sector to these problems appear to be decreasingly feasible as the public increasingly embraces fiscal austerity and rejects governmental regulation of private industry.

To date, the approaches to solving the problems of excessive energy consumption and air pollution from mobile sources have been characterized by both a technical dimension and a political dimension. The technical dimension distinguishes between transportation supply and transportation demand solutions. Supply solutions include the construction of new mass transit facilities or the increasing of the capacity of existing transit facilities and improvement of the fuel efficiency and emissions levels of automobiles. Supply solutions generally try to accommodate existing or projected demand for transportation; they represent the traditional approach of transportation planners and engineers to transportation problems.

On the other hand, demand solutions focus on the reduction or redistribution of VMT, which in turn reduces or redistributes vehicular emissions and reduces energy consumption. Demand solutions include automobile and gasoline taxes, staggered work hours, increased parking fees, congestion pricing, and influencing the location of travel-producing or travel-attracting activities. This last option may offer the greatest potential for reducing automobile-related energy consumption and air pollution, but it is difficult to implement due to American traditions in land use development (2). Demand solutions have gained popularity in recent years, at least within the academic community.

Potential solutions can also be categorized along a political axis. The political dimension distinguishes between distributive and restrictive solutions, to borrow Altshuler's useful dichotomy (1).