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Impact of Flexitime Work Schedules on an Employer-Based Ridesharing Program

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The impact on commuting behavior of employees when flexitime is superimposed on a large employer-based ridesharing program is discussed. The case study uses the Tennessee Valley Authority (TVA) program in downtown Knoxville, Tennessee. Based on the first 6 months of experience with TVA's Knoxville flexitime program, it is shown that giving employees greater choice in working hours can serve to upset an established ridesharing program. It must be noted that the TVA ridesharing program is unique in that it provides a high level of consumer-oriented services. Buses operate equivalent to a subscription program and, along with vans, arrive just before the work day starts and leave immediately at the end of the work day. The element of choice then adds complexity to the operations. With shifting demands for different starting and leaving times, it becomes difficult to balance the services with the demand. Also, it is difficult for 35 to 40 people who use the same vehicle to reach a mutually agreed on schedule. Van operations are easier to adapt to flexitime because the decisions involve a smaller number of individuals and decisions can be made at the decentralized level of the van. However, when individuals are accustomed to receiving a high level of commuter service, and events take place to spread that demand over a longer time period, readjustments in travel behavior and accompanying services will be required. These adjustments will require the provision of additional commuter services. As TVA's experience indicates, without service adjustments, people will make use of the flexitime opportunities by carpooling or by driving alone. Both ridesharing and flexitime are important concepts for energy conservation. However, when flexitime is added to a large customized ridesharing program, the net energy savings will not equal the sum of both energy conservation actions taken singularly.

Two critical issues that confront transportation planners are increased concern over the cost and availability of energy and the ability of the government to undertake large-scale capital investment programs to increase the capacity of transportation facilities. Increasingly, it is becoming apparent that many transportation problems are related to the peaking of trips. Work trips tend to cluster during about 4 hr of the day, which necessitates the sizing of transportation facilities to accommodate the travel demand concentrated in these hours. Peaking problems create travel delays and cause inconvenience to users of the transportation systems; these delays are also costly in terms of excess pollution and energy use.

Rather than building excess transportation capacity that is only used for a few hours per week, a philosophy of peak-period demand management is evolving as a transportation system management (TSM) strategy. Attempts are being made to reduce peak-hour demands through such concepts as staggered work hours, flexitime, or the 4-day work week.

Flexitime, in particular, is receiving increased attention as a peak-period demand management technique. Flexitime differs from staggered work hours in that it does not formally assign work arrival and departure times to groups of employees. For example, in a firm in which all employees worked from 8:00 a.m. to 4:30 p.m., the work force could be divided into three groups by initiating staggered work hours. The first group might work from 7:30 a.m. to 4:00 p.m., the second from 8:00 a.m. to 4:30 p.m., and the last from 8:30 a.m. to 5:00 p.m. Some employees will benefit from improved transportation because of less congestion, but each employee's arrival and departure time remains fixed.

Flexitime is different. One popular variation is to designate certain hours as flexible or core hours within the span of a work week. An employee must work a set number of hours, but there is more latitude in choosing working hours within an established range. Typically, all employees must be available for a core time (e.g., 9:00 a.m. to 3:00 p.m.); within a certain number of flexible hours employees may choose their own arrival and departure times. In some programs, lunch breaks may also be defined as flexible time (1).

Flexitime is a relatively new idea that is receiving increased attention in the United States. Historically, flexitime is generally attributed to a program initiated in 1967 by the Messerschmidt-Boelkow-Blohm aerospace firm in West Germany. Since that date, flexitime has spread rapidly through Europe; but, until recently, it has received only limited attention in the United States (2). It is estimated that more than 3,000 West German companies have extended the flexitime concept to more than 50 percent of the labor force (3). Similar acceptance rates have been achieved in other European countries. Projections made from a 1977 survey conducted by the American Management Association estimated the use of flexitime in the United States as follows (4):

1. Almost 13 percent of all nongovernment organizations with 50 or more employees use flexitime,
2. More than 5 percent of all employees are on flexitime, and
3. Between 2.5 and 3.5 million employees are on flexitime, not counting self-employed persons and many professionals, managers, and sales people who

have long set their own hours without calling their schedule flexitime.

Experimentation with flexitime is continuing, with many private and public organizations actively exploring the concept. The question to be addressed is: What are the benefits to be derived from flexitime?

Flexitime appears to provide substantial benefits to employees and management (1):

1. For employees--improved working climate, an opportunity to exercise self-reliance, easier accommodation of family responsibilities, increased usable leisure time, reduced morning stress associated with occasional late arrivals, and reduced traffic congestion and possible reduction of automobile gasoline consumption; and
2. For management--reduced tardiness, reduced short-term sick leave and annual leave, less interruptions during the early morning and late afternoon, increased productivity, and increased recruiting advantage.

However, concern has also been raised that flexitime might create some ridesharing problems. Besides the obvious problems of potential workers' abuse, increased recordkeeping requirements, additional overhead costs from longer hours, and the fact that supervisors are not available for the entire work day, flexitime also has uncertain implications on ridesharing.

There are two distinct schools of thought concerning the consequences of changing work schedules on commuter travel behavior. One is that greater flexibility in work-trip scheduling will permit employees to avoid peak crushes and will make it more attractive for commuters to drive their personal automobiles. In this sense, adoption of a flexitime schedule will be counterproductive to energy conservation plans that rely on the encouragement of carpooling and transit riding.

However, contrary data have been provided that suggest that additional flexibility in scheduling work trips will in fact enhance ridesharing efforts. This will be achieved by allowing individuals to enter carpools that were previously inconvenient due to scheduling differences or permit riding transit at other than peak crush, thereby reducing inconvenience, travel time, and wait time.

Interestingly, survey evidence has been developed by Blakely that supports the contention that flexitime will enhance ridesharing (1). Unfortunately, flexitime is still a relatively new concept and does not have the benefit of extensive demonstration or testing. It is not clear what impact flexitime will have on ridesharing, either as a counterproductive force or as a mutually supporting element.

OBJECTIVES

The impact of flexitime on the commuting behavior of Tennessee Valley Authority (TVA) employees who work in downtown Knoxville is discussed in this paper. The significance of this experimental group is that TVA maintains an extensive employer-based ridesharing program that involves 92 vanpools and 27 express buses. This provides an interesting example of superimposing flexitime on a mature ridesharing program, where 84 percent of the 4,200 work force was already coming to work by means other than driving alone. Almost half of those who participate in ridesharing commute in vanpools and buses.

TVA RIDESHARING PROGRAM

The commuter ridesharing program in Knoxville evolved gradually over the past 9 years. Before the inception of express buses and vanpools, TVA employees participated in ridesharing primarily in the form of carpooling and, to a lesser extent, through the use of regular bus service. The first proposal for an express bus was brought up at a citizens' meeting in west Knoxville with city traffic engineers and planners. The citizens were concerned with the traffic congestion on I-40 and the sole reliance being placed on the automobile to meet all current and future needs in the corridor. The citizens' group represented an area that has a large concentration of TVA employees, and the group seriously pursued the proposal for an express bus.

A commuter express bus was initiated in Knoxville on December 3, 1973, and was highly successful. Joint efforts between the city administration and TVA employees proved effective in promoting ridesharing, and by the end of 1974 there were 10 express buses and 6 vanpools, all of which were serving primarily TVA employees.

A major change in the ridesharing program occurred in January 1975 with the initiation of TVA's incentive program, which was called the Commuter Pooling Demonstration Program. This incentive plan called for

1. A one-third discount on commuter bus tickets,
2. Issuance of a $5 monthly municipal parking ticket to each bona fide carpool (a carpool for this purpose was defined as a group of three or more riders with at least two being TVA employees),
3. Credit to vanpool accounts of $3/month for each TVA employee participating in vanpooling, and
4. Reimbursement to handicapped employees for the direct cost of parking in a commercial lot convenient to their place of work.

The impact of the incentive program was significant. There was an immediate reduction of 12 percent in the number of TVA employees driving alone to work while the number of express bus and vanpool riders continued to increase. Two private bus operators had to be used in addition to Knoxville Transit Corporation (K-Trans) to meet the increased need for express bus service during peak hours. By January 1977, there were 23 express buses (13 public and 10 private) and 18 vanpools serving TVA employees. Finally, by 1979 there were 29 express buses and 69 vans. Table 1 gives the modal-use pattern of TVA employees.

TVA FLEXITIME PROGRAM

In June 1979, a flexitime demonstration was adopted for a major portion (82 percent) of TVA office em-

Table 1. Modal-use patterns of TVA employees.

Item	Modal-Use Pattern of Work Force Over Time				
	11/73	12/74	1/75	1/77	1/79
Mode of transportation (%)					
Drive alone	65.0	42.0	30.0	18.0	17.0
Regular bus	3.5	3.0	5.0	3.0	3.0
Express bus		11.0	18.0	28.0	22.0
Carpool	30.0	40.0	42.0	41.0	40.0
Vanpool		1.7	3.0	7.0	16.0
Bike, walk, etc.	1.5		2.0	3.0	2.0
Total work force	2,950	3,000	3,100	3,400	4,200
No. of express buses		10	12	23	29
No. of vans		6	6	18	69

ployees in downtown Knoxville. The four flexitime plans available are noted in the table below:

Scehdule	Start Time (a.m.)	End Time (p.m.)
A	7:00	3:45
B	7:30	4:15
C	8:00	4:45
D	8:30	5:15
E	9:00	5:45

(Note that employees may select schedule A, B, C, or D. The core time is from 9:00 a.m. to 3:45 p.m., excluding 45-min lunch periods beginning 11:30 a.m. and ending 12:45 p.m. Employees may use schedule E only on an infrequent basis for individual circumstances or emergencies. When schedule E is used, employees inform their supervisors as soon as possible after determining that this option is to be exercised.)

A core time of 6 hr, excluding lunch, is defined. All employees are required to work an 8-hr day, and the 45-min lunch period cannot be flexed. Each employee uses a sign-in and sign-out sheet to record arrival and departure times. Also, all employees are required to declare their anticipated schedules on a biweekly basis. The impact of adopting flexitime on the TVA ridesharing program will be discussed based on its two major elements: vanpools and buspools.

A survey of 10 percent of TVA personnel who work in downtown Knoxville was conducted in fall 1980. The survey was initiated to determine current TVA employees' commuter travel modes and the impact of flexitime on commuting schedules. Of the 424 TVA employees surveyed, slightly more than 50 percent continued to select the 8:00 a.m. to 4:45 p.m. work schedule:

	Modal Choice (%) by Flexitime Schedule				
Mode	A	B	C	D	Other
Bus	21.3	9.8	68.9	-	-
Van	25.3	36.0	38.7	-	-
Drive alone	37.9	11.1	41.7	6.5	2.8
Carpool with family	27.3	18.2	47.3	7.2	-
Carpool	24.4	19.5	56.1	-	-
Other	35.7	28.6	28.6	7.1	-
Total	28.0	17.6	50.8	2.9	0.7

The 7:00 a.m. to 3:45 p.m. flexitime period was the second most desirable work schedule with 28 percent of the work force selecting this work period. Note that the work schedule is not totally flexible, as 20 percent of the survey respondents who work from 8:00 a.m. to 4:45 p.m. were employed in sections not eligible for flexitime. As expected, modal choice was influenced by flexitime work schedule.

Bus ridership, partly reflecting seating capacity, is highly oriented to the 8:00 a.m. to 4:45 p.m. time period, with more than 68 percent of the bus riders selecting this time. The drive-alone mode indicates a heavy concentration in the 7:00 a.m. to 3:45 p.m. and 8:00 a.m. to 4:45 p.m. time periods, but limited participation in the 7:30 a.m. to 4:15 p.m. flexitime period. Vanpools provide a relatively equal participation in the three flexitime periods. Carpooling is oriented to the 8:00 a.m. to 4:45 p.m. period, although not as extensively as bus riders.

Approximately 10 percent of the respondents indicated an intention to change their flexitime period in the fall and winter. Sixteen percent of the individuals in the 7:00 a.m. to 3:45 p.m. time period indicated a desire to change working hours, with 89 percent desiring a later starting time. Changes by other time periods were minor, except for tne 8:30 a.m. to 5:15 p.m. time period, where 25 percent indicated a desire to start earlier. The greatest number of changes were planned by the drive-alone mode, which of course has the greatest flexibility in selecting working hours.

VANPOOLS

An important element of the TVA ridesharing effort was the 69 vanpools operated by the TVA Employees Credit Union. Before flexitime, all vans arrived at TVA's starting work time of 8:00 a.m. and then departed immediately after work at 4:45 p.m. Vanpools were able to respond to flexitime in most instances by having vanpool riders and drivers work out their own arrangement without intervention by the Commuter Pooling Operations Section that administers the ridesharing program.

Nine months after flexitime was initiated, a telephone survey was conducted of all 75 Knoxville van drivers to determine their experience and reaction to flexitime. The survey revealed that 20 percent of the vanpools had shifted to a 7:00 a.m. arrival time, 30 percent to 7:30 a.m., and 50 percent remained at the original time of 8:00 a.m. Where sufficient demand and interest existed for a revised work schedule and an existing vanpool did not or could not change arrival times, new vanpools were established. For example, of the six new vanpools established after flexitime was initiated, four arrived at 7:00 a.m. and two arrived at 7:30 a.m.

Most decisions with respect to flexitime were decentralized and made by the members of each vanpool. For 54 percent of the vanpools, the decision was reached by strict majority vote, whereas for 20 percent, the decision was by a general consensus. There were only a few cases in which the vans did not change schedules either because the driver would not or could not change or because of special concern for hardships imposed on a few riders. Only one vanpool experimented with different flexitimes and eventually decided to revert back to the original 8:00 a.m. arrival time.

A critical question concerning the implementation of flexitime is the impact of altering vanpool arrival and departure times on the travel behavior of vanpool riders. Of the 34 vanpools that selected a new starting time, 38 percent lost riders because of the schedule change. Of the 35 vanpools that did not alter the arrival time, only 26 percent reported losing riders. Fifty percent of the vanpools that altered arrival times reported being able to attract new riders because of the new arrival times.

Table 2 provides a summary of the modal shift in ridership due to flexitime. In total, there was a net loss of 18 riders to vanpools out of the total ridership base of 1,012 individuals. The largest shift occurred between vanpools because individuals already vanpooling selected vanpools that operated closer to their preferred work hours. Because the express buses operating at this time all retained the original 8:00 a.m. to 4:45 p.m. schedule, it became attractive for employees desiring to start work before 8:00 a.m. to switch to vanpools and, also, for riders in vanpools that had changed arrival times to switch to buses if they desired to retain the original work hours. Flexitime, then, had only a minor effect on vanpool ridership. A few additional riders were diverted from the buses, carpools, and drive-alone modes to the vanpools, but this accounted for less than 1 percent of the total ridesharing population.

In general, vanpools were able to adjust to the flexitime schedules with minimum difficulties. In

Table 2. Modal shift to and from vanpools due to flexitime.

Item	Modal Shifts to and from Vanpools by Operating Times		
	7:00 a.m.-3:45 p.m.	7:30 a.m.-4:15 p.m.	8:00 a.m.-4:45 p.m.
No. of vans	14	20	35
No. of vans adding riders due to time shift	5	10	4
No. of vans losing riders due to time shift	6	7	9
Riders joined vans from			
Bus	2	2	0
Van	7	3	4
Carpool	1	2	0
Drive alone	2	3	1
Unknown	0	1	0
Total	12	11	5
Riders left van to use			
Bus	2	6	2
Another van	11	8	12
Carpool	1	3	0
Drive alone	2	10	1
Unknown	1	0	4
Total	17	27	19
Net change in van ridership (persons) going to or from modes other than vans	-1	-11	-6

cases where selection of flexitime posed some difficulty, it was possible to add new vanpools to the fleet to accommodate those seeking an earlier starting and departing time. Interestingly, 92 percent of the vanpool drivers stated they had no plans to shift hours during the summer or fall. This indicates a high degree of stability and satisfaction with the chosen schedules. The vanpools were then able to adjust to flexitime, reach a stable condition, and retain their former ridership.

BUSPOOLS

At the time of adoption of flexitime, all of the express buses were operating to accommodate the 8:00 a.m. to 4:45 p.m. work schedule. After the vanpools adopted a flex schedule, pressure mounted for the buses to alter schedules. Because buses carry 26 percent of the work force, retaining the buses on the 8:00 a.m. to 4:45 p.m. work schedule was a major obstacle to implementing flexitime on an agencywide basis.

In comparison to the vanpools, the adjustment to a flexitime schedule had a major impact on the bus program. After numerous suggestions, the decision was made to develop a new bus schedule and begin the schedule on the first Monday in February 1980. Altering the bus arrival and departure times required developing a new schedule and communicating the revisions to the riders. In order to ascertain schedule preference, a survey was conducted of 1,174 employees by zip codes in areas where express bus service was available. As noted in the table below, the desired starting times were varied, which made it difficult for the transportation coordinator to work out a compromise:

Desired Time to Start Work (a.m.)	Responses	
	No.	Percent
7:00	469	40.0
7:30	210	17.9
8:00	456	38.8
8:30	39	3.3

Unlike the vanpools, only the schedules of eight buses were changed, with seven arriving at 7:00 a.m. and one at 7:30 a.m. Although a majority rule was attempted, an unhappy and vocal minority was always dissatisfied with the decision. In hopes of converting to bus commuting individuals who were previously lost due to the rigid bus schedule, additional bus service was provided on the first day. The net result was expanding the bus fleet by two buses--one added by the public operator (K-Trans) and one by a private bus operator (B&C Bus Lines). The number of buses increased, but average occupancy dropped.

A major concern was the impact of flexitime on bus ridership. With the institution of a flexitime bus schedule, it was hoped that many riders who had changed from bus to other modes of transportation in order to get to work earlier would start using the buses again.

In order to compare preflexitime and postflexitime ridership trends, K-Trans ridership statistics were used because K-Trans provides the largest amount of bus service (17 out of 29 buses) and had provided continuous service for at least 3 years before flexitime with the same routes, equipment, and fares. The base year of 1978 was used because it best reflects historical trends. As noted in Figure 1, once flexitime schedules were adopted on June 17, 1979, bus ridership started to decline when compared with ridership during the first 5 months of the year. By using January through May 1979 as the preflexitime control period, monthly bus ridership dropped an average of 5,000 riders, or a daily average of 121 persons during the July to December 1979 time period. All of these figures were corrected for seasonal variations in ridership by using 1978 as the historical base. The resulting 21 percent decline in bus ridership during this time can be largely attributed to the inability of the bus system to serve the needs of those individuals desiring to participate in the flexitime program.

As noted in Figure 2, in each of the 5 months before flexitime schedules were instituted, the bus ridership was higher than the preceding year. However, once the flexitime program was initiated in June 1979, there was a lower ridership in each of the following months of 1979 than in the preceding year. The decision by K-Trans to put the buses on a flexitime schedule was an attempt to recapture these lost riders.

The data in Figure 2 show that the concept worked well, with bus ridership increasing 2.5 percent over the preflexitime ridership of 1979 and 24 percent over the seasonally corrected ridership during the last months of 1979. The only direct monthly com-

Figure 1. Comparison of preflexitime and postflexitime (1979): express bus ridership versus control period (1978).

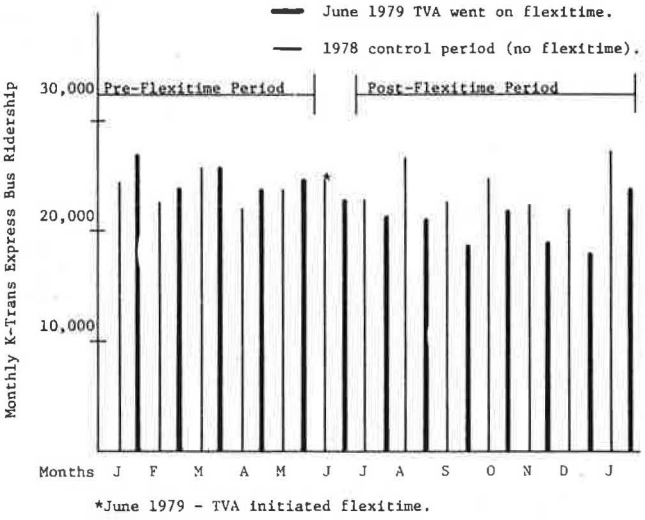
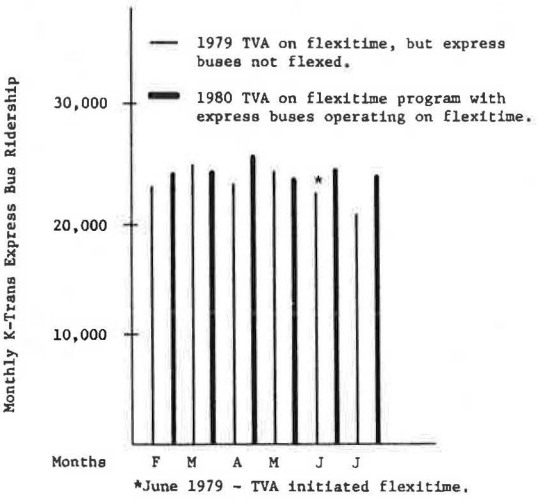


Figure 2. Comparison of express bus ridership with (1980) and without (1979) buses operating on flexitime schedules.



parison with both the flexitime program active and the buses operating on a flexitime schedule was July 1979 with July 1980. The July 1980 period had a bus ridership of 24 percent over 1979. This increased bus ridership was accomplished with only 7 percent additional vehicle miles of bus service. As a countertrend, the express bus fare was raised from $0.60 to $0.75/ride effective July 1, 1980, but during this same time period, automobile driving costs increased markedly, which made bus service more attractive. Also during this 1-year time interval, TVA substantially increased the number of vans to a fleet size of 86 vehicles.

Currently, the transportation coordinator is closely monitoring ridership to detect any seasonal changes in desired starting times and thus the need to alter bus schedules. After a difficult adjustment period, ridership appears to have stabilized. One of the buses lightly used in the flexitime schedule will be eliminated and another rerouted to accommodate riders left without service.

The public bus company (K-Trans), has been able to integrate the express runs with the regular work schedule; two drivers make both the 7:00 and 8:00 a.m. runs, while other drivers are used mainly for regular service runs or school runs after the express peak. The bus manager believes that opportunities exist for multiple runs, but with Knoxville's extensive freeway reconstruction program and unpredictable traffic tie-ups, the risks are too great for providing reliable service. If more peak-hour work could be found for the drivers, this might give the transit manager greater flexibility in cutting runs.

CONCLUSIONS

Where peak loads can be spread to reduce vehicle concentrations and congestion and the transportation services are readily available, flexitime work schedules have a definite advantage. However, if ridesharing services are provided at fixed intervals (e.g., TVA's vans and buses that arrive just before 8:00 a.m. and leave at 4:30 p.m.), the introduction of travel choice adds complexity and requires incremented additions to the services already being provided. Flexitime as an energy conservation concept then requires careful planning and tailoring to the local situation.

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