Is Teleworking Really Working?

- Findings from the eWorkPlace Telecommuting Project in Minnesota

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Abstract

As a major initiative of telecommuting in Minnesota, eWorkplace worked with 48 employers from different industries and over 4,000 of their employees to promote teleworking and flexible work scheduling to reduce peak period commuting on congested roadways. Recurring online surveys with travel diaries provided information on individual travel behavior and perceptions of teleworking, and it also enabled a quantitative evaluation of the results from eWorkplace. Congestion reduction was a key piece and main goal of the Urban Partnership Agreement program that funded eWorkplace, and major reductions in peak-period trips taken and vehicle miles travelled were found in the evaluation. These reductions led to three-fold benefits to individual employees, employers and the community at large. Employees reported increased productivity and available work hours. The productivity boost transformed into benefits for employers including higher retention and improved work morale. ; Finally, fewer trips taken on the mostly congested highways in the metropolitan area during the peak period provided economic, social and environmental benefits to the community at large.

BACKGROUND

The Urban Partnership Agreement is a program initiated by the U.S. Department of Transportation to reduce congestion. Metropolitan areas applied for funding for aggressive congestion management programs through 4 T's: Tolls, Transit, Technology, and Telecommuting, among which telecommuting requires usually the least amount of infrastructure input. On December 9, 2010, President Obama signed into law H.R. 1722, the "Telework Enhancement Act of 2010". This law directed federal agencies to develop telework policies and support the adoption of teleworking within federal agencies where possible. Besides the federal government, many employers have started their own telecommuting program, mostly on an informal basis.

As a major initiative of telecommuting in Minnesota, eWorkplace worked with 48 employers from different industries and over 4,000 of their employees to promote teleworking and flexible work scheduling and to reduce peak period commuting on congested roadways. The eWorkPlace project was administered by the Minnesota Department of Transportation (Mn/DOT), with the University of Minnesota's Humphrey School of Public Affairs (Humphrey School) managing the program. eWorkplace provided assistance to employers regarding: setting up a telework project, formalizing telework policy and evaluating telework results for individual employers.

PROJECT MECHANISM

The eWorkPlace program relied on employer commitment to include employees to participate in teleworking. Transportation Management Organizations (TMOs), the nonprofit organizations in the Metropolitan Twin Cities area served as the recruiter and the liaison between participating employers and the project manager. After assessment by the respective TMO, organizations who formally agreed to participate signed a commitment letter identifying a goal for a number of employees to participate. The TMOs, with assistance from the consultant team, then worked with these employers to establish pilot programs, receivingfree or reduced price consulting services to implement and sustain employee participation.

A parallel part of the project, Results-Only Work Environment (ROWE), was conducted by CultureRx. CultureRx had been working on promoting their model of flexible work before the start of eWorkplace which called for a workplace cultural shift concept that might include traditional telework or flexible schedules. The idea of ROWE was to move away from a focus on when and where employees work to one where only work results were looked at. After identifying the mutual benefits to be brought by participating in eWorkplace, CultureRx agreed to carry over its potential client base to eWorkplace and to provide its consultaning services to interested employers.

Firm commitment from participating employers ensured the sustainability of telecommuting during the project period and in the long term. Employers submitted a letter of commitment from upper management prior to official entry in the project including participation criteria, level of commitment to telecommuting, company goal for number of telecommuters, readiness for telecommuting implementation/expansion, and willingness to participate in the evaluation process. In return, they received services including but not limited to: employee training, business strategy development and IT trouble-shooting.

EVALUATION

This paper focuses on the evaluation of eWorkplace results and tried to answer the question of whether teleworking realized its goal of reducing traveling and boosting productivity. Recurring online surveys with travel diary provided information on individual travel behavior and perceptions of teleworking, and it enabled a quantitatively intensive evaluation.

Survey

The hub for surveys was called the Commute Tool site. It was a web application free to users through the eWorkPlace website which allowed employees to track their travel and calculate the Vehicle Miles Traveled (VMT) and cost savings of telecommuting from recurring surveys. A commute tool survey was sent to each participant 1 week, 3 months and 9 months after their registration on the Commute Tool site. It was composed of two sections. The first part was multiple choice questions asking about commuting behavior and perception of telework; the second part was a travel diary asking the time, location and purpose of trips taken on the most recent telework day (defined as the most recent day worked but did not go into the office for ROWE participants) and office day. A detailed explanation of the questions and research variables constructed from the questions follows.

1. Commuting behavior
    a. Weekly Commuting Mode

Question 1 of the survey asked about the commuting mode on each day of the week prior to the survey. Seven types of modes were identified: driver of a car, van or motorcycle; passenger in a car, van or motorcycle; public transit; active transportation like biking and walking; teleworking; taking the day off and being out of office for business or personal reasons. Detailed divisions under each category were offered for click-selection on each day of the week. From the response to Question 1, we were able to calculate if the respondent teleworked in the week given and how many days they teleworked per week.

    b. Highway commuting

Question 3 asked if the participants drove or carpooled in a vehicle during their commute, whether they used I-394 or I-35W. These highways were selected as they are among the most congested in the Twin Cities area, and are the only roads with MnPASS High Occupancy / Toll (HOT) lanes available for single-occupant vehicles that wanted to “pay their way” out of congestion. Indeed, another key component of the UPA project was to implement the HOT lane on 35W, and a key measure of the entire project was to reduce congestion (peak period trips) on 35W. The responses were used to construct the dummy variable showing whether these two highways of interest were utilized for commuting, and thus the distance travelled on these highways saved by teleworking.

2. Perceptions about telework
    a. Optimal telework days per week

Question 5 asked participants “to do your job best, how many days per week would you work from a location other than your company’s office?” We were able to measure the preferred telework intensity from responses to this question and using the calculated actual telework days from Question 1, the difference between the optimal and actual telework days per week could be obtained. This difference shed some light on the potential for future telework projects.

    b. Productivity

Question 9 asked participants how they feel about their productivity when they teleworked/participated in ROWE. Three answered were provided: decrease, does not change or increase. We could measure the perceived change in productivity from responses to this question.

c. Available work hours

Question 10 asked participants how they felt about the change in available work hours when they teleworked/participated in ROWE. Again, they could choose from decrease, does not change or increase. This question was built on the hypothesis that if the time of commuting on the road could be saved, more working hours would be possible. Admittedly, this was reported change in available work hours, thus did not mean more hours had in fact been devoted to work. But it was reasonable to believe that the availability of work hours had an impact on employees' working morale and work-life balance.

3. Travel diary

The travel diary was composed of two identical sections asking about trips taken on the most recent day teleworked (telework day) or the most recent day they worked in office (office day). The participants could report up to 10 trips in each section. This enabled us to probe whether any trips were taken on a telework day or whether additional trips were taken on an office day, to compare the travelling behavior on the two types of working day and to measure if teleworking actually led to less travelling and more time saving. The variables constructed from the travel diary, for both telework day and office day, were shown below.

Information directly from the survey response included:

a. Highway travelled

Similar to the commute behavior, the participants were asked if I-394 and/or I-35W were used in each trip they took on a telework and office day. The responses were used to measure the approximate distance travelled on those two highways on a telework day versus an office day.

b. Start and end time of the trip

Participants were asked to fill out the start and end time of each trip and the responses were used to identify the trip as peak-hour or non-peak-hour trip. Peak hours were defined as the periods of 6 am to 9 am and 3 pm to 6 pm.

c. Method of travel

Participants reported the primary mode for the trip. Only the trips taken by driving alone or carpooling/vanpooling were selected in the final calculation of VMT saved or emission saved. Other methods shown in the drop-down response box were walking, jogging, in-line skating, and public transit/shuttle.

Variables constructed from the survey responses included:

a. Number of trips per telework/office day

From the method of travel, we were able to count how many trips were taken on a telework/office day by driving or carpooling/vanpooling. If trip taken on a telework day was less than that on an office day, some trips were saved by teleworking and we were able to quantify such savings. Similarly, from the start and end time of the trip information, we were able to determine whether the trip was a peak-hour trip or a non-peak hour trip, and calculate the savings accordingly.

b. Vehicle Miles Travelled (VMT) savings

Based on review of literature describing impacts of telecommuting on travel behavior elsewhere, and from the pilot surveys we conducted with some employers prior to the Commute Tool site surveys, where more detailed trip distance information was acquired, , the distance of an additional trip on a telework/office day was estimated to be 45% of the commute distance. Using this assumption, the number of trips calculated and the reported commute distances, we were able to calculate VMT saved on a day replacing traditional office work with teleworking.

c. Highway related information

Following the same methodologies and taking into consideration whether one specific trip took place on I-394 or I-35W, we were able to construct the number of trips travelled on these highways on a typical telework/office day and thus to calculate the peak-hour and total highway trips saved if teleworking. Assuming that a major proportion of a trip, if reported using these highways, took place on these highways, the distance not travelled on that why because of teleworking was also obtained.

Survey Respondents Overview

1. Number of respondents

Although all eWorkplace participants were invited to register on the Commute Tool site and take surveys sent from the site, not all of them did so. 23.9% of all participants were sampled in at least one survey. The proportion of ROWE and traditional telework participants stayed quite steady across the surveys.

Among the 1005 people who registered on the Commute Tool Site (note that they registered on different dates depending on when their employers participated in eWorkplace), 279 of them only took the 1-week survey. 426 people took up to the 3-month survey, the majority of whom finished the 1-week survey. Out of the 207 people who took the 9-month survey, 191 finished all three surveys and they were the group with the most valuable and longitudinally comparable data.

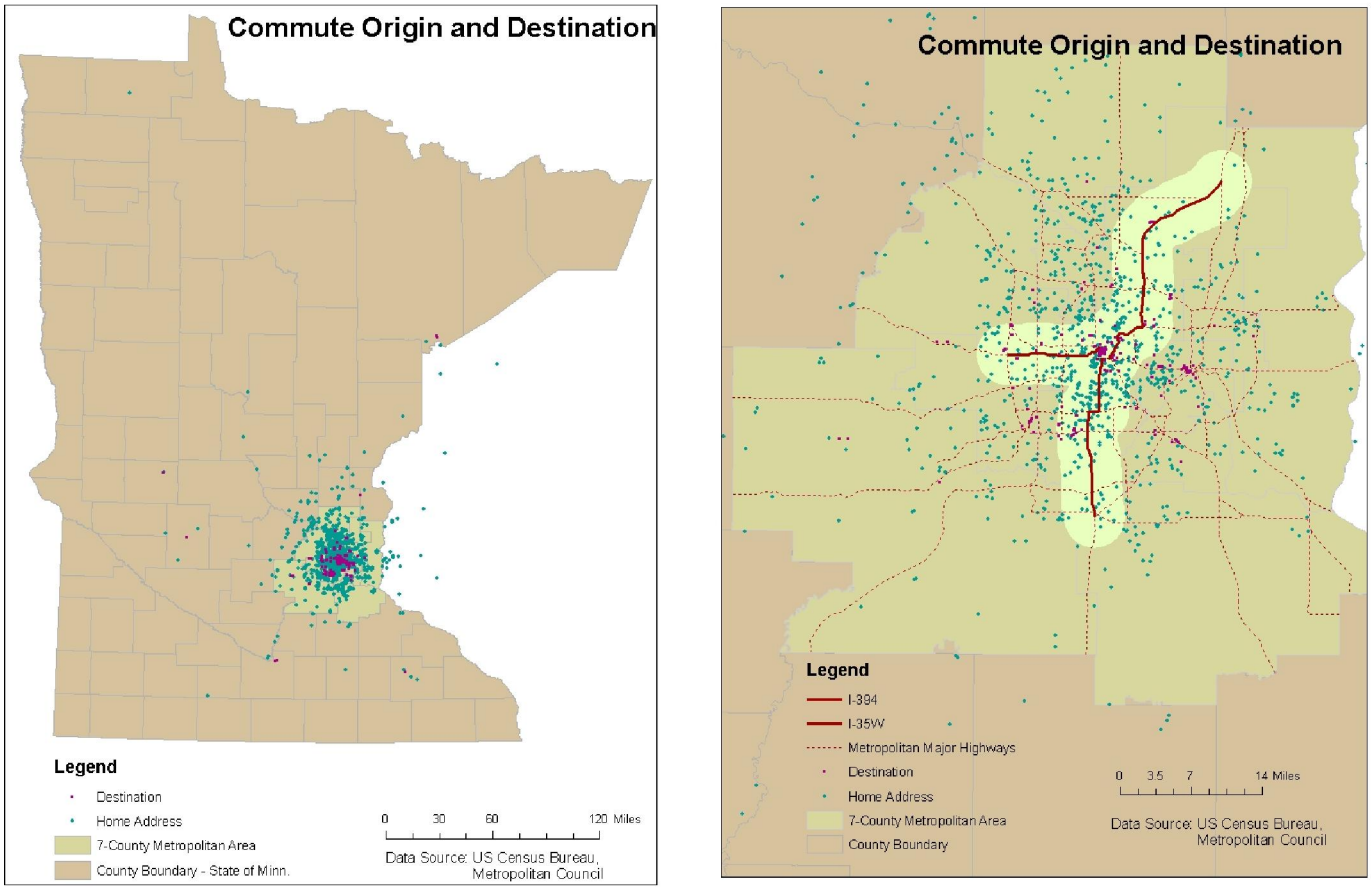
2. Commuting distances and routes

The participants were asked to fill out their home locations and employer addresses upon logging onto the Commute Tool site for the first time. A Google map was generated to show the commute route and the commute distance was calculated accordingly. We set these with a one-way commute distance longer than 100 miles to missing because they were likely to be erroneous numbers. The average one-way commute distance for respondents was around 13 miles.

ArcGIS was used to map out the home locations and destinations of their commute of all participants, as shown below in FIGURE 1-1. The majority of participants lived in or close to the Metropolitan Area. Most of employers' offices were in the city centers, with five outside of the Metro Area. FIGURE 1-2 zoomed into the 7-county Metropolitan area and showed that I-35W and I-394 were the most likely to be used highways connecting participants' homes and offices. 62.6% of all employers' offices were within 3-mile buffer zone of I-35W and I-394.

FIGURE 1-1 Participants' Home Locations and Destinations of Commute.

FIGURE 1-2 Participants' Home Locations and Destinations of Commute – Metro Area.



3. Demographics

The participants were asked immediately after they finished their registration in Commute Tool to fill out a survey about their demographic information. Using responses to those questions and information from the 2006 American Community Survey [1], we were able to see if the participating population was different from the general population in the 13-county metropolitan area or the state of Minnesota and what these differences were.

There was an over-representation of females in our participants. Over 75% of the respondents were working women. This could mean that females have a higher need for teleworking because they were traditionally and are continuously trying to strike a balance between work and life. Working at home or working flexible hours give them more freedom to maintain such balance.

The survey respondents had more vehicles per household comparing to the general population. Close to 30% had 3 vehicles or more available to family members. Therefore, they were more likely to drive and drive alone to work due to the abundance of vehicles at home.

Over half of the survey respondents had a college degree. This was significant higher than the general population (the data for 13-county Metro and the state under Education referred to those over 25-year old). Thus we were looking at a well-educated labor force in this study.

67.64% of all survey respondents were married or partnered. This was again higher than the proportion of that group in the general population. Participants in the eWorkplace were more

likely to have the need of balancing life and work responsibilities and therefore the need of teleworking or working on flexible hours.

Longitudinal Comparison across Surveys

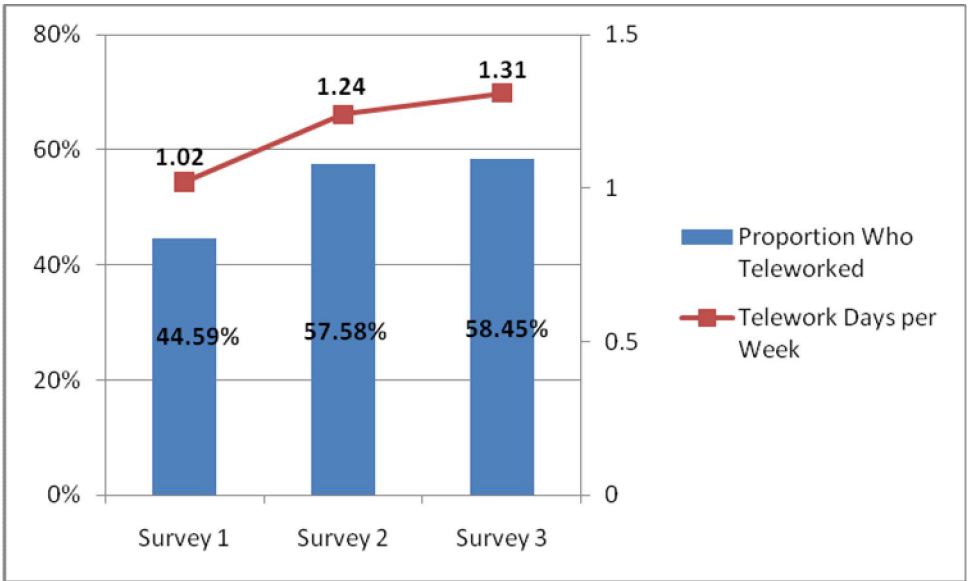
Because participating employers signed up for the project at different time, the date of their employee registration varied. This meant the three surveys were sent out to people in different months. We observed two peaks in early and late winter time. We wanted to know if different registration times had different effect on people's telecommuting choice. Looking at the proportion of participants who teleworked in a given week in each month, we did not see a seasonal pattern, but rather a continuously increasing trend, meaning that people who had been in the program for longer tended to telework more, no matter which month of year they got on board.

For the longitudinal comparison across the surveys, we first took all responses and grouped them into Survey 1 (1 week after registration), Survey 2 (3 months after) and Survey 3 (9 months after) and compared the aggregated result to see if there is a change in behavior or attitude at different points of time upon being enrolled in the project. The findings included:

1. The percentage of respondents who teleworked at least once during the surveyed week and the average number of days per week teleworked increased

The proportion of respondents who teleworked at least once during the surveyed week increased from 44.59% in Survey 1 to 57.58% in Survey 2 to 58.45% in Survey 3. There was also an increase in the average number of days per week teleworked from 1.02 in Survey 1 to 1.24 in Survey 2 to 1.31 in Survey 3 (FIGURE 2). We were able to find this increase statistically significant from Survey 1 to Survey 2 but not from Survey 2 to Survey 3. A learning curve seemed to be present: from getting enrolled to 3 months after registration, participants learned the benefit of teleworking and adjusted their schedule to telework more, but the number of telework days per week did not keep increasing after 3-month till the 9-month cutting point. However, as we will mention later, there was always a gap between the preferred number of telework days and the actual number of days teleworked. Therefore, the fact that we did not see significant difference between Survey 2 and Survey 3 did not mean the number of telework days per week had reached its saturation point. On the contrary, the willingness of participants to telework more still presented, but institutional constraint for employer to allow more telework and the time needed to getting over other barriers were possibly the causes of the pause in the increasing trend.

FIGURE 2 Proportion of Respondents teleworking in a Given Week and Average



Number of Telework Days Per week.

We found that some literature, such as the Minnesota Department of Transportation Omnibus Survey [2], reported the average number of day teleworked per week was roughly 2 days, which was higher than our number above. However, it should be noted which base population was discussed to get the number. Notice that slightly over half of all eWorkplace participants teleworked (defined as teleworked at least one day per week) in a given week. If using only those teleworked in that specific week as the base population, the average number of telework days was 2.25 in Survey 3, very much in alignment with existing literature.

2. Available work hours after teleworking/participating in ROWE

We found a statistically significant change in available work hours from Survey 1 to Survey 3. In Survey 1, 41.10% respondents said their available work hours did not change after participating in the program, but the number dropped to 34.30% in Survey 3 while the percentage of respondents feeling about increased work hours improved from 53.27% to 58.50%.

The two points of comparison listed above used information from all responses, meaning that the population in each survey group varied. Taking only the 191 respondents who filled out all three surveys, we got a panel data set which provided us with a smaller sample but more comparable information. Comparing responses of those 191 people in all three surveys, the two findings still held. Therefore, we had confidence to say that participating in the eWorkplace program caused more people to telework in a given week, increased the average number of days teleworked in that week and improved the available work hours to participants.

FINAL RESULTS: BENEFITS OF TELEWORKING

As shown above, the factors changing from Survey 1 to Survey 2 stabilized from Survey 2 to Survey 3. On one hand, we had good reason to expect the benefit may further increase if the program would have continued and we could have been able to measure participants' behavioral and attitudinal change beyond 9 months; on the other hand, we recognized the learning curve that new participants would be facing, i.e. the benefit at the beginning of their enrollment was not as high as it would be several months later. Taking both sides of the effect into consideration, in the Final Results section, we reported the numbers from Survey 3 (covering all participants who finished all three surveys) and used that to present the benefit of eWorkplace and predict its long-term impact.

Commuting behavior

1. Proportion of participants teleworking in a given week

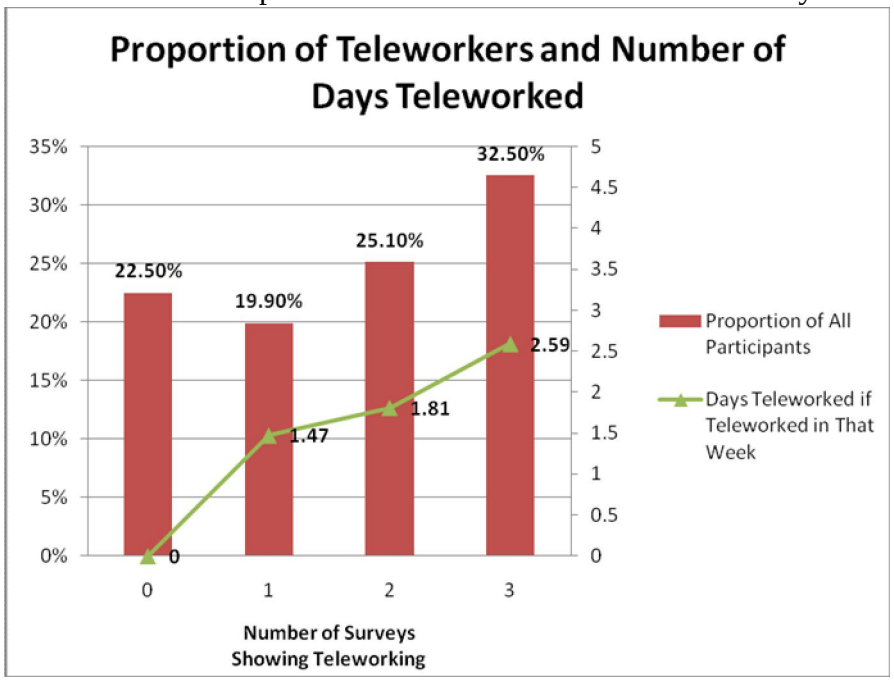
As mentioned in the previous section, there was an increase in the proportion of participants who teleworked at least once in a given week across three surveys. The percent in Survey 3 was 58.45%. We looked at the breakdown number by employers and did not find any pattern in the individual employer's telework rate, nor did participating in ROWE versus traditional telework programs make a difference. The number showed that on average, the participants in eWorkplace, no matter what type of jobs they were working on, teleworked at least once every two weeks.

2. Average number of days per week teleworked

Also as mentioned above, the average number of telework days per week for all eWorkplace participants is 1.31, but, if only looking at those who teleworked in a given week, the number increased to 2.25. We wanted to see 1) if a subgroup of participants continued teleworking while the other teleworked very rarely or 2) if all participants tend to telework intensively in some weeks and worked in the office every day in other weeks.

The data seemed to be in support of both hypotheses. FIGURE 3 below showed that around 22.50% of those who finished all three surveys responded that they didn't telework at all in the week prior to each survey, while 32.5% teleworked at least once in all three weeks. It seemed we had a subgroup of participants continued teleworking and another subgroup rarely teleworked. Furthermore, those who teleworked more often, in terms of number of weeks teleworked, also tended to telework on more days within each week. For those who responded "had teleworked" in all three surveys, the average telework days per week was close to half of the weekdays, while for those who only indicated "had teleworked" in only one survey, the average number of telework days per week was 1.47.

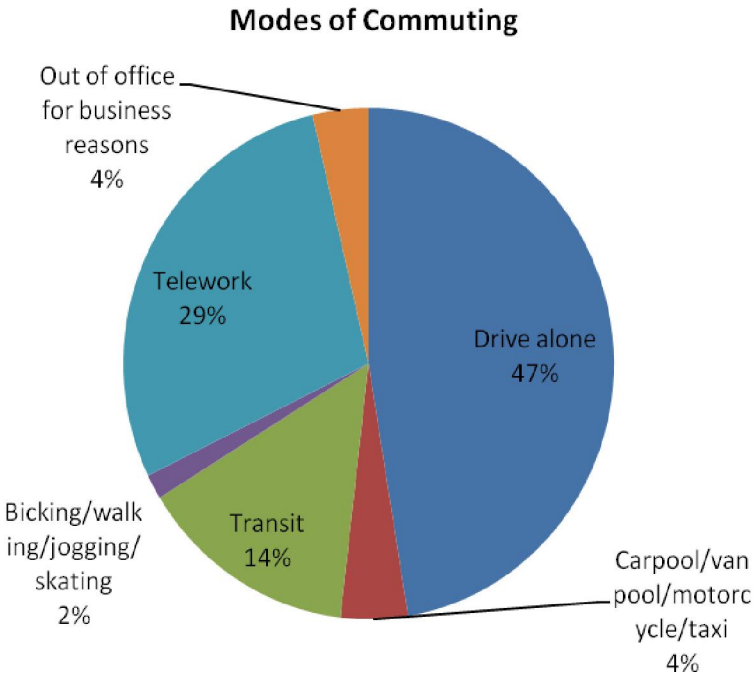
FIGURE 3 Proportion of teleworker s and Number of Days Teleworked.



3. Modes of commuting used and their distribution

FIGURE 4 showed the commuting modes used in the week prior to Survey 3 reported by participants. From the chart we saw that in all workdays, the most common commuting choice was driving alone, taking up 47% of the workdays. Teleworking was the second popular choice, with an percentage higher than that of transit or other modes.

FIGURE 4 Distribution of the Commuting Mode.



4. Highway usage on I-394 and I-35W

35.3% of the respondents stated that they use I-394 and I-35W for commuting. The peak-hour trips made on an office day on these two highways were 0.744 across all respondents, no matter whether they used them at all, while that on a telework day was 0.024. Teleworking helped reducing traffic on these two usually congested highways during the peak hours.

Employee Perception of Telework

1. Optimal number of telework days per week and Available work hours

The average number of telework days per week preferred by respondents "to do their job the best" was 2.29 while the average of actual telework days was 1.31. Thus there was a discrepancy of about 1 day per week and we found such difference statistically significant. This indicated that there was a potential for more telework programs in the future. The intention for teleworking was not a barrier, but rather, other constraints such as organizational rigidity, employers' willingness, technological support, etc. should be targeted at.

One benefit of teleworking that intrigued people might be the increase in available work hours (about 60% felt so) mentioned earlier. Another reason was shown below related to increased productivity.

2. Productivity

67.1% respondents felt their productivity increased when they teleworked/participated in ROWE while only 1.9% feeling there was a decrease. Although we only quantified the estimated productivity and changes in available work hours as the benefits of teleworking, other commonly quoted reasons included cost saving, comfort and convenience, avoiding bad weather, good for environment and fewer interruptions.

Trip Diary Result

1. Proportion taking additional trips on a telework/office day

People did not seem to take more trips during the day just because they teleworked at home. 63% of our respondents reported that they didn't leave home at all while teleworking. This was the same as the proportion of people who did not leave office during the day they worked in the office.

2. Trips saved

Participants reported an average of 0.15 peak-hour trips on a telework day and 2.13 peak-hour trips on an office day. These statistically different average numbers indicated that 1.98 peak-hour trips were reduce by replace traditional office day with teleworking. 0.26 non-peak-hour trips were taken on a telework day across all respondents while the number was 0.25 on an office day. However, the difference was not significant. Therefore, the total trips saved were mainly contributed by the peak-hour trips saved, and averaged to 1.99 trips per day (these two trips were likely to be the round-way commute trips).

3. VMT saved

Since more trips were taken on an office day comparing to a telework day, not surprisingly, a longer distance was travelled on an office day. The average VMT saved by replacing a traditional day in office with teleworking was 27.96 miles per individual per day.

4. I-394 and I-35W usage for additional trips

We did not find more trips taken on highway 394 and 35W on an office day. However, there were more peak-hour trips happening on these two highways on an office day compared to a telework day. About 0.72 peak-hour highway trips were saved per day per person if teleworking, and this saving was statistically significant.

Longer distance was also travelled on these two highways an office day, probably because the commute trips were usually the longest trips people took on a typical weekday. The average distance saved by teleworking that could have been travelled on these two highways was 2.68 miles per person per day.

Benefit summary

In this section, we attempted to estimate the benefits brought about by eWorkplace. From the reduced trips and vehicle miles travelled, we were able to quantify such savings and convert it into dollar value.

1. Peak-hour trip and VMT reduction

Comparing to an ordinary day working in the office, teleworking reduced peak-hour trips by 92.58% and daily VMT by 91.50%, half of which could have been travelled on I-394 and I-35W. Peak-hour trips travelled on I-394 and I-35W for all participants were reduced by 96.67% from teleworking.

2. Annual reductions and savings

Based on the average number of days teleworked of all participants and the average daily reduction per person for all factors of interest, we were able to estimate the annual savings of eWorkplace:

- 7.46 million Vehicle Miles Travelled were reduced by teleworking, which was the total vehicle miles travelled by 678 individuals in one year [3]. Half of these miles would have been travelled on I-35W or I-394.
- 580,000 peak-hour trips were saved, equivalent to about five weekdays' vehicle trips carried by I-394.
- 240,000 trips on I-35W and I-394 were reduced by eWorkplace participants, a significant contribution to congestion mitigation on these two highways.
- Assuming the average commuting speed by driving was 40 mph, each eWorkplace participant saved 44 hours of commuting every year. That was a whole week of working time.
- Based on 1.10 pounds of carbon dioxide emissions per mile traveled [4], eWorkplace participants saved 8.14 million pounds of CO2, equivalent to planting 1,000 acres of trees [5].

3. Dollar amount benefit assessment
   Abundant literature discussed about the benefit of telework, including but not limited to:

- Improvement in emergency responsiveness and continuity of operations [6]
- Office space and operating cost savings
- Reduction of energy consumption and the associated carbon footprint
- Reduction of vehicle tear-and-wear, congestion and commuting time
- Improved employee performance, work morale and employer staffing and retention
- Improved accommodation for persons with disabilities and those with domestic obligations

These benefits could be categorized and understood in different ways. First, they were enjoyed by different parties, including employers, employees, employees' family members, the community and the broader society. Second, they were reflected in different aspects of life, economically, psychologically and socially. In addition, they were intertwined instead of separated. For instance, the improved accommodation for persons with domestic obligations and the time-savings aspect of telework might be important causes of improved employee performance. Last but not least, some of benefits, such as reduction in travelling time, were quantifiable while others, such as productivity increase, could hardly be converted into a number.

All these add to the complexity of conducting a cost-benefit analysis of teleworking. In our study, we focused on the quantifiable trip reduction and VMT reduction and calculated accordingly the vehicle savings, time savings and emission savings. We meanwhile recognized there were other unquantifiable but demonstrated benefits, such as productivity and available work hour increase explained in the previous sections.

The same issues presented in the cost analysis of telework, which included participant recruitment and training, hardware procurement and maintenance, home office set-up, and data collection and evaluation. A prominent feature of cost estimate was that it varied across employers and employees with different job responsibilities. We did not break down the components of eWorkplace cost, but instead used the total project input as a general assessment of such cost.

Minnesota Department of Transportation's instruction on benefit-cost analysis [7] stated several principles for selecting the timeframe for which project benefits were compared and

evaluated, including 1) the timeframe should be long enough to capture the majority of benefits, but not so long as to exceed capabilities to develop good traffic information; 2) it should be consistent with that used for other analysis being undertaken for the project; 3) it should be consistent for all alternatives.

Based on these standards, we decided to use five years as the timeframe for our benefit projection. Unlike typical transportation improvement projects involving infrastructure building, telework projects did not require major construction but rather continuous employer interest and input in such initiatives. eWorkplace recruited, developed telework plan and provided technical consultancy for over 40 employers in the past three years. The depreciation period for hardware such as computers and printers was expected to be around five years and the software such as telework plan, policy as well as management tools could be continuous utilized. The eWorkplace website, an important information hub for the project would be managed for another three years by the professional consultant group. Several TMOs stated that they would continue having telework as a key component of their work and that some employers had showed interest to extend the current project over planned eWorkplace project time. In sum, we deemed the five year time frame consistent with the actual impact of the project and other analysis being conducted.

Table 1-1 showed the summarized program benefits, consisted of vehicle and time savings to the participants and emission savings to the whole community. Table 1-2 separated out the benefits to each individual participant. Based on VMT savings calculated and the 2010 IRS mileage deduction of $ 0.5 per mile, each teleworker saved $886 in fuel and vehicle maintenance cost per year. In addition, based on Mn/DOT Office of Planning and Programming's data on FY 2011 value of travelling time ($13.8 per hour), each eWorkplace participant saved 44 hours of commuting each year. As to the environmental externality of eWorkplace, the Federal Register refers to an estimate of $33 per metric ton of carbon [6]. This means $120,000 worth of carbon emission was saved each year by eWorkplace. This brought the total projected benefit of eWorkplace to $32 million.

Table 1-1 Program Benefit Summary

Program Benefit Summary	Per Week	Per Year	5-Year
Vehicle Savings (miles)	155,407	7,459,521	37,297,603
Value of Vehicle Savings ($)	77,703	3,729,760	18,648,801
Time Savings (hours)	3,885	186,488	932,440
Value of Time Savings ($)	53,615	2,573,535	12,867,673
Emission Savings (pounds)	170,947	8,205,473	41,027,363
Value of Emission Savings ($)	2,518	120,884	604,422
Total	$133,837	$6,424,179	$32,120,896

Table 1-2 Individual Participant Benefit Summary

Participant Benefit Summary	Per Week	Per Year
Vehicle Savings (miles)	36.90	1,771
Value of Vehicle Savings ($)	18.45	886
Time Savings (hour)	0.92	44

Value of Time Savings ($)	12.73	611
Total	$31.18	1,497

As part of the UPA, the State of Minnesota provided $3.2 million to fund eWorkplace. It took about half a year to recover such investment. Mn/DOT Office of Capital Programs and Performance Measures provided in its Benefit-Cost Analysis Standard Value Tables the discount rate for the year of 2009 at 2.9 percent. Using this number, we were able to estimate the present value of program benefit for the starting year of 2009.

$$\text{Present Value of Benefit} = \sum \frac{\text{Annual Benefit}}{(1+\text{Discount Rate})^{\text{Number of Years}}} = \$29.5 \text{ million}$$

Therefore, the Benefit-Cost Ratio was 9.22 ($29.5 million/$3.2 million), which was much larger than 1, meaning eWorkplace was economically justified.

CONCLUSION

The evaluation of eWorkplace showed the positive results generated by teleworking through reduction in peak-period trips taken and vehicle miles travelled. More importantly, these reductions led to three-folded benefits to individual employees, employers and the community at large. Employees reported increased productivity and available hours to work. Productivity boost could obviously transform into benefits for employers and this was actually confirmed by our employer survey results which were not included in this paper (employer reported benefits included higher retention and more work morale). For the community, congestion reduction was a key piece and the main goal of UPA project. Less trips taken on the mostly congested highways in the metropolitan area during the peak period was beneficial to the community economically, socially and environmentally.

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