

TELECOMMUTING AS A BACK-UP IN EMERGENCIES

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1. EXECUTIVE SUMMARY

The Network Reliability Council (NRC) was established by the Federal Communications Commission to provide recommendations concerning network reliability and service issues for the FCC and for the telecommunications industry that, when implemented, will assume optimal reliability of the public telecommunications network. Among the issues selected for study by NRC II at the direction of the FCC was the use of telecommuting as a back-up in emergencies. A Focus Group Team was assembled by the NO REST II Steering Committee to address this issue.

The Focus Group Team prepared an Issue Statement (Appendix A), approved by the NO REST II Steering Committee, which described the work to be completed. The team would collect information and real life examples of telecommuting capability and use in disasters; identify related telecommunication services such as call forwarding, remote call forwarding, and data communication services (e.g., frame relay, SMDS, ATM, ISDN); and package this information in a way that could be easily accessed by all industry participants.

Major findings and conclusions from the comprehensive study of telecommuting include the following:

- A complete failure of the public switched network during large emergency events is very rare and is usually the first infrastructure to be restored.
- Robust telecommunication technology is the critical path in providing telecommuting and the related telecommunication services for day-to-day operations but also for improved reliability in emergencies.
- Telecommuting is usually associated with the flexible work concept and not for effective emergency mitigation. Available telecommunication services used to restore service in emergencies are not promoted as effective ways to mitigate emergencies or disasters.
- Telecommuting programs are much more effective at the time of emergencies when they are put into place in advance of emergencies and become a normal way of doing business.

- Telecommunication services need to be bundled and promoted not only as an alternate way of doing business but as an effective and efficient way of mitigating impacts of emergencies.

2. BACKGROUND

The NRC was established by the Federal Communications Commission in December of 1991 to explore how telecommunication industry cooperation and shared expertise can overcome network reliability problems. To establish a framework for issue identification and study, the NRC established a Steering Committee (NO REST) that was chartered to identify and explore specific areas of study. The initial set of seven focus areas (signaling, fiber cable cuts, digital cross-connect systems, powering, switching, fire and E911 reliability) reflected the analysis of recent outages and their root causes. Mutual aid arrangements, which serve as examples of outage mitigation techniques, were not identified for study in the initial set of focus areas. However, because the FCC wanted to better understand how formal and informal mutual aid and restoration arrangements operate today, the NO REST Steering Committee expanded its study to include mutual aid and restoration agreements. The NRC and NO REST Steering Committee successfully completed all focus area study work and published their findings in the *Network Reliability: Report to the Nation (1993)*.

The FCC chartered NRC II to continue its exploration of ways to mitigate network reliability problems through January 6, 1996. The NRC II and NO REST II identified and explored five specific areas:

- network reliability reporting
- increased network interconnection
- network reliability concerns arising out of new technology
- essential communications during emergencies
- telecommuting as a back-up in emergencies

The NO REST II Steering Committee assembled five Focus Group Teams to address each of the identified study areas. The Focus Group Team for telecommuting as a back-up in emergencies comprised the following members:

- Ross Ireland, Pacific Telesis, Mentor
- Michael D. Caren, Pacific Bell, Focus Team Leader
- Stanley Bryant, MCI
- Joel Kugelmass, University of California Davis Medical Center

- Sandra McCubbin, AT&T Wireless Services
- Dr. Barbara O'Connor, California State University.

The Focus Group Team used a comprehensive search to gather its information. This search included (1) a review of published works and pertinent articles in text and abstracts, (2) case studies, (3) a questionnaire that was sent to the industry to get real world emergency event information, and (4) telephone interviews.

Contributors to the report are listed in Section 10 with major real world examples supplied by Ameritech (Chicago flood), BellSouth (Hugo and Andrew hurricanes), NYNEX (World Trade Center bombing), Pacific Telesis (Loma Prieta and Northridge earthquakes), Southern New England Telephone (hurricane-like storms in New England), and Southwestern Bell (Oklahoma City bombing and southwest floods).

3. INFORMATION, DATA COLLECTION METHODOLOGY, AND ANALYSIS

This diverse industry and telecommunication user Focus Group Team, under the guidance of the NO REST II Steering Committee undertook two major tasks:

- Collect information from the industry of real world examples of telecommuting and related telecommunication services capabilities and use as back-ups in emergencies
- Package the collected information to serve as an information resource about the services that were offered by different telecommunication carriers as effective back-ups in emergencies.

3.1. Definitions of Telecommuting, Telecommuting Centers and Related Telecommunication Services

The following definitions have evolved from (1) the telecommunication technologies supporting the services and (2) the various ways the terms are used in the industry:

- Telecommuting - Working off-site. The process of commuting to the office through a communications link rather than physically (e.g., working at home with a computer, a modem, maybe a facsimile machine, and of course a telephone).
- Telecommuting Center - Centers with telecommuting capability remotely located from the office where people can go in the event of an emergency and communicate with the office.
- Call Forwarding - A service that redirects an incoming call to another destination. It is available in many central offices, and a feature of many PBXs and some hybrid PBX/key systems.

- Remote Call Forwarding - A service offered by telephone companies whereby all calls to a given number (often one serving no line or instrument) are automatically transferred to a different number.
- Frame Relay Switching - A form of packet switching good at efficiently handling high speed, bursty data over wide area networks.
- Switched Megabit (or multi megabit) Data Services (SMDS) - A way for a corporate network to dial up switched data services as fast as 45 megabits per second (mbps).
- Asynchronous Transfer Mode (ATM) - A very high speed data transmission technology. It is a high bandwidth, low-delay, packet-like switching and multiplexing technique.
- Integrated Services Digital Network (ISDN) - A switched network providing end-to-end digital transparency where voice and high data rate data services are provided over the same transmission and switching facilities. One ISDN line can be used to connect as many as eight separate devices, including telephones, computers and fax machines. They can be connected to the same ISDN line and given multiple separate telephone numbers. ISDN allows for and facilitates home-based offices. The current ISDN data rate is 128 kbps.
- Internet - A computer network that joins many government, university, and some private computers together over phone lines (mostly T-1s). Internet traces its origins to a network set up in 1969 by the Department of Defense. For the first time in telecommunication history, high data rates to a diversity of business (large and small) as well as to residence (for telecommuting) have become a part of the “lifestyle” of work; this is largely due to the exploding penetration of the Internet for e-mail, electronic publishing, remote information retrieval, and file transfer. The Internet’s origin as a defense-related system made its design especially resilient to local emergencies due to its multi-nodal character.

3.2 *Review of Published Works*

Utilizing the background and experience of two Focus Team Members, (1) Joel Kugelmass, noted author on Telecommuting and, (2) Dr. Barbara O’Connor, Professor, Communications Studies at California State University, a review of published works was completed. The findings of this effort are as follows:

- Joel Kugelmass writes about the value of telecommuting programs in disaster mitigation in his book titled *Telecommuting: A Managers Guide to Flexible Work Arrangements*

“During California’s major earthquakes in 1990 and 1993 many companies established remote work centers and telecommuting arrangements because arterial damage made commuting untenable for many employees. In the aftermath of the Los Angeles earthquake, the city and Pacific Bell set up a special agency to assist companies trying to use telecommuting to end run transportation chaos. In Florida, employees who lost their homes in the 1993 hurricanes

became telecommuters at the homes of friends and relatives who took them in. Employees at the World Trade Center worked from home and remote offices after the building was bombed and closed for repairs. A Texas newspaper that allowed writers to telecommute burned to the ground in 1992. For months it borrowed presses from another paper and coordinated writers and reporters by telephone; its prior experience with telecommuting helped the work flow smoothly during the crisis.

Studies of the 1990 Loma Prieta earthquake in San Francisco showed that companies who had telecommuting programs in place before the disaster struck were significantly less affected by the commuter crisis it created than those who attempted telecommuting “on the fly” when their staffs could not come to work as normal. This quake forced closure of eleven transportation structures (bridges, overpasses, raised freeways, including the principal connection between the East Bay and the City of San Francisco). Flexible work arrangements, especially telecommuting, thus carry the side benefit that they help prepare for the disruption of work due to disasters such as earthquakes, floods, fires, highway construction, office relocation, epidemic, or civil disorder.”

Following are excerpts from various articles and abstracts included in various databases that underscore the emergence of new technologies and their relationship to disaster response and recovery:

- “The report regarding the making of the national information infrastructure outlines eight areas in which the transmission of high volumes of video, voice, and data is expected to pave the way for new applications. **Telecommuting** and disaster response are two applications listed in the report.” [Castillo]
- “**Telecommuting** can help disaster-proof a business.” [Cuban]
- “One final application for frame relay dial access is worth mentioning: disaster back-up. Dial-up **frame relay** access can be used as a back-up mechanism if a site’s dedicated services fail. In such a situation, users can dial into the frame relay network to connect with other network end points.” [Rosenbaum]
- “In the past year, floods, hurricanes, frigid cold and an earthquake have taken a tragic toll on America, disrupting all aspects of life. But business is business, and work will always need to get done despite Mother Nature. The solution **Telecommuting**” [Cuban]
- “Shortly after a massive earthquake struck Los Angeles last January, Pacific Bell found itself flooded with phone calls. Suddenly a slew of local businesses were interested in **telecommuting**. Within two weeks after the quake, the Company quickly established a telecommuting hotline and fielded more than 2,000 calls.” [Soroan]
- “When the quake hit, our first responsibility was to our customers. We managed a **telecommuting center** and routed calls there. Health Net since has added a second

telecommuting center nearby and plans to add other centers throughout Southern California.” [Dutton]

- “By destroying Los Angeles’ freeways, the recent California earthquake has created an opportunity for companies to test the principles of **telecommuting** in the real world. Now is the time for network users and vendors to work together to make **telecommuting** a viable work style.” [Welch]
- “Vendors such as Ocean Isle Software, Vero Beach, FL., and Digital Communications Associates, Inc., Alpharetta, GA., said they have seen heightened interest in their remote connectivity software since the recent 6.6 temblor rocked the Los Angeles area. A new breed of **telecommuter** has been requesting the software since thousands were forced suddenly on January 17 to consider working from home rather than battle the traffic that was a nightmare even before the 30-second Northridge earthquake struck.” [Mitchell]
- “The January, 1994 earthquake provided the jolt that many California companies needed to try new, innovative work methods to change their corporate cultures. Now the broader use of flextime, **telecommuting**, compressed work-weeks, vanpools and carpools is subtly changing the corporate culture for the better, making it more focused, creative, and results-oriented by enabling managers to concentrate on managing the results rather than the process.” [Dutton]
- “The effects of the January 17, 1994 earthquake in Southern California on business will be felt for months, if not permanently. The magnitude 6.6 quake, centered in the community of Northridge, about 25 miles north-north west of downtown Los Angeles, left at least 50 people dead and more than 5,000 injured. The quake damaged major arteries into the city and caused commuting problems for both businesses and employees. Businesses responded to the commuting problem in various ways, including **telecommuting** technologies, facsimile machines and carpooling.” [Clark]
- “It’s disgraceful that California officials have done so little to insist on **telecommuting** as a vehicle to reduce the negative economic impact of a seismically shattered freeway system. Maybe these bureaucrats thought the traffic would get better after the 6.6 temblor. Similarly it’s disappointing that so few major Southern California companies had **telecommuting** contingency plans ready to go in the after-math of the Northridge earthquake.” [Schrage]
- “It took an earthquake to make Los Angelenos avoid their cars and consider **telecommuting**. Available space in the few pilot suburban **telecommuting centers** — which provide offices, modem hookups, fax machines, and computers — was snapped up by earthquake victims who faced commutes extended by hours. Los Angeles mayor Richard J. Riordan included **telecommuting** in his plan to manage traffic problems caused by the earthquake. Caltrans and other groups have subsidized many **telecommuting centers**, while local telephone companies offered discounts such as free phone-line connection to subscribers requiring new services. AT&T offered complete computer hardware systems, teleconferencing, and fully equipped office space. Government officials pledged to open freeways by year’s end, so it remains to

be seen whether Angelenos abandon their sacred autos for modems.” [Glitman; Abernathy; Bertolucci; Brownstein; and others]

- “The California emergency planning community is now experimenting with the concept of an emergency operation center (E.O.C.) that is decentralized. The ‘Virtual E.O.C.’ is a natural evolution from the centralized ‘war room’ facilities first designed during the 1940’s....**Telecommuting**/telework (work performed away from the central work site or headquarters) is also becoming a common work practice in California, as well as other parts of the United States. The connection of the technology of telecommuting and the virtual E.O.C. is a natural fit.... **Telecommuting** provides new abilities and scope to emergency response organizations through the promise of survivability of an operation, improved data management and access, better recovery schedules, continuity of service, and most of all, continuity of government and culture.” [Tobin]

3.3 *Information Questionnaire*

A questionnaire (Appendix B) was designed and distributed to the telecommunications industry and user communities to identify “real world” examples and experiences, and to obtain documentation of services offered by the providers. The questionnaire asked for the extent of experience with telecommuting and the related telecommunication services, how the services are provided during emergencies, and the users perspectives of reliability.

Three channels were used to distribute the questionnaire:

- The NRC Single Point of Contact List. This list provided approximately 27 telecommunication industry organizations including local exchange carriers, interexchange carriers, other network providers, industry groups, and network user associations and groups.
- The membership list of the TeleCommunications Association (TCA)
- The Office of the Manager, National Communications System (OMNCS).

Ten telecommunication providers returned questionnaires with real world disaster events. The Focus Team’s findings are based on this information, coupled with subsequent polling of a select list of TCA members that expressed knowledge of and/or experience with telecommuting during emergencies. These questionnaires are summarized as follows:

Extent of Experience

- Because of their resiliency and robustness, telecommuting and especially the related telecommunication services are used extensively during emergencies as viable alternatives to damaged community infrastructure particularly as caused by earthquake, fire, floods, etc.

- Because few providers promote telecommuting and related telecommunication services (call forwarding, remote call forwarding, wireless, data communication services) as effective back-ups in emergencies, there is little statistical information about customer activities on these services for such a purpose. However, there is pervasive acknowledgment throughout the industry of direct benefit of technology helping users prepare for the disruption of work and normal daily living patterns due to disasters (i.e., large scale emergencies).
- Most providers do not identify telecommunication services through tariffs or documentation as uniquely beneficial during times of emergency/disaster. One provider, however, recently embarked on this type of approach.

How Services are Provided

- Half of the survey responders said nonrecurring charges were waived for re-establishment of service damaged in an emergency. Some recurring charges were offered without charge for a specific time interval.

Reliability

- Users throughout the industry are aware of related telecommunication services and their value during emergencies, particularly in areas where event(s) have been previously experienced.
- Users who ordered telecommuting and telecommunication services during large scale emergencies retained these services well beyond the immediate emergency response and recovery period (one to several weeks after the event). A survey of 106 telecommuters (total population of 1,283 customers or users) six months after the Northridge Earthquake showed the following:
 - 9 out of 10 telecommuters still telecommute
 - 42% of telecommuters had not considered telecommuting before the earthquake
 - 37% were telecommuting 5 days a week
 - 84% rated their overall telecommuting experience as good or excellent.

4. EXAMPLES OF TELECOMMUTING LEGISLATION, REGULATION, AND PROVIDER TARIFFS

A review of legislative and regulative emergency response activity and providers' current tariffs and procedures show for the most part a gap or void in specifically identifying and encouraging customer use of telecommuting and the related telecommunication services during times of emergency. Rather, provider services such as call-forwarding, remote call-forwarding, data services are everyday tariff offerings and available to users at any time. It is the user (i.e., customer) who identifies the services' application during emergencies. In this sense customers are the proactive party and the providers reactive. This is further exacerbated by a lack of government support in terms of leadership and direction in the use of these services in emergency service planning.

4.1 Legislation and Regulation

The survey response showed there is some national interest in encouraging Telecommuting Public Information Programs. H. R. 1555 (Appendix C) proposes the Federal Government carry out research to identify successful telecommuting programs in the public and private sectors and provide for the dissemination to the public information regarding (1) the establishment of successful telecommuting programs and (2) the benefits and costs of telecommuting.

Also, one state has advanced telecommuting through its legislative process. California's Legislative Counsel's Digest of October 24, 1994, reports the introduction of Senate Bill (SB) 1939. This bill enacts specific telecommuting legislation and requires modification of the Public Utilities Code to encourage telecommuting throughout the entire state.

This bill would require the California Public Utilities Commission (CPUC) to extend special programs for up to a 3-year period to encourage telecommuting in the area of the state affected by the 1994 Northridge earthquake.

It also would require the CPUC to investigate the establishment of special telecommunications programs to encourage telecommuting in the entire state, and report to the legislature its findings and recommendations by December 1, 1995.

The bill reads:

“The people of the State of California do enact as follows:

SECTION 1. Section 739.9 is added to the Public Utilities Code, to read:

739.9. The commission shall extend special programs for up to a three-year period, requested by telephone corporations, and found by the commission to be reasonable, to encourage telecommuting in the area of the state where transportation systems have been damaged and disrupted by the Northridge earthquake of 1994. The commission shall also initiate an investigation into the establishment of special telecommunications programs to encourage telecommuting in the entire state, and shall report to the Legislature its findings and recommendations by December 1, 1995.”

On the negative side, one contributor to this report brought to our attention that a large municipality, Chicago, had a city ordinance banning all home-based work (Telecommuting). The ban was recently repealed as of June 1, 1995. A new ordinance maintains various restrictions governing the types of businesses that can be operated from home, however, telecommuting employees will not be required to apply for home business licenses.

4.2 Provider Tariffs and Procedures

Local exchange providers have tariffs on all telecommunication services such as call-forwarding, remote call-forwarding, and the various data communication services, e.g., ISDN. The tariffs are not uniquely identified for use during emergencies. These services are everyday tariff offerings. Customers may take advantage of them for emergency purposes on request. There are currently no tariffs on telecommuting service nor specific methods and procedures, that outline how telecommuting is to be enacted during an emergency. One local exchange carrier, Pacific Bell, has broken new regulatory ground with the Loma Prieta and Northridge earthquake events. The CPUC passed a resolution requested by Pacific Bell to implement certain measures to assist in implementing telecommuting centers in Los Angeles (Appendix D).

Although tariffs, methods, and procedures do not uniquely identify these services for use during emergencies nor describe how they are enacted, write ups from “provider” contributors to this report tell us that nonrecurring charges are usually waived for re-establishment of service damaged in an emergency and some carriers waive for a specific time interval recurring charges (Appendices E and F). At Pacific Bell, waiver requests (i.e., Advice Letters) are based on one tariff called a “disaster tariff” (Appendix G). This tariff authorizes the waiver of installation charges for the re-establishment of service in the same or different location where there has been damage to premises or customer provided equipment.

5. USERS’ PERSPECTIVE OF TELECOMMUNICATION SERVICES IN EMERGENCIES

Major emergency events show that a complete failure of telecommunication systems is very rare and when those systems fail they are usually the first infrastructure restored. What usually occurs is network congestion because of extreme call volumes into and within the damaged area(s). Call volumes during the first day of the two California earthquake events exceeded 200 percent of normal for example. By the end of day 2, call volumes had nearly returned to normal levels. Affected local exchange carriers and interexchange carriers successfully work as a team to mitigate the call volume problem.

Access to telecommunications service is paramount following a disastrous event. Analysis of past major events show catastrophic impacts to communities and their infrastructure. Transportation access can be significantly impaired for long periods of time requiring dramatic adjustments to normal lifestyles that can threaten the political, social and economic foundation of affected communities. For this reason it is important that carriers (i.e., telecommunication services providers) have well-developed emergency planning and response programs including a number of alternate or back-up capabilities.

5.1 Definition of Emergency

The definition of what constitutes an “emergency” has common elements in both public and private sectors. The definition can be set forth as:

“A catastrophic event resulting in serious disruption of services that exceeds the response capability and resources within the damaged area to restore services in a timely fashion.”

The common elements include serious disruption of services, a response capability lacking adequate response resources, and a delayed restoral period.

Telecommunication services can and often do allow for more normal lifestyles during catastrophic events. Telecommuting and the related telecommunication services listed in 3.1 mitigate the disruption and also help neutralize the insufficient resource and prolonged restoration issues.

Two case studies clearly register the positive perceptions of users in both sectors.

5.2 Survey of Telecommuters After Northridge Earthquake (Appendix H)

On January 17, 1994, Los Angeles experienced a 6.7 magnitude earthquake. Sections of several main freeways were destroyed and were expected to remain under repair for up to a year. In response, Pacific Bell offered a comprehensive telecommuting relief package for businesses and residents in the area who faced months of traffic delays.

For a 2-month period, Pacific Bell customers in the 213, 310, 714, 805, 818, and 909 area codes were offered free installation of services that facilitate telecommuting. Included in the offering were business access lines, Centrex service, Ctx-IS, SDS-IS, Custom Calling Features, , 800 Service (included a \$100 usage credit), SDS-56, and ADN (Advanced Digital Network. ADN is Pacific Bell's leased 56-kbps digital service available for intra-lata calls). In addition, Pacific Bell loaned modems and terminal adapters to small businesses establishing telecommuting programs.

The main objectives of follow-up research were to determine the following:

- How effective was the telecommuting relief offer?
- What were the perceptions of the telecommuters?

A total population of 1,283 telecommuters ordered this capability during the event. A sample of 660 were queried 6 months after the event. The summary of major findings is as follows:

- 93% of telecommuters were still telecommuting
- 84% rated their overall telecommuting experience as good or excellent

5.3 Travel Behavior Impact of Telecommuting Following The San Francisco Earthquake: A Case Study (Appendix I)

A severe earthquake in the San Francisco Bay area offered an unexpected opportunity to study the relation between telecommuting and travel behavior under emergency conditions. Coincidentally, the state agency with the highest participation in a state telecommuting pilot project was located in San Francisco. Interviews with pilot telecommuters, post-earthquake telecommuters and managers in the CPUC revealed telecommuting as a flexible response to a transportation emergency that could be expanded without delay because it was already a known and accepted work mode of that institution. The experience of the CPUC suggests that increased telecommuting can help minimize work disruption within an organization that has previously implemented telecommuting. Those persons already telecommuting before the emergency increased their number of telecommuting days only temporarily, if at all; new telecommuters were added, nearly half of whom continued to telecommute months after the emergency was over. Thus a short-term modification of behavior stimulated by emergency conditions led to long-term changes in travel behavior. Semi-structured telephone interviews were used to elicit the detail of personal attitudes and perceptions about telecommuting. The interviews were begun December

18, 1989, 2 months after the earthquake (1 month after the Bay Bridge reopened) and completed April 20, 1990, 6 months following the emergency.

Telecommuters were questioned about their telecommuting pattern before, immediately after, and 2 to 6 months following the earthquake, their job title and branch, and where they lived. They were asked to describe their home office work place, how it was equipped and whether they had adapted it for telecommuting. Finally, they were asked whether they felt they were more productive when they worked at home and, if so, in what ways. Managers of telecommuters were asked the size of their groups, the names of telecommuters they supervised, and if they telecommuted themselves. They were then asked to recall the memoranda or briefings they received on handling the emergency, the means they used to offer these options to their groups, and the names of those who chose telecommuting. They were questioned about their selection criteria for post-earthquake telecommuters, and any observed differences between them and pilot telecommuters. They were asked if they planned to continue telecommuting within their group indefinitely. Managers and coworkers also were asked about other people in their groups who were telecommuting before, immediately after, and months following the earthquake.

The conclusion reached in this case study was simply that telecommuting is a primary vehicle for mitigating travel problems created in emergencies.

Because the CPUC was prepared with a tested telecommuting plan in operation, managers were able to quickly and smoothly add telecommuters during the emergency. Managers and staff knew what telecommuting was and how it worked. Telecommuting reduced stress because employees did not have to change their travel times or become subjected to long commutes on overcrowded roadways and public transit systems. Work disruption at the CPUC was minimized.

6. CONCLUSIONS AND RECOMMENDATIONS

Research of major emergencies experienced by several major telecommunication carriers clearly shows that the public switched network technologies are very robust and resilient to catastrophic impacts of disasters. As previously reported, complete failure of telecommunications systems is rare and when those systems fail they are usually the first infrastructure restored.

In the World Trade Center bombing, NYNEX's telecommunication services did not fail. In this case other suppliers of services were less fortunate and NYNEX was able to work with them to restore many circuits, thereby lessening impact on customers. In addition, some customers had other work locations in the New York City metropolitan area and since NYNEX's switches were still functioning, NYNEX's customers made extensive use of call forwarding capabilities.

Similarly, in Florida during Hurricanes Hugo and Andrew, BellSouth provided call forwarding and remote call forwarding to its customers disrupted by these two major natural disasters.

Southwestern Bell also provided telecommuting, call forwarding and remote call forwarding to its customers during the 1993 floods in Kansas and western Missouri and again during the recent 1995 floods.

Pacific Bell's and GTE's public switched networks remained in tact and performed well during the Loma Prieta and Northridge earthquakes. Telecommuters and the related telecommunication services of call forwarding and remote call forwarding were used extensively by their customers and employees.

Ameritech assisted its customers with service alternatives in several ways during the Chicago floods where businesses were either flooded or people were not allowed into buildings that were in jeopardy.

- Thousands of small businesses had variable call forwarding (VCF) placed on their lines.
- Approximately 1,000 larger multi-line businesses had remote call forwarding (RCF) added to their lines.
- There was a considerable demand for wireless services, many of which were provided to city officials and emergency agencies involved in the emergency operations.
- Ameritech and alternative providers such as Centrex resellers found a market in providing Centrex services to some companies that found temporary quarters. Ameritech processed the service orders issued by the Centrex resellers as well as their own. Chicago City Hall was completely relocated due to the flood and was provided over 600 Centrex lines over night.

These real world examples of telecommuting and the related telecommunication services provided by these major telecommunication carriers and supported by the research of published works and case studies affirm the growing use and reliability of these services during major emergencies.

However, up to this time telecommuting and the related telecommunication services addressed have been that "side benefit" of helping to prepare or mitigate the disruption of work and normal daily living patterns due to disasters. These services are not yet at the forefront of the industry's emergency preparedness and disaster response programs. One survey respondent points out that the magnitude of the emergencies in the area his company serves "is not as significant as that of the coastal areas. Incidents are generally of a short duration, precluding most alternative methods of providing service."

Experienced in the "real world" as excellent disaster mitigation tools, telecommuting and the related telecommunication services must be actively promoted as effective and reliable alternatives or back-ups in emergencies. Furthermore, they should be proactively marketed and promoted as keys to any emergency contingency plan, business or individual.

The Focus Group Team has identified seven key findings from its study of this issue and makes a specific recommendation for each:

Finding 1: Telecommuting programs and related telecommunication services that are in place prior to the emergency or disaster are much more effective than those established at the time of disaster.

Recommendation: Users (business and residential) of telecommunication services who require reliability of these services during times of emergency need to consider putting in place a telecommunications platform for use in nonemergencies so it is immediately available for use during times of emergency.

Finding 2: Most telecommunication providers do not package telecommuting and related telecommunication services in tariffs and associated documentation as uniquely beneficial at times of disasters.

Recommendation: Providers should package these services in a comprehensive disaster recovery tariff and clearly document with methods, procedures and guidelines how they are provided.

Finding 3: Available telecommunication services are not advertised prior to disasters as effective ways to mitigate emergencies or disasters.

Recommendation: Once packaged as recommended for Finding #2, companies should advertise the effectiveness of these services for disaster mitigation.

Finding 4: Telecommuting and the related telecommunication services are not widely promoted at times of emergency.

Recommendation: Telecommuting and the related telecommunication services should be widely promoted at times of emergency as well as before the occurrence of catastrophic events.

Finding 5: Major emergencies show complete failures of the telecommunications system are rare and when they do fail they are usually the first to be restored.

Recommendation: People should do their primary disaster planning in advance assuming the survivability and reliability of the public switched network rather than building and/or developing alternatives.

Finding 6: Telecommunication is the primary vehicle for mitigating travel problems created by emergencies or disasters.

Recommendation: People who are located in areas subject to natural disasters more than others should definitely consider telecommuting because it is the best way to mitigate travel problems.

Finding 7: Some municipalities may have established regulations that restrict telecommuting in their jurisdiction. These restrictions will limit the use of telecommuting as a way of mitigating the effect of disasters and network outages to these areas.

Recommendation: The NRC recommends that the FCC identify and take action to work with municipalities to remove these restrictions.

7.

ACKNOWLEDGMENTS

NO REST II Steering Committee:

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9.

BIOGRAPHIES

(Focus Group Team)

Stan Bryant is Director of Network Administration for MCI Telecommunications Corporation. Mr. Bryant is responsible for planning, implementation, and management of network interconnections between MCI and local exchange carriers throughout the country.

Mr. Bryant joined MCI in 1975 and has served in a number of Network Administration and Operations positions. In 1991 he became Director of Network Administration. His responsibilities include Access Management, Access Provisioning/Database Management and West Area Project Engineering and Installation.

Michael Caren is the Director of the Emergency Preparedness and Disaster Response Plan for Pacific Bell. Mike joined Pacific Telephone and Telegraph in 1962 after graduation from the University of Notre Dame in Indiana. He has served in various Operations, Marketing and Financial positions during his career. He was assigned his current Emergency Preparedness responsibilities in April, 1988. Among his accomplishments in the Emergency Preparedness field was the establishment of Pacific Bell's Emergency Management Organization Structure. This structure links with the State of California Office of Emergency Services and Bellcore for National Security when responding to disasters. His work in the Emergency Preparedness field resulted in Pacific Bell receiving special recognition from the Governor of the State of California as well as special recognition from the California Public Utilities Commission commending Pacific Bell for extraordinary response to the Loma Prieta Earthquake on October 17, 1989. Mr. Caren is actively involved with the State of California Office of Emergency Services and the California Utilities Emergency Association, a consortium of publicly and privately owned utilities which acts in support of the State Office of Emergency Services in Emergency Planning and Response. He recently played a major role in developing the Emergency Management Organization Structure for the utilities and in drafting the Utilities' Emergency Plan for the State of California. He lives in the San Francisco Bay Area.

Joel Kugelmass is an Analyst for the University of California Davis Medical Center and writer and consultant in telecommunications, social policy, and organizational development. He recently authored "Telecommuting: A Manager's Guide to Flexible Work Arrangements." (New York: Lexington Press). He lives in Mendocino, California.

Sandra McCubbin is Director of External Affairs for AT&T Wireless Services for the California, Nevada, Hawaii Region. Her previous employment was Deputy Director of the California Public Utilities Commission. She has a Bachelor's Degree from the University of Wisconsin, Madison, and a Master's Degree from the University of California Davis.

Dr. Barbara O'Connor is a nationally recognized expert in the fields of political communication and telecommunications policy. She is the author of numerous publications in both of these areas and recently completed her eight and final year of service, by appointment of the California Legislature, as chair of the California Educational Technology Committee. The committee has an annual budget of over \$16 million and is charged with infusing technology in California's K-12 schools. She is also serving for the 5th year as the elected chair of the Alliance for Public Technology, a Washington, D.C., non-profit organization devoted to building constituencies on information age issues. She is the former chair of the California Public Broadcasting Commission and founder of KXPR-FM, Sacramento's Public Radio Station. Recently, Dr. O'Connor was appointed by the FCC to represent consumers on the Network Reliability Council and was recently appointed as one of eleven persons to Bellcore's Advisory Board.

Dr. O'Connor has served as an expert consultant to McClatchy Newspapers, the Boston Globe Media Properties, the Tribune Company, the Washington Bureau of the Associated Press, the California Legislature, the Congress of the United States, the Federal Communications Commission, National Public Radio, Time Inc. Cable Systems, Cablevision Systems Inc., Scripps Howard Cable, Pacific Bell, NYNEX, Ameritech, Pacific Gas and Electric, the State Bar of California, the Soviet/American Journalists' Exchange Program, and Stentor Communications of Canada. Dr. O'Connor received her Ph.D. in Communications from the University of Southern California in 1974.

10.

LIST OF CONTRIBUTORS

Ameritech (Joseph Baranek, Barbara Kemp, Sandy Brooks)

AT&T (Luiz Vitoria)

BellSouth (Archie McCain)

GTE (Michelle Amador)

MCI (Donna Giammona)

NCS (Colonel Walter L. McKnight)

Nynex (Dan Hochvert)

Pacific Telesis (Scott Grago, Julie Dodd-Thomas)

Southern New England Telephone (Bill Black)

Southwestern Bell (Elizabeth Ham)

Sprint (Dennis Schnack)

State of Washington Emergency Management (Robert Oenning)

TAO Services (Rick Tobin)

Telecommunications Association (Naomi Adams-Ritz)

11.

APPENDICES

- Appendix A Issue Statement
- Appendix B Telecommuting As A Back Up In Emergencies Questionnaire
- Appendix C H.R. 1555 Extract
- Appendix D Public Utilities Commission of the State of California Resolution T15519 approving Pacific Bell's request to implement certain measures to assist in implementing Telecommuting Centers in Los Angeles.
- Appendix E Pacific Bell Letter to the California State Public Utilities Commission Advisory and Compliance Division requesting authorization to waive non-recurring and recurring charges for telecommunication needs of the victims of the Southern California Firestorm.
- Appendix F Pacific Bell Advice Letter to the State of California Public Utilities Commission requesting waiver of non-recurring charges for services in order to encourage telecommuting.
- Appendix G Pacific Bell Tariff 2.1.24 Rule No. 24 - Re-establishment of Service Due To Fire and Natural Disasters Such As Earthquakes or Floods.
- Appendix H Pacific Bell Survey of Telecommuters After Northridge Earthquake.
- Appendix I Travel Behavior Impact of Telecommuting Following the San Francisco Earthquake: A Case Study.

Appendix A

NETWORK RELIABILITY COUNCIL

ISSUE STATEMENT

Issue Title: Telecommuting As Back-Up In Disasters

Author: Mike Caren
Pacific Bell

Problem Statement/Issues to be Addressed

Access to telecommunication service is paramount following a disastrous event such as an earthquake, hurricane, flood. Analysis of past major events show catastrophic impacts to communities and community infrastructure. Transportation access can be significantly impaired for long periods of time requiring dramatic adjustments to normal lifestyles that can threaten the political, social and economic foundation of impacted communities. Lifeline services, and in particular telecommunications service, are vital to the communities' viability. Therefore, it is important to understand how telecommunications services can back-up or provide alternatives to the public (both residential and business) in impacted communities when vital infrastructure is significantly impaired, particularly for long periods of time.

Area of Concern/Problem Quantification

History has shown that telecommunication services can be a positive alternative particularly for extended outage situations such as earthquake, fire, floods, etc. For example, telecommunication services such as call forwarding, remote call forwarding, and voice mail are routinely provided to damage impact areas. These services were provided free for periods of time to the public who lost homes and businesses in the Loma Prieta Earthquake of 1989, the Oakland Fire of 1991, Hurricanes Hugo (1989) and Andrew (1992), the Northridge Earthquake of 1994, and the Northern California Floods of 1995. Another service, telecommuting, also proved to be an effective alternative in the Los Angeles Northridge Earthquake.

We should take a broad view of telecommuting including alternative network access such as cellular service, 1 OXXX dialing, and alternative local exchange services. During disastrous events telecommuting service can also be more valuable as the result of partnering or utilizing it with other telecommunication services such as voice mail, call forwarding, remote call forwarding, etc.

Description of Proposed Work

The team working this issue will collect information from the industry on real world examples of telecommuting use in disasters and how this capability has been used effectively during times of emergency. The following areas will be considered:

- The use of telecommuting services
- The reliability of telecommuting services during outages
- Telecommuting hoteling which provides locations where people can go to in the event of an emergency and telecommute
- List the use of telecommunication services to enhance the telecommuting experience
 - data communication services (i.e. frame relay, S.M.D.S., A.T.M., I.S.D.N., etc.)
 - call forwarding, remote call forwarding
 - voice mail
- Alternative telecommunication options
 - 10XXX dialing
 - wireless
 - alternate local exchange services

The team will package this information in a way that it can be made available and easily read by all industry participants. This will serve as a compendium of services offered by different telecommunication carriers.

Appendix B

TELECOMMUTING AS A BACK-UP IN EMERGENCIES

QUESTIONNAIRE

The best way to answer this questionnaire is to complete one for each individual event experienced. Please provide the name of the event:

- 1 . Using the following list indicate the extent of experience with the use of Telecommuting/Telecommuting Hoteling services during the times of emergency (i.e. a catastrophic event resulting in serious disruption of telecommunication service that exceed the response capability & resources within the damaged area to restore service in a timely fashion) Place check marks where applicable:

	YES	NO
Provider of Telecommuting Service		
To Business	_____	_____
To Residence	_____	_____
User of Telecommuting Service		
Business	_____	_____
Residence	_____	_____
Telecommuting Hoteling*		
Provided Service	_____	_____
Used Service	_____	_____

- Hoteling means providing locations where people can go to in the event of an emergency and telecommute.

2. If a Provider, what was the approximate number of customers who ordered and used the service because of the emergency?

	<u>Telecommuting</u> # Customers	<u>Telecommuting Hoteling</u> # Customers
Business	_____	_____
Residence	_____	_____
Total	_____	_____

3. What percent are these customers to the total customer base?

	<u>Telecommuting</u>	<u>Telecommuting Hot</u>
	%	%
Business	_____	_____
Residence	_____	_____
Total	_____	_____

4. Subsequent to the emergency response and recovery did you solicit from the Telecommuting/Telecommuting Service Hoteling user satisfaction perception of the reliability of the Service(s) during emergencies?

YES _____ NO _____

If you said NO please go the Question #8.

5. If users were solicited what type of satisfaction survey methodology was used to determine reliability perceptions? Please check all used.

Survey	<u>Telecommuting</u>	<u>Telecommuting Hoteling</u>
Telephone	_____	_____
Mail	_____	_____
Focus Interview	_____	_____
Other	_____	_____

If Other is checked please describe methodology used and provide examples.

6. If surveys were used, please indicate the level of perceived reliability by users:

	<u>Telecommuting</u>	<u>Telecommuting Hoteling</u>
Very Satisfied	_____	_____
Somewhat Satisfied	_____	_____
Neither Satisfied or Dissatisfied	_____	_____
Somewhat Dissatisfied	_____	_____

Please describe the above rating:

Telecommuting Hoteling

7. Of the # of users provided Telecommuting/Telecommuting Hoteling Service during emergencies, please provide approximate percent stick rate for the service provided (stick means users who retained the service after the emergency was over).

	<u>Telecommuting</u> (days)	<u>Telecommuting Hoteling</u> (days)
	<u>30</u> <u>60</u> <u>90</u> <u>90+</u>	<u>30</u> <u>60</u> <u>90</u> <u>90+</u>
90-100%		
80-90%		
70-80%		
60-70%		
50-60%		
Less than 50%		
0%		

8. Please describe the technical impacts of the emergency(ies) on Telecommuting Service and/or Telecommuting Hoteling Service (i.e. Service affected by facility outages, call congestion impacts on dial tone, etc.) in the space provided below.

9. Using the following lists indicate the extent of experience with the use of these other telecommunication services during times of emergency: Place check marks as appropriate

<u>YES</u>		<u>NO</u>
Customers	% Total	
	Cust. Base	

* Call Forwarding
 Provider of Service
 To Business(es) _____
 To Residence(s) _____

User of Service
 To Business(es) _____
 To Residence(s) _____

* Remote Call Forwarding
 Provider of Service
 To Business(es) _____
 To Residence(s) _____

User of Service
 To Business(es) _____
 To Residence(s) _____

* Voice Mail
 Provider of Service
 To Business(es) _____
 To Residence(s) _____

User of Service
 To Business(es) _____
 To Residence(s) _____

* Data Communications Services
 Provider of Service
 To Business(es) _____
 To Residence(s) _____

User of Service
 To Business(es) _____
 To Residence(s) _____

10. If a Provider of Data Communications Services during emergencies, briefly describe how each of the following was used:

Frame Relay - _____

S. M. D. S. - _____

A.T.M. - _____

I.S.D.N. - _____

11. Subsequent to the emergency response and recovery did you solicit from the "Other Telecommunication Service" user satisfaction perception of reliability during emergencies? YES _____ NO _____
12. If users were solicited, what type of survey satisfaction methodology was used to determine reliability perceptions? Please check all used.

Survey

Telephone Mail _____
Focus Interview _____
Other _____

If Other is checked please describe methodology used and provide examples.

13. If surveys were used, please indicate the level of perceived reliability by users:

	<u>Call Fwding</u>	<u>Remote Call Fwding</u>	<u>Voice Mail</u>	<u>Data Com Svcs.</u>
Very Satisfied	_____	_____	_____	_____
Somewhat Satisfied	_____	_____	_____	_____
Neither Satisfied or Dissatisfied	_____	_____	_____	_____
Somewhat Dissatisfied	_____	_____	_____	_____
Very Dissatisfied	_____	_____	_____	_____

14. Using the following matrix, please indicate how the following services are provided during emergencies: Please check mark all applicable.

<u>Type of Service</u>	<u>Free Usage</u>	<u>Charge to Customer</u>	<u>Partner w/Other Carriers</u>	<u>Other</u>
Telecommuting				
Telecomm. Hoteling				
Call Forwarding				
Remote Call Fwd.				
Voice Mail				
Data Comm- Svcs-				

If Other is checked, please describe in space provided below:

15. Please describe the technical impacts of the emergency(ies) on these Telecommunication Services during emergencies (i.e. Services affected by facility outages, call congestion impacts on dial tone, etc.) in the space provided below,

16. Using the following matrix, please indicate any unique ways these Services are provided during emergencies:

	Provider Owned Site-5 (e.g. Central Offices & <u>Admin. Bldg. Space</u> <u>Sites</u>	<u>Leased</u>	Standby	<u>Sites</u>
	<u>Other</u>			
Telecommuting				
Telecomm. Hoteling				
Call Forwarding				
Remote Call Fwd.				
Voice Mail				
Data Comm. Svcs.				

If other is checked, please describe in space provided below:

17. To what extent were any of the following alternate telecommunication options provided/used during emergencies

(See Notes on following page)

	Extent				
	Great	Moderate	Little	None	Don't Know
- 10XXX Dialing					
- Wireless					
- Alternate Local Exchange Services					

- Other

If you marked Other, please describe:

Notes: 1 OXXX dialing means access to another interexchange carrier when one's I.E.C. is unavailable during an emergency for any reason.

Wireless means cellular, radio or otherwise alternate to wire capability.

Alternate Local Exchange Services means local service provided where local multiple carrier choice is available because of local area competition.

18. Please quantify extent of provision/use below: (# of users who took advantage of alternate telecommunications options during emergencies)

1 OXXX Dialing	_____
Wireless	_____
Alternate Local Exchange Service	_____
Other	_____
Totals	_____

19. Provide below user perception of Alternate Telecommunications Options reliability:

Users

Very Reliable	Somewhat Reliable	Somewhat Unreliable	Very Unreliable	Totals
---------------	-------------------	---------------------	-----------------	--------

1 OXXX

Wireless

Alternate Local Exchange Service

Other

20. Additional Comments

Appendix C

H. R. 1555 EXTRACT

Appendix C

FROM H.R. 1555
(Proposed Federal Legislation)

SEC. 113 TELECOMMUTING PUBLIC INFORMATION PROGRAM

(a) TELECOMMUTING RESEARCH PROGRAMS AND

PUBLIC INFORMATION DISSEMINATION - The Assistant Secretary of

Commerce for Communications and Information , in consultation with the Secretary of Transportation, the Secretary of Labor, and the Administrator of the Environmental Protection Agency, shall, within three months of the date of enactment of this Act, carry out research to identify successful

telecommuting programs in the public and private sectors and provide for the dissemination to the public of information regarding -

- (1) the establishment of successful telecommuting programs; and
- (2) the benefits and costs of telecommuting.

(b) Report - Within one year of the date of enactment of this Act,

the Assistant Secretary of Commerce for Communication and Information shall report to Congress the findings, conclusions, and recommendations regarding telecommuting developed under this section.

Appendix D

**PUBLIC UTILITIES COMMISSION OF THE STATE OF
CALIFORNIA RESOLUTION T-15519 APPROVING
PACIFIC BELL'S REQUEST TO IMPLEMENT CERTAIN
MEASURES TO ASSIST IN IMPLEMENTING TELECOMMUTING
CENTERS IN LOS ANGELES**

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA
COMMISSION ADVISORY AND COMPLIANCE DIVISION- RESOLUTION T-15519
Telecommunications Branch March 16, 1994

RESOLUTION

RESOLUTION T-15519. REQUEST BY PACIFIC BELL (U-1001-C) TO
IMPLEMENT CERTAIN MEASURES TO ASSIST IN IMPLEMENTING
TELECOMMUTING CENTERS IN LOS ANGELES.

BY ADVICE LETTER NO. 16907, FILED ON FEBRUARY 81 1994, SUPPLEMENT
NO. 16907A, FILED ON FEBRUARY 16, 1994

SUMMARY

On February 8, 1994, Pacific Bell (Pacific) filed Advice Letter (AL) No. 16907 requesting a six-month waiver for installation charges for customers who install services in new or existing telecommuting centers. This waiver will be applicable to telecommuting centers in areas affected by the Los Angeles Earthquake. This Resolution grants Pacific's request.

BACKGROUND

.Advice Letter No. 16907, filed February 8, 1994, requests a six-month waiver of the installation charges for any of the services listed below installed in new telecommuting centers established in the areas affected by the Los Angeles earthquake. This waiver would apply to new telecommuting centers in the 213, 310, 714, 805, 818 and 909 areas. The waiver applies to services order by new telecommuting centers within 30 days of the beginning of their operation. The requested waiver is for the installation charges for the following services:

Centrex Lines, ISDN lines, Switched 56 Service, PBX trunks,
Business Lines (IMBs), Call Waiting, Three-Way Calling,
Call Forwarding, Voice Mail Services, 800 Service, and ADN
Service

The advice letter also requests a 30 day waiver for-the installation charges of these same services for existing telecommuting centers in the Los Angeles areas as defined above.

Pacific states in its filing that it will incur administrative expenses associated with managing this plan. It will also forgo certain revenues that otherwise would have been generated. Pacific states it does not intend to seek compensation from the

Resolution T-15519
Pacific Bell/16907/JOG

March 16, 1994

California Public Utilities Commission to recover these-foregone revenues.

On February 15, 1994, Pacific filed Advice Letter No. 16907A requesting that the Call Waiting, Call Forwarding, and Three-Way Calling services be removed from AL No. 16907. This supplement noted that these services are being removed because on February 22, 1994, Pacific will begin a promotional campaign discounting the installation charges on all Custom Calling Services by 50% for all Pacific Bell customers.

PROTESTS

Pacific has mailed a copy of Advice Letter Nos. 16907 and 16907A to competing and adjacent utilities and/or other utilities, and interested parties, as requested. Notice of AL No. 16907 and AL No. 16907A were published in the Commission Calendar on February 11, 1994, and February 18, 1994, respectively. The Commission Advisory and Compliance Division (CACD) has received no protest to Pacific's Advice Letter No. 16907 or Advice Letter No. 16907A.

DISCUSSION

CACD has reviewed AL No. 16907 and AL No. 16907A. CACD recognizes that Pacific's plan to assist new and existing telecommuting center in the Los Angeles area is designed to help companies who chose to have their employees telecommute rather than travel Los Angeles' congested freeways. CACD believes that Pacific's request is reasonable, and therefore, recommends authorizing the waivers requested in Pacific's AL No. 16907 and .AL No. 16907A.

FINDINGS

1. On February 8, 1994, and February 15, 1994, Pacific Bell filed AL Nos. 16907 and 16907A, respectively.
2. CACD finds Pacific's request reasonable and recommends approval of AL No. 16907 and AL No. 16907A.

Resolution T-15519
Pacific Bell/16907/JOG

THEREFORE,, IT IS ORDERED that:

March 16, 1994

1. Pacific Bell is granted the authority requested in Advice Letter No. 16907 as supplemented by Advice Letter No. 16907A.

The effective date of this Resolution is today.

I hereby certify that this Resolution was adopted by the Public Utilities Commission at its regular meeting on March 16, 19.94.
The following Commissioners approved it:

NEAL J. SHULMAN
Executive Director

DANIEL Wm. FESSLER President
NORMAN D. SHUMWAY P. GREGORY
CONLON JESSIE J. KNIGHT, Jr.
Commissioners

Commissioner Patricia M. Eckert
is absent.

February 8, 1994

U 1001 C
Advice Letter No. 16907

Public Utilities Commission of the State of California

This filing requests authority to implement certain measures to assist in restoring telecommunication services in areas of Los Angeles.

With this advice letter Pacific Bell requests that the Commission issue a resolution authorizing the waiver of installation charges for customers who install services in new or existing telecommuting centers. This waiver will be applicable in areas affected by the Los Angeles earthquake.

Existing Telecommute Centers:

Pacific Bell will waive installation charges for any of the services listed below installed in centers in areas surrounding the Los Angeles area for a period of thirty days.

New Telecommute Centers:

Pacific Bell will waive installation charges for any of the services listed below installed in new centers in the areas surrounding the Los Angeles area for the first 30 days that the center is in operation. This offer is only applicable to centers established during a 6-month period following the approval of this advice letter.

- waive installation charges for the following services:

Centrex lines, ISDN lines, Switched 56 Service, PBX trunks, Business lines (IMB's), Call Waiting, Three-Way Calling, Call Forwarding, Voice Mail Service, 800 service (installation charges only), and ADN Service.²

These special arrangements are for customers in area codes 818, 805, 213, 310, 714 and 909.

- All usage and recurring charges will be applicable.

PACIFIC BELL

These offers are designed to assist companies who are choosing to have their employees telecommute rather than travel congested freeways.

Cost

Pacific Bell will incur administrative expenses associated with managing this plan. We will forego certain revenues that otherwise would have been generated. Pacific does not intend to seek compensation from the CPUC to recover these foregone revenues.

In compliance with Section III. G. of General Order No. 96-A, we are mailing a copy of this advice letter to competing and adjacent Utilities and/or other Utilities, and interested parties, as requested.

Anyone may protest this advice letter to the California Public Utilities Commission. The protest must set forth the specific grounds on which it is based, including such items as financial and service impact. A protest must be made in writing and received within 20 days of the date this advice letter was filed with the Commission. The address for mailing or delivering a protest to the Commission is:

Chief, CACD Telecommunications Branch
505 Van Ness Avenue, Room 3203
San Francisco, CA 94102

A copy must be mailed to the undersigned utility on the same date it is mailed or delivered to the Commission.

We request you issue a resolution authorizing this filing to become effective March 23, 1994.

Yours truly,
PACIFIC BELL

A.E. Swan

Executive Director

Appendix E

**PACIFIC BELL LETTER TO THE CALIFORNIA STATE PUBLIC
UTILITIES COMMISSION ADVISORY AND COMPLIANCE
DIVISION REQUESTING AUTHORIZATION TO WAIVE NON-
RECURRING AND RECURRING CHARGES FOR
TELECOMMUNICATION NEEDS OF THE VICTIMS OF THE
SOUTHERN CALIFORNIA FIRESTORM.**

October 29, 1993

Mr. J. M. Leutza, Chief
Telecommunications Branch
Commission Advisory and Compliance Division
505 Van Ness Avenue, Room 3203
San Francisco, California 94102

Dear Mr. Leutza:

RE: Services to customers impacted by the Southern California fires

In an effort to meet the telecommunication needs of the victims of the Southern California Firestorms, Pacific Bell would like to offer the following services at no charge to affected customers:

0 Remote Call Forwarding - No charge for installation and no recurring charges for 30 days. (usage charges will apply)

0 Call Forwarding Feature - No charge for installations and no recurring charge for 30 days. (usage charges will apply)

Number Referral Service charges will be waived

Inside Wire charges may be waived to get the customer back in service when the Inside Wire Plan coverage cannot be verified by the technician.

0 Message Center Service will be offered with free installation and no monthly charges for up to 90 days.

Attached is a list of the prefixes known to date in the impacted areas. We will be developing Methods and Procedures for our Service Representatives to follow when affected customers call us for assistance.

Pacific will incur administrative expenses associated with managing this plan. We will also forego certain revenues that otherwise would have been generated. Pacific does not intend to seek compensation from the CPUC to recover these foregone revenues.

Please call me on (510) 823-7411 if you have questions or require additional information on this subject.

D. O. Jacobsen
Director - State Regulatory
Network and Exchange Services

Attachments

attachment 1 - List of Prefixes
attachment 2 - Press Release

PREFIXES IN THE IMPACTED AREAS

FOX CANYON FIRE

818 Area Code

226,227,340,346,347,586,587,592,593,594,595,596,610,702,703,704,710,
712,713 715,716,19,883,884,887,888,992,999

ALTADENA FIRE

818 Area Code

398,791,794,797,798

213 Area Code

684

OJAI FIRE

805 Area Code

640,646,651

FOR

DATE RELEASE

October 28, 1993

CONTACT: Judy Peterson

4084914444

John Britton 619-237-2430

**PACIFIC BELL OFFERS FREE SERVICES
TO SOUTHERN CALIFORNIA FIRE VICTIMS**

Pacific Bell is offering free Voice Mail and Call Forwarding service to Californians who have lost telephone service because of this week's fires. Because both services are central office-based, fire victims can continue to use their regular phone numbers - even if their home, business or telephone cables have been destroyed.

Voice Mail will take private messages from callers trying to reach fire victims at their home or business phone number. And it lets those affected by the fires leave a personal message for family and friends telling them where they are, how they're doing and what they need. Fire victims can change this personal message at any time, and listen to messages left by others, from any touchtone phone. Residence customers who want to order Voice Mail can do so by calling 1-800-273-7000, ext. 345. Business customers should call 1-800-540-8020.

For those who would rather have their phone calls forwarded to another phone number, Pacific Bell is also offering free Call Forwarding. To order Call Forwarding, fire victims should call the following numbers:

Los Angeles/Ventura Residence Service: 1-800-371-2355 Business: 1-800-499-2355 Orange County Residence Service: 1-800-491-2355 Business; 1-800-300-2355

As fire victims re-establish their lives, Pacific Bell will also be waiving fees for new installations. So, if a customer wants to install service in a temporary location they can do so at no charge.

Voice Mail, Call Forwarding and new connects can all be established within 24 hours after the order is placed by the customer. GTE customers temporarily residing in Pacific Bell territory are also eligible for these services. GTE is honoring the same policy with Pacific Bell customers who may have to temporarily reside in GTE's service area.

Pacific Bell is a subsidiary of Pacific Telesis Group, a worldwide diversified telecommunications corporation based in San Francisco.

Appendix F

**PACIFIC BELL ADVICE LETTER TO THE STATE OF
CALIFORNIA PUBLIC UTILITIES COMMISSION REQUESTING
WAIVER ON NON-RECURRING CHARGES FOR SERVICES IN
ORDER TO ENCOURAGE TELECOMMUTING**

95057

MAY 31, 1995

U 1001 C
Adv.- Letter No. 17511

Public Utilities Commission of the State of California

We attach .for filing,(-z the following- changes 4@n tariff schedules:

SCHEDULE CAL.P.U.C, NO. A.

68th Revised check Sheet A
6th Revised Table Of Contents Sheet B

SCHEDULE CAL.P.U.C..NO., A2.

295th Revised Check Sheet A
133rd Revised Check Sheet C
2nd Revised Sheet 124.2
Original Sheet 124.3

This filing rev-revises Schedule CAL.P.U.C.No. A2. General Regulations, 2.1.24 Rule No. 24 Re-establishment of-service Due to Fire and Natural Disasters Such As Earthquakes or Floods, to include Certain services that may be offered to customers-affected by disasters, civil disturbances and/or events that.-significantly impact transportation to and from work locations.

For disasters, civil disturbances and/or s4-similar catastrophes, the nonrecurring charge will be waived for the following services for 60 days:

- Remote Call Forwarding
- Call Forwarding
- Number Referral Service

Customers will be responsible for paying all usage and recurring charges.

PACIFIC BELL

For events that-significantly impact transportation to and from work locations, the nonrecurring charge will be waived for the following services for 60 days in order to encourage telecommuting:

0 B-Business Access Lines

* Private Branch Exchange Trunk Line service

a Centrex and Centrex ISDN

- Custom Calling Services (Call Forwarding, Three-way Calling and Call Waiting)
Custom 800 a
- Switched 56
- Advanced Digital Network (AZ)N

Customers will be responsible for paying all usage and recurring charges.

This revision will allow Pacific Bell to waive nonrecurring charges for certain services offered to customers affected by certain catastrophes. in addition, we are modifying the title of 'Rule No. 24 by removing "natural" in order to expand the tariff to cover such incidents as civil disturbances and/or events that significantly impact transportation to and from work locations. This revision will also correct typographical errors inadvertently made through- Advice Letter No. 16578 dated July 12, 1593.

This-revision does not require new or additional equipment or software
the existing cost of providing the

in compliance with Section III. G. of General Order No. 96-A, we are mailing a copy of this advice letter and related tariff sheets to competing and adjacent Utilities and/or other utilities, and interested parties, as requested.

This filing will not increase any rate or charge, cause the withdrawal of service, nor conflict with other schedule or rules.

Anyone.- may protest this advice- letter to the California Public Utilities Commission. The protest must set forth the specific grounds on which it is based, including such items as financial and service impact. A protest must be made in writing and received within 20 days of the date this advice letter was filed with the Commission. The address for mailing or delivering a protest to the Commission is;

Chief, CACD -Telecommunications Branch
505 Van Ness Avenue, Room 3203
San Francisco.-, CA 94102

PACIFIC BELL

A copy must be mailed to the undersigned utility on the same date it is mailed or delivered to the Commission--'or..

We would like this filing to become effective July 10, 1995.

Yours truly,

PACIFIC BELL

A.E. Swan
Executive Director

Attachments

a-.id therefore does not
services.

Pacific Bell
San Francisco, California

SCHEDULE CAL.P.U.C. 1
2nd Revised Sheet 124.2
Cancels 1st Revised Sheet

NETWORK AND EXCHANGE SERVICES
A2. GENERAL REGULATIONS

2.1 RULES (Cont'd)

2.1.24 RULE NO. 24 - RE-ESTABLISHMENT OF SERVICE DUE TO FIRE AND DISASTERS SUCH AS EARTHQUAKES OR FLOODS

A. DAMAGE TO PREMISES OR CUSTOMER PROVIDED EQUIPMENT

The same network facility service will be re-established on a one-time, temporary or permanent, basis as a maintenance provision and without charge, in ~~the~~ or different location and within a period of time that would no.-normally be required to repair or reconstruct the damaged premises or customer-.provided equipment (CPE).

This provision does not include wire or equipment on the customer's side of the local 'loop demarcation point except as set forth in Schedule Cal.P.U.C. No. AS.3.1.

B. DIFFERENT SERVICE

If the service as re-established is different from that which was disconnected, the subscriber will be charged the difference between the current 'total nonrecurring charges originally applicable to establish the new service and the current nonrecurring charges which would be applicable to re-establish the old service. (No credit will be given if the current total nonrecurring charges originally applicable to establish the new service is less than the current nonrecurring charges which would be applicable to re-establish the old service.)

C. TEMPORARY SERVICE NEW LOCATION

When service is re-established on a temporary basis at a new location and later permanent-ly established at the former location, the practice sat forth in A. and B. above may be applied to either service as elected by the subscriber and regular charges, without allowances, will be applied to the re-establishment of the other service.

NOTE 1: The subscriber shall provide proof of loss if such proof is required (T) by the Utility.

A2. GENERAL REGULATIONS

2.1 RULES (Cont'd)

2.1.24 R= NO. 24 - R=-ESTABLISHMENT OF SERVICE DUE TO FIRE AIM DISASTERS
SUCH AS EARTHQUAKES OP. FLOODS (Cont,d)

D. OPTIONAL SERVICES²

1. The Utility will waive the nonrecurring charges for the following services for a period of 60 days. Customers will be responsible for all recurring and usage charges.

The following optional services will be offered to customers affected by disasters, civil disturbances and/or other similar catastrophes:

- a. Remote Call Forwarding
- b. Call Forwarding
- c. Number Referral Service

Inside Wire Services will be provided as described in Schedule Cal.P.U.C. No. AB.3.1.

2. The Utility will establish free public pay phones at the request of an emergency agency for use by affected customers who have been relocated to designated shelters. The Utility will provide free intraLATA service for these pay phones. When disasters, civil disturbances and/or similar catastrophes are declared emergencies by appropriate governmental agencies (e.g., state or federal), access charges normally charged; by the Utility to an 4-interexchange carrier will be waived³.

NOTE 1: -The Subscriber shall provide proof of loss if such proof is required (N)
by the Utility.

NOTE 2: Services will be provided where facilities and operating conditions
permit.

NOTE 3: Subject to MFJ waiver. (N)

Continued

Pacific Bell
San Francisco, California

NETWORK AND EXCHANGE SERVICES r--r
AZ. GENERAL REGULATIONS M*

2.1 RULES (Connoted)

2.1.24 RULE-E NO. 24 - RE-ESTABLISH OF SERVICE DUE-. TO FIRE W DISASTERS;
SUCH AS EARTHQUAKES OR FLOODS (Connoted)

E. TELECOMMUTING OPTIONAL SERVICES2

1. The Utility will'. waive th~~on~~recurring charges for the following services for a period of 60 days to encourage telecomm-uting when events and/or catastrophes occur that significantly affect transportation to and from, work locations. Customers will be responsible for all recurring and usage charges.
 - a. Business Access Lines
 - b. Private Branch Exchange (PBX) Trunk Line Service - :-includes extension lines fro-,r, a PBX switch to a customer's residence.
 - c. Centrex/Centrex ISDN - Includes extension lines from the main Centrex to ~~the~~ customer's residence.
 - d. Custom Calling Services - Call For-warding, Three-Way Calling, and Call Waiting.
 - e. Custom 800 Service - Includes a credit of \$100.00 towards the first month's usage and-'provides the Emergency Update feature at no charge.
- Switched 56
- h. Advanced Digital Network (ADN)

NOTE 1: The subscriber shall provide proof of loss if such proof is required (N)
by the Utility.

NOTE 2: Services will be provided where facilities and operating conditions
permit.

Appendix G

**PACIFIC BELL TARIFF 2.1.24 RULE NO. 24 -
RE-ESTABLISHMENT OF SERVICE DUE TO
FIRE AND NATURAL DISASTERS SUCH AS
EARTHQUAKES OR FLOODS**

NETWORK AND EXCHANGE SERVICES
A2. GENERAL REGULATIONS

2.1 RULES (Cont'd)

2.1.24 RULE NO. 24 - RE-ESTABLISHMENT OF SERVICE DUE TO FIRE AND
DISASTERS SUCH AS EARTHQUAKES OR FLOODS

A. DAMAGE TO PREMISES OR CUSTOMER PROVIDED EQUIPMENT

The same network facility service will be re-established on a one-time, temporary or permanent, basis as a maintenance provision and without charge, in ~~the~~ or different location and within a period of time that would normally be required to repair or reconstruct the damaged premises or customer-provided equipment (CPE).

This provision does not include wire or equipment on the customer's side of the local loop demarcation point except as set forth in Schedule Cal.P.U.C. No. AS.3.1.

B. DIFFERENT SERVICE

If the service as re-established is different from that which was disconnected, the subscriber will be charged the difference between the current 'total nonrecurring charges originally applicable to establish the new service and the current nonrecurring charges which would be applicable to re-establish the old service. (No credit will be given if the current total nonrecurring charges originally applicable to establish the new service is less than the current nonrecurring charges which would be applicable to re-establish the old service.)

C. TEMPORARY SERVICE NEW LOCATION

When service is re-established on a temporary basis at a new location and later permanently established at the former location, the practice set forth in A. and B. above may be applied to either service as elected by the subscriber and regular charges, without allowances, will be applied to the re-establishment of the other service.

NOTE 1: The subscriber shall provide proof of loss if such proof is required (T) by the Utility.

Appendix H

PACIFIC BELL SURVEY OF TELECOMMUTERS AFTER NORTHRIDGE EARTHQUAKE

Survey of Telecommuters After Northridge- Earthquake

Executive Summary

Background

On January 17, 1994, Los Angeles experienced a 6.7 magnitude earthquake,. Sections of ,several main freeways were destroyed and expected to remain under repair for up to a year. In response, Pacific Bell offered a comprehensive telecommuting relief package for businesses and residents in the area who faced months of traffic delays.

For a two month) period, Pacific Bell customers in the 213, 310, 714, 805, 81 9, and 909 .Area Codes were offered free installation of services that facilitate telecommuting. Included in the offering were business access lines, Centrex service, Ctx-IS, SDS-IS, Custom Calling Features, Voice Mail, 800-.,Service (included a \$100 usage credit), SDS56,- and ADN. In addition, Pacific Bell provided modems*and terminal adapters* on a loan basis to small businesses establishing telecommuting programs,

Research Objectives

The main objectives of the research were to determine the following:

- How effective was the telecommuting relief offer?
- What were the perceptions of the telecommuters?
- Who is the telecommuting target market?

Methodology

The total population of 1283 customers (4540 orders) were distributed as follows:

LA	70 %
South	13%
National	10%
Public	7%

A sample of 660 telecommuters was selected from the original population, This included 440 from the LA RBU and 170 (a census) from the South RBU, National and Public accounts were excluded from the research survey,

Our research consultant contacted sample members by phone and conducted the survey using a questionnaire designed by our Telecommuting Team-L There were 106 completed surveys: 77 from the LA RBU, and 29 from the South RBU. The survey was conducted during August 1994.

September 15, 1994

Page I

Summary of the Findings

How effective was the offer?

- 9 out of 10 (93%) of telecommuters are still telecommuting
- 42% of telecommuters had not considered telecommuting before the earthquake
- 37% were telecommuting 5 days a week

What are the perceptions of the telecommuters?

- 84% rated their overall telecommuting experience as good or excellent

- 85% PB services as good or excellent
- % of respondents aware of PB services: Call Forwarding 100%; Call Waiting 99%; 800 Service 94%; Voice Mail 91 %; ISDN 40%

Who is the target market?

Wide variation by industry; only Computers and Banking & Finance comprised ~~dash~~ as 15% of the population

63% of the businesses had 25 or fewer employees

Telecommuters had primarily sales (76%) and/or managerial (45%) responsibilities

90% of companies did not offer any formal telecommuting training Supplier of office equipment was mixed between the organization- (48%); the employee 24%; and both (28%)

Appendix I

TRAVEL BEHAVIOR IMPACT OF TELECOMMUTING FOLLOWING THE SAN FRANCISCO EARTHQUAKE: A CASE STUDY

SURVEY METHODOLOGY

Sample

A telephone survey was conducted within the PUC, which, has the largest number of participants in the State's Telecommuting Pilot of all the state agencies" (4). As of June 1989, the reported number of total state telecommuters was 230, with 71 working in PUC (5). Assuming similar participation 4 months later, at the time of the emergency, about 8 percent of the PUC Bay area staff of 880 had been telecommuting for nearly 1@ years.

Fifty-five professional staff from 5 of the largest of the 10 companies within the PUC were surveyed (Table 1)(3). None

3, c interviewed held clerical positions. The sample included 20 pilot telecommuters out of a total of 30 who began :tele-ommuting about May 1988, one of four midpilot tele-

commuters who began 4 to 6 months later, and three managers %, ho themselves-, telecommuted. All were scheduled for training 19 and 1-0. 1988. Additionally, five chiefs or managers who did not telecommute were interviewed.

The remaining third of the sample consisted of postearthquake telecommuters who began telecommuting after the earthquake occurred. Sixteen of 33 people mentioned by coworkers or

managers as having begun to telecommute after the earthquake were interviewed. One of those was a manager. Another prepared to telecommute but never actually started.

A supplementary sample of 8 pilot, 1 midpilot, and 17 postearthquake telecommuters was composed of persons on the training lists and new telecommuters who could not be reached for interviews. Information about their telecommuting was obtained from managers and coworkers who were in the survey sample.

TABLE I SAMPLE OF TELECOMMUTERS AND MANAGERS INTERVIEWED

Group	Pilot Telecommuters Interview- Total Sample	post-Earthquake - :2 Interview Total Sample	Non-Telecommuting Managers Interview- Sample
Initial Telecommuters		30	.10 32 Is
Mid-pilot Telecommuters		4	1
Telecommuting Managers		6	3 1 1
Non-telecommuting Managers			
TOTALS		70-	2-4 6@

Interviews

Semistructured telephone interviews were used to elicit the rich detail of personal attitudes and perceptions about telecommuting that might not be revealed in responses to written questionnaires. In order to obtain as full a view as possible of the telecommuting experience from the interviewee's perception, questions were not held strictly to a specific wording or sequence. The interviews were begun December 18, 1989, 2 months after the earthquake (1 month after the Bay bridge reopened) and completed April 20, 1990, 6 months following the emergency. Some persons on the training lists did not actually attend the training; others could not be reached after

several telephone calls. Information about some telecommuters who had been transferred or who could not be reached by phone was obtained from their managers and coworkers.

Telecommuters were questioned about their telecommuting Pattern before, immediately after, and 2 to 6 months following the earthquake, their job title and branch, and where they lived. They were asked to describe their home office work place, how it was equipped and whether they had adapted it for telecommuting. Finally, they were asked whether they felt they were more productive when they worked at home and, if so, in what way.

Managers of Telecommuters were asked the size of their groups, the names of their telecommuters, and if they telecommuted themselves. They were then asked to recall the memoranda or briefings they received on handling the emergency, the means they used to offer these options to their groups, and the names of those who chose telecommuting. They were questioned about their selection criteria for postearthquake telecommuters, and any observed differences between them and pilot telecommuters. They were asked if they planned to continue telecommuting within their group indefinitely.

Managers and coworkers also were asked about other people in their groups who were telecommuting before, immediately after, and months following the earthquake. The persons named are referred to as the "supplementary sample" of 26 telecommuters.

FINDINGS

Travel Behavior before the Earthquake

Before the earthquake, the California Telecommute Pilot Project conducted an impact assessment of telecommuting on

trip rates. On the basis of a sample of 66 telecommuters (representative of all pilot telecommuters including the PUC subgroup), the study found that "telecommuting indeed reduces peak-period trips while adverse impact (e.g., increase in nonwork trips) is not apparent." The decrease in daily average trip rates "shown by the telecommuter employees is almost twice that of the control group employees . . . which confirms that "telecommuting leads to an overall reduction in trip generation" (6).

Although up to 3 days per week telecommuting was said to be permitted as PUC policy, there was no evidence that before the quake anyone was telecommuting more than 1 or 2 days per week. Of the interviewed sample, four never started and four stopped for equipment, job-related, or personal reasons (see Table 2). According to their coworkers, some of the pilot group who were not interviewed telecommuted only a few days, or never started, for reasons such as retirement, transfer to another branch, owning an incompatible computer, and limitation of telecommuting to the period of a maternity leave. Telecommuting days that were missed for any reason could not be rescheduled. These anecdotal findings are consistent with midterm and final reports that state participants telecommute, on the average, 1.5 to 1.6 full days at home (4.5).

Management Response to the Earthquake Emergence.

In the chaos resulting! from the quake, the San Francisco PUC headquarters building was closed and the computers were down. Wednesday through Friday. employees 'A-ere put on administrative leave. although reportedly several telecommuters continued to work (4). By the following Monday". October 23, when employees were expected back to work. one division manager already had telephoned managers and decided to increase the numbers of telecommuters. At a meeting held that afternoon, the top managers in the division discussed the emergency and, as one option, they formalized the rules to expand telecommuting. Managers in other branches recalled a similar story. That first day they were back, the executive director authorized adding telecommuters with complete branch discretion in helping staff get to work in that difficult period. Other options included a compressed work week, decreasing the required core hours, allowing staff to start carrier to shift travel to off-peak hours, added parking incentives for carpools, and larger discounts on transit passes

(3). (A 9180 compressed work week schedule. for example.

TABLE 2 POST EMERGENCY TELECOMMUTING BEHAVIOR
OF
PILOT GROUP

Reason *No. of times mentioned*

9 Pilot Telecommuters Not Telecommuting at Time of Emergency

4 Never Started, and did not start Telecommuting after emergency

No computer or incompatible computer at home 2

Changed to compressed work week 1

Personal preference 1

7

4 Stopped before earthquake and did not restart telecommuting after emergency

No computer or incompatible computer at home

Face-to-face meetings required

Field trips

Traffic returned to normal

Transferred to another group

Personal preference

16 Pilot Telecommuters Telecommuting at Time of Emergency

1 Increased telecommuting

Completed seasonal task 1

3 Decreased telecommuting after temporary)- increase

Travel 1

Personal preference 1

Field work 1

8 Did not change telecommuting during emergency)-

Commuted on BART 4

Moved to San Francisco 1

Supervisor restriction 1

Traffic returned to normal 1

No reasons given 1

4 Decreased or stopped telecommuting

Business travel

Field work

Supervisor attitude 2

Worked in district office I

T

means working 9-hr days for 8 week days, 8 hr for a 9th day, and not working on the 10th weekday.) Later that same day)r the next morning, managers called together their entire staffs and discussed options and passed the word along in memoranda. One postearthquake telecommuter recalled a note from the Information Resources Department explaining .hat telecommuting was an option and asking "if you have a computer and can you call in or log in." Telecommuting was completely voluntary for the employee but required the supervisor's approval.

Travel Behavior Immediately after the Earthquake Emergency

in telecommuting patterns related to the emergency -were primarily a function of the telecommuter's job requirements at the time. Reasons for decreasing the number of telecommuting days or stopping altogether were similar for both pilot and new telecommuters.

Pilot Telecommuters

Of the 21 pilot telecommuters and 3 telecommuting managers, only I permanently increased his amount of telecommuting (from none before the earthquake to a sustained 1 day per week) immediately after the earthquake (Table 2). Coincidentally to the earthquake, he was able to work Wednesdays at home beginning in October because he finished a seasonal period that had required his supervising in the main office. Three people temporarily increased their telecommuting. One of those people who was doing earthquake-related field work telecommuted part time 5 days a week, reporting from home by the office automation system. Eight telecommuters did not change their schedules. One of the eight, for example, who lived in San Francisco, became a priority person to staff the office. Four people decreased or stopped working at home on their scheduled days. Finally, none of the four who had never started telecommuting nor the four who had stopped before the earthquake started to telecommute because of the emergency.

Those who did telecommute benefited from not having to drive or take mass transit when the Bay bridge was down. Bay Area Rapid Transit (BART) parking lots were full and parking was difficult to find nearby-, trains were crowded and late. On days when they worked at PUC, employees coped by commuting outside peak periods, parking at friends' houses when they rode BART, and commuting by the ferry that was put into emergency operation.

Postearthquake Telecommuters

The postearthquake telecommuters added as a result of the policy change circulated from the executive director of the PUC were concentrated in C division, which had taken immediate aggressive action to expand telecommuting. That division added 32 new people (Table 3). Within the division, managers who already had telecommuters tended to let additional staff telecommute. One manager of 18 people, for example, had three pilot telecommuters, and added eight. Another manager's group of 21 had two pilot telecommuters and added four. That group had 3 or 4 people on compressed work week and another 14 whose commuting did not change after the earthquake.

The four other sampled divisions were less active in expanding telecommuting. Only one new telecommuter was added in Division B-although all four had pilot telecommuters. Many of one manager's group lived in San Francisco or on the Peninsula, so nothing changed, no additional telecommuters were added. In other groups, the reason was upper management's not permitting both compressed work week and telecommuting. In some groups, a lot of employees preferred a compressed work week. Some worked flextime, i.e., they worked 8-hr days but not from 8:00 a.m. to 5:00 p.m. One employee, for example, worked from 6 a.m. to 11:30 p.m. to cut commuting time from 1 1/2 hr to 25 min.

But there may have been employees who did not think of themselves as telecommuters. For example, the counts may underreport telecommuting in Divisions D and E whose employees were out in the field full time doing safety inspections of structures following the earthquake. As a pilot telecommuter in one of the divisions remarked: "I guess you could say they were telecommuting since they were doing field work reports at home and sending them in via their computers just like I was, but they weren't officially on the program."

Long-Range Changes in Telecommuting

Pilot Telecommuters

In an effort to estimate the pattern of telecommuting following the emergency, that is, to understand whether telecommuting was continued under normal conditions, individuals, managers, and peers were asked for names of people who were and were not telecommuting at that time. The numbers convey a sense of the telecommuting pattern, but should not be taken as an absolute count. Sixteen of 34 persons (47 percent) listed on the May 19-20, 1988, training schedules as pilot telecommuters (but not managers) were telecommuting at least 2 months after the earthquake. They continued their pre-earthquake telecommuting pattern, typically using BART to get to work the other 3 to 4 days. Eight of the group (26 percent) never started. The one person mentioned earlier who started telecommuting after the earthquake coincidentally,

because his work finally permitted him to begin, continued to telecommute. Three people had stopped telecommuting before the earthquake. Incomplete information was obtained for the remaining six. Two or more months after the emergency, one of four mid-pilot telecommuters was still telecommuting; another had stopped. Whether or not the others were still telecommuting could not be determined.

Of the interviewed pilot group who continued to telecommute, eight had computers, that did not. Three pilot telecommuters who owned computers stopped for reasons such as travel or field work, rotation to another group, and for personal reasons. Other reasons for not continuing to telecommute included lacking a computer at home, change in task demands, supervisor attitude, and a personal situation or preference such as changing to a compressed work week, wanting to ride in a carpool with a spouse, or wanting to take advantage of the PUC child care facility.

Postearthquake Telecommuters

Thirty-two employees were named by managers or coworkers as having begun telecommuting in response to the emergency. Sixteen (50 percent) started and were continuing to telecommute at the same rate for at least 2 months after the earthquake with the exception of two persons who telecommuted fewer days because of the holidays, business travel, and easier

TABLE 3 DISTRIBUTION OF TELECOMMUTERS WITHIN PUC DIVISIONS

Division	Pilot Telecommuters	Post-Earthquake@ Telecommuters
A	2	0
B	12	1
c	15	32
D	5	0
E	3	0
	@0	33

-muted. Twelve (38 percent) telecommuted for 1 month, stopped. Another four individuals were identified as telecommuting after the earthquake but coworkers were not sure whether they had continued after the Bay bridge reopened.

As discussed later, having a computer in the home office influenced whether or not the postearthquake telecommuters continued to telecommute after the emergency was over (Table 4). Because they used a computer in the main office, they were limited in the tasks they could carry out at home. Other factors affecting telecommuting behavior included not liking to carry bulky work materials back and forth, particularly if they commuted via mass transit, transfer to another group, because they had completed the report or task, and interruption of telecommuting by the holidays.

Those who reported business travel and face-to-face meetings required were staff who needed to be at PUC the days they were in the city to interact with other members of their groups.

This study did not uncover any telecommuters who had stopped because a manager was dissatisfied with their performances. With regard to postearthquake telecommuters, it may have been too soon to identify problems at the time managers were interviewed. (If there were any pilot telecommuters in that category, they likely were no longer in the program.) However, telecommuters were alert to their supervisors' general attitudes toward telecommuting and adjusted their requests to telecommute accordingly.

30 new telecommuters felt positive about their experience. Most people worked alone in their homes in either a

separate room or place such as an alcove of the living room or hall desk. Despite the fact that many postearthquake telecommuters lived in the east Bay region with available mass transit, they began and continued to telecommute.

Managers' Attitudes and Perceptions

Managers generally were satisfied with telecommuting, and planned to continue it within their groups indefinitely. As one supervisor commented, "it wasn't division policy to cut back. We play it by ear. We're more relaxed-so long as there is no problem." Another understood that "after a while in some groups they had telecommuters who couldn't concentrate at home. Telecommuters had small kids or other distractions." The supervisor makes it clear to his group that telecommuters can stop and restart again when the home situation permits.

After the earthquake, managers did not use the selection process required for the pilot group. "Since it was an emergency, anyone who wanted to telecommute, we tended to say .yes.' " One manager felt that the pilot only was needed "so if the state decides to form a policy we'll get our say as to our needs. They didn't have to have the pilot in order to telecommute. A manager could say OK, work at home. We have lots of authority delegated to us. A lot of staff wanted to telecommute once in awhile. Upper management told supervisors that they had flexibility and should be lenient. After the earthquake they allowed some people to who wouldn't have [been allowed to] otherwise."

Managers noticed little difference between the pre- and postearthquake telecommuters. "We kind of monitor them.

TABLE 4 E,%-EMERGENCY-RELATED TELECOMMUT-ING BEHAVIOROF POSTEARTHQUAK
GROUP

ReasonNo. of times mentioned

32 Post Earthquake Telecommuters

14 Continued telecommuting

2 Decreased telecommuting

Business travel 1

Holidays

Commuting easier

3

12 Telecommuted one month, then stopped

No computer, no office automation access from home⁴

Task-related, e.g. project finished 2

Bulky reference materials inconvenient to carry back and forth

Business travel 1

Face-to-face meetings required 1

Holidays 1

Reason not reported 5

15-

4 Long range telecommuting unknown 4

Some people gave more than I reason.

The new telecommuters are the type we would have chosen anyway. The earthquake took waverers and added them to the program." Typically, like the pilot telecommuters, postearthquake telecommuters submitted a work plan to their supervisors for approval. It was then passed to the manager. Supervisors had a positive perception of work effectiveness: "Seeing the work done it was obvious that telecommuters were doing at least 8 hours work at home." "If anything the productivity has increased" and telecommuting was "good for morale."

Managers who were less enthusiastic about telecommuting remarked that "too many changes are being made." One manager would accept one more telecommuter, but feels he doesn't have highly motivated, responsible people, and moreover, has not had strong requests by staff to telecommute. Another manager is afraid that "if telecommuting becomes a right. employees I don't trust would get to work at home. Telecommuting depends on the individual." He wants telecommuting to be a managerial option. He knows the capabilities of his staff - "we have people we'd rather not have."

Most of the managers interviewed feel that so long as there is reasonable structure they will support telecommuting. "The questions are "Will the telecommuter be available?" "Is the telecommuter there when you call at home?" "Does he have a PC, modem, and office automation connection?"

DISCUSSION OF RESULTS

Factors Promoting Telecommuting

The PUC initiated a 5-year Transportation Management Program in 1989. That transportation and energy conservation policy was reaffirmed after the quake: "Our current objective is to continue the post-quake reliance on public transit, ridesharing, flextime and telecommuting in the Bay Area" and maintain the 50 percent reduction in single-occupancy vehicle travel by its employees that was achieved from 1989 to 1990 (3). That commitment appears paramount in analyzing why people who began telecommuting to mitigate the impact of an emergency continued to telecommute when normal conditions were restored.

What part did the State Pilot Telecommuting Program play in opening opportunities for more employees to telecommute? Having a trained body of telecommuters in place with managers enthusiastic about or, at worst, tolerant of telecommuting for their own people, was critical. Also influential was verbal endorsement by the governor of California on Tuesday, October 24, 1989, a week after the earthquake. On October 31, the governor issued Executive Order D-82-89 requesting all state agencies, among other measures, to "implement telecommuting procedures and programs to increase work at home or at satellite facilities." In late November, the Department of General Services held management briefings on "Telecommuting During the Earthquake Recovery: Mitigating Traffic Congestion and Office Space Options" to PUC and other state agencies. However, evidence gathered from employee and manager interviews suggests that new PUC telecommuters were added prior to the briefings.

Discrepancies in the reported numbers of telecommuters blur the extent of telecommuting. Even in a formal telecommuting program, work assignments interrupt telecommuting

schedules, sometimes for indefinite periods of time, so that accurate counting of telecommuters is difficult. This study found that neither managers nor coworkers were always up to-date on who was telecommuting.

Most employees enthusiastically endorse telecommuting and feel they are more productive working at home. Under emergency conditions, telecommuters saved time and stress by not having to leave their homes early in the morning and commute on overcrowded streets and mass transit. One employee could sleep an extra 2 hrs, so felt the quality of her work was better. But also under normal conditions telecommuters report working "harder at home than at PUC because there are no interruptions." "At PUC they work in cubicles and you can hear everything . . . so I get most of my work done at home." Telecommuting saves transportation time and "you don't have to stop for lunch so you have long stretches of time to work in." Moreover, telecommuters were pleased about their productivity: "I don't even think about the time I'm not being paid. I just get the job done. It's more relaxing at home, more productive. When I come in to work I have to get up, get ready, get to the bridge, get here, got set up, while at home all I have to do is start."

Factors Limiting Telecommuting

Policy

In spite of PUC's stated goals to encourage telecommuting, several guidelines acted to limit the number of telecommuters and telecommuting days. First, there was a perceived policy that forced the worker to choose between telecommuting and a compressed work week. Some managers thought the policy was in effect; another thought it had been changed in response to the emergency and might or might not have been reinstated.

Limiting telecommuting to 2 or 3 days did not appear to affect the actual time telecommuted because of workers' task-related 'needs to be at the main work site. to travel, or perform work in the field. The more serious barrier to increased telecommuting is the limitation of each telecommuter to an approved schedule of, for example. Tuesday and Thursday or Monday and Wednesday home-based work. A telecommuting day cannot be rescheduled if telecommuters are called for a meeting or needed elsewhere on their home office days. Some postearthquake people who stopped telecommuting might have established a routine if the end of

the year holidays had not disrupted their schedules so soon after they had started to telecommute. Because they could not make up days that fell on a holiday, many found their actual number of days at home to be very few.

PUC's policy of training some of the staff by rotating them among branches for periods of 6 months deters telecommuting in two ways: first, telecommuters are uprooted from established telecommuting patterns by placement in new groups in which they are neither well enough known by their supervisor nor familiar enough with their new tasks to work at home immediately. Some transferred individuals hoped to be permitted to start telecommuting again when they had worked a little longer with their new branch. Second, having flexible work options as well as staff rotation gave some managers the perception that everything was changing at once, leading to chaos.

Their supervisor's attitude was mentioned by several people -the reason they stopped telecommuting. Although managers who were less than enthusiastic about PUC's policy apparently did not deny their staff the opportunity to telecommute, they did nothing to encourage it. From the perspective of a telecommuter, "the general lack of organization in the office forces the organization to rely heavily on the presence of people. Management reacts to crisis management." Telecommuting gives him "three hours of life," and he "wouldn't mind working in those three hours rather than fight traffic." Another telecommuter felt his supervisor's attitude is changing because telecommuters "are showing they do good work."

Equipment

Although lack of a computer did not deter most people from starting to telecommute after the earthquake, it did affect whether or not they continued after the first few weeks. Lack of a computer at home was the most common reason given by the postearthquake group for stopping telecommuting. Four of the 12 who stopped said they needed a computer at home (8 are known to have had them). Several mentioned the importance of sending files back and forth on the office automation system. Other factors also affected telecommuting behavior.

Three pilot telecommuters also stopped telecommuting for lack of a computer and one never started because his computer was incompatible with the office automation system. Of the interviewed pilot group who had not stopped telecommuting, 13 had computers, 3 did not.

Many telecommuters from both groups added equipment at their own expense. They had purchased a phone outlet, business line, a 386SX computer (because a borrowed portable "fails so much it's frustrating to use"), modem, software, and office furniture. One completely equipped a home office feeling that "it was an obligation to set up a home office with communication with everyone before starting to telecommute." Several people mentioned that the state pays for a call-back system on the office automation system so the employee does not have on-line telephone charges.

Being on the office automation system was crucial to getting the job done from a home office. Of 19 computers owned by telecommuters (both groups combined), only 2 were not equipped with modems. According to the Information Resources Department, before the earthquake, 180 telecommuters in state agencies had been given a security password to reach a port selector on the office automation system. Following the earthquake, 30 more telecommuters

were added. Because of incompatible equipment, several telecommuters had only partial use of the office automation system; they could send notes but not edit files.

CONCLUSION

Loma Prieta earthquake created an emergency travel-problem that could be mitigated by telecommuting. The existing pilot set a precedent such that adding telecommuters did not require an organizational change. Because the PUC organization was prepared with a tested plan in operation, managers were able quickly and smoothly to add telecom-

muting volunteers. The disaster created a sudden increase in incentive for management to expand the concept. Managers and staff knew what telecommuting is and how it worked at PUC. New telecommuters could and did ask their pilot telecommuting coworkers about the experience before deciding to volunteer. Telecommuting reduced stress because employees did not have to change their travel times or be subjected to long commutes on overcrowded freeways and public transit. Work disruption within the organization was minimized. Particularly important was the ability of workers in the field conducting critical safety checks to send back reports by computer from their homes. The division that had the most telecommuters before the earthquake added the most in response to the emergency. Managers seemed comfortable with telecommuting in their departments and expected it to continue. Those not enthusiastic about telecommuting admitted it had benefits but, in actuality, their own groups had people on a compressed work week with few or no telecommuters.

Evaluated in terms of the pilot project guidelines, pilot telecommuters increased their telecommuting time only temporarily, if at all, then returned to pre-earthquake schedules when the Bay bridge reopened. But looking at telecommuting in a broader sense, the pilot group who were on business travel, out doing field work, or working in a district office also woe telecommuting. New telecommuters were added who continued to telecommute. Nearly half were still telecommuting when interviewed 2 to 6 months after the earthquake. Most of those who had stopped telecommuting did so, not because of dissatisfaction with telecommuting, but for equipment, job-related, or personal circumstances. Travel behavior changed because telecommuting as a work option was given permission under emergency conditions that was not rescinded when traffic returned to normal.

In contrast to the California PUC, a Texas newspaper publisher had no preexisting telecommuting program when disaster struck. Under more transitory emergency conditions-a fire that shut down the press room-the Dallas Times Herald improvised work from homes and satellite locations in hotel rooms. Management did not think of the experience as telecommuting. Unlike the PUC experience, the incident did not result in permanent change in travel behavior. No policy changes resulted, only the lesson learned that every paper "has to have a doomsday defense set up . . . a fall back" (7). This one comparison suggests that long-term travel reduction will not be achieved unless management is educated about the concept and benefits of telecommuting under normal business conditions.

The telecommuting behavior of pilot and postearthquake telecommuters revealed in this study suggest the following employer actions that would promote long-term telecommuting:

- o Provide computers for use in home offices or laptop computers equivalent in performance to telecommuters' on-site equipment,
 - a Supplement employee-owned equipment as needed with a modem and updated hardware and software,
 - o Pay telephone costs or costs for a call-back system on the office automation system,
 - o Make available duplicate copies of bulky reference materials or provide scanning assistance from the central office,
 - o Publicize top management support of telecommuting to encourage reluctant middle managers to participate,

- o Publicize policy that staff may both telecommute and work compressed work weeks, if that policy is in effect,
 - * Permit shifting and make-up of telecommuting days where feasible, and
 - o Explore ways to accommodate telecommuting within the staff rotation program.

As for future plans at the PUC, the internal Employee Transportation Plan proposes continuing telecommuting as one option to promote alternatives to single-occupant vehicles. Specifically to expand telecommuting participation, the plan recommends (a) purchasing 10 to 15 laptop computers, (b) doubling the telephone lines to 18 (to accommodate 10 to 15 more telecommuters), and (c) over the next 5 years installing an additional 18-port dial-in unit to the office automation system (3).

The present findings suggest that several times more than 15 additional telecommuters could be anticipated so far as task-related factors are concerned. The study identified 33 new telecommuters by name, examining only half of the divisions, albeit the largest, in PUC. Added because of an emergency, most new telecommuters, if their tasks permitted, would continue to telecommute. Providing laptop computers would help those who travel or work in the field or do not own a computer although employees express their willingness to equip their offices at their own expense. Of even greater priority is access to the office automation system that many telecommuters increasingly need to perform effectively from home. Finally, it is apparent that more research is needed on the factors determining choice of telecommuting versus a compressed work week to anticipate travel behavior when planning transportation management programs.

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