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TEL8 TELECOMMUNICATIONS NETWORK: A POOLED FUND STUDY FOR TRANSPORTATION VIDEOCONFERENCING

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for the
North Dakota Department of Transportation

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16. Abstract

The document reports the research efforts and results of a telecommunication network dedicated to transportation. These efforts include the establishment of a satellite-based video conference network, development of TEL8 programming and training, the video conference delivery of university graduate level transportation courses to DOTs and the creation of the network's program director and its governing organizational structure. The research results include the programming, training, educational and communications activities developed by the network, an evaluation of the technological and organizational changes and expanded video conferencing at the networks DOTs.

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PREFACE

The TEL8 Pooled Fund Study was created in 1994 to support the development of a telecommunications system dedicated to improving and enhancing transportation in the Federal Highway Administration (FHWA) Region 8. The telecommunications network established a partnership among the region's six state Departments of Transportation (DOT) and the four Mountain-Plains Consortium (MPC) universities. The TEL8 system included video conference facilities at each of the original ten sites and a satellite-base transmission medium connecting the network. The TEL8 elected a board of directors to govern the system and established a network control center to manage the administrative, technical and programming functions of the network. Initial programming activities on the network included graduate transportation classes, the DOT information series InfoX, national transportation conferences and other transportation-related events.

The network undertook a major reconfiguration of its telecommunications technology in 1997-98 and established a terrestrial-based video conference system. Included in the new system was a video conference bridge sited at the network control center. Moreover, the video conference enhancements of the new system were utilized with expanded TEL8 programming and training including the employment of a half-time program director. The TEL8 programming director is responsible for the development and acquisition of all TEL8 programming, training, and video conferences. The program director coordinates graduate classes and training with the MPC executive director and chairs the TEL8 programming committee. The network's increased video conference capabilities provided a more user-friendly environment for programming and training, encouraging the initiation of several programming activities including an expanded DOT information seminar series (TransX) and additional leadership and organizational management classes. In addition, TEL8 developed a new cost structure and refined its organizational structure during the technological reconfiguration.

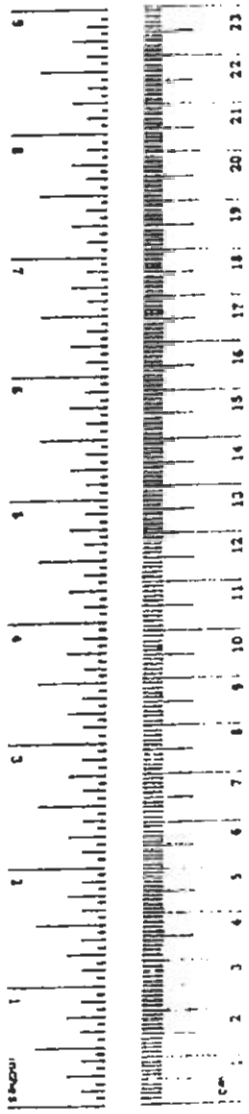
Finally, the Pooled Fund Study stimulated the development of video conferencing facilities at the DOT district level in several states. An additional eleven video conference sites at TEL8 DOT districts had been established by the summer of 2000. Moreover, an additional TEL8 DOT is actively considering video conference expansion to several of their district sites. TEL8 expansion to additional state DOTs is also under consideration in 2000.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°f	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°c

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°c	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°f

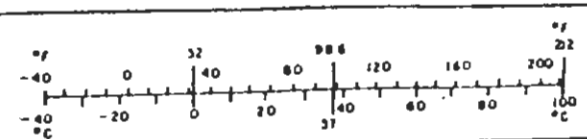


Figure 1. Metric Conversion Factors

INTRODUCTION

This report presents and summarizes the TEL8 Pooled Fund Study. The study was undertaken to support the efforts of the six state departments of transportation (DOT's) in the Federal Highway Administration (FHWA) Region 8 establish a telecommunications network dedicated to improving transportation in the region through the use of enhanced communications, technology transfer, education and research. The telecommunications network was named TEL8 and included a partnership with the Mountain-Plains Consortium (MPC), a consortium of transportation research Universities in the region. This report includes this important partnership as integral in the development of TEL8.

Ten sites participated in the system during 1994-2000 including the six state DOTs of North Dakota, South Dakota, Montana, Wyoming, Utah, and Colorado; and the four MPC universities consisting of North Dakota State University, University of Wyoming, Colorado State University, and University of Utah. The nine current sites are illustrated in Figure 1. Colorado DOT and Utah State University also participated during the pooled fund study. The system is governed by a board of directors with representatives from each of the state DOTs and MPC universities and a liaison from the FHWA regional office. The North Dakota Department of Transportation contracted the administration of the Pooled Fund Study to the Upper Great Plains Transportation Institute (UGPTI) at North Dakota State University (NDSU).

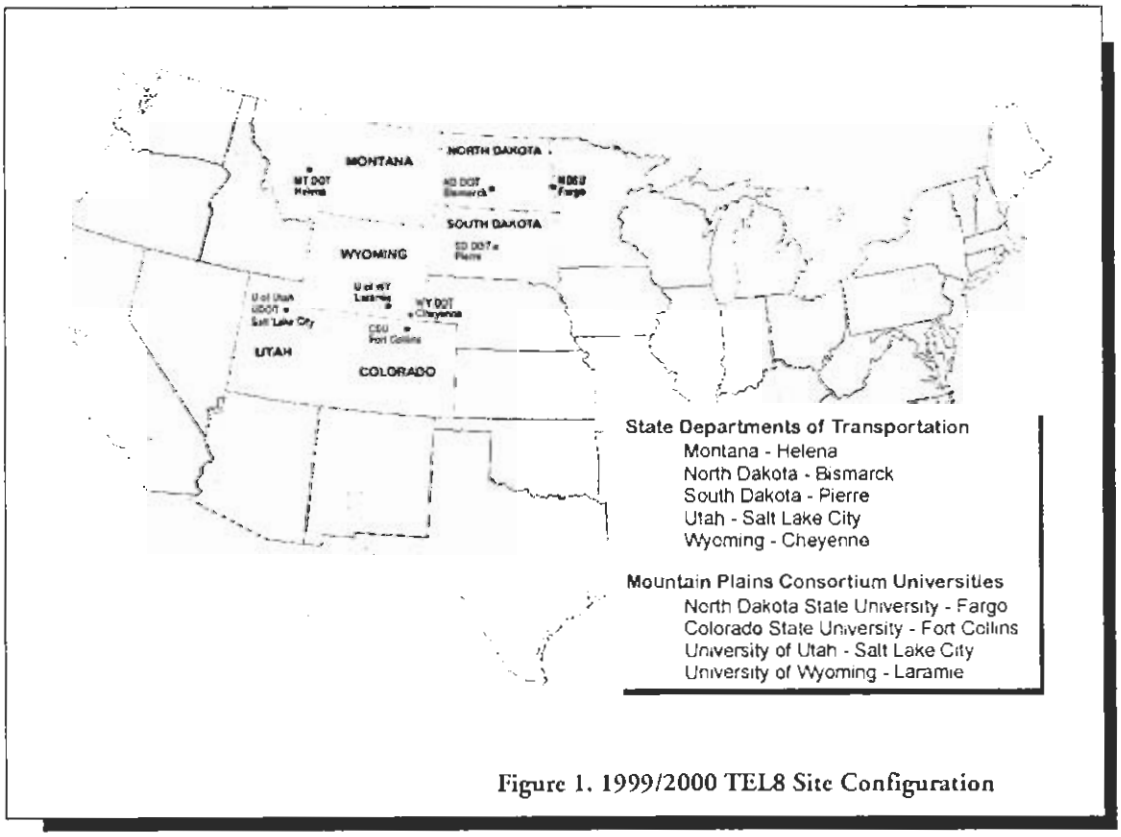


Figure 1. 1999/2000 TEL8 Site Configuration

TEL8 supports and strengthens the transportation systems of the region through the use of a state-of-the-art video conference network. All nine TEL8 sites operate a fully-equipped video conference system consisting of in-room audio and video equipment or a portable, mobile video conference unit. With this equipment, each TEL8 site is fully capable of initiating or participating in video conferences with the other TEL8 sites and other video conference systems. TEL8 also operates and maintains a video conference bridge which provides system connectivity among all TEL8 sites as well as multi-point video conference capability outside the system.

TEL8 programming activities delivered during the pooled fund study include the popular InfoX and TransX DOT-sponsored information series, graduate level courses in transportation, technology transfer seminars, professional management and training classes, and teleconferencing among state DOT's and MPC universities. Moreover, several national transportation conferences and events were delivered via TEL8 including a congressional field hearing on national transportation policy. TEL8 programming provides unique professional opportunities drawing upon the partnership between the state DOT's and MPC universities bringing together transportation practitioners and researchers.

TEL8 is guided by the vision and mission statements adopted by the board of directors. The vision for the system is:

> *"To be a leader in the United States in distance learning and communications by utilizing cutting-edge technology and maximizing the capability of that technology by providing superior customer-driven programming that adds maximum value to the TEL8 clientele."*

The TEL8 mission is:

> *"To contribute to quality transportation in Region 8 through a distance learning and teleconferencing network that serves the participating DOT's and universities by enhancing communications, education, technology transfer, and research."*

Mission attainment is measured by the achievement of the following goals:

- Enhance communications among the participating state DOT's, universities, FHWA, and other national and regional organizations.
- Improve the access to, and the quality and quantity of, inter- and intrastate education to all participating DOTs and universities.
- Focus the development and prioritization of the use of TEL8 on (1) interstate transportation teleconferencing, (2) interstate transportation education, and (3) intrastate transportation education.
- Assure that the system responds to the priority needs of participating departments of transportation on a pilot basis in the short term and an established strategic direction in the long term.
- Maximize the cost effectiveness and efficient use of communications time and resources available to the system.

- Research and demonstrate applications that improve the effectiveness and efficiency of distance communications and learning.

- Facilitate the improvement of transportation emergency communications and management among participating states.

The TEL8 vision and mission guided the system's development which included establishing the organization and governing structure, deploying of the telecommunications technology, initiating and developing TEL8 programming and utilizing the system for special events.

TEL8 ORGANIZATIONAL AND OPERATIONAL STRUCTURE

Organizational Overview

The TEL8 organization was established through the TEL8 Pooled Fund Study and funds provided to the Mountain-Plains Consortium through a grant from the University Transportation Centers Program of the U.S. Department of Transportation. Each state's department of transportation contributes funding to the TEL8 Pooled Fund Study. The organization operates under the Transportation Telecommunications Network Region VIII Bylaws developed and adopted by the organizing TEL8 entities. The governing body is a Board of Directors with a representative from each of the TEL8 sites. The officers of the board consist of a President, Vice-President and a Secretary-Treasurer. The president calls meetings as required with an annual face-to-face meeting held at a central location. Additionally, standing committees are appointed by the Board and have responsibilities in the programming, finance and technology areas.

An Executive Director is appointed by the Board and is responsible for carrying out the administrative functions and purposes of the TEL8 as directed and approved by the Board. Additional staff responsible for administering the day-to-day operations of TEL8 include a program director, an administrative assistant and a telecommunications technician. The telecommunications technician has been financially supported by TEL8 on a half-time basis since TEL8's inception while the other administrative positions have been partially supported by TEL8 starting July 1, 1998. An associate director position existed during the second and third years of the study but the executive director has assumed those responsibilities.

TEL8 Committee Structure

TEL8 committees include the: 1) Programming Committee; 2) Finance Committee; and 3) Technical Committee. Each is presented below.

Programming Committee

The programming committee is chaired by the program director and is responsible for developing, initiating, and acquiring TEL8 programming. The committee includes representatives from the DOTs and a MPC liaison each assigned the responsibility of representing their organization in the coordination, facilitation, and implementation of viable educational and training programs over the system. As well, the programming committee develops and presents to the board an annual budget addressing the financial requirements of TEL8 programming.

The committee members work within specialty areas in developing and presenting the InfoX program series, developing and administering surveys, assisting the NHI in developing workable programs, and embracing pertinent mini-courses within the program's budget. Committee members also handle registration, payment, and advertisement of courses to participants and distribute instructional materials. The committee's achievements include a web site conraining scheduling and information, yearly programming of InfoX topics, initiating presentation of NHI courses over Te18, developing guidelines for distance learning programming, and promotion and registrarion of graduate courses.

Finance Committee

The finance committee was established in 1998 with the following charge:

- Prepare and recommend annual budget for the TEL 8 Network to the Board of Directors for approval
- Negotiate the annual financial commitment of the member universities and DOT's to provide their funding support of the Network
- Plan and coordinate the continuation of the pooled fund study which supports the participation of the departments and the funding provided by the member universities.
- Review the funding and billing procedure managed by the TEL 8 Network Staff and verify there continued use or recommend appropriate adjustments.
- Receive reports, monitor and report the financial affairs of the Network to the Board of Directors.
- Assist the TEL8 staff in the identification and resolution of budging and funding and billing problems.
- Conduct periodic (annual) audits and prepare reports for the Board of Directors.

In addition, the finance committee has identified several issues including: 1) TEL 8 revenues; 2) fiscal year definition; 3) local TEL 8 site cost recovery; 4) programming budget; 5) program director's funding support; 6) TEL 8 bridge rental costs; and account management and simplification.

The committee is charged by the vice president and includes members from the DOTs, the MPC universities and the administrative staff.

Technical Committee

The technical committee is chaired by the TEL8 technician and, under the original satellite-based technology, required each TEL8 site to designate a local TEL8 technician to support that site. The TEL8 telecommunications technician coordinated efforts with the local technicians to ensure system reliability. The switch to a terrestrial-based network modified the committee's responsibilities to include 1) assess current TEL8 technology , 2) evaluate potential TEL8 technology and 3) monitor emerging video conference systems and technology.

Major committee accomplishments include the installation of the original satellite-based network and the major reconfiguration of the system's technology to a terrestrial-based transmission medium.

DOT and MPC Partnership

The partnership among the state DOTs and the MPC universities has been recognized by TEL8 as one of the primary strengths of the organization. These two entities have different but very complementary roles in improving transportation activities and the development of the TEL8 network brought them together within a formal structure. The partnership itself has provided avenues of exploration for new opportunities between the two groups as well as providing concrete educational, training and research interaction. For example, students from the MPC universities and several DOTs have participated in various graduate classes during the study. Additionally, the DOT training implementation committee has invited the universities to participate in the InfoX program series, a seminar series devoted to sharing the experiences of practical DOT training and transportation-related applications.

TEL8 Vision, Mission and Operational Objectives

The TEL8 vision and mission was detailed in the introduction. Additionally, TEL8 annually reviews and establishes operating objectives for the upcoming year. Selected operational objectives are reported below.

TEL8 operational objectives for 1999/2000 are:

- Evaluate the need for technical upgrades/enhancements of the PictureTel teleconferencing system and continue necessary operational support.

- Evaluate the planned use of the 'bridge' which supports the Picture-Tel system and identify the potential for making bridge services available to support other non-Tel8 users.
- Prepare a prioritized programming plan to guide education, training, and conferencing uses of the network.
- Develop and implement an evaluation process to assure the programming conducted by the Network responds to the objectives and plans approved by the Board of Directors.
- Prepare a strategy and initiate efforts to increase the coordination and shared use of training resources.
- Initiate an effort to plan and invite expansion of the membership of the Tel8 Network.
- Evaluate the funding and billing structute of the Network, and finalize or adjust it to assure the most effective and efficient operations, and the continued stability of the organization.
- Develop and begin implementation of a performance measuring strategy to monitor and report the operations, technical, programming and financial performance of the Network.

TEL8 Evaluation and Strategic Plan

The 1997 TEL8 annual meeting assessed the current TEL8 system as part of a strategic planning process to identify and recommend any needed changes to improve the system. A survey of TEL8 personnel revealed the following strengths and weaknesses of the system:

Strengths

- Education: Students at various sites able to pursue graduate degrees
- Communication link with regional DOTs readily available
- Concept is basically sound; particularly for universities

- Universities use the system for expanding the offering and selection of classes; universities gain students
- Programming recognized as key issue; programming director appointed
- Centralized Network Control Center
- Overall, the technology is stable
- Educators at the MPC Universities have accepted the system
- People are willing (want) to make TEL8 a success
- Administrative leadership (director, executive director)

Weaknesses

- System should be more user-friendly
- System has had some technical problems
- TEL8 would benefit with increased involvement by the Board; a more active Board would help see that the goals, objectives, and vision of the organization are fully realized
- No system standard for site configuration
- Organization has two major groups (DOTs & Univ.); TEL8 hasn't taken complete advantage of the opportunities or challenges presented with the two groups
- Some turnover of DOT board members
- Service and support from HNS
- Top management at the DOTs seem indifferent to the potential of the system
- There has not been a proactive effort at providing programming, but this seems to be changing
- Technical resources have not been adequately provided at all the sites to support the system
- Board has been ineffectual

The strengths and weaknesses were reviewed, discussed and synthesized into a series of prioritized goals for improving TEL8. The following is the prioritized list of strategic objectives:

1. Increase/improve programming
2. Improve quantity use of system
3. Improve quality use of system
4. Improve technical functionality of system
5. Improve direction/management of system
6. Improve technical support at sites
7. Increase internal/external marketing
8. Improve budget and revenue support
9. Increase state/university top level support
10. Continue/increase sale of surplus capacity
11. Improve connectivity of TEL8 and state systems
12. Increase federal/state/local/university membership

These strategic objectives have been incorporated into subsequent TEL8 operational objectives.

Programming Director and Administrative Staff

The programming director's position was created in 1997 and strengthened during 1998. The program director is a half-time position supported by TEL8 and is located at NDSU to facilitate the coordination of TEL8 operations. The program director remains responsible for developing, marketing, acquiring and managing programming and training. Moreover, the program director chairs the TEL8 programming committee, the committee responsible for planning and initiating TEL8 programming and training.

TEL8 initiated financial support for the system's executive ditector and administrarive assistant in 1998. The executive director is supported on a quarter-time basis while the administrative assistant is supported on a one-third basis. Both are located at NDSU to maintain a cohesive administrative unit.

Each TEL8 location also continues to designate a local technician responsible for supporting that site's technology. In addition, the administrative staff provides limited technical support for the entire network. However, new terrestrial-based technology installed in 1997-98 has improved the technological performance of the system and reduced the need for technological support at individual sites.

TEL8 Cost Structure

TEL8's extensive technological reconfiguration required the defining of a new cost structure and paradigm. The original satellite system was more cost effective at the time the network was established when compared to the land-based technologies and provided low-cost, 24 hours-a-day, seven days a week video conference capability. The costs for the original system was not dependent upon the usage of the system by any individual TEL8 site. In contrast, the new terrestrial system, now cost-effective when compared to the original satellite vendor, has costs associated with an individual site's usage of the system as well as system-wide costs. TEL8 developed a new cost structure to meet the requirements of the new system. The current cost structure has been defined as:

Shared Costs (divided equally among all Tel8 sites as a system):

- Access into the AT&T Network
- Bridge purchase and operation
- Tel8 Technician/Bridge Administrator
- Program Director (from existing TEL8 revenues)
- Administrative Staff

Shared Costs (two different levels of cost, one for DOT's and one for MPC)

- Tel8 Training Program

Individual Site Costs:

- Line usage charges (including NDSU portion of bridged Tel8 events)
- Video conference room equipment
- In-room audio-visual equipment

The shared cost of access into the AT&T network dictates that every TEL8 site has the same cost of access into the TEL8 telecommunications system. This policy ensures that all sites are connected into the system equally in terms of cost and, from an organizational standpoint, enables all sites to participate as equals in the telecommunications system. Such a policy mirrors the cost structure first developed by TEL8 for the satellite system and means that no particular site becomes disadvantaged because of their geographical location.

The 1998 TEL8 costs included a large capital investment for the network reconfiguration discussed later in the report (Figure 2).

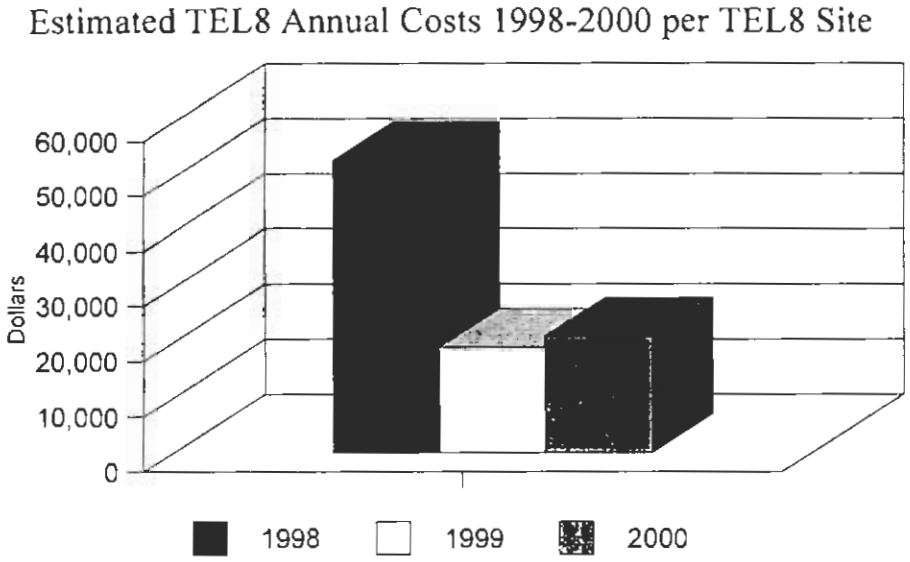


Figure 2. Estimated TEL8 Annual Costs 1998-2000 per TEL8 Site.

TEL8 Partners and Associates

Several outside entities were associated with TEL8 during the study. These other states, organizations, and educational networks were/are interested in available TEL8 satellite space segment, TEL8 bridging and/or current TEL8 programming. The joint activities with these organizations include:

West Virginia Television Network (WVTN)

The WVTN purchased unused satellite space segment and contracted with TEL8 to schedule and manage that space segment during the study. WVTN utilizes the available evening hours of the TEL8 satellite time for providing classes over their twelve site community college system. In addition, WVTN has two mobile satellite units available for TEL8 use, making available special remote video conferences including TRB and other transportation conferences. Revenues from WVTN were used to support the TEL8 program director.

VSAT Tri-Schools

This organization of high schools in western North Dakota purchased TEL8 space segment and have it managed rhrough the TEL8 Network Control Center. VSAT Tri-Schools uses the available early morning hours of TEL8 satellite time for providing classes over their three-site system. Revenues from rhe VSAT Tri-Schools were used to support the TEL8 program director.

Other States

Other states informally expressed an interest in developing or considering an association with TEL8. These inquires range from eirher joining TEL8 or developing a sysrem compatible with TEL8. TEL8 will continue to respond positively and encourage other states to develop systems facilitating telecommunications with TEL8.

Other Organizations

The development in 1996 of a satellite-terrestrial gateway provided opportunities for developing video conference capabilities wirh other organizarions interested in transportation. These organizations include the United States Department of Transportation, the United States Department of Agriculture, and other transportation related agencies. The current TEL8 terrestrial-based network provides connectivity to any video conference site in the world.

NETWORK TECHNOLOGY

Satellite-Based Network Topology

The TEL8 telecommunications network was originally established as a Hughes Very Small Aperture (VSAT) satellite-based system. Each TEL8 site purchased satellite uplink and downlink transmission equipment allowing two-way interactive video conferences among all sites (Figure 3). Additionally, each site developed a video conference room or room capability incorporating audio and video conference technology. A major piece of video conference equipment, the codec, utilized CLI technology, a leading codec manufacturer at the time.

A Network Control Center (NCC) was established at the NDSU site. The NCC is responsible for daily operations of the system including the satellite connectivity for all sites, the satellite space segment scheduling of video conferences and the maintenance and support of all satellite-related technology at all sites across the system. The NCC is staffed by the TEL8 telecommunications technician and other administrative staff as necessary.

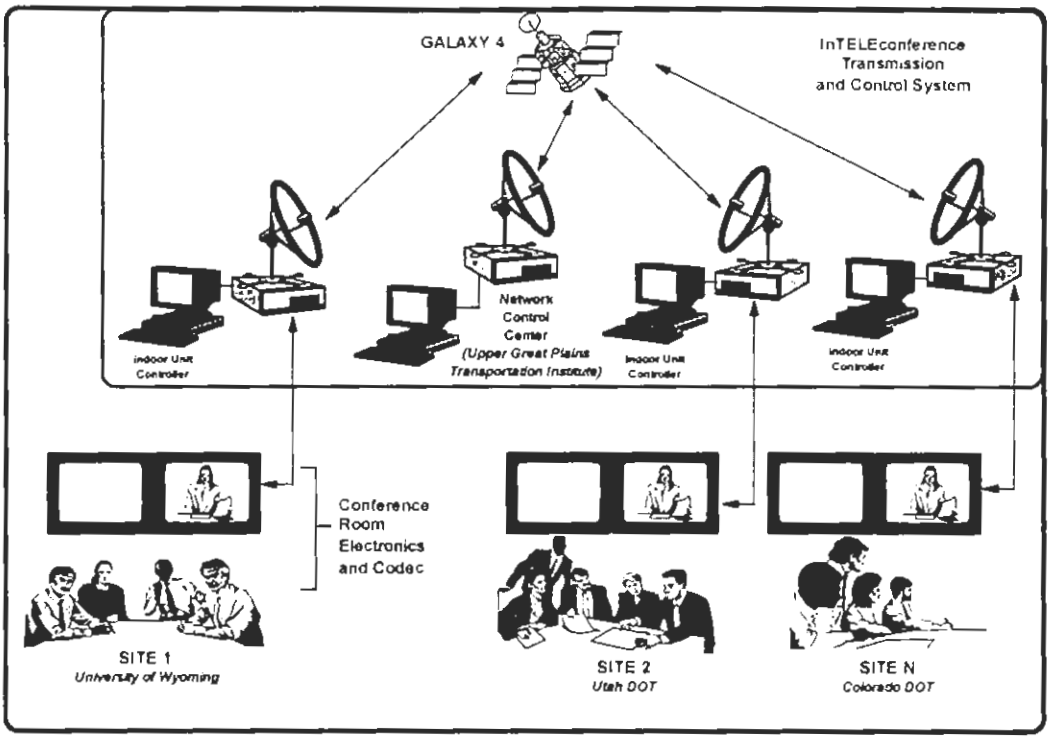


Figure 3. TEL8 Site Equipment Configuration for Satellire-Based Network

The VSAT transmission medium proved to be efficient and adequate but not elegant for TEL8. VSAT was more cost effective at the time the network was established when compared to the land-based technologies. It provided low-cost 24 hours a day, seven days a week video conference capability and afforded a first opportunity for many TEL8 users to be exposed to videoconferencing. However, as video conference technology evolved during the study, other transmission mediums developed additional functionality, particularly full-duplex audio, that made them attractive to TEL8.

Satellite-Based Network Enhancements

Several TEL8 video conference rooms were re-engineered early in the study. Enhancements were made in the audio portion of the room and video and AMX control portions.

Audio Enhancements

Several TEL8 sites installed more sophisticated microphones, which will offer a tighter, more controlled polar pickup pattern. This alleviated potential feedback issues and provided more gain from each microphone. Another enhancement was the addition of a different microphone mixer which, in conjunction with an automatic gain control device, brought greater control over the audio sources.

Video Enhancements

An additional VCR was installed at the NDSU site to record TEL8 video conferences. A "MADDEN PAD" graphics tablet also was installed. Several sites installed scan converters to allow utilization of a laptop or desktop PC as a video source.

AMX TouchControl Panels

Two TEL8 sites installed AMX TouchControl panels that allow for greater control of a video conference, audio conference or presentation. This enhancement allows control switching of the secondary visible site, selection of video sources, control of both VCR's, control of the slide to video projector, control of the CODEC for graphics and incoming audio, and control of a microphone mixer for volume and audio muting.

Southwestern Bell Gateway

A major engineering effort came to fruition in 1996. This system engineering enhancement was fueled by the Transportation Research Board's desire to broaden the distance audience for it's 1996 Annual Meeting utilizing TEL8. The Southwestern Bell Gateway allowed TEL8 sites to conference with any terrestrial site that has ISDN dial out capabilities.

Satellite-Based Network Transmission Costs

Hughes Network Systems Maintenance Contract

TEL8's maintenance service contract with Hughes Network Systems covered the video conference equipment providing network connectivity through the satellite transmission medium. Maintenance costs ranged from $175/month/site to $200/month/site while TEL8 used the satellite for network connectivity. The maintenance contract provided service coverage of eight hours per day, five days per week - local time.

Satellite Space Segment

TEL8's space segment was located on Galaxy 4, Transponder 10. This satellite is located at 99° 00' West longitude. Six percent of this transponder was leased at a cost of $1,152/site/month.

Satellite Space Segment Utilization

Selected Satellite Use Report

The following numbers represent system wide conference activity including events originating from West Virginia Telecommunications Network, VSAT Tri-School Consortium and TEL8 from January 1, 1996 to December 31, 1996.

0	Off Net Conferences for 0 minutes
30	Broadcast Conferences for 139 hours 54 minutes
336	Two-Way Conferences for 255 hours 28 minutes
1	N-Way Conferences for 1 minute
407	2+N-Way Conferences for 587 hours 37 minutes

262	2+N-Way Conferences had 3 stations
51	2+N-Way Conferences had 4 stations
25	2+N-Way Conferences had 5 stations
27	2+N-Way Conferences had 6 stations
25	2+N-Way Conferences had 7 stations
10	2+N-Way Conferences had 8 stations
7	2+N-Way Conferences had 9 stations

TOTAL = 774 Conferences for 983 hours 0 minutes
Broadcast were 3.9% by conference type and 14.2% by duration time.
Two-Way were 43.4% by conference type and 26.0% by duration time.
N-Way were 0.1% by conference type and 0.0% by duration time.
2+N-Way were 52.6% by conference type and 59.8% by duration time.

Selected Satellite Utilization Report for TEL8 Sponsored Events

April 1996	
Two-Way Conference hours:	6 hours 9 minutes
Two + N-Way Conference hours:	7 hours 51 minutes
Total:	14 hours 0 minutes
May 1996	
Broadcast Conferences:	1 hour 2 minutes
Two-Way Conferences:	18 hours 1 minute
Two + N-Way Conferences:	18 hours 51 minutes
Total:	37 hours 54 minutes
June 1996	
Broadcast Conferences:	0 hours 19 minutes
Two-Way Conferences:	7 hours 16 minutes
Two + N-Way Conferences:	51 hours 56 minutes
Total:	59 hours 31 minures

July 1996	
Broadcast Conferences:	3 hours 0 minutes
Two-Way Conferences:	9 hours 16 minutes
Two + N-Way Conferences:	43 hours 57 minutes
Total:	56 hours 13 minutes
August 1996	
Broadcast Conferences:	3 hours 2 minutes
Two-Way Conferences:	18 hours 50 minutes
Two + N-Way Conferences:	34 hours 30 minutes
Total:	56 hours 22 minutes
September 1996	
Two-Way Conferences:	4 hours 4 minutes
Two + N-Way Conferences:	42 hours 24 minutes
Total:	46 hours 28 minutes
October 1996	
Broadcast Conferences:	9 hours 38 minutes
Two-Way Conferences:	5 hours 9 minutes
Two + N-Way Conferences:	55 hours 59 minutes
Total:	70 hours 46 minutes
November 1996	
Broadcast Conferences:	0 hours 6 minutes
Two-Way Conferences:	4 hours 55 minutes
Two + N-Way Conferences:	46 hours 26 minutes
Total:	51 hours 27 minutes
December 1996	
Two-Way Conferences:	21 hours 2 minutes
Two + N-Way Conferences:	31 hours 56 minutes
Total:	52 hours 58 minutes

Report Total : *560 hours 5 minutes*
Average use per month: *46 hours*

Network Technology Evaluation

The 1997 annual meeting strategic planning process and two years of experience with the original technological configuration, including the satellite transmission medium and the CLI codec, coupled with the rapid evolution of video conference technology revealed the need for major improvements to the system. Improvements identified as necessary were improved codec video conference functionality, increased transmission medium functionality and connectivity and an enhanced video conference environment for TEL8 users. A Request For Proposal (RFP) committee was formed to develop and assess potential solutions to implement these improvements.

The RFP committee developed a technical document which formed a subsequent RFP issued in May of 1997. The RFP asked for solurions to improve TEL8 technology, functionality, and capability in the following areas:

- Transmission Medium
- Codec Technology
- System Integration/Configuration

The Board of Directors voted for network improvements with a significant investment in enhancing TEL8 video conference technology. In addition, the Board stressed that while improved technology will greatly improve the system, additional resources needed to be allocated to programming, the highest priority strategic objective.

Second Generation TEL8 Network Technology

TEL8 undertook a major reconfiguration of its video conference technology and network technology in 1998. Initially planned and designed during 1997, the technological reconfiguration was part of an overall enhancement of TEL8's telecommunications capability. The entire system switched from a satellite-based transmission medium to a terrestrial-based T1 private network. The switch allowed for enhanced video conference functionality and provided increased connectivity to all parts of the world. In addition, TEL8 acquired new codec technology and installed a network video conference bridge which allows a cost effective mechanism for video conferencing among all network sites and with other video conference locations worldwide. The system reconfiguration includes:

- Network Reconfiguration - New land-based network
- Video conference equipment upgrade - New codec technology
- Video conference bridge Installation - TEL8 bridge

Network Reconfiguration

TEL8 switched to a terrestrial transmission medium from a satellite-based medium for the following reasons:

- Full duplex audio, as currently developed in a terrestrial medium, was not available in the satellite-based technology. Full duplex audio provides the best interactive voice communications possible in a video conference setting.
- TEL8 connectivity outside of TEL8 using the old satellite technology was cumbersome. The establishment of a satellite-terrestrial gateway during 1996 had only provided limited connectivity.

The original satellite transmission medium had illustrated the need for a more elegant system in terms of ease-of-use and site switching. Additionally, the lack of full duplex audio hindered the ease of voice communication among users and became a major quality issue. Moreover, the satellite system was a closed system preventing easy access to other telecommunication sites outside of TEL8. Video conference communications outside the satellite network proved difficult or required exrensive resources. The other avenue of outside connectivity involved the use of a mobile satellite unit which was used for several successful national events but required significant coordination and scheduling resources. Within this context, the switch to a terrestrial transmission medium was completed in the spring of 1998 for all sites. One TEL8 site

required additional AT&T facilities preparation and came online during the second quarter of 1998. The satellite-based system was utilized during the early months of 1998 to facilitate the transition period from satellite to terrestrial.

The components of the new TEL8 terrestrial system include:

- An AT&T Pri Network
- IMUX at ISDN Bri sites
- T1 Base Units at ISDN Pri sites
- A TEL8 Video conference Bridge
- Bridge Network Access
- A TEL8 Technician and Bridge Administrator

The AT&T private T1 Network consists of Primary Rate ISDN over T1 lines inside a private network. The network has an exclusive tariff filed for TEL8 including "on-network to on-network" and "on-network to off-network" rates. The network is now fully capable of connecting to any standards-based video conference system in the world. Furthermore, the new network provides increased quality and functionality when compared to the original satellite-based transmission medium. The IMUX and T1 Base Units are video conference transmission components required at each TEL8 site. The TEL8 satellite technician assumed the responsibilities for supporting the new terrestrial network and the new TEL8 bridge described below.

TEL8 Video Conference Equipment Upgrade

TEL8's enhancements also included new codec technology. The existing CLI codec technology required significant resources to update and improve its functionality to state-of-the-art video conferencing. The new codecs provide improved video quality, increased user and system functionality and voice-activated camera switching. The new codec technology also allows the network to operate at established industry video conference standards and at different bandwidths. These new features provide greater flexibility in connecting to other video conference systems as well as providing video conference participants an easier and more user-friendly environment.

The installation of the new codec technology includes:

- PictureTel S4200 Codecs
- PictureTel World Carts at several sites for increased mobility
- Remote Access Modems for improved remote diagnostics
- 30 Frames-per-second codec technology standards
- AMX video conference room integration at two sites

The installation and configuration of the new codec technology was completed during the first quarter of 1998.

TEL8 Video Conference Bridge Installation

A comparative cost analysis of the potential transmission mediums indicated that TEL8 would benefit from purchasing and operating its own video conference bridge. A bridge is required for video conferences involving more than two sites, a configuration predominantly utilized by TEL8. A PictureTel

Montage 570A bridge was installed at North Dakota State University (NDSU), the Network Control Center under the satellite-based transmission medium. The TEL8 telecommunications technician received bridge training and has been certified as the TEL8 bridge administrator.

The bridge has an 11 port capacity, generally available continuously. However, additional port capacity is available at reduced bandwiths. During 1998, video conferences with up to 13 locations, including several non-TEL8 sites, were supported by the TEL8 bridge. Furthermore, TEL8 has cascaded with other video conference bridges substantially increasing the potential for videoconference connectivity. In summary, the TEL8 bridge provides:

- Cost-effective network connectivity
- Increased non-TEL8 connectivity
- TEL8 expansion economies of scale
- Continuous video conference capability

TEL8 supports a bridge administrator/system technician responsible for TEL8 bridge operations and overall system reliability. The bridge administrator/system technician maintains the bridge at NDSU (the network control center) and provides technical support for the system.

TEL8 PROGRAMMING

Programming Introduction

The development of TEL8 programming has been recognized as a major organizational priority since the initiation of the pooled fund study. Initial programming efforts included board committees, particularly the DOT implementation commirtee, DOT training staff, MPC university personnel and others. Examples of programming offered over TEL8 include NHI courses, MPC graduate classes, MPC research seminars, InfoX (DOT seminar series), TEL8 Board of Directors meetings, TEL8 technicians' meetings and technical committee meetings. Several conferences were specifically developed for TEL8 and delivered over the system including a Low Volume Roads Conference and a Rural FBO Conference.

The Board of Directors emphasized and formalized TEL8 programming through the appointment of a TEL8 program director during the third year of the study. The program director is responsible for the initiation, development and acquisition of a structured, extensive TEL8 training program. Moreover, the program director will be a liaison with those involved at all TEL8 sites who are responsible for training and programming at their respective sites. The program director is supported financially on a half-time basis and starting in 1997 initiated and lead the development of a program and training schedule. The first formal TEL8 training program was approved by the Board of Directors in early 1998 with the financial support for the program being allocated across all sites.

Initial TEL8 Programming

Initial TEL8 programming included MPC graduate classes, MPC research seminars, TEL8 technician's meetings, technical committee meetings, and the DOT seminar series InfoX. Additional TEL8 programming events involved TEL8 Board of Directors meetings, NHI courses, and delivery of the Transportation

Research Board's (TRB) annual meeting. The following data reflects events occurring between 9/14/95 and 12/31/95:

Event Type	Minutes	% of Total
Interstate Class	6,780	50.9
Intra-Srate Class	0	0.0
Interstate Meeting	2,190	16.4
Intra-State Meeting	1,380	10.4
Interstate Seminar	960	7.2
Intra-State Seminar	0	0.0
Testing	1,470	11.0
Other	60	0.0
Non-TEL8	480	3.6
Total Minutes	13,320	

1995 TEL8 Programming Evaluation

The 1995 TEL8 programming was evaluated to determine the benefits attributed to programming in two areas — program value and program savings.

Program value is the value provided to an organization by the TEL8 programming. For example, an organization may receive valuable information through the TEL8 system it would not necessarily receive otherwise. A more specific example is the InfoX series. Program savings would be the costs saved by using the system, and would include travel costs to a conference telecast over TEL8.

The 1995 TEL8 programming evaluated included: 1) InfoX, 2) TRB, 3) graduate classes, 4) Low Volume Roads Conference, 5) NHI course, 6) monthly DOT meetings, and 7) other. A survey asking TEL8 sites to assess the value and savings these programs contributed to their organizations was sent to each TEL8 site.

Program Value

All tenTEL8 sites responded to the program value section of the survey. The number of sites indicating each type of programming that added value to rheir organization is tabulated in Figure 4.

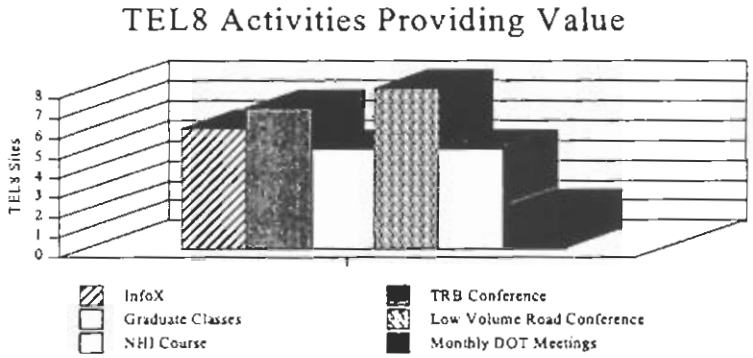


Figure 4. TEL8 Activities Providing Value

Other activities listed as providing value included:

- Teleconference meetings between DOT's and universities
- Research meetings among DOT's and universities
- T^2 conferencing
- Facilitating T^2 training and regional directors meetings
- Five-state conference with lobbyist
- NHS orientation — Law Changes
- Avalanche Control Discussion
- NHTSA meeting series
- MPC planning sessions

Responses to the question asking what contributions or benefits has TEL8 provided to your organization included:

- Enhanced training opportunities
- Potential for reduced travel for state meetings
- Potential for reduced training costs by sharing NHI expenses with other states
- Opportunities for faculty and graduate student research to be seen and discussed
- A strengthened relationship with DOT and universities
- Facilities understanding of DOT needs for graduate education and research
- The exchange of ideas, methods, and procedures within highly specialized topics; considered especially valuable
- An increase in the value with use each year as more projects and activities take place
- Significant recognition with department, college, and university
- Dramatic increase in the frequency and timeliness of meetings for planning and organizing events

- Visibility on regional and national levels
- Open conversations with other DOT's
- That InfoX will be a great exchange of information
- Access to information and meetings that wouldn't be available to some because of travel limitations
- An increased opportunity for DOT employees to receive training, and facilitate the exchange of information between DOT and other states
- Support of an off-campus graduate program
- Exposing on-campus students to more research findings
- More options provided to all students
- Improved MPC planning process

The last question in the program value section asked each site to estimate a dollar value TEL8 programming had provided. Four sites provided an estimate totaling $63,566. In addition, one site noted that the value provided to graduate students receiving advanced degrees, not otherwise available to them, would amount to a benefit in the millions of dollars to those students' potential earning power.

Program Savings

All ten TEL8 sites responded to the program savings part of the survey and the number of sites indicating each type of programming providing savings to their organization is tabulated in Figure 5.

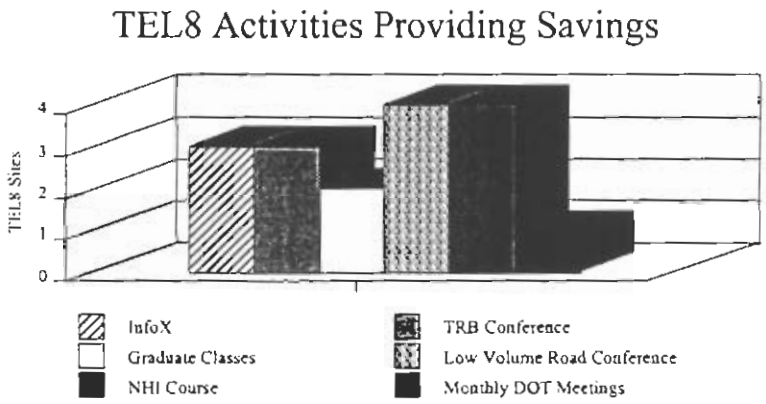


Figure 5. TEL8 Activities providing Savings

Other activities listed as providing value included:

- Teleconference meetings with DOT and MPC
- Exchange of technical information among universities
- Organizational meetings
- MPC time and travel savings

Six sites provided an estimated savings amounting to $136,695. Figure 6 illustrates the estimated value and savings TEL8 programming has provided. The graph does not include the estimated millions of dollars in value provided to graduate students' potential earning power.

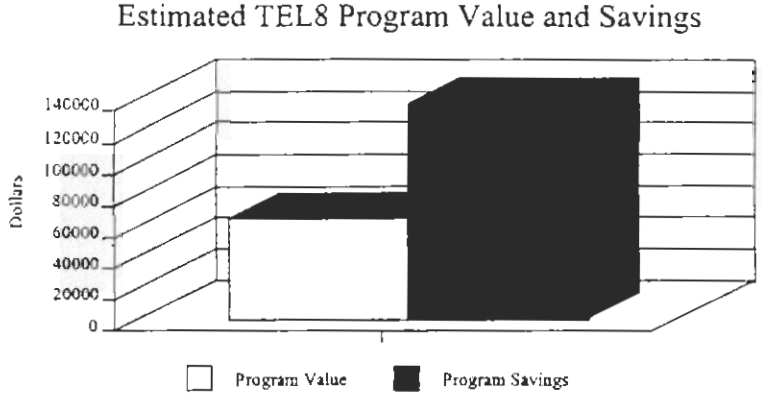


Figure 6. Estimated TEL8 Program Value and Savings

Several TEL8 sites included general comments which provided additional information about TEL8 programming. These comments include the following:

- It's hard to put a number on savings. We had a NHI course that would have cost us $3,000 but we got it free from another TEL8 site.
- TEL8 is an experimenral test bed for trying out new ideas about distance learning and research collaboration.
- In nearly all cases, the people who attended meetings and sessions would not have been sent out of state, and would have been unable to participate. TEL8 provides a valuable means to still expose staff to new ideas and gain from sharing experience in their field. Generally for less than one-fourth of the cost to send one person, we can have several participants.
- The system usage is just now starting to increase. It will be a highly valuable tool in our DOT's future.
- People got to participate in some things that they wouldn't get to.
- Employees who normally attend TRB (or other meetings) attended in person anyway. If TEL8 did not exist, employees who participate through TEL8 would simply not participate.

1996 MPC Transportation Program Graduate Courses Offered

A total of five graduate courses were offered over the TEL8 system during the 1996 program year.

Spring Semester:

Traffic Engineering

Instructor:	Dr. Amiy Varma
Host:	North Dakota State University - Fargo, ND
Additional Sites:	ND Department of Transportation - Bismarck, ND
No. of Students:	18 - 13 NDDOT (7 auditing class); 5 NDSU

Logistics and Distribution Management

Instructor:	Dr. Frank Dooley
Host:	North Dakota State University - Fargo, ND
Additional Sites:	ND Department of Transportation - Bismarck, ND
No. of Students:	11 - 3 NDDOT; 8 NDSU

Fall Semester:

Rural and Non-Metropolitan Transportation

Instructor:	Dr. Denver Tolliver
Host:	North Dakota State University - Fargo, ND
Additional Sites:	ND Department of Transportation - Bismarck, ND
No. of Students:	8 - 5 NDDOT; 2 NDSU; 1 CDOT

Environmental Management and Regulations

Instructor:	Dr. Darwin Sorenson
Host:	Utah State University - Logan, UT
Additional Sites:	North Dakota State University - Fargo, ND
No. of Students:	12 - 8 UTDOT; 2 USU; 2 NDSU

Geotechnical Engineering for Transportation and Infrastructure

Instructor:	Dr. Tom Siller
Host:	Colorado State University - Fort Collins, CO
Additional Sites:	ND Department of Transportation - Bismarck, ND University of Wyoming - Laramie, WY
No. of Students:	15 - 5 CSU; 2 UWY; 7 NDDOT; 1 USU

1996 TEL8 Programming Evaluation

The 1996 TEL8 programming evaluated included: 1) InfoX, 2) TRB, 3) AASHTO, 4) Graduate Classes, 5) Seminars and Conferences, 6) NHI course, 7) Monthly DOT Meetings, and 8) Other. A survey asking TEL8 sites to assess the value and savings these programs contributed to their organizations was sent to each TEL8 site.

Program Value

Figure 7 illustrates the TEL8 activities providing value. The percentage of those TEL8 sites responding to the survey indicating each type of programming that added value to their organization is displayed in the graph.

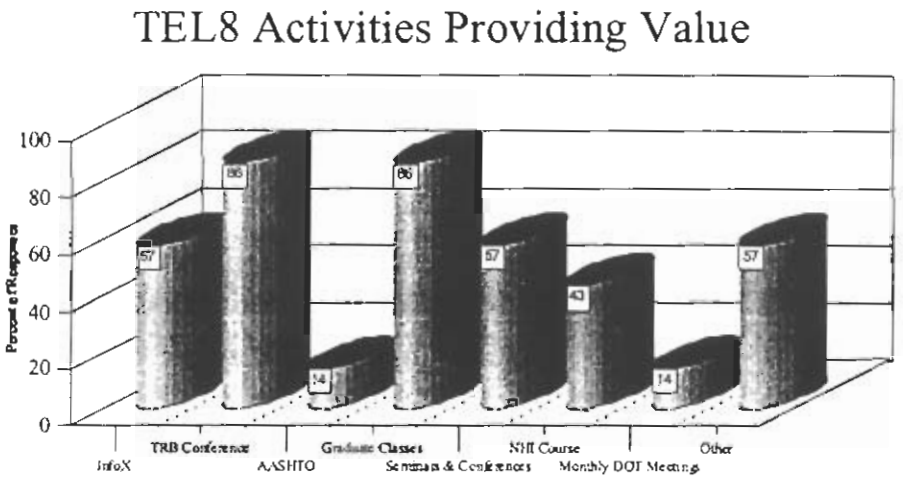


Figure 7. TEL8 Activities Providing Value

Other activities listed as providing value included:

- Connect with FHWA (Washington, DC) for meeting traffic modeling expert
- Technicians Meetings
- Implementation Committee Meetings
- Preliminary Field Review with Field Office
- Four-state meeting explaining multi-state infrastructure bank
- Research Dissemination
- Interview Consultants and Architects
- Four-state CEO meeting

Responses to the question asking what contributions or benefits has TEL8 provided to your organization included:

- InfoX has been of the greatest value.
- TRB sessions were good but there was a very low number of attendees.
- InfoX sessions have been very popular with our employees.
- Unfortunately very little. Almost no participation in TRB or AASHTO.
- We have had great success presenting NHI courses to our staff at two locations.
- We have had only one graduate course. We do not get information from the university coordinators on what is available. Graduate fee structure needs to be looked at.
- Communication with states like our own.
- Leveraged training.

- Expansion of graduate curriculum offerings.
- Knowledge from a wider professional base.
- Learning opportunities for external constituencies (training).

The last question in the program value section asked each site to estimate a dollar value TEL8 programming had provided. Those sites that responded to this question provided an estimate totaling $153,500.

Program Savings

The TEL8 programming activities providing savings were the InfoX, TRB, graduate classes, seminars and conferences, and NHI courses. Those sites that responded to the estimated savings question provided an estimate totaling $183,500. Other activities providing savings included:

- Meetings of T^2 center directors.
- Local travel to DOT.
- Meetings of MPC executive committee.

Figure 8 illustrates the estimated value and savings TEL8 programming has provided. Several sites responding to the survey did not provide dollar estimates of TEL8 program value and savings.

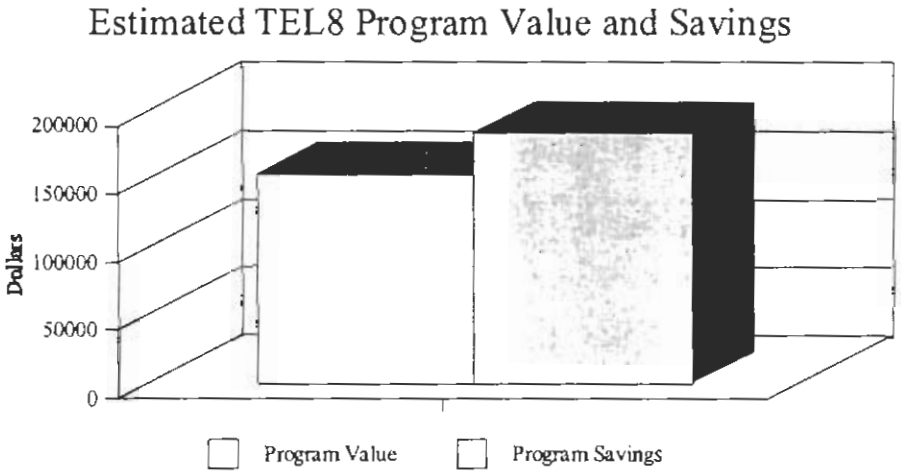


Figure 8. Estimated TEL8 Program Value and Savings

Several TEL8 sites included general comments. These comments include the following:

- Hard to value. "Real Value is in future system"
- We haven't had anything of great value that people would have gone to out of state
- Just not having 15 people travel to D.C. for TRB is a major savings. We estimate with a new system we can expand & pay for it with the savings from not traveling in state.
- TEL8 also saves each site the difference between per site annual operating costs versus downlinks if we did not have fully dedicated time.

TEL8 Special Event Programming

Several significant national events were telecast by TEL8 during the study. A significant milestone was accomplished with the programming of the 1996 and 1997 Transportation Research Board (TRB) sessions from Washington, D.C., back to the TEL8 sites. The 1997 TRB programming was telecast to six additional states via a TEL8 satellite-terrestrial gateway. The gateway enabled terrestrial-based video conference systems to receive TEL8 satellite programming.

Other national events telecast by TEL8 and described below included an ISTEA re-authorization hearing from Helena, Montana; the 1996 AASHTO Annual Meeting from Buffalo, New York; and a transportation-education national conference from Knoxville, Tennessee. Secretary Pèna and Secretary Slater were some of the notable transportation officials who made presentations during TEL8 special events.

Transportation Research Board Annual Meeting

The Transportation Research Board (TRB) and the TEL8 telecommunications network collaborated during the study to provide video conference programming of selected TRB annual meeting sessions to parts of the western United States. The first TRB/TEL8 video conference, in 1996, brought interactive TRB video conferences to the TEL8 system and included 11 program sessions in the Design, Construction, Geotechnical, and Materials category. All of the sessions were transmitted from the Washington Sheraton and telecast to seven remote TEL8 sites. The West Virginia Telecommunications Network (WVTN) provided a mobile satellite unit that linked into the TEL8 space segment with over 300 transportation professionals participating in the video conferences. The 1996 TRB video conference sessions were interactive which allowed the remote sites to participate in a question and answer session. The remote site Q&A was conducted after the question and answer session was completed with the on-site audience.

The 1997 TRB/TEL8 video conference delivery project was a continuation and expansion of the 1996 effort. The 1997 TRB video conference project expanded the number of states receiving the video conference sessions to include 12 western states and doubled the available programming to include two tracks of programming sessions. The video conference transmission medium was a satellite telecommunications system directly linked to TEL8 and to other western states through a satellite-terrestrial gateway. In addition to the TEL8 sites, the western states participating included Arizona, California, Kansas, Nebraska, Nevada, and Washington (Figure 9). The number of remote sites in these states totaled 31 while a total of 35 sessions were delivered from Sunday through Thursday.

Figure 9. States participating in the teleconference delivery of the 1997 TRB Annual Meeting Video conference Sessions

The TRB sessions selected for the video conference were chosen after a survey was circulated to the TEL8 and western states soliciting their preferences for TRB video conference programming. The survey presented each srate the programming categories at the TRB annual meeting and asked the states to rank their priorities for receiving programming. The survey results were used by TRB to select the video conference program schedule and are illustrated in the table below. The WVTN provided two mobile satellite units that linked into the TEL8 satellite space segment and the satellite-terrestrial gateway. The sessions were delivered in broadcast mode only with the remore sites participating in the question and answer session via telephone.

Table 1. TEL8 and Westetn States TRB Programming Priority

Session Theme	*State Priority (1 = low, 7 = high)*
Materials and Construction	6.8
Maintenance	6.5
Operations and Safety	5.8
Design	5.5
Planning, Administration and Environment	5.3
Freight Transportation	5.0
Energy and Environment	4.6
Intermodal Transportation	4.5
Finance	3.8
Public Transit	3.6
Aviation	3.5
Rail	3.0
Marine Transportation	1.8

The TRB/TEL8 video conference was delivered January 12-16, 1997 to the 12 participating states including each state's Department of Transportation and several transportation research universities. There were approximately 400 participants at the 31 remote sites. The 1997 TRB/TEL8 video conference doubled the number of western states receiving TRB programming and increased the number of video conference participants by one-third. The attendance at TEL8 sites decreased from 311 in 1996 to 147 in 1997.

AASHTO

The American Association of State Highway and Transportation Officials invited TEL8 to participate in their 1996 annual meeting in Buffalo, New York. The sessions telecast included the Highway Subcommittee on Design chaired by Thomas Warne of Utah and which involved Federal Highway Administrator Rodney Slater. The West Virginia Television Network's mobile satellite unit was utilized to provide the satellite ttansmission link.

ISTEA Hearing

The ISTEA Reauthorization Missoula Regional Forum sponsored by the U.S. Department of Transportation was telecast over the TEL8 system in August of 1996. The forum, chaired by Secretary of Transportation Federico Pena and Senator Max Baucus of Montana, heard testimony from regional transportation official including participants from the six TEL8 DOTs via TEL8. TEL8 participants included DOT CEOs and other transportation policy officials.

Transportation Education Conference

The U.S. Department of Transportation hosted a national conference on meeting the demand for transportation professionals in the next century. TEL8 telecast the conference, which focused on the need to prepare transportation professionals to design and operate the complex transportation systems of the future. The TEL8 participation included interaction with Morrimer Downey, Depury Secretary of Transportation.

TEL8 Re-Dedication

TEL8 re-dedicated its system July 14, 1998. Associate Deputy Secretary of Transportation John Horsley gave the keynote address from the United States Deparrment of Transportation in Washington, D.C. as part of the video conference re-dedication. (Mr. Horsley participated in an earlier TEL8 video conference, a five-state congressional hearing with Secretary of Transportation Pena originating from Missoula, Montana.) The re-dedication noted the technological reconfiguration of the system and highlighted:

- The importance of utilizing partnerships and technology to further the advancement of national, regional and local transportation systems.
- The pooling of resources among DOT's and universities in a symbiotic relationship dedicated to serving the region's transportation interests.
- The development of regional programming and training activities to meet the needs of transportation professionals, researchers and students.
- The employment of communication technology to more effectively administer transportation organizations.

- The utilization of a state-of-the-art video conference system to pool resources, develop new regional relationships, maximize educational and training opportunities, and provide communication facilities.

Mr. Horsley particularly noted the role of organizations like TEL8 in developing transportation policy.

Aviation Teleconference `98

The Second Annual Aviation Teleconference entitled Aviation Teleconference `98 held over TEL8 addressed the topic of "Fixed-Base Operators and Air Service Access." This video conference included 12 locations across 8 states and the District of Columbia utilizing the bridge cascading functionality of the TEL8 bridge (Figure 10). Bridge cascading functionality provides connectivity into other video conference bridges and greatly expands TEL8's telecommunications potential. Non-TEL8 participants were located in Nebraska, Minnesota, Wisconsin and Washington, DC. Several Minnesota sites were included in the video conference.

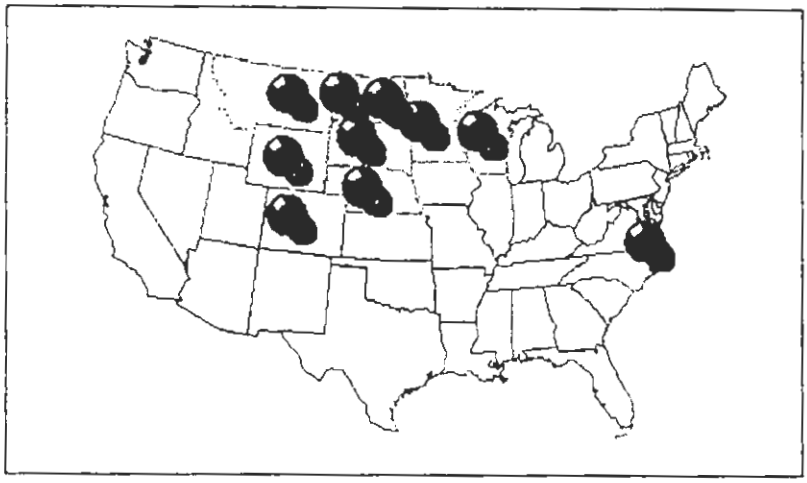


Figure 10. Aviation Teleconference '98 Site Locations

Aviation Teleconference `98 brought together over 50 aviation professionals including fixed-based operators, airport managers, regularors, aircraft technologists and other aviation specialists from around the country. It provided an excellent forum for the development and discussion of policies directly impacting rural aviation. Furthermore, the conference provided a vehicle for collaboration among the region's and nation's senior aviation officials.

Second Generation Programming and Training

Increasing and improving programming and training was recognized as the highest priority among the strategic goals and objectives. During the third year of the study the Board of Directors hired a program director to meet those objectives. The program director will be financially supported half-time by the system.

The program director initiated the development of a 1998 training and program schedule. This schedule was developed during the third year of the study and approved by the board in early 1998. Costs

for providing the training program are estimated at $37,800 and were allocated among all TEL8 sites with the DOTs assuming a larger proportion of the costs.

The 1998 TEL8 programming and training schedule included:

- Two Asphalt Pavement Courses
- Rural Transit Coordination Seminar
- Rural Transportation Management Course
- Several NHI Courses
- Leadership Development Institute for Transportation Series
- Several Workshops including DOT personnel
- FranklinCovey Courses
- Three Intelligent Transportation Systems Short Course

The adoption of a formal, system-wide programming schedule financially supported by TEL8 as a whole was an important organizational milestone and contributed significantly to the evolution of the system. The schedule also included the InfoX seminar series, graduate level transportation classes, implementation committee meetings, and many other activities. Additional programming and training beyond the formal schedule will include DOT information exchanges and ad hoc meetings.

A total of three graduare courses were offered via the TEL8 system during the 1998 program year.

Rural Logistics and Distribution Management -Spring Semester, 1998
Instructor(s): Frank Dooley, NDSU
Host(s): North Dakota State University
Addnl Sites: University, University of Wyoming; Wyoming Dept of Transportation
# of Students: 15 - 2 UWY; 1 WYDOT; 12 NDSU

Statewide Transportation Planning - Spring Semester, 1998
Instructor(s): Ayman Smadi, NDSU
Host(s): North Dakota State University
Addnl Sites: ND Dept of Transportation
# of Students: 5 - 2 NDDOT; 3 NDSU

Transportation Planning - Fall Semester, 1998
Instructor(s): Dr. Amiy Varma, NDSU and Dr. Eugene Wilson, UWY
Host(s): North Dakota State University/University of Wyoming
Addnl Sites: ND Dept of Transportation; University of Wyoming; Utah State University; Utah Dept of Transportation; South Dakota Dept of Transportation
# of Students: 12 - 1 NDDOT; 3 NDSU; 2 UWY; 3 USU; 1 UDOT; 2 SDDOT

1999 TEL8 Programming and Training

TEL8's 1999 training and programming schedule included:

- InfoX — A 1999 InfoX program coordinator has been appointed and the following programs are scheduled for 1999.

Jan	Pavement Management	MTDOT
Feb	Traffic Data/Weigh-in-Motion	NDDOT
Mar	New Products Evaluation	UDOT
Apr	Small Airport Management	MTDOT
May	Quality Assurance	MTDOT
Jun	Avalanche Detection	UDOT
Jun	Employee Safety	MTDOT
Jul	Equipment Management and Retrofit	UDOT
Aug	Finance	UDOT
Aug	Innovative Contracting	MTDOT
Sep	Crack Sealing	NDDOT
Oct	Rest Area Maintenance	WYDOT
Nov	Project Analysis/Selection	MTDOT

- TransX — This new program was initiated in 1999. Its focus is providing information and training to specific professional groups inside the DOT's.

- NHI Courses — A TEL8/NHI relationship is being developed. TEL8 surveyed the DOT's to identify information needs and coordinate NHI efforts to develop training to meet those needs. TEL8 will also assist the NHI in any modifications required of existing NHI courses for video conference and TEL8 delivery.

- FranklinCovey — The TEL8 FranklinCovey trainer has completed her training and will be presenting several Covey courses over the network.

- Grad. courses — Graduate Classes offered for the spring semester 1999 include:

  Geotechnical Engineering
  Intermediate Timber Structures
  Additional classes are planned for the fall.

- Short courses — The TEL8 MPC partners are considering re-designing graduate courses into short courses to meet the needs of the DOT's and for the video conference format.

- T2 — The TEL8/T2 relationship will be fostered.

FY2000 Tel8 Programming and Training

The FY2000 programming and training schedule was approved by the board in 1999. Costs for providing the training program are estimated at $45,380 and were allocated among all Tel8 sites with the DOT's assuming a larger proportion of the costs.

The FY2000 Tel8 training schedule included:

- Monthly InfoX and TransX Events
- 4 Leadership Development Institute Workshop
- 3 FranklinCovey Seven Habits Workshops
- 5 FranklinCovey What Matters Most Workshops
- 1 NHI Course (SuperPave)
- 0 MPC Courses and Special Events
- TransX
  TransX has expanded rapidly and now includes the following focus areas that meet twice a year on a rotating basis: Finance, Maintenance, Intelligent Transportation Systems, Motor Carrier Operations, Transportation Research, Human Resources.

CONCLUSION

The TEL8 Pooled Fund Study demonstrated the effectiveness and the potential of a tele-communications network dedicated to transporration. The TEL8 system delivered transportation-related resources, programming and training to a region-wide audience in FHWA Region 8 and beyond. The pooling of resources by the states in the region to establish TEL8 broughr new opportunities for cooperation, education, outreach, extension of training opportunities, and the maximizing of training and reseatch funds. The sharing of human resources across the network exposed more transportation professionals to existing expertise in the region. TEL8 provided a new medium for addressing the problems and issues shared by the transpottation sysrems in the region while illustrating a new paradigm for developing solutions to those problems.

The partnership between DOTs and universities highlights the TEL8 paradigm and proved to be a valuable outcome to the study. The formalization of this relationship inside the TEL8 organization focused each group on the requirements, opportunities and issues of the other. Both groups have benefitted from the partnership and are addressing several challenges in an effort to take full advantage of this relationship. These issues are actively being examined and include university credits for courses, DOT employee time fot educarion and university courses railored to meet DOT needs.

The TEL8 study also demonstrated the feasibility and value for other transportation agencies to access the TEL8 network. The TRB and AASHTO special events brought rhose organizations to a new audience of transporration professionals and displayed the efficiency of an organized, video conference network. The ISTEA hearings with Secretary Pèna showed the effectiveness of rhe network by allowing the Secretary the opportunity to interact with the CEOs from six state DOTs. This TEL8 ability to effectively provide connectivity to other transportation entities will be further utilized in the future. Furthermore,

individual state DOTs have learned through the TEL8 experience the advantages of developing intrastate videoconference facilities within their own organizations and have initiated programs to do so.

The study identified several issues vital to TEL8 and the development of a successful transportation telecommunications network. The quality and quantity of the programming in the system remains the primary challenge to TEL8. The crearion of a programming director position during the third year of the study is an effort to meet that challenge and the role of the program director will be paramount in the success of TEL8. Additionally, the videoconference technology deployed by any system must not inhibit the utilization and development of an organization. Early TEL8 experience demonstrated that the original technological configuration of the system was not elegant and prevented the maximization of the network. Finally, the project identified the potential of the network. This potential not only includes the programming challenges already discussed but the communication facilities provided by the system. TEL8 needs to expend additional effort to utilize the network communications capability more fully.

TEL8 expansion is under discussion and other transportation organizations in the region have expressed interest in joining TEL8. Beyond the region, other organizations have expressed similar interest in TEL8. While any expansion is only in the preliminary discussion stage, expansion is viewed as a positive outcome of the project and is seen as an opportunity for TEL8.

RECOMMENDATIONS

The TEL8 project makes a series of recommendations for other transportation telecommunication networks. The first is the development of a partnership or working relationship with other transportarion entities similarly situated. The DOT/MPC partnership within TEL8 has proven invaluable in the opportunities afforded to the system. Secondly, a strong emphasis on developing and acquiring programming for the system's clientele should be established. The appoinrment and financial support of a program director and other administrative staff should be considered. It is as important to invest in the people in the system as in the video conference equipment utilized by the network. Thirdly, communicate with the users of the system to make it relevant to the solutions or opportunities they seek. This may be realized through traditional means but should include training in using the system so these users will be active in letting their organizations learn of the network's potential. Finally, take advantage of latest telecommunications technology and place special emphasis on the user-friendliness of the system. Furthermore, to reduce system complexity and any requisite technical support have the system configured as a whole including in-room video conference equipment.

These recommendations underline the importance of developing an organizational structure that meets the needs of rhose using the network. Technology is necessary in establishing a network bur technology should not overshadow the human resources necessary for the system. TEL8's experience recommends developing the human potential of any network.

APPENDIX A: TEL8 POOLED FUND STUDY EXPENDITURES

NORTH DAKOTA STATE UNIVERSITY
STANDARD BILLING FORM

FUND-DEPT: 4352-5980 Voucher # 23 (Final)
GRANT-CONTRACT ID: 17-893-0794
AGENCY NAME: US Department of Transportation
SUBAGENCY NAME: ND Department of Transportation
PROJECT NAME: Transportation Telecommunications Network Region VIII
PRINCIPAL INVESTIGATOR: Gene Griffin

ELEMENTS OF COST	Current Period Expense 4/1/00 6/30/00	NDDOT Cumulative Expense 7/1/94 6/30/00	TOTAL BUDGET
SALARIES AND WAGES-FACULTY	4,447.68	17,920.77	4,165.00
SALARIES AND WAGES-SUPPORT	3,464.83	44,988.42	31,652.00
FRINGE BENEFITS	2,017.09	15,326.98	2,485.25
Subtotal	9,929.60	78,236.17	38,302.25
TRAVEL	0.00	14,312.83	85,425.00
COMMUNICATIONS	13,395.00	133,159.18	0.00
DATA PROCESSING	0.00	162.83	0.00
RENTS & LEASES	0.00	900.00	0.00
OFFICE	1,748.21	4,160.23	0.00
REPAIRS	-2,817.10	98,309.31	0.00
SUPPLIES	-2,396.73	15,687.73	0.00
FEES	1,171.20	289,890.07	167,061.70
INSTRUCTIONAL	1,613.55	1,643.55	0.00
GENERAL	0.00	6,078.07	5,675.00
EXPENDABLE EQUIPMENT	0.00	4,413.00	0.00
Subtotal	12,714.13	568,716.80	258,161.70
MAJOR EQUIPMENT	0.00	760,142.14	1,440,000.00
Subtotal	0.00	760,142.14	1,440,000.00
Total Direct Cost	22,643.73	1,407,095.11	1,736,463.95
INDIRECT COST	0.00	0.00	0.00
TOTAL COST	22,643.73	1,407,095.11	1,736,463.95
LESS: PAYMENTS PREVIOUSLY REQUESTED		1,384,451.38	
TOTAL THIS REQUEST		**22,643.73**	

I CERTIFY THAT ALL EXPENDITURES REPORTED OR PAYMENTS REQUESTED ARE FOR APPROPRIATE PURPOSES AND IN ACCORDANCE WITH THE PROVISIONS OF THE APPLICATION AND AWARD DOCUMENTS.

**Note: of this amount, $ .00 is outstanding

APPROVED BY Darlene Kuai Grants Officer DATE 7-18-00