PRELIMINARY REPORT ON THE HIGHWAY RESEARCH INFORMATION SERVICE ON-LINE RETRIEVAL DEMONSTRATION PROJECT

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This is a report of the Highway Research Information Service on-line retrieval demonstration project and includes summary data about on-line retrieval sessions, specific searches, remote terminal configurations and composition, communication systems used to connect the user's terminal with the on-line file subjects of searches, and user remarks about the overall quality of the service. The service was provided to selected users during a 6-month period from August 1973 through January 1974. The participants included sponsors of HRIS and other organizations interested in highway transportation research.

•THE HRIS storehouse currently contains about 11,000 active or recently completed research project summaries and about 42,000 abstracts of research documents. Until now, HRIS has provided 3 modes of access to the stored records:

1. Annual publication and dissemination of Highway Research In Progress, and quarterly publication and dissemination of HRIS Abstracts;
2. Monthly dissemination of computer printouts of specific subject areas that have been stored during the previous month (current awareness service is available for any or all of the 34 HRIS subject areas) and distribution of the HRIS response to a single request to a number of other users; and
3. Weekly response to specific questions that require search and retrieval from the entire file (the output is screened and often supplemented by Transportation Research Board staff).

For several years the Board has experimented with a fourth access mode: on-line retrieval, whereby the user may search and retrieve information through direct interaction with the computer file. The HRIS demonstration project represents an effort to determine in what ways and to what extent the on-line retrieval access mode can be a valuable adjunct to, or substitute for, the traditional access modes.

The Transportation Research Information Services Network (TRISNET) is an evolving network of transportation information services and centers in the United States and is linked with centers outside of the United States. The rationale for TRISNET, shown in Figure 1, is that transportation research information flows from the research community into information service centers that process and transform the information into utilities and products that are useful to the transportation research community. TRISNET objectives are

1. To create and maintain machine-readable files that contain summaries of transportation research and development projects and abstracts of transportation research reports and articles,
2. To provide on-line access to selected parts of the machine-readable files,
3. To provide access to all primary documents represented by the abstract file,
4. To provide directories to specific information services and organizations in the transportation research community, and
5. To coordinate the network among the services and between the services and the transportation research community.

Thus, the HRIS on-line retrieval demonstration project not only is of concern to HRIS and to HRIS users but also is a step towards the accomplishment of TRISNET objectives.

HRIS is one of several information services whose machine-readable files provide potential for an on-line file of transportation research records (Table 1). Other potentials include HSIS abstracts, MRIS abstracts and project summaries, RRIS abstracts and project summaries, TNRIS abstracts and project summaries, and TRAIS summaries of all projects supported by the U.S. Department of Transportation.

PROJECT ELEMENTS

Sponsors and Participants

The HRIS on-line retrieval demonstration project is sponsored by the Transportation Research Board and by the Federal Highway Administration. The Board contracted with Battelle Columbus Laboratories (BCL), Columbus, Ohio, to provide access to the HRIS on-line file and to assist in the conduct of the project. BCL's automated search information system (BASIS) computer programs are used for on-line retrieval from the TRISNET file.

There are 2 groups of project participants. The first group includes the following government agencies that provide financial support: California Department of Transportation; Indiana State Highway Commission; Michigan Department of State Highways and Transportation; New Mexico State Highway Department; New York State Department of Transportation; Ohio Department of Transportation; Pennsylvania Department of Transportation; Texas Highway Department; Utah State Department of Highways; Washington Department of Highways; Fairbank Highway Research Station (Washington, D.C.), Region 3 (Baltimore), and Region 7 (Kansas City) of the Federal Highway Administration; and the Urban Mass Transportation Administration. The second group includes the following universities and other organizations that do not provide financial support for TRB activities, but have an interest in its work: Canadian Ministry of Transport, Association of American Railroads, Virginia Polytechnic Institute and State University, Ford Motor Company, and Calspan Corporation.

Participants in either group must furnish their own terminal equipment and arrange for payment of telephone line costs between terminals and BCL. The cost of storing the HRIS on-line data base is covered by the TRB contract with BCL.

A distinction in on-line use between the 2 groups is that the BCL contract includes the cost of 400 hours of connect time to be allocated among the participants in the financial-support group. Since there are 14 participants (terminals) in this group, each is allocated approximately 26 hours of connect time, or approximately 1 hour per week for the period of the project. Participants may elect to use more than the allotted hours, but must pay $30 per hour for the extended use.

Participants in the other group arranged with BCL to gain access to the TRISNET file by paying an initial fee of $300 and $45 per hour of connect time.

Composition of TRISNET On-Line File

The TRISNET on-line file contains 2 types of records (summaries of projects and abstracts of reports and articles) for 4 modes of transport (air, highway, rail, and water). Any component of the overall file occupies one or more of the 8 cells of the matrix shown in Figure 2.

The matrix shows that the project summary portion of the file now contains nearly 3,000 TRAIS records, which are in 2 categories that may be searched individually or collectively: inactive projects and active projects. These records cover the research and development activities of the Office of the Secretary of Transportation, FAA, FHWA, NHTSA, UMTA, and USCG.

Nearly 5,000 additional HRIS project summaries cover HP&R and NCHRP projects, nonfederally sponsored research in the United States, and non-U.S. projects that have been received from the Roads and Transportation Association of Canada (RTAC), the International Road Federation (IRF), and the International Road Research Documentation (IRRD) network.

Figure 1. Rationale for Transportation Research Information Services network.

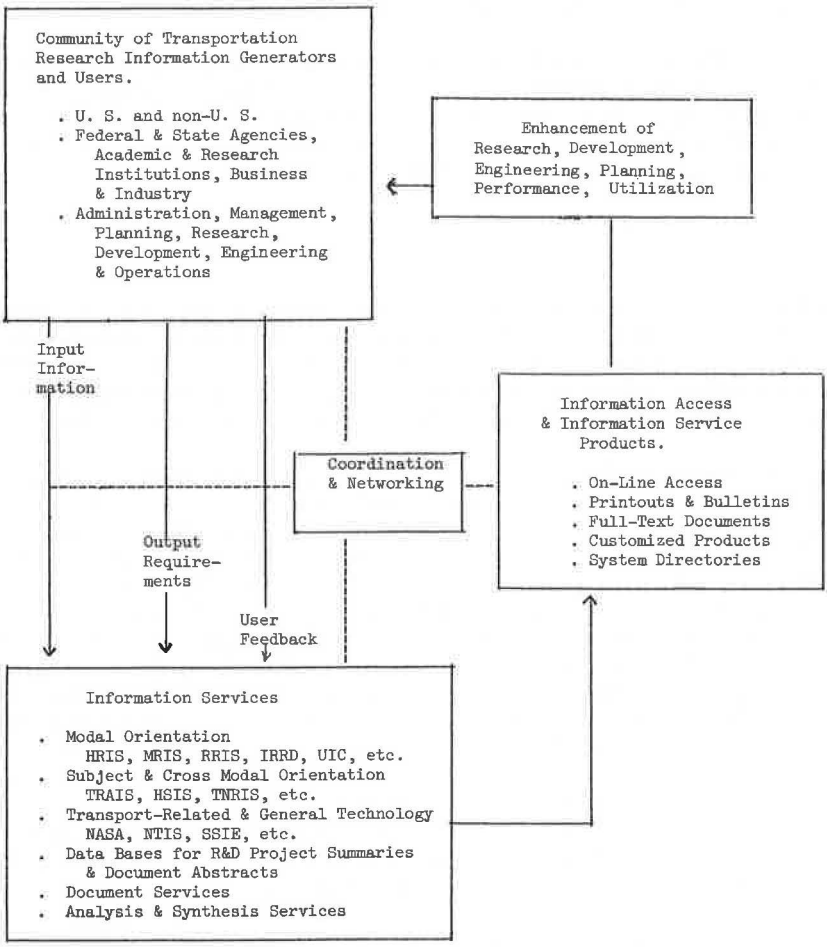


Table 1. On-line file potential.

Service	Sponsors	Project Summaries	Abstracts
HRIS	States, FHWA, UMTA	11,000	40,000
HSIS	NHTSA	0	13,000
MRIS	U.S., MARAD	500	4,000
RRIS	FRA	200	3,000
TNRIS	DOT, TST	300	4,000
TRAIS	DOT, TST	2,600	0

The HRIS abstracts portion of the TRISNET file covers FHWA, UMTA, and TRB publications. It includes abstracts of many other U.S. reports and articles and abstracts that have been received through RTAC and IRRD.

An additional component of the TRISNET on-line file will include a few thousand abstracts of reports of research sponsored by the U.S. Department of Transportation from 1970 to the present and not otherwise represented in the file.

The BASIS software has been developed to show the user which components of the TRISNET file are available and to permit the user to search any combination of the component files. Thus, participants in the HRIS demonstration project may elect to search only the HRIS components or to search the HRIS components in conjunction with other components that may be available.

Other BASIS users may also search the TRISNET file components by special arrangement with BCL and TRB, even though they are not participants in the demonstration project.

PROJECT PHASES

Figure 3 shows a time-lined presentation of the various phases of the HRIS on-line retrieval demonstration project.

A conference of all participants and staff from both TRB and BCL was held at BCL during July 1973 to explain and discuss the project, the BASIS system, and on-line retrieval procedures. Participants were given individual instruction and hands-on experience with on-line retrieval.

During August, September, and October 1973, the project staff made initial visits to the participants and checked the use of the terminal log and the search log.

Regular Acquisitions

From September 1973 through January 1974, each participant sent TRB a copy of the terminal log and a copy of each of 4 search logs for searches that were made during the month. Through its contractual agreement with BCL, TRB will also receive monthly use statistics that are recorded at BCL.

Special Acquisitions

To estimate averages and variations for on-line retrieval proficiency and utility among users requires the acquisition of data from a number of users who perform the same research.

In October 1973, each participant received the same set of 5 specified searches whose results were to be recorded on the search log and returned to TRB. The questions on the average required about 10 minutes of search time and all retrievals could be completed in less than an hour. This special acquisition of project data was repeated in December 1973; a parallel but different set of specified questions was used. The purpose of this repetition was to observe what changes occurred in user proficiency with on-line retrieval during a 3-month period of use.

The in-depth interviews with each participant during December 1973 and January 1974 provided the remaining specially acquired data for the demonstration project.

OBJECTIVES OF THE HRIS ON-LINE RETRIEVAL PROJECT

The objectives for the HRIS on-line retrieval demonstration project are as follows:

1. To provide each project participant with on-line access to highway research-in-progress summaries that have been newly acquired or updated by HRIS since 1971 and with on-line access to HRIS abstracts that have been stored since 1970;
2. To provide training and assistance whereby each participant may understand, gain experience with, and become proficient in the on-line retrieval process; and
3. To acquire data and feedback from the on-line retrieval experiences of the participants, and thereby to assess the utility of on-line retrieval through the BASIS system as an HRIS access mode.

Figure 2. On-line storage of TRISNET file components.

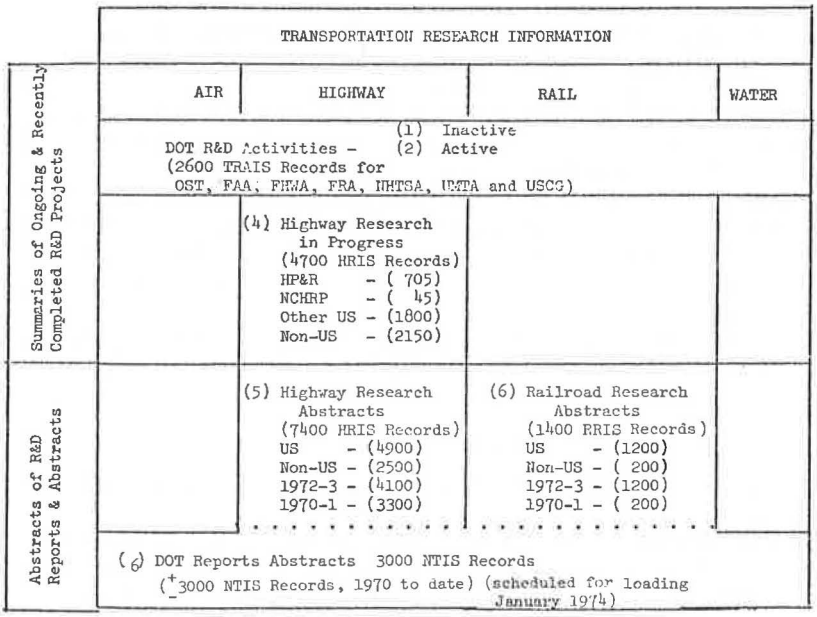


Figure 3. Time line of project activities.

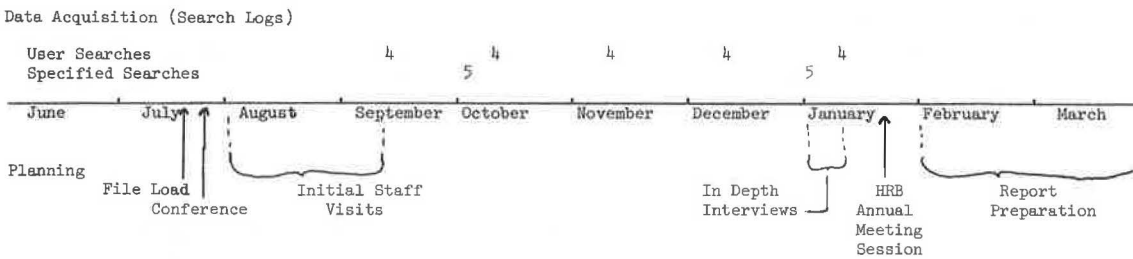
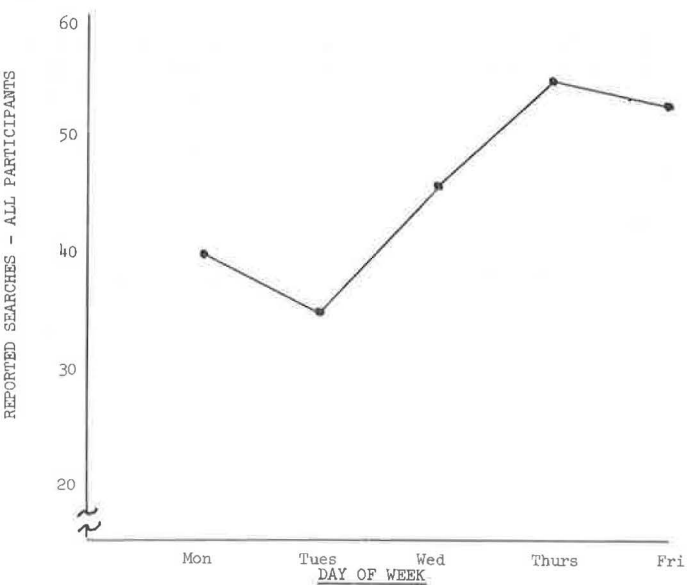


Figure 4. Number of searches by day of week.



Implicit within the objectives are several reference points at which judgments must be made before major recommendations are made for the continuance of the HRIS on-line retrieval service.

1. Do HRIS users agree that there is a need for on-line retrieval service?
2. Can this on-line service be used?
3. What is the utility of the software package?
4. To what extent will the service be used?
5. What level of satisfaction does this on-line service offer, especially with regard to hardware, software, and information content of the file?
6. How should the material currently in the on-line file be updated?
7. How should the on-line file be expanded?

PROJECT DATA

Terminal Configurations

The hardware at each participant's terminal consists of a keyboard acoustic coupler and printer. Terminal printer makes and models include:

Make	Model	Operating Speed (characters/sec)
Hazeltine	2000	30
NCR	Data 100	30
NCR	Data 200	30
Execuport	300	30
Datel	90	30
IBM	2741	14.7
Texas Instrument	Silent 700	30
TTY		10
Western Union	300 ASR	30
UNIVAC	DCT 500	30
GE	233	10
GE	Terminet 300	30

A cathode ray tube (CRT) screen is used on a continuous basis by the Transportation Research Board, but is not necessary for on-line retrievals. Other participants have used a CRT for demonstration purposes only. Most participants rent the terminal equipment at fees that vary from about $100 to $250 per month.

Communication Links

Participants may communicate with the TRIS on-line file by choosing among several schemes for voice-grade telephone linkage or normal telegraph contact. Most participants have elected to use the TYMNET System to communicate between a city near the terminal and the BCL computer. The Ohio Department of Transportation is in the unique position of being able to place a local telephone call from its terminal in Columbus to the BCL computer across town. Other participants use direct-dialing long-distance telephone service. Combinations of linkages used by the participants are as follows:

Linkage	Participant
Direct-dial local telephone	Ohio
Direct-dial long-distance telephone	Indiana
Local call, plus TYMNET	AAR, California, Calspan, FHWA-FHRS, FHWA-R3, Ford, TRB, Pennsylvania, and UMTA
Long-distance telephone plus TYMNET	Canada, New Mexico, New York, Texas, Utah, VPI, and Washington

Linkage	Participant
Wide-Area Telephone System (WATS)	Michigan
Federal Telecommunications System (FTS)	FHWA R7

On-Line Service Utilization

Times of Searches—The terminal and search logs submitted by the participants and the connect-time statistics furnished by BCL were reviewed to learn whether a particular day of the week or time of day was favored for on-line retrieval. Although a scattered pattern was obtained, Thursday and Friday were favored (Fig. 4) as were the hours from 11 a.m. through 2 p.m. (Fig. 5). The file was open for on-line retrieval from 8 a.m. until 12 midnight Monday through Friday each week, and all participants could have processed all of their searches had the file been open from 8 a.m. to 8 p.m., eastern standard (or daylight) time, Monday through Friday.

Batched Searches—Most terminal operators performed more than 1 search during each session at the terminal. The maximum number of searches reported during a session was 9, and the average was 1.6.

Time Expenditures for Searches—As hoped, the average connect time for a single search decreased as the participant's experience with the on-line service increased. Figure 6 shows that the average search during August used 17.5 minutes of connect time and that the average search during November used only 11.6 minutes, a decrease of 34 percent in search time during the 4-month period. The data suggest either that the searches were not so complex or that the terminal operators became increasingly proficient or that both occurred.

Monthly Quantities of Searches—The reported number of searches made each month is shown in Figure 7. The data suggest either that the first set of specified searches requested during October stimulated usage of the on-line service or that the results of searches made during October discouraged extensive use of the service during November.

Classification of Searches—Retrievals reported by participants on their monthly search logs were classified according to the 34 HRIS subject areas. The results of the classification are given in Table 2. The largest number of searches was in the areas of highway safety and vehicle characteristics. Surprisingly, few searches were reported in the areas of transit and transportation economics.

Search Response Quality—During the early months of the project, there was a correlation between the quality of the search and the volume of the output. Searches that yielded a large number of selections were judged to be good searches, and searches that produced few or no selections were rated poor. The correlation did not hold up during the later months of the project after terminal operators gained more experience and feedback was obtained from the initial requester by the terminal operator.

Terminal Operation and Location—The HRIS on-line retrieval project terminals are operated by people of widely differing academic backgrounds. Also, the organizational participating agencies have located terminals in quite different parts of their organizations. As might be expected, the procedure to conduct an on-line search varies among the participants. In general, the terminal is operated by a professional transportation subject specialist, a computer specialist, a librarian, or a clerk typist. Academically, the operator may have one or more degrees in traffic engineering, mathematics, or library science or may have a high school diploma.

Participants have located terminals in their libraries, in engineers' offices, in computer services divisions, in engineering colleges of state universities, or in office services sections of administrative divisions.

All arrangements appear workable; however, the most frequent and successful users of the on-line service located terminals in libraries and appointed librarians to be terminal operators. Searches are conducted by the librarian in consultation with and in the presence of the requester.

Specified Searches—During October, 5 search questions were sent to each participant to process by on-line retrieval.

1. Find the number of research projects that deal with applications of laser technology to highway transportation and identify the agencies doing the work.

Figure 5. Number of searches by hour of day.

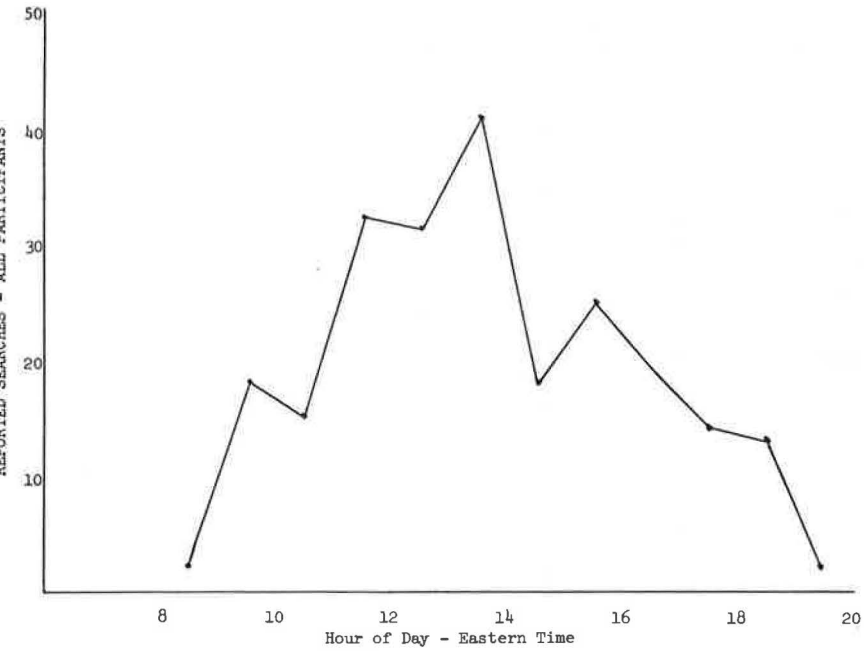


Figure 6. Average time per search by month.

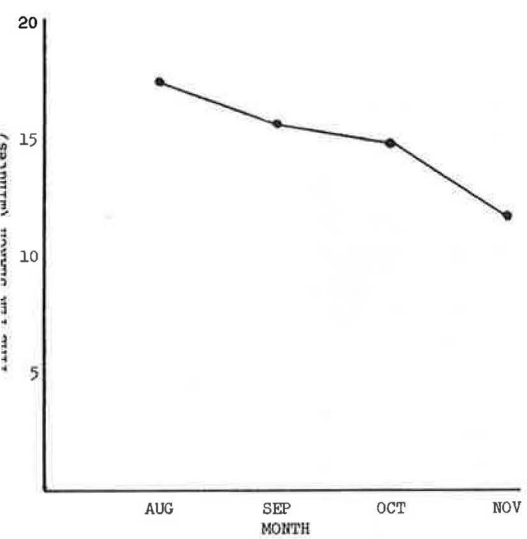


Figure 7. Number of searches reported by participants each month.

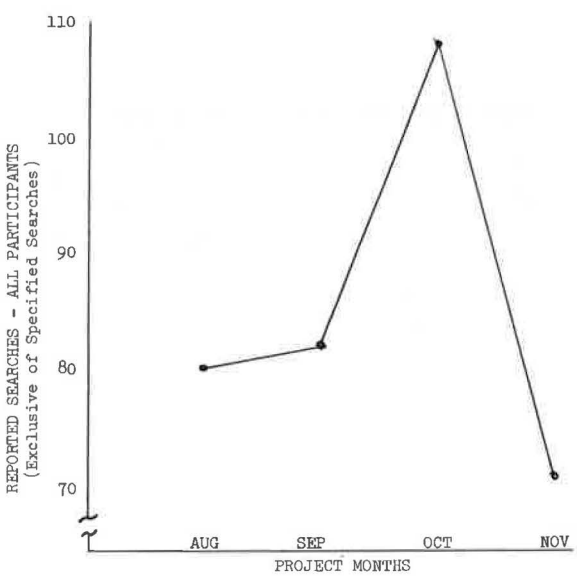


Table 2. HRIS on-line retrievals by subject area.

Subject Area	August and September	October	November
11 Transportation administration		3	1
12 Personnel management	1		
13 Land acquisition		1	
14 Transportation finance			1
15 Transportation economics			
70 Legal studies		1	1
81 Urban transportation administration	1	1	
82 Urban community values	1	1	1
83 Urban land use	1		
84 Urban transportation systems	2		
90 Highway research, general	2	1	
51 Highway safety	3	8	1
52 Road user characteristics	4	4	4
53 Traffic control and operations	1	6	2
54 Traffic flow		1	
55 Traffic measurements	4	2	1
21 Photogrammetry		1	
22 Highway design	1	3	3
23 Highway drainage		1	
24 Roadside development		1	
25 Pavement design			1
26 Pavement performance	4	2	
27 Bridge design	1	2	1
31 Bituminous materials and mixes	1	1	
32 Cement and concrete		2	
33 Construction	1	1	
34 General materials	3	1	2
35 Mineral aggregates			
40 Maintenance, general	3	1	
41 Construction and maintenance equipment			
61 Exploration-classification, soils			1
62 Foundations, soils	1		
63 Mechanics, earth mass	1	2	
64 Soil science	—	—	1
Total	35	46	21

Table 3. Responses to specified search questions.

Question			Items in Final Retrieval	Accession Numbers	
Number	Subject	Search Fields		TRIS	HRIS
1	Lasers	1114, F	10	604684	2R90214041
				600257	2R21040627
				600937	2R26069582
				601224	2R27069521
				602209	2R34226626
				602214	2R34226653
				603034	2R52069946
				604080	2R63220352
				604083	2R63226361
				604117	2R63226600
2	Noise abatement and air pollution	1114, 4516, F	0		
3	Polymer concrete	1114, F	13	601773	2R32069711
				601904	2R32600135
4	Tunnels	1114, F	176	604816	2C11300200
				605090	1P21222998
				605123	2C22022827
				605137	2C22134387
				605145	2C22150170
5	Snow and ice control on bridge decks	1114, F	6		2R40218390
					2R53207574
					1P40214592
					1P53223898
					1P40221209
					1P40224614

Note: Retrieval connect time for the 5 questions was 33 minutes.

2. Identify research projects that started during 1973 and are concerned with noise abatement or air pollution control.
3. Who, outside the United States, is doing research on polymer concrete?
4. Identify 5 recently published articles about tunnels.
5. What sources of information about snow and ice control on bridge decks are identified in the HRIS on-line records?

Responses to the questions were received from 13 participants. Although the responding participants furnished accession numbers for retrieved documents, the specifics in the questions were, in many instances, unanswered. However, the principal purpose of the specified searches was to estimate averages and variations for on-line retrieval proficiency and utility among users. Thus, the explicit answers per se were only an interesting adjunct to the main thrust of the user learning experience. Responses are given in Table 3.

A second set of specified searches was mailed to the participants during January 1974, and those results will be included in a later report.

On-Line Service Use Patterns—The on-line retrieval service use patterns of the participants are one measure of the acceptance and utility of the service. The number of searches made by participants each month can be used to illustrate one facet of their use patterns. One participant may perform many searches each month, but the searches may be very short so that the total connect time for the month may be less than the connect time used by another participant who made fewer but lengthier searches. A measure of only the number of searches made each month by each participant presents an incomplete, if not erroneous, picture of the value of the on-line retrieval to the user.

Some participants may use a large amount of connect time each month. However, large use of connect time does not necessarily indicate efficient use of the service. A participant may develop a search strategy after establishing contact with the computer or may be a novice operator who is getting "on-the-job training" at the terminal. Another searcher may employ very efficient search strategy and be very frugal in the use of on-line retrieval service so that the total connect-time charge for a month may be small. Thus, connect-time charges are also only a partial measure of on-line service utility. However, connect-time charges at $30 to $45 per hour, plus telephone charges, do offer an economic valuation of the service by the participants. The amount of connect time used by each participant each month is given in Table 4. Table 5 gives the participants according to the amount of connect time used. The California Department of Transportation is one of the leading users, and the Fairbanks Highway Research Station of the Federal Highway Administration moved up from a low position in August to the highest position by the end of November. Some participants started off the project as low users and for different reasons remained as low-level users of the service. Michigan started off as a moderate user; the retrievals were made by the Highway Safety Research Institute (HSRI), the action agent for the Michigan Department of Transportation, and decreased substantially as the project progressed. HSRI attributed the decrease to the relative remoteness of Ann Arbor to Lansing, the limited number of HRIS selections available for on-line searching, and the completeness of its own library.

The connect-time use rates of all participants are given in Table 6. Moderate users of the service were judged to range from the mean of the low half of users to the mean of the high half of users. The remaining quarter of users in the low half and the quarter in the high half were designated as low users and high users of the service respectively.

COMMENTS FROM IN-DEPTH INTERVIEWS AND OTHER OBSERVATIONS

There was a marked decline in use of the on-line retrieval during November that continued through December. The Transportation Research Board budgeted 25 hours of connect time for each sponsoring participant, and the maximum connect time used through December 1973, five-sixths of the way through the project, is 1,133 minutes, or 76 percent of the allocation. Through December 1973, all sponsoring participants used 7,500 minutes of connect time, or 35 percent of the budgeted time. At this point in the analysis of the data and the comments made during the interviews, there is no strong evidence that HRIS on-line retrieval service should be continued.

Table 4. Connect time, in minutes, by participants.

Participant	August	September	October	November	Total
Washington	137	16	239	37	429
California	280	278	182	173	913
Utah	171	199	268	205	843
New Mexico	37	0	0	0	37
Texas[a]	195	285	342	78	900
Indiana[a]	0	0	0	62	62
FHWA-R7	0	38	275	74	387
Ohio	43	0	375	39	457
FHWA-R3	0	0	0	0	0
Pennsylvania	87	206	99	71	463
New York	148	145	153	141	587
Michigan[a]	85	99	115	33	332
FHWA-FHRS	0	97	179	671	947
UMTA	0	0	0	0	0
Ford	—	—	75	228	303
VPI	—	—	60	0	60
AAR	—	—	20	0	20
Calspan	—	97	262	179	538
Canada	—	—	100	69	169

[a] Acting through university.

Table 5. Participants ranked by amount of connect time used.

Rank	August	September	October	November
1	California	California	Texas	FHWA-FHRS
2	Texas	Texas	California	California
3	Utah	Utah	Utah	Texas
4	New York	New York	New York	Utah
5	Washington	Pennsylvania	Ohio	New York
6	Pennsylvania	Michigan	Pennsylvania	Calspan
7	Michigan	Washington	Washington	Pennsylvania
8	Ohio	FHWA-FHRS	Calspan	Ohio
9	New Mexico	Calspan	FHWA-R7	Washington
10	AAR	Ohio	Michigan	FHWA-R7
11	Calspan	FHWA-R7	Canada	Michigan
12	Canada	New Mexico	FHWA-FHRS	Ford
13	FHWA-FHRS	AAR	Ford	Canada
14	FHWA-R3	Canada	VPI	VPI
15	FHWA-R7	FHWA-R3	New Mexico	Indiana
16	Ford	Ford	AAR	New Mexico
17	Indiana	Indiana	FHWA-R3	AAR
18	UMTA	UMTA	Indiana	FHWA-R3
19	VPI	VPI	UMTA	UMTA

Table 6. Connect-time use rates of participants.

Rate	Participant	Remarks
1 Sustained high use	California	Continue service; update HRIP; extend abstract file; newsletters and memo generate surges of use
	Calspan	Valuable service; desire continuance of operation
2 Changed from high to low use	Canada	Initial usage high because of availability of new tool; December drop off is seasonal; continue service
	Texas	Lack of communication; continue service
3 Changed from moderate to low use	FHWA-FHRS	High usage during November as a result of conference; December usage paralleled October
4 Sustained moderate use	Utah	Engineers like service; new terminal put in operation January 2, 1974; continue service
5 Changed from moderate to low use	Michigan	Seasonal drop off in usage; continue service
	Washington	Valuable tool; continue service; constant PR required at local level
6 Sustained low use	Ford	System performs well; possibilities look excellent; continue service; data base lacks substance for our purposes
	New York	New user guide is helpful; new software is also good; continue service
7 Insufficient data to classify	Ohio	Lack of personnel to operate the terminal; service looks good and should be continued
	FHWA-R7	Limited use made of HRIS on-line; has been an educational process; continue service for states
8 No data received	AAR	No need for service; our function is not transportation systems operations or research; continue service for others
	FHWA-R3	Do not need service in regional office; function is not research; continue service for states
	Indiana	Insufficient time to properly evaluate the service, but should be continued
	New Mexico	Not given a fair trial; personnel changes; continue service for awhile
	Pennsylvania	No use during December because of installation of a new terminal; continue service
	VPI	Useful service that should be continued; ordering a compatible terminal
	UMTA	No need for on-line service; relevant queries can be answered in house

All of the sponsoring participants, however, recommended that HRIS on-line retrieval be continued. Among the nonsponsoring participants, 4 of the 5 were hopeful that HRIS would remain on line. These 4 and all sponsors were in favor of updating the HRIS ongoing research portion of the file and expanding the literature coverage. Many participants reported that requests for on-line retrieval came in clusters subsequent to a stimulus administered by the terminal operator to the potential user group within or contiguous to the agency. Some stimuli used were briefings, demonstrations, newsletter articles, and memorandums. The participants agreed that extended and repeated communication with their potential community of users was necessary to preserve the vitality of the service. Further, the participants felt that the HRIS on-line retrieval service, like a reference library, should always be available for instant use without accountability for frequency of use. The participants pointed out that the time of year for the project was not optimum because highway operations are slowed during November through the winter months and researchers usually conduct their literature searches during the beginning of projects, which usually start during the early summer months. In addition, research programs are structured during late winter and early spring. There is unanimity among the participants that the BCL BASIS software package is good and improving, the HRIS file content has substance, and the potential utility of the HRIS on-line retrieval service is outstanding.

CONCLUSIONS

Although the project started July 1, 1973, the first participant did not go on line until August 6, and the last went on line October 17. The second half of December was virtually lost because of the holidays. Thus, a limited amount of data has been acquired. Comments from the participants during the course of the project, and particularly during the in-depth January interviews, are only partially supported by the acquired data. A significant criticism of the project appears to be the time of the year chosen to conduct the demonstration. Presumably all participants should have turned on their terminals on February 1 and conducted the demonstration through July 31.

To meet the requests of the participants and to provide the participants time to confirm their project timing arguments require that the HRIS on-line retrieval demonstration project be continued through July 31, 1974. Some funds from the initial contract with BCL for connect time not used may be available for use during the continuation period. The summaries of ongoing research projects in the HRIS file should be updated to coincide with the 1974 issue of Highway Research in Progress. Additional states should be encouraged to participate in the project, initially perhaps through their state universities if terminal equipment is unavailable in the state agency. Additional funding will have to be obtained to continue on-line storage of the existing HRIS file and to update or expand the file.