SUMMARY REPORT

1995
[with inserted material for 1996]

GEOGRAPHIC INFORMATION SYSTEMS
FOR TRANSPORTATION (GIS-T)
SYMPOSIUM

D. David Moyer

Sparks Nugget Hotel
Sparks, Nevada
April 3-5, 1995
I. INTRODUCTION

The eighth symposium on Geographic Information Systems for Transportation (GIS-T) was held in Sparks (Reno), Nevada April 23-5, 1995. A list of the dates and locations of earlier symposia can be found on the inside of the back cover of this report. The 1996 GIS-T Symposium will be held in Kansas City, Missouri, April 1-3, 1996.

This summary report provides an overview of the activities that took place at GIS-T 95. In addition to this summary report, a proceedings containing many of the papers presented at the 1995 symposium has been prepared. The proceedings for 1995, as well as for a earlier years, are available from:

American Association of State Highway and Transportation Officials (AASHTO)
Attn: Jack Stanton
444 North Capitol Street, NW
Suite 225
Washington, DC 20001

The cost is $25.00. A complimentary copy will be provided to all registered attendees at the 1995 conference.

The remainder of this summary report is laid out as follows. Section II describes the background for GIS-T 95. Section III provides an overview of the symposium and how it was organized. Section IV contains a summary of the plenary sessions and an outline of material contained in the concurrent sessions. Section V provides a listing and brief discussion of the major transportation GIS issues identified by conference participants. These issues, summarized by concurrent session moderators and a panel at the final plenary session of the symposium, are intended to provide a guide for planning future symposium programs, suggestions for research needs in the GIS-T arena, as well as suggestions for future activities that individual states and transportation agencies may wish to undertake.

II. BACKGROUND

The 1995 GIS-T Symposium is the eighth in a series of conferences that have now become a regular, annual event. The GIS-T conferences focus on opportunities for the application of GIS technology to transportation agencies and the problems they face. Organized by AASHTO and co-sponsored by the Highway Engineering Exchange Program (HEEP), the Urban and Regional Information Systems Association (URISA), the Federal Highway Administration (FHWA), the Federal Transit Administration, the Federal Railroad Administration, and the Bureau of Transportation Statistics in the U.S. Department of Transportation, the Transportation Research Board (TRB), and the National Association of Regional Councils (NARC), the symposium is intended to provide:

- education
- information sharing with other transportation agencies
- vendor displays of current technology available
- information as to individuals who are facing similar problems in other states.
In 1995, pre-conference workshops continued as a integral part of the Symposium. 1995 workshops included:

- Workshop I on "Transportation Location Reference Systems: Problem Definition and Current Topics" led by Simon Lewis and Roger Petzold,
- Workshop II on " DP85 to DP113: The FHWAs Technology Transfer Efforts in Decision Support Technologies" led by Vincent Nowakowski and Bobby Harris,
- Federal Transit Administration-sponsored on " The Development of the National Transit Geographic Information System, with Special Focus on Applications",
- Bureau of the Census-sponsored "TIGER Enhancement Technology Working Group Meeting", and
- A Pooled Fund Study Workshop for project sponsors.

In addition to plenary sessions each day, four or five technical sessions ran concurrently for the remainder of the day. These concurrent sessions were organized around topical subject areas that included: linear reference systems and models, distributed data management strategies, GIS for planning and managing transit systems, TIGER in the future, state implementation strategies, GIS tools, standards and specifications, routing applications, conflation, technology trends, national spatial data infrastructure (NSDI), ISTEA management systems, data acquisition, desktop dynamic segmentation, spatial crash data analysis, and national framework issues identified by the Federal Geographic Data Committee (FGDC).

III. SYMPOSIUM STRUCTURE

GIS-T 95 began with the five one-day pre-conference workshops and meetings noted above. Over 150 people attended these workshops, a slight increase over attendance at the two workshops held in 1994.

The symposium itself ran for two and one-half days, from Monday morning through Wednesday noon. The 370 registrants came from 45 states and the District of Columbia, 6 Canadian Provinces, and three countries outside of North America (Belgium, Quatar, and Taiwan). Total attendance was down about 15 percent, related at least in part to travel restrictions imposed shortly before the conference by a number of governmental units and agencies.

In addition to state and provincial departments of transportation, attendees represented federal agencies, non-transportation state agencies, metropolitan planning organizations (MPOs), universities, and numerous vendors of hardware, software, and related services.

Exhibitors continue to play a key role in GIS-T symposia. In 1995 16 vendors had 28 booths in the exhibit hall. The exhibitors provide attendees with the latest information on hardware, software, data and data conversion, and other consultant services. The fees which vendors provide also helps keep the registration fees low, making this conference one of the most reasonable GIS conferences to attend.
Attendees had opportunities to visit vendors during morning and afternoon breaks, as well as during luncheon periods. In addition, receptions sponsored by the vendors were held in the exhibit area on Sunday and Tuesday evenings. Both attendees and exhibitors indicated they were well pleased with the 1995 exhibit show.

A continuing emphasis of the symposium is to facilitate informal interaction among participants. In addition to the breaks and lunch periods, a dinner held at the National Auto Museum on Tuesday evening provided opportunities to visit with colleagues in similar situations facing common problems.

Formal Program

The formal program of the symposium contained a mix of both plenary sessions and concurrent sessions. The program opened each day with one or more plenary sessions, with topics of general interest to all participants. During the remainder of the day, four or five concurrent sessions were on-going, providing attendees the opportunity to select sessions and speakers that were of greatest interest to them. In total, the program included four plenary sessions and twenty-two concurrent sessions. Concurrent sessions were held at the same number as 1994, in response to concern among attendees of time conflicts among sessions they wished to attend. The number of abstracts submitted to the Program Committee continued to increase in 1995. This made it necessary to reject nearly 50 percent of the proposals, most of which were of good quality. During the conference, 75 speakers made formal presentations in sessions presided over by 25 moderators.

Another feature of GIS-T symposia is to have moderators prepare and present a short summary of issues that were raised and/or discussed during their session in a plenary session on Wednesday morning. Moderators are requested to summarize key issues in their session. These summaries thus indicate the current status of GIS-T and provide direction for future research, education, and conference programs for GIS-T. Highlights from these summaries are included in Section IV of this report.

Attendance at GIS-T 95 was down slightly from 1994. Based on the review of the speaker evaluation survey by the Program Committee, attendees continue to emphasize the quality and usefulness of the conference. Plans are already underway to modify the structure of the 1996 conference in Kansas City, Missouri, in order to provide time for more sessions and try out new presentation formats. Also, because the size of the conference is making it more difficult to obtain suitable meeting space, the Steering Committee has gone to a multiple year time frame in planning future conferences. The 1996 conference will be held in Kansas City, Missouri, April 1-3. In 1997, the conference will be held in Greensboro, North Carolina, March 24-26. Tentative plans are also being developed for Utah to host the 1998 conference.
IV. SUMMARY OF PRESENTATIONS AND ISSUE IDENTIFICATION

Pre-Conference Workshop

As noted above, a total of five workshops were held on the weekend preceding the symposium. Workshop I was on Transportation Location Reference Systems. Led by Simon Lewis and Roger Petzold, the workshop was an advancement of a previously offered GIS-T workshop. It was intended for field practitioners with a knowledge of core GIS concepts, and covered practical issues in the design and implementation of GIS systems. Topics covered in the day-long workshop included:

- an overview of transportation spatial data concepts
- an overview of data tools
- linear reference methods
- global positioning system applications
- a review of current linear reference activities
- an overview of linear reference applications, with special attention to a number state departments of transportation

Workshop II was on the FHWAs Technology Transfer Efforts in Decision Support Technologies. Led by Vincent Nowakowski and Bobby Harris, the workshop reviewed how the GIS/video project has evolved, the content of the DP85 demonstration project including review of several applications, plans for a new demonstration project DP113, and solicited suggestions from participants as to the content, format, and delivery mechanisms for the new project.

In addition, three additional workshops were held, dealing with:

- development of the National Transit GIS, with focus on applications;
- TIGER Enhancement Technology Working Group Meeting; and
- the GIS-T ISTEA pooled fund study, (for project sponsors).

Day 1 - Symposium Program

The morning of day 1 was devoted to two plenary sessions, one devoted to a Roll Call of states, provinces, MPOs and agencies; and a second one featuring a keynote address by Dean Carlson, the Secretary of the Kansas Department of Transportation.

The Roll Call session provides an opportunity to learn about the status of GIS-T programs throughout the country, as well as progress that has been made in the last year.

To facilitate this session, a form was prepared that outlined the kinds of information that most attendees would like to know about each state, province, MPO, or other agency. (A copy of the Roll Call form can be found in Appendix A.) Additional detail, in the form of a matrix table, is available from:

Diane Pierzinski
California DOT
Among the conclusions gleaned from the oral and written summaries from this session are the following:

Forty states and provinces and the District of Columbia provided responses to the request for written information. In addition, 11 additional federal, state, MPO, and city agencies provided written information as well.

In the states and provinces, Intergraph is still the dominant player, with half of the jurisdictions reporting this hardware vendor. However, PC-based systems continue to grow, with 35 percent of the jurisdictions reporting their use in 1995, up from 25 percent in 1994. Sun was the third most frequently reported software platform.

MGE and Arc/Info software (by Intergraph and ESRI respectively) continue to dominate in State and Province DOTs. However, ArcView is now reported by nearly 20 percent of the states and provinces, with GDS, GIS PLUS, Microstation, DigiMap, AtlasGIS, MAPINFO, MapPub, in-house, and SYBASE also being reported.

The number of PCs and workstations reported in use for GIS-T activities varied widely among the states and provinces.

<table>
<thead>
<tr>
<th>Total PC's and Workstations</th>
<th>States/Provinces</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 or less</td>
<td>18</td>
</tr>
<tr>
<td>11-19</td>
<td>2</td>
</tr>
<tr>
<td>20-49</td>
<td>8</td>
</tr>
<tr>
<td>50-99</td>
<td>4</td>
</tr>
<tr>
<td>100-249</td>
<td>1</td>
</tr>
<tr>
<td>250 or more</td>
<td>1</td>
</tr>
</tbody>
</table>

Nearly 60 percent of the reporting jurisdictions indicated they had less than 20 PCs and workstations devoted to GIS-T activities. Between 1994 and 1995 there was an increase in the average number of PCs and workstations devoted to GIS-T.

State of GIS development in transportation agencies still varies considerably, from just beginning to implementation to operational systems. This variation is reflected in the budget and staff resources dedicated to GIS-T activities. For instance, reported GIS-T budgets ranged from $100,000 to four jurisdictions with budgets in excess of one million dollars. The number of jurisdictions reporting $500,000 or more in GIS-T budgets was 12, the same as in 1994.

<table>
<thead>
<tr>
<th>Budget Range</th>
<th>Number of Jurisdictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $100,000</td>
<td>0</td>
</tr>
<tr>
<td>100,000-249,999</td>
<td>6</td>
</tr>
<tr>
<td>250,000-499,999</td>
<td>2</td>
</tr>
<tr>
<td>500,000-999,999</td>
<td>7</td>
</tr>
</tbody>
</table>
$1,000,000 or more  5

A similar pattern of staff numbers devoted to GIS-T activities was reported by state and province DOTs, ranging from one to 300.

1 4
2-3 6
4-5 6
6-9 8
10-19 7
20 or more 3

While there did appear to be a trend to greater numbers of staff devoted to GIS-T activities, 70 percent of the jurisdictions still report less than 10 staff devoted to GIS-T. The comparable 1994 percentage was 75 percent.

It appears that job classifications that recognize "GIS" continue to be slow in developing. One state indicated GIS was used in position descriptions. Five states indicated GIS use in job titles in 1993 and 1994, therefore, some states apparently did not report it in 1995, or perhaps it is becoming less of an issue than earlier.

[inserted this here, probably needs to be moved to later in text]
In his keynote address, Dean Carlson discussed recent GIS-related work in the Kansas DOT. He noted that in his experience in the Federal Highway Administration, prior to moving to Kansas, four areas (research, policy, engineering, and planning) all wanted to be in charge of GIS. Regardless of who is in charge, it is important to remember that GIS is a tool for analysis. Kansas has established statewide standards in a number of areas, including a common data center and a common base map. Carlson also noted the need for common architecture, using the example of the need for uniform toll collection systems among states. He also emphasized the importance of not creating something you cannot maintain and the power of analyses presented on maps.

Carlson discussed institutional resistance in agencies, and the difficulty this presents to innovation. This is especially true with managers who tend to micro-manage their staffs. As to the future, Carlson suggested there is a need to access information in state DOT computers, in order to aide policy-makers in Congress. He also discussed the impact that making ISTEA management systems is going to have on their installation.

[end of Carlson insert]

MPOs, Cities, Regional Commissions, COGs, and Universities

Ten municipal planning organizations, cities, regional planning commissions, councils of governments, and universities also reported on the status of their GIS-T efforts. Eighty percent of these jurisdictions reported PC-based hardware systems. Arc/Info was the dominant software, reported by 70 percent of the jurisdictions. Other software reported included AtlasGIS, DigiMap, MAPINFO, and MGE. GIS use in position description titles was less than
1994, dropping from 40 to 20 percent.

Base Maps

Thirty-one states and provinces reported the existence of jurisdiction-wise base maps. Over 80 percent reported a map scale of 1:24,000, up from two-thirds in 1994. Most other jurisdictions reported the use of 1:100,000 scale base maps, but there were reports of base mapping at scales ranging from 1:10,000 to 1:1,000,000. As in 1994, 15 percent of the jurisdictions reported multiple scales in use for base maps, with most dual systems containing both 1:24,000 and 1:100,000 scale maps.

Applications

Roll call presenters reported use of 48 different applications in state and province GIS-T systems. About one-half of the applications were reported by only one or two jurisdictions. Applications reported by five or more states and provinces included (in order of frequency of reporting):

- mapping/display
- pavement management
- accidents
- HPMS (highway performance monitoring system)
- bridge
- planning
- dynamic segmentation/linear referencing system
- traffic monitoring
- base map development
- data management
- environmental
- modeling
- congestion management
- database query system
- functional classification
- interagency support
- ISTEA
- project tracking

The major finding from the report on applications appears to be the increase in number of states and provinces using specific applications, indicating a growing maturity of GIS-T.

Overall, the roll call tabulations indicated few major changes from a year earlier. The proposed switch to written reports instead of a roll call session should provide the basis for more analysis of year to year changes in the future.

The remainder of Day 1 was devoted to a series of concurrent sessions, the content of which is described later in this document.
Day 2

[inserted material starts here]

The Tuesday morning plenary session featured two keynote addresses, one by David Fletcher of the Alliance for Transportation Research and one by Michael Domaratz of the U.S. Geological Survey.

Fletcher reviewed the history of GIS and suggested three paradigms have dominated the GIS arena: hardware, software, and language in this order. The latest shift is from software to language. He also noted that when computer aided mapping (with symbolization dominating this domain), shifted to GIS, we added topology and layers. The dynamic analytical capability of GIS was an improvement of computer aided mapping.

Fletcher noted that GIS has limitations, including being a limited model of reality, it is expensive, and it is difficult to share hardware and software. He suggested that the pooled fund study lead to an abandonment of the relational database model and an adoption of the object oriented model.

Fletcher indicated that while inanimate objects are dumb, digital model objects (i.e. software), can be given smart characteristics (e.g. they can schedule their own maintenance, similar to an automobile. He labeled this new GIS as "hypergeography", resulting when digital objects are added to a traditional GIS. He concluded that in the future, we will spend less time writing software and more time writing specifications: and that ecological and linguistic metaphors are more useful than engineering metaphors.

In the second Tuesday keynote presentation, Michael Domaratz discussed the role of the Federal Geographic Data Committee in the National Spatial Data Infrastructure. Domaratz provided several examples of spatial data and noted several trends as to these data, including:

- decreasing costs
- increasing ability to communicate these data
- the existence of many data producers, and
- the existence of many data users.

Issues that need to be considered:

- data are hard to find
- data are hard to access
- data are not current
- data are not well documented, and
- data are incomplete.

Domaratz discussed the need for spatial data clearinghouses and the use of meta data. He noted that ready access will increase use of spatial data, noting the example of one agency with data on the internet distributing more data in the first six months of internet access than in the previous 12 years.
In the final section of his presentation, Domaratz discussed how we can go about collecting spatial data to meet everyone's needs. He noted the federal government is estimated to spend $4 billion annually collecting spatial data. Local governments are estimated to spend two or three times this amount (i.e. as much as $12 billion annually.)

The remainder of day 2 was devoted to 12 concurrent sessions. An early evening vendor-sponsored reception concluded the formal program for Tuesday. However, an ad-hoc brainstorming meeting on developing statewide GIS roadway data bases occurred after the reception. It was organized by Chris Levy (Oregon DOT) and Tom Ries (Wisconsin DOT) since they were interested in what other government agencies were doing. The meeting's topic was multi-government sharing of responsibility in developing and maintaining a single spatial reference roadway data base. The goal of this 2 hour session was to exchange both institutional and technical issues and discuss cases solutions. Over 20 people from federal, state, regional and private organizations attended. All agreed it was a very informative session. Names, phone numbers and e-mail addresses were collected to keep the lines of communication open throughout the year.

Day 3

The Wednesday morning keynote was presented by Brian Soliday of the Trimble Corporation, a major Global Positioning System (GPS) vendor. His topic was GPS as an Enabling Technology for GIS Users.

Soliday discussed GPS applications, how GPS works, accuracies and accuracy requirements of users, and future prospects as to selective availability (SA) of GPS signals. Due to the capabilities and decreasing costs, Soliday asserts that any GIS user is a potential GPS user. He estimated that by 1999, a majority of all new automobiles will contain a GPS receiver.

The wide range of uses that GPS is already addressing were reviewed. Soliday also discussed the development of GPS, starting in 1973, and laid out the geometry and technology that is currently employed.

Soliday indicated that accuracy of GPS depends on a number of factors, including: time on site, type of receiver used, relative positions of satellites, amount of selective availability that the Department of Defense is employing, and whether differential, real time, post processing, etc, are used. Soliday urged the use of mission planning software, to assure the highest accuracy and most effective use of resources.

A careful review is needed by each user to determine how much accuracy they really need. A comparison of relative accuracy and costs is the best way to approach the analysis. GPS is being used not only for positioning, but also for populating GIS databases. Use of a data dictionary provides a data base schema that provides consistency in data capture.
Use of base stations and bulletin board services are also expanding, which is increasing the use and accuracies that may be attained. Other advances in GPS that are occurring include:

- establishment of U.S. Department of Transportation as the lead civilian agency for GPS,
- possible turning off of selective availability in the relative near future.
  (may occur in next three years, or as long as 10 years, as provided in Section 279 of the Department of Defense authorization of February 20, 1996)

The main reason for delay in turning SA off is the need to develop jamming capabilities, in case of war. There will still be a need for differential GPS for the typical GIS user of GPS. It is also expected that there will be a 50 percent increase in the market for GPS products if SA is turned off. This could increase GPS sales to $5 billion by the year 2000.

[end of insert]

The final day of the symposium was devoted to two plenary sessions. These sessions are designed both to provide a summary of the symposium and solicit suggestions and plans for future GIS-T activities. In the first session, presentations were made by each of the 22 session moderators, summarizing the key issues that had been identified and/or discussed in their session. To help moderators distill the key points that would be useful in guiding future GIS-T activities, moderators were provided with a standard one page format report form (see Appendix B).

In the second Wednesday Plenary Session, a member panel, moderated by Roger Petzold of FHWA, provided comments on how the GIS-T symposium can be improved and suggestions for an action plan to guide GIS-T activities in general.
- standards are necessary for GIS-T development and for clear and efficient communication
- benefit/cost ratio of 7:1 is estimated for quality data collection for underground utilities
- to be effective, GIS-T standards must be:
  - accepted and supported
  - easy to implement
  - have functionality
- there are a wide range of uses and substantial opportunity for growth in GIS-T transit applications
- a transportation network profile (TNP) is needed for exchange of network data
- the development of a National Transportation Analysis Platform (NTAP) requires the coordination of the development of both standards and information systems
- GIS-T is a vital component of ISTEA management systems
- logical modeling is an effective technique for understanding the requirements of ISTEA management systems
- a rational analytic process can be applied to all ISTEA management systems

  - GIS-T tools can be used to support the analytical process

- geo-referenced video data can preclude repetitive visits to field for data collection
- GPSVan technology can produce both digital maps and digital databases
- data conversion is not necessarily the best or most cost effective approach
- global positioning system (GPS) technology provide for determination of spatial coordinates of features
- key issues in spatial data exchange:
  - data sharing
  - data validation
  - open data structures
  - data integration

- location referencing solutions depend on:
  - flexible data formats
  - flexible data structure
  - efficient coding
  - unambiguous information transfer

- effectiveness of GIS-T visualization and spatial analysis tools
- problems of data handling and data conversion
- efficient intermodal systems depend on realistic intermodal planning
- application design depends on orderly process to insure user needs are met
- crash analysis requires the integration of many types of data
- need data collection techniques are needed for data for crash analysis
- GIS-T is an effective tool for displaying results of holistic data analysis
- valuable information, but current format takes too much time
- collect information before conference, on a standardized form like used for moderator summaries, then publish before conference, like abstracts
- supplement Roll Call booklet with poster session
- still would be useful to do an introduction of people, by state and province, to see who in attendance
- use timer to limit time, if continue to use roll call

Submittal of Abstracts and papers

- need more DOT papers (e.g. what they are doing, practical, on-going applications
- continue publication of abstract booklet

- need to continue to encourage to use standard abstract format that is contained in the Call for Papers
- need commitment to attend if selected
- consider publishing papers that are not presented
- ask on Call for Papers form if paper has been presented elsewhere
- consider a reduced registration fee for presenters
- Emphasize time available for each presentation in the call for papers, (similar to the information that is currently included in the presenter acceptance packets)
- provide peer review, by vendors, for papers prepared by vendors
- have peer review of all papers, or abstracts, to improve quality, and cut down on "reinventing wheel" papers
- add a student award paper (additional lead time required for judging)
- add vendor track, to provide vendors with opportunity to make presentations on products

Sessions

- Summary session is good idea
- Interactive - like these sessions
- Showcase - good to be staggered as to time
- Birds of a Feather = okay to be all at once.
- frustrated with conflicts with concurrents, want to attend more than one at same time
- consider evening sessions, e.g. for Showcase
- Showcase - leave "tone" up to vendors
- Showcase - would be good to have non-vendors involved in these
- Showcase - don’t allow vapor ware in these sessions
- Showcase - do to rapid changes, need to allow for vapor ware in some instances
- Showcase - have a user (DOT, County, etc.) be the lead on these presentations
- Showcase - vendors like the flexibility of the current setup
- Showcase - Steering Committee didn’t provide a lot of guidance, let vendors know what we want and they will comply
- Interactive - need session particularly centered on research
- Interactive - need less on research (this belongs in TRB meetings)
- Showcase - need session reporting on progress from one year to the next,
(need some sort of tickler system, and someone to follow-up)
- Showcase - need session on what DOTs are doing, in a particular area

- Need more discussion sessions:
  - without formal presentations
  - e.g. "birds of a feather"
  - more sessions like ad-hoc Tuesday evening session on linear referencing
  - need to provide better networking opportunities (e.g. dynamic interest
groups, with time set aside in afternoon, or reserve two or three
sessions for brainstorming
- add Wall of Fame (with posters, examples of best maps, graphics)
- more presentations on applications would be helpful (but application sessions
poorly attended in 1995)
- separate tracks for theoretical topics, applications, and management topics
  would be helpful
- moderator summary session can be deleted, since abstract booklet has been added
- divide Transit sessions into: advanced level, entry level, and policy level
- need renewed effort to involve MPOs
- need renewed emphasis on State DOT presentations

Publicity and Advertising
- AASHTO will provide support for GIS-T home page on WWW
- Lotus notes in another possibility for publicity
- need more emphasis on MPOs
- more emphasis on MPOs, where multi-modal things come together
- involve organizations who would be using GIS-T, even from overseas

- increase advertising, to reach a wider audience
- expand MPO participation
- use targeted mailing lists, e.g.
  - FTA mailing lists for transit (with FHWA cover letter)
  - use University Consortium for Information Sciences to increase university participation
  - other potentially useful mailing lists could be obtained from
    APTA, NARC, ASPRS/ACSM
- develop an award program (peer recognition, rather than competition)

Presentation and Paper Standards
- enforce abstract format standards, to improve Abstract Booklet
- presentation visuals need to meet a minimum standard (similar to TRB)
- related work should be cited in developing papers and presentations
- encourage moderators to follow Moderator Guidelines
- encourage presenters to provide bio sketch to moderator

Workshops
- Sunday workshops were good
- More workshops would be good
- Specific topics:
  - converting TIGER files, roundtable of those who are doing it
  - digital ortho quarter quads (DOQQ)
- Consider variation in length of workshops (e.g. some half day)
- More emphasis on applications (e.g. traffic records) instead of tools, where current workshop emphasis has been
- Lay out early in year to facilitate good publicity program
- Data modeling and business process re-engineering are topics that need attention
- May be necessary to increase fees to raise level of workshops

General Conference Comments

- Limit to what can be done with volunteers, may be time to hire professional conference managers
- Switch to professional conference management may result in loss of good will and could increase costs significantly
- Need to refine, update the GIS-T Action Plan
- Invite training company participation
- Add one or one and one-half days to conference length
- Start conference on Sunday, with workshops on Saturday
- Need to coordinate, expand educational activities for GIS-T community (e.g. via internet, midyear newsletter, etc.)
- Bureau of Transportation Statistics (BTS) at USDOT has a World Wide Web (WWW) site, therefore Internet access can be provided through USDOT, to facilitate ongoing GIS-T information exchange
- More invited speakers and speakers (e.g. to deal with educational needs and opportunities, and how university curricula are being adjusted (or not) to meet these needs)
- Need a mechanism to facilitate interest groups within GIS-T
- Improve quality of speakers at plenary session

The Steering Committee and Program Committee plans to consider these and any other suggestions received as plans are made for 1997 and subsequent years. Additional ideas are invited and should be sent to the 1997 Symposium Chairman:

Diane Pierzinski
California Department of Transportation
1120 North Street, Room 4400
Sacramento, CA 95814
- GIS-T and GPS uses in railroad applications include:
  - accurately locating rail features
  - improved accident analysis
  - simultaneous analysis of passenger and freight rails
  - national clearing house for GIS data must include publicity and educational efforts to ensure users are aware of clearinghouse and of its capabilities
  - application-focused standards are needed to facilitate data sharing
  - the National Spatial Data Infrastructure (NSDI) has intuitive appeal but specifics of NSDI are still unclear to many users

Suggestions for Future Activities

[1996 items in this section are in bold type]

The final plenary session was devoted to determination of appropriate future activities to aid in the development of GIS for transportation agencies.

The session began with short presentations by seven panelists (Simon Lewis, GIS/Trans., Ltd.; Frank Bouchard, Intergraph; Larry Harman, EG&G Dynatrend, Inc.; Chris Levy, Oregon DOT; Alan Vonderohe, University of Wisconsin; Roger Petzold, FHWA; and Jim Dolson, Florida DOT. Each panelist provide suggestions and often offered examples of how their ideas might be implemented. Following the panel, all symposium participants were invited to add their suggestions. The following is a summary of the points made by the panelists and audience participants in this wrap-up session.

Badges
  - Use larger font for organization name on badge
  - include business card with registration

Length and Structure of Conference
  - extra day good, not so rushed
  - too concentrated, needs to be longer
  - limit to a maximum of four concurrent sessions
  - 120 abstracts submitted in 1995, room for 66 presentations

Roll Call
  - return to roll call or variation
    (e.g. include a couple of comments on highlights
      - one or two key points, directed (selected) by steering committee.
    - or a simple introduction of each attendee
    - publish roll call survey results, possibly in abstract booklet