TELECOMMUNICATIONS IN TRANSPORTATION

KEY ISSUES & BEST PRACTICES

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U. S. DEPT. OF TRANSPORTATION
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BACKGROUND

Over the past several years, many states and local communities have been dealing with the need to substantially increase their usage of telecommunications. This is a result of the deployment of more surveillance capability, specifically television cameras, and the need to distribute this and other transportation data to more public agencies and to the public at large. This, along with the deployment of other Intelligent Transportation System (ITS) technologies, has required the development of sophisticated telecommunications networks to gather and distribute the data.

While the needs have been growing, the telecommunications industry has also been undergoing major changes in both technology and the marketplace. The Telecommunications Act of 1996 (TCA) has added new impetuous to the change process. The days of a single telecommunications provider serving an area have disappeared, and have been replaced by a variety of companies that can serve the needs of the community, including public agencies. Further, because of this new competitive market, service providers are offering new levels of service at ever more attractive prices. In other words, the whole telecommunications business has changed dramatically. These changes can produce a major opportunity for public agencies that coincidentally are seeking to expand their telecommunications capability.

Other changes in the regulatory environment have been occurring in the same time frame. FHWA changed its policy on the use of Right Of Way (ROW) several years ago, and now AASHTO is in the process of altering its ROW policy. Public private partnerships are encouraged by the U.S. DOT, and Federal aid can now be utilized for operating expenses, including capital leases.

All of these changes have also created new issues as government agencies have tried to deal in this new environment. It is the purpose of this memorandum to provide an overview of the approaches that have been successfully employed by a number of state and local governments to deal with this new environment -- a few “Best Practices.” To this end, three current topics that have proved to be difficult or contentious will be addressed:

- **Designing a telecommunications network**
- **Should you lease or build a network**
- **Using your ROW to obtain telecommunications**

There are several supporting documents that delve into more detail on these subjects referenced

at the end of this paper.

Designing a Telecommunications Network

Traditionally, traffic signals were connected to the operations center via standard telephone lines, whether a dedicated or dial up connection. This is a very simple network using straightforward technology. Today, with the deployment of video cameras, variable message signs, and advanced surveillance systems, the amount of data being transmitted has grown by orders of magnitude. Further, the technologies available to transport this data are expanding at a similar rate. The result is an increase in the complexity of the network to interconnect the devices and the number of ways, or architectures, that they might be used for this connection. Therefore it is important that a thorough systems engineering study be undertaken before embarking on the deployment of a telecommunications network.

Maryland's experience is a good example of this fundamental requirement. Maryland's CHART program has been underway for several years defining and testing options for their deployment. In this process, they needed to expand their telecommunications capability. Using their traditional consultant cadre, they laid out a network architecture that connected a number of TV cameras, VMS's, and other equipment to their statewide operations center. This network served them well and accomplished all their objectives. However, when they were ready to expand their program and their network statewide, Maryland decided to do an analysis of leasing vs building the complete statewide telecommunications network.(This is a subject that will be covered subsequently.) It was found that the technical capabilities of their normal transportation consultants needed to be enhanced with an expert in telecommunication networks. Therefore, Maryland hired Computer Sciences Corp. (CSC), an expert in sophisticated telecommunications networks for this task, under subcontract to PB Faradyne Inc..

The first task CSC set upon was the determination of the requirements for telecommunications. Although Maryland had defined the location of all their roadway devices, e.g. cameras, loops radars, VMS's, pavement and weather sensors, etc., they had not decided who should receive what data and at what quality. When you consider the list of potential users of the transportation data; 3 State Operations centers; 5 district and county centers; State highway district offices and maintenance facilities; 8 State police barracks; Maryland Mass Transit Administration; Interstate park and ride lots; etc., the net work to serve those needs is extensive. Therefore, CSC interviewed a crossection of these offices to determine what data they needed, how often, and at what quality. The quality issue is associated with the distribution of video to the potential users. Since video is by far the most demanding in terms of bandwidth or data rate, it is crucial to determine if broadcast quality video was required or if compressed video would do the job.

To evaluate this issue, CSC gathered several hours of traffic video. Both broadcast quality and 100 to 1 compression were used in gathering the data, and then a side by side comparison was made to show the users in the state. The users were asked if the compressed video was of sufficient quality to meet their needs. These users were the people who would actually use the video on a day to day basis. The result was that compressed video was quite adequate to perform

all the tasks defined , including the local TV stations that might wish to use it.

There were several lessons learned through this experience. First, the vast majority of the individuals who must use the data had never seen compressed video, or seen the two side by side. Secondly, the question usually asked of those users that had seen both was " which do you like best?", which would result in a different answer from which will serve your needs. There is a difference between compressed and uncompressed video, however the difference is not as great as some might think, obviously not enough different to be significant for the transportation functions,

Having defined the video needs and which functional entity needed what data, it was then feasible to consider the design of the telecommunications network. In this process there were a number of alternatives that required exploration. First, the network configuration that would be optimum to build would be very different than a network designed to take advantage of private industry's existing infrastructure . Secondly, one must consider potential combinations of building and leasing, which produces yet another architecture. The result is that there are a multiplicity of network architectures that must be evaluated in this process. This is where a real telecommunications network expert is required.

In Maryland's case, this process resulted in the evaluation of 22 network configurations.

Should You Lease or Build

Having defined the alternatives to be considered, it remains to then perform a cost tradeoff analysis . There are several important issues that must be considered in the performance of this analysis. First, the analysis must be a "life cycle " cost analysis. This means it must consider all elements of cost that might be incurred to design, implement, operate, and maintain the network over a designated period of time; usually the expected life of the network and/or equipment. In Maryland, they chose to evaluate over a 10 year period. To accomplish this, it is necessary to define the level of reliability expected of the network and the maximum restoration time required in the event of failure. These two factors will have an impact on the level of redundancy, if any, the network configuration, and certainly the level of maintenance required.

When performing this analysis, it is necessary to obtain as much actual cost data as possible, or to obtain quotes for hardware and services, this especially true for lease costs. The rapid change and expansion of competition in the telecommunications industry, means that using published tariffs for leasing rates is certainly an overstatement of those costs. How large that overstatement is, is a function of the local conditions.

In Maryland's effort, they received multiple quotes from telecommunications providers for the actual network configurations defined in the process noted above.

The results of this analysis were a major surprise to Maryland. Midway through the analysis, it became clear that the cost of building the entire state was prohibitive. Therefore, they decided to

focus the tradeoff on hybrid configurations that included the option of building or leasing in the major metropolitan areas of Washington D.C., Baltimore, and Frederick Md., where the density of devices might justify the expense of a build option. The rest of the states network would be a leased configuration. The metropolitan area accounted for 188 miles of roadway out of the 546 miles in the state, but contained 64% of the over 2000 devices on the roads.

When they compared the lowest cost hybrid options from each scenario, the bottom line was that building hybrid was 30% more expensive than leasing over the 10 year period. However, the contrast between leasing and building was really more dramatic than these results indicate. The build portion of the option only considered 188 miles of their roads, while the lease option had lease costs for 546 miles of roads. If one looked at the direct comparison of just the lease costs vs the build costs, the build scenario was over twice as expensive as leasing .

Another interesting result concerned the use of Maryland's existing owned network. Maryland had 75 miles of fiber in the Baltimore/Washington corridor. They found that the cost of hooking up devices to that fiber, the way it was architected, was slightly more than the cost of leasing to serve this area, even though there were no actual fiber construction costs to be born by this build option. This just emphasizes the need to have an expert architect the entire network considering all the costs before any construction is begun.

At the outset of this analysis, it was assumed that Maryland would seek a long term lease for that option , to avoid the past problems of escalating lease costs. However, when CSC began examining the technologies that were deployed, and planned for deployment by the local telecommunications providers, they recommended that Maryland execute only a three year lease. This is a result of the very rapid change in technology in the telecommunications industry. In Maryland, providers are already testing several new technologies that will significantly lower their lease costs over the next several years. The analysis assumed that the costs of leasing stayed constant over the ten year period; whereas, the real world is that the lease costs will only go down because of technology and competition, which will only make the difference between the cost of building and leasing more dramatic.

All of these results point out one clear truism.

In the fast changing area of telecommunications, DOT's must do a good analysis, up front, before investing their scarce capital resources.

In order to assist states in this process, FHWA will have reports documenting the lessons learned by Maryland, and providing a detailed methodology on how to go about a lease vs build analysis. In addition, FHWA will be offering a one day seminar on these topics including a demonstration of the video tradeoff.

Using Your ROW to Obtain Telecommunications

In many states there are opportunities to obtain portions of their telecommunications network by bartering access to state owned highway Right Of Way (ROW) for telecommunications. In other words, share your ROW resource with private telecommunication providers; thus the term

"Shared Resources ".

A number of states have successfully engaged in this process gaining significant portions of their network in this fashion.

The preferred approach to this process is to first define your telecommunication needs and some potential network architecture before engaging in this process. This better prepares the state to negotiate with private industry.

However, several states have entered into Shared Resource projects without doing the analysis defined above. This may produce quite satisfactory results gaining the state a valuable telecommunications capability. However, this may not always be the case.

For instance, Maryland did a Shared Resources deal obtaining fiber along the Baltimore/Washington corridor. When the cost tradeoff study was performed they found that it was slightly less costly to lease service than to hook up to the fiber they already owned. This is due to the configuration of the network using the fiber, and the cost of hooking up devices to the fiber.

Shared Resource projects are time sensitive ventures. When the telecommunications market conditions warrant, a deal might be done. However, a state or local government must be prepared to move when the opportunity presents itself or the private company may go elsewhere to obtain access to ROW to suit his business needs. Having acknowledged the time issue there is usually enough time to allow a 3-6 month analysis effort to help define at least the needs and some networking alternatives.

In addition to technical issues discussed above, there are a number of difficult non-technical issues that must be dealt with to conclude a Shared Resource project. FHWA sponsored a detailed study of several Shared Resource projects and has found seven key issues that seem to be the most difficult or contentious. These seven issues are:

- Public sector authority to receive and/or earmark compensation.
- Exclusively- under what circumstances might a single telecommunications provider he granted exclusive use of the States ROW.
- Valuation of public resources - how can the value of the governments ROW be determined.
- Compensation - what are the compensation approaches and their relative merits.
- Liability - who is liable for system repair, tort actions, etc..
- Tax issues - what are the tax implications in a Shared Resource project?

- Relocation - allocation of responsibilities in the event of roadway improvements.

To assist state and local governments in the Shared Resource process FHWA has published the results of the study mentioned above that indicates potential approaches to each of the issues and how other states have dealt with them. This report, in both summary form and the full detailed final report are available. In addition, FHWA has been offering workshops, conducted by the contractor, Apogee Research Inc., for those states interested in Shared Resource projects. The approximately 19 states that have received these workshops have found them most useful. While it is not clear at this time if funding in FY 97 will permit continuation of FHWA paying for the workshops, it is recommended that states considering Shared Resources should obtain this expertise prior to embarking on a project.

The Telecommunications Act of 1996 (TCA)

The TCA has had, and will continue to have, far reaching affects on the telecommunications industry. This process can be viewed as an opportunity for state and local governments in satisfying their telecommunications needs.

A cautionary note----

The TCA reaffirmed the rights of state and local government to manage and control access to their ROW. However, the TCA also said that in so doing, states must do so in a "non-discriminatory and competitively neutral" manner. Therefore, before a state enters into a Shared Resource deal, or decides to own its telecommunications infrastructure, it would be wise to consult legal consul on the implications of the TCA and the proposed course of action.

Supplementary Documentation

Shared Resources: Sharing Right-Of-Way For Telecommunications; Guidance on Legal and Institutional Issues: FHWA-JPO-96-0015

Shared Resources: Sharing Right-Of-Way For Telecommunications; Identification, Review, and Analysis of Legal and Institutional Issues; Final Report: FHWA-JPO-96-0014

ITS Telecommunications; Public or Private? Results and Lessons Learned from Maryland's Analysis: FHWA-JPO-96- (Available in October 96)

ITS Telecommunications; Public or Private? A Cost Tradeoff Methodology Guide FHWA- JPO-96- (Available in October 96)