Process of Site Selection for Handbook on Benefits of Regional Transportation Collaboration

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Abstract—Five University of Virginia Systems Engineering students worked in partnership with Science Applications International Corporation (SAIC) and the Federal Highway Administration (FHWA) to develop a handbook detailing agency benefits from regional transportation collaboration. The UVa students were responsible for devising site selection metrics and tangible benefits metrics, applying the metrics to rank and select a list of sites, interviewing these sites, and finally presenting the data for the eventual incorporation into a handbook. This report details the methodology used in selecting the interview sites and the creation of the tangible benefits and preliminary interview strategy.

I. INTRODUCTION

Irvin Pointer, threatening to commit suicide, stood dangerously close to the edge of the Woodrow Wilson Bridge on November 4, 1998. Authorities closed the bridge, which serves as an integral passage linking Virginia and Maryland, for the duration of the incident. Pointer proved capable of tying up traffic in the Washington D.C. metropolitan area for twenty miles in both directions. His actions brought the beltway traffic to a stand-still and traffic congestion spilled over onto arterial roads. With Maryland having jurisdiction on one side of the bridge, Virginia owning jurisdiction on the opposite side, and the District of Columbia in charge of jurisdiction over the bridge, agencies should have collaborated with each other to manage traffic during this unfortunate event.

“Since responding agencies had no way to effectively communicate with each other, they were acting without knowing what their counterparts were doing. Detours in one jurisdiction led to dead ends in others” [1]. The mishandling of the incident led to the formation of CapWIN (Capital Wireless Network), as the Virginia Department of Transportation (VDOT) and Maryland State Highway Association entered into a coordination effort. The coordination improved and information sharing among public safety and transportation agencies in Maryland, Virginia, and the District of Columbia. Specifically, CapWIN resulted in multiple mobile data platforms capable of communicating seamlessly across agencies and jurisdictions through a shared network. The CapWIN case study serves as an example of regional transportation collaboration.

Beginning in 2004, the Federal Highway Administration (FHWA) contracted with Science Applications International Corporation (SAIC) and its subcontractor, the University of Virginia to prepare a reference manual that would document tangible benefits of successful transportation collaboration across the United States. Specifically, this project’s goals were the following: select ten to twenty successful case studies, interview key agencies within each case study, gather data that supports the claim that agencies benefit from collaboration, and draft a handbook that documents these benefits.

The benefits of the project are far-reaching in the field of transportation improvements. According to previous FHWA studies, collaboration helps transportation agencies address and solve problems regarding jurisdictional control. Integrating systems between agencies results in improved data processing and increased communication flow. Moreover, participating in a successful collaborative effort qualifies agencies for additional funding from both federal and private sources.

FHWA’s objective is to encourage transportation collaboration by documenting successful collaborative efforts across the United States. The goal is to provide a detailed reference manual to help facilitate a higher rate of participation in transportation collaboration.

To select the best coordination sites from across the country, the project team developed evaluation criteria which are discussed in Section Three. These criteria serve as the mechanism for scoring each site. The team
performed considered numerous scoring criteria before arriving at the selection metrics described in section three. This paper presents evidence that the safety, efficiency, and reliability of the United States’ transportation system can be greatly improved by implementing a regional concept for transportation operations. The subsequent sections will provide further insight into successful collaborative entities across the country as well as a methodology for evaluating and choosing among these entities. Analysis and documentation of successful collaborative efforts among transportation agencies can garner a higher participation rate and a greater success rate of regional transportation collaboration in the future.

II. NEED FOR COLLABORATION

The importance of gathering transportation data and collaborating on regional transportation needs at a regional level was recognized as early as 1962 when “the federal government required states to establish Metropolitan Planning Organizations (MPO) to address regional transportation impact and needs” [2]. Since 1962, the responsibilities of a transportation agency have expanded beyond the original tasks of providing basic transportation infrastructure. “Today, transportation is considered part of a larger societal strategy to improve air quality, provide access to jobs, stimulate economic growth, and enhance quality of life. The public is demanding solutions that go beyond the ability of any one agency” [3]. Dianne Schwager, Senior Program Officer of the Transportation Research Board, explains that, “To rise to the occasion, transportation research managers must find creative ways to share ideas, information, funding, facilities, and even staff” [3]. The concept for regional transportation collaboration is characterized by “a deliberate, continuous, and sustained activity that takes place when transportation agency managers and officials responsible for daily operations work together at a regional level to solve operational problems, improve system performance, and communicate better with one another” [4]. Cooperative efforts among transportation agencies allow road users to hear reliable, timely, and relevant news about weather conditions and traffic situations due to a regional traveler information service that seamlessly delivers information across jurisdictions, agencies, and modes [5]. For example, the Advanced Regional Traffic Interactive Management and Information System (ARTIMIS) brings together the Ohio Department of Transportation (ODOT) and the Kentucky Transportation Cabinet (KYTC) to provide incident, congestion, and freeway management for 88 miles of highway in the Cincinnati and Northern Kentucky area. While implementing a traveler advisory telephone service, two dedicated radio channels, service patrol vans, 80 closed-circuit television cameras, and over 40 electronic message signs, ARTIMIS has achieved a ten percent reduction in interstate highway crashes and an annual savings of one million gallons of fuel [6]. Similarly, the Traffic Incident Management Enhancement program (TIME) brings together over thirty agencies in Southeast Wisconsin with the expectation of reducing traffic incident vehicle delay by as much as 73 percent, improving travel times by nearly 50 percent during traffic incident conditions, reducing the number of secondary crashes by nearly 80 percent, and cutting fuel consumption during traffic incidents by as much as 35 percent [7]. The AZTech case study, which consists of the Arizona Department of Transportation (ADOT), Maricopa Association of Governments (MAG), Maricopa County DOT (MCDOT), two transit agencies, and over twenty private companies, displays a different vision of transportation collaboration benefits. This partnership ensures the coordination of traffic signals across multiple jurisdictions, manages mobility and demand to meet community needs, and keeps freeway ramp meters working together with arterial signal systems to balance demand throughout the regional network [5] “AZTech began in the early 1990’s when traffic engineers in Maricopa County, Arizona wished to synchronize signal lights across multiple jurisdiction” [1]. An Evaluation Report by the FHWA in April 2000 confirmed that retiming of the signals improved mainline travel speed by an average of 6.2 percent, reduced average stops by 4.2 percent, and reduced fuel consumption by 1.6 percent [1]. Emergency evacuation and the general public safety can also be improved through collaboration. CapWIN demonstrates how regional collaboration can improve incident management across multiple jurisdictions. The failure in the evacuation process of Hurricane Katrina, as different parishes in the New Orleans area were not able to communicate with each other, highlights the importance of strong collaboration and coordination. All these case studies show the potential benefits to society and the agencies if various stakeholders can collaborate their efforts. The next section details the method used to find the best examples of strong collaboration to be analyzed for the benefits manual.

III. PROCEDURE USED FOR SITE SELECTION

This section details the method used to select the best 10-20 collaboration sites for further analysis. The selection process included researching trends of transportation coordination, creating a trade study to evaluate the sites, and selecting the final sites.

A. Initial Research

Initial research was conducted by reviewing various articles that described the current trends in transportation operations coordination. The selection process entailed researching key collaborative efforts across the country in order to determine the projects which would be pursued further. Specifically, the team identified a pool of sites as candidates for inclusion in the manual.
The goals for site selection were to include successful collaborative efforts that covered various types of transportation coordination, such as signal synchronization or incident management. FHWA’s ITS (Intelligent Transportation System) Benefits Database was used in addition to case studies and articles to find 62 potential sites to be analyzed. Other sources used in collecting data included the Transportation Research Board, the Institute of Transportation Engineering, and the Associated Metropolitan Planning Organization.

In order to ensure all project team members with easy access to all of the site information, a centralized electronic filing structure was created and made available through a single website.

B. Site Selection Metrics

With the large number of potential site collected, a tool was needed to narrow the pool to the best ten sites. The site selection metrics developed from the goals of FHWA. Since one of the goals of the project was a mix of population sizes of the final sites, each location was categorized as either urban or rural. Another focus was selecting case studies from a variety of geographic locations across the United States.

Next, five evaluative criteria were created in order to objectively score each site. The actual site selection metrics are briefly described below. Using the metrics, the group felt that objectivity could be achieved and that all sites would be graded fairly thereby eliminating any individual evaluator bias.

The first evaluative criterion detailed the health of collaboration and was subdivided into three factors entitled: involvement, spectrum and presence. Involvement was geared towards establishing if there were enough relevant agencies involved in the collaboration to have an effective outcome, and was scaled with three possible outcomes. Spectrum was aimed at calculating how many relevant agencies involved in the collaboration to have an effective outcome, and was scaled with three possible outcomes.

The second factor was titled applicability to other sites and was aimed at determining if the collaboration could be replicated by other agencies/sites. Each site was evaluated using these criteria and recorded in the form shown below. Figure 1 depicts such a scoring method for Hampton Roads in Virginia. The holistic score was a subjective score generated by the group member based on the overall judgment of the site. The table also included a total score, which will be explained in the ensuing section.

<table>
<thead>
<tr>
<th>Quality of Data</th>
<th>Health of Collaboration</th>
<th>Range of Benefits</th>
<th>Maturity of Collaboration</th>
<th>Applicability to Other Sites</th>
<th>Total Score</th>
<th>Holistic Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td>90</td>
<td>88.7</td>
<td>90</td>
</tr>
</tbody>
</table>

Fig. 1: Hampton Roads Score Sheet

C. Trade Study

The total score was calculated through a trade study based on a rank and weight algorithm that was structured based on the FHWA goals. The weights are displayed in Figure 2. Each factor score was multiplied by the corresponding weight and summed together to yield a final score for the trade study.

<table>
<thead>
<tr>
<th>Weight</th>
<th>4/15</th>
<th>3/13</th>
<th>2/18</th>
<th>1/18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td>Health of Collaboration</td>
<td>Quality of Data</td>
<td>Maturity of Collaboration</td>
<td>Range of Benefits</td>
</tr>
</tbody>
</table>

Fig. 2: Weights for Different Factors

Since FHWA wanted the final sites to tell a story that would compel agencies to collaborate in the future, a separate subjective score was given to each potential site. This holistic score looked at the entire picture and scored the site on its potential to bring future agencies into collaborative efforts.

The two separate scores for each site were used to generate two rankings of the sites. In general, the two
rankings were similar which led the group to conclude the trade study and holistic score were adequate methods of ranking the sites.

D. Final Sites Selected

While the trade study yielded a ranking of the best sites, other criteria were also used in making the final selection of sites. For example, since an even mixture of rural and urban sites was desired, a few rural sites were selected for the final list that were ranked slightly lower than urban sites that were not selected. The sites fulfilled the goal of capturing a wide spectrum of geographic locations across the country. This diversity is important to ensure agencies across the country can find similarities with the successful collaborative examples.

Another aspect considered in the final selection was similarity of the site to other sites chosen. For example, two sites, Denver and Kansas City, contained collaborative benefits that were practically identical in which both sites coordinated traffic lights. Rather than include both of the successful sites, only one (Denver) was chosen for inclusion in the final sites. In addition, different types of collaboration were important in the final group of sites. The goal was to select sites that found a wide range of benefits from different types of coordination efforts.

The end result of this process was the selection of 18 sites that are listed below. These sites were to be interviewed in two-stages. The first interview stage ensured that the collaborative entity still existed by talking to a central point of contact for each site. The second stage was more specific and involved interviewing key officials from different agencies within the same site to obtain the specific agency benefits. Based on the interview process, the final ten sites will be chosen from this list.

<table>
<thead>
<tr>
<th>Site Partnership</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Salt Lake City</td>
<td>CommuterLink</td>
</tr>
<tr>
<td>VA, DC, MD</td>
<td>CAPWIN</td>
</tr>
<tr>
<td>San Antonio</td>
<td>MMDI</td>
</tr>
<tr>
<td>Baltimore</td>
<td>BROC</td>
</tr>
<tr>
<td>Lake Tahoe</td>
<td>Lake Tahoe CTS</td>
</tr>
<tr>
<td>Virginia, Minnesota</td>
<td>Fire Department and Police</td>
</tr>
</tbody>
</table>

Fig. 3: Final Sites Selected

IV. TANGIBLE BENEFITS

A. Measuring Benefits to Agencies

The main goal of the Handbook was to present the tangible benefits received by the agencies involved in collaboration. In order to have these agencies work together and share resources and information that they normally would not share, there had to be benefits that they received outside of those provided to the public. Many of these benefits were directly related to money and resources. Through collaboration, these agencies often had an increase in funding, shared resources, and information that allowed for improved efficiency in operations. Furthermore, agencies were able to develop infrastructure and projects that they would not have normally been able to do.

The tangible benefits entering the interview process were operational cost savings, public perception, financial benefits (funding, discounted purchase agreements, free equipment/service provided through other agencies/corporations), technological benefits and safety benefits for the agency.

B. Interaction Matrix

The interaction matrix was the preliminary tool used in discerning whether or not the site selection metrics and anticipated tangible benefits were correctly mapped to each other. Tangible benefits were mapped along the x-axis and site selection metrics were mapped along the y-axis. The cells describe what kind of correlation was to be expected, ranging from none to high.

V. INTERVIEW PROCESS

A. Creation of Interview Strategy

The interview strategy was comprised of questions that were to be asked of each interviewee. There were sample questions to be used for the initial interview. A more detailed interview strategy was developed for follow-up interviews based on the information gathered from the preliminary interview. The goal of these questions was to ensure that the interview went smoothly and that the desired information was achieved. The desired information included whether or not there was significant and ongoing collaboration and if there were measurable benefits.
B. Interview Process

The goal of each interview was to identify the three following items: why the agency joined the collaboration, how the agency has benefited from participating in collaboration, and the measurable or anecdotal evidence to substantiate the claimed benefits. The interviews proved successful in obtaining the desired information from each site.

C. Interview Matrix

The Interview Matrix was created with the aim of cataloging the information from each interview with interactive notes. Each site was subdivided into different projects that they accomplished with the ensuing benefits mapped against a column of tangible benefits. A note was attached to each of the cells that provided more details about the specific benefits.

D. Benefits to Agencies

Many types of collaborative efforts are currently operating in the United States. Each collaborative entity consists of a variety of agencies pooling their resources to deliver a better service to the traveling public. However, delivering a better service, such as improved incident management and reduced traffic delay, is not always sufficient in convincing agencies to participate. The purpose of the interviews was to identify the bottom line advantages and benefits experienced by the participating agencies from collaborating and coordinating with others. The following specific benefits have been observed by participating agencies:

- Joint Pricing Agreements
- Operational savings
- Better public perception
- Access to expertise
- Information sharing
- Increased funding
- Resource sharing
- Health savings- safer environment for emergency responders
- Greater Efficiency

Previously, many firms cited the need for extra time and resources as a key reason for lack of collaboration. However, with agencies receiving the benefits mentioned above, many agencies realize that the numerous benefits that can be received through the collaborative process.

VI. Conclusion and Future Work

A. Conclusion

The work performed this year laid the foundation for the final Handbook. The group was successful in condensing all the potential sites to the current 18, which will be narrowed down to the final ten after substantial interviews with the sites. The majority of the final 18 sites were ranked highest by the holistic score and trade study score.

Some of the eliminated sites were removed due to client preference and not necessarily due to the site’s values. These sites include Las Vegas, which was eliminated due to a large amount of private financing in addition to public funding. Other sites such as Operation Greenlight in Kansas City were eliminated because they were too similar to other sites (Denver). The final sites represent a diverse spectrum of rural and urban sites that span different types of collaboration efforts from signal synchronization to establishing smart traffic centers. The sites also span geographically across the country. All the goals of site selection were met through the site selection process.

B. Future Plans

Future interviews will enable the final ten sites to be selected for inclusion in the transportation coordination manual. The manual will be dispersed throughout the country to transportation agencies in an effort to initiate more collaborative efforts. Hopefully the increase in collaboration will yield an increase in the efficiency of transportation agencies across the country.

REFERENCES