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Comparing the Operation Cost of Washington Safety Rest Areas with Other States Using Performance-Based Method

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Abstract: In the United States, the Safety Rest Areas (SRAs) were introduced as highway roadside infrastructures in the early 1900s. The State Departments of Transportation (DOTs) operate/maintain their SRAs using different methods. The Washington DOT used the in-house workforce method for over 20 years, whereas some states moved to Performance-Based Contracting (PBC) from the in-house workforce to save cost primarily. Several existing studies claimed that using the PBC approach saved costs on several highway assets. Thus, the principal objective of this study is to compute and compare the unit operating/maintenance cost of SRAs using the in-house workforce method (in Washington state) with the PBC approach (in other states). The findings of this study show that the average annual cost using the PBC approach was much more than the average annual cost using the in-house workforce approach. The findings also show that in Washington state, the 'Labor Cost' category was a key expenditure, which is statistically higher than other categories. The 'Labor Cost' was followed by the 'Other Services', and then 'Materials and Supplies' and 'Equipment.' The study's findings indicated that outsourcing does not always save costs for agencies. The study findings may help transportation construction/maintenance professionals select a cost-effective approach for their future planning.

Key words: Rest Area Operation Cost, Performance-Based

1. INTRODUCTION

In the United States, Safety Rest Areas (SRAs) were introduced in the early 1900s [1]. They were constructed as part of the interstate highway system. The SRAs were envisioned as an important facility where highway users could take a restroom break and the opportunity to get rest, especially for tired and weary drivers. A full-size SRA may provide several amenities, including restroom facilities, parking, drinking water, picnic tables, tourist information, etc. The extent of services provided may drive the operation cost. As SRA facilities make roads safer by providing

rest to fatigued drivers, they are important components of the highway safety initiative. States operate their SRAs using either an in-house workforce or outsourcing to private contractors [2].

When using the in-house workforce, transportation agencies use their resources (workforce and supplies) to operate SRAs [3,4,5]. As they use their own resources, states plan to operate and maintain their SRAs in their way, and they pay their staff on a regular monthly or bi-monthly basis. Using this method, the total operating cost of SRAs includes in-house staff salary, utility cost, materials and supplies, equipment cost, etc. Along with many states, Washington has utilized the in-house method to operate SRAs for a long time. A study showed that chip seals and striping works performed by the in-house workforce are cost-effective as compared to outsourcing [6].

Several state Departments of Transportation (DOTs) outsource work to contractors for various reasons [7]. When the states outsource, they use either traditional contracting or Performance-Based Contracting (PBC) [8]. The three major reasons for outsourcing were lack of workforce, lack of skilled workers familiar with DOT policies, and time constraints [9]. A study showed that one of the key reasons to shift to the PBC method is to save cost [3]. Studies also showed that this method yields increased quality of the work performed, agency's risk transferred to the contractor, and increased users' satisfaction levels. [3,10].

There are over 2,700 SRAs across the United States [11] and 47 SRAs in Washington state. Washington state is divided into six regions: Northwest (NW), Northcentral (NC), Olympic (OL), Southwest (SW), Southcentral (SC), and Eastern (ET). There are eight SRAs in NW, six in NC, four in OL, eight in SW, twelve in SC, and nine in ET regions. And, 27 SRAs are along the interstate highway, and 20 SRAs are on state routes [12].

States shifted from the in-house workforce to the PBC method is to save cost. Thus, the main objective of this study is to compute and compare the average annual operating costs of Washington SRAs (used in-house workforce) with other states that used the PBC approach.

2. LITERATURE REVIEW

An NCHRP study quantified the benefits and costs of SRAs [11]. Data were collected through a questionnaire survey conducting a phone survey with drivers, meetings with SRA staff, and site visits. This study also conducted a benefit/cost (B/C) ratio. The findings show that the B/C ratio of operating SRAs was over 3.0. This study found that the cost of SRA operation was affected by several factors: location, cost of drinking water, sewage disposal, utilities, labor cost, acreage of the rest area, number of parking slots, etc. The results showed that the operation costs of SRAs ranged from about $65,000 - $200,000 per year per SRA when adjusted ($26,000 - $81,000 per year in 1989). The cost components are categorized into four: labor cost, material cost, equipment cost, and other miscellaneous costs. The labor cost was the highest cost.

A TRB study calculated the operation and maintenance cost of SRAs [13]. This study shows that the SRA operation cost varied between $16,000 and $60,000 per year per SRA. The factors that impacted operation cost were size, location, amenities provided, and level of service. The major costs were ground maintenance, building maintenance, and utilities. This study shows that labor cost is one of the major cost components of the SRA operation cost. The SRA operation was conducted using in-house workers or hiring private contractors.

Another study studied on the benefits of SRAs to various parties in Texas [14]. This study showed that the operation cost of SRAs depends upon several factors. They were availability of drinking water, sewage disposal service, utility cost, size of the facility and the number of parking slots provided, method of SRAs operation (in-house vs. contracting), etc.

Another study was carried out to compare the cost of routine maintenance works [15]. The cost comparison was conducted for four routine maintenance activities: SRA maintenance, seal coats, guardrail repairs, and pavement markings. 403 project data points were collected for analysis. The

findings show that the SRA maintenance works conducted by Texas in-house method were 34.70 percent higher than outsourced work. Both direct and indirect costs were included in this study.

3. METHODOLOGY AND DATA COLLECTION

3.1. Washington SRAs

The authors collected cost data of SRA operations from the WSDOT Head Office in Olympia. There are 47 SRAs in six regions. The list of SRAs is presented in Table 1. The authors collected in-depth cost data for each of the SRAs from July 2012 to December 2019. The cost data consists of monthly expenditures in several cost components such as regular and overtime charges of labor costs, electricity use, fuel cost for mowing, water and wastewater, material and supplies, etc. These costs have been categorized into four main topics, which are explained below.

Table 1. A list of 47 SRAs in six regions in Washington state

Region	Name of SRAs
Northwest	Bow Hill NB; Bow Hill SB; Custer SB; Custer NB; Smokey Point SB; Smokey Point NB; Silver Lake; Sea tac
Northcentral	Nason Creek; Iron Goat Trail; Winchester WB; Winchester EB; Quincy Valley; Blue Lake
Olympic	Elbe; Maytown SB; Scatter Creek NB; Elma
Southwest	Gee Creek SB; Gee Creek NB; Forest Learning Center; Toutle River SB; Toutle River NB; Bevin Lake; Dismal Nitch; Chamberlain LK
Southcentral	Indian John Hill WB; Indian John Hill EB; Ryegrass WB; Ryegrass EB; Travelers Rest; Vernita; Selah Creek EB; Selah Creek WB; Prosser; Alpowa Summit EB; Alpowa Summit WB; Dodge Junction
Eastern	Dusty/Mader; Horn School; Schrag WB; Schrag EB; Hatton Coulee; Sprague Lake WB; Sprague Lake EB; Telford; Keller Ferry

3.2. A framework to categorize cost components

The cost data of Washington State consists of over 15 cost components. The main cost components are listed in Table 2. Based on the cost data, a framework was developed to categorize the cost components to see in which category Washington DOT is spending more funds. The expenditures were categorized into four main components. The NCHRP (1989) also categorized the cost components into these same four main categories. Table 2 presents the cost components and their categories. The four cost categories are i) Materials and Supplies, ii) Labor, iii) Equipment, and iv) Other Services. All the expenditures to purchase supplies and materials were categorized in this category. All the labor charges were categorized into the ‘Labor’ category. There were two types of labor charges; regular work time charges and overtime work charges; both of these labor charges were categorized into the ‘Labor’ category. Similarly, all the expenditures on using equipment are categorized into the ‘Equipment’ category. Although the equipment used is owned by the state, their rental charges were charged as an ownership cost of equipment. There were a few types of equipment charges, which are listed in Table 2. All other charges which fall outside of these three main categories are grouped into the ‘Other Services’ category, which includes the cost of utility, fuel for equipment, garbage collection, etc. The key cost components of the ‘Other Services’ category are listed in Table 2. The total cost of SRA operation is calculated by adding these four cost categories using a simple mathematical equation as shown below.

Total Operating Cost = Material and Supplies + Labor + Equipment + Other Services (1)

Table 2. Cost components and Their respectice cost categories

Cost Components	Cost Categories
▪ Supplies and materials	Materials and Supplies
▪ Regular work time charges ▪ Overtime charges	Labor
▪ Equipment rental - operator ▪ Equipment rental-per w/ equipment ▪ Services rendered	Equipment
▪ Motor fuel for mowing, Utility electricity ▪ Utilities general, Utility sewage pumping ▪ Garbage collection, Protective and safety clothing ▪ Private testing services, Gen repair ▪ Other services	Other Services

3.3. Annual costs of SRA operations

The total annual cost of an SRA operation is calculated using equation (1). To calculate the annual cost, the four cost categories in equation (1) were calculated and then added. The average annual cost is calculated as the total cost of SRAs over the total number of SRAs in each region.

Cost data were collected from June 2012 to December 2019. The collected data were arranged in fiscal year (start of July to end of June). These costs were rearranged to calculate calendar year costs for each year. The 2012 data contains costs incurred from the start of June to the end of December; therefore, a full calendar year data was calculated from that data.

3.4. A survey with states

This study also conducted a questionnaire survey with states that were using the PBC approach in operating their SRAs. First, the authors closely reviewed all state DOTs' website to identify states that were using the PBC method. As the PBC approach is a newer method for SRAs, from the web review, the authors listed nine states that were using the PBC method and they were invited to participate in this study. Six of them agreed to participate and a survey was distributed via email attachment. Out of six, three states completed the survey and provided detailed cost data and SRA operation. They are Arizona, Texas, and Virginia. The other three state representatives were not able to complete the survey due to job changes, working from home due to the Pandemic and they do not have full access to the cost database, and due to shortage of staff during the Pandemic. The respondents provided in-depth cost data from 2010 to 2020. In the survey, the respondents were also asked to provide the number of visitors and total site area of SRAs; however, all the states do not have these data and so were not included them in this paper. To calculate the average annual operation cost, the same procedure was used that was used for Washington SRAs. The cost data received from states other than Washington were adjusted for the location using the RSMeans data.

4. RESULTS AND DISCUSSIONS

The cost data from the Washington State DOT was collected from the year 2012 through 2019. The collected raw cost data were categorized into four cost categories: 'Labor', 'Equipment', 'Materials and Supplies', and 'Others Services'. These four cost categories were calculated for each SRA yearly. The result shows that the 'Labor' category holds the highest expenditure followed by

'Others Services', 'Materials and Supplies', and 'Equipment' categories. The NCHRP study also showed that the 'Labor' category was the major expenditure in operating the SRAs [11]. A summary of these four cost categories is presented in Figure 1. The study conducted a T-test to see the difference between the 'Labor' cost category and other categories. The result shows that the 'Labor' cost category, which holds 58.17%, is significantly higher than the other three categories. At SRAs, staffing hour is continuous from morning to evening seven days a week; thus, labor cost is a crucial expenditure. The 'Other Services' category comprises expenditures on electricity, gas, water, garbage collection, sewage pumping, testing, etc.

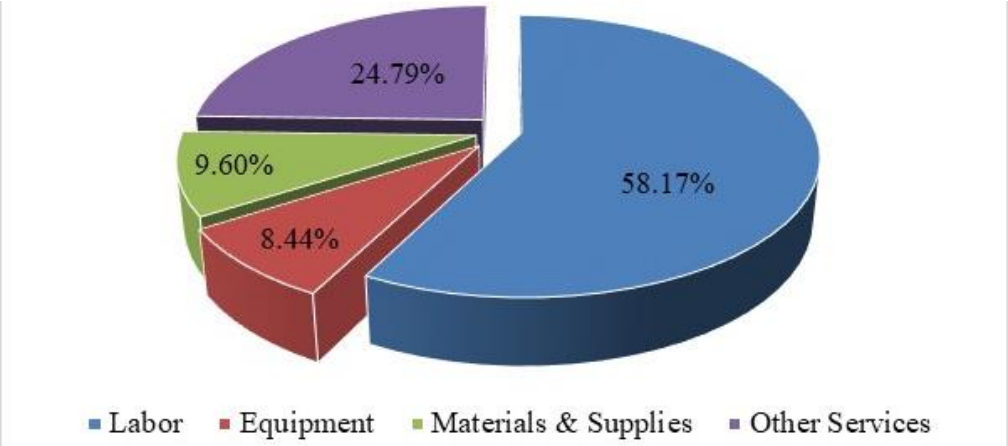

Figure 1. SRA operation cost percentages in four categories

This study calculated the annual cost of SRA operations for each of the SRAs in six regions and then averaged their cost in each region. Table 3 presents a summary of average annual costs in each of the six regions and total expenditures from 2012 to 2019. The result shows that the operation cost (in 2019) is the highest in the Olympic region and then followed by the Northwest, Southwest, Eastern, and Southcentral regions. This may be due to higher SRA users per SRA in the Olympic region and lesser in Southcentral regions. On average, in 2019, there were over one million users per SRA in the Olympic region and less than a quarter-million users per SRA in the Southcentral region. Higher the number of visitors, the higher the labor cost.

Table 3. Average annual SRA operation costs (x1000) in Washington regions (in-house method)

Regions	**2012 #**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Northwest	$115.3	$146.0	$152.7	$153.2	$171.5	$166.9	$154.3	$162.3
Northcentral	$64.2	$55.1	$57.8	$58.6	$55.2	$56.6	$68.5	$71.8
Olympic	$241.5	$170.5	$154.3	$181.9	$187.9	$192.5	$204.3	$206.8*
Southwest	$101.5	$110.5	$120.5	$117.4	$119.4	$128.9	$144.9	$148.2
Southcentral	$76.6	$110.5	$99.2	$110.5	$106.9	$105.6	$110.0	$119.7
Eastern	$87.2	$90.6	$85.1	$96.9	$97.3	$102.3	$99.0	$109.7
Total Cost	$4,559	$4,874	$5,006	$5,332	$5,569	$5,664	$5,832	$6,165

1. * Highest average cost within the six regions
2. # Calculated annual costs from half of the fiscal year data were collected

Figure 2 illustrates the average annual operation costs of SRAs from 2012 to 2019 in six regions of Washington using the in-house approach. Figure 2 also shows the trendlines of average costs of

SRAs in each region and a major trendline (thicker trendline) of all SRAs in six regions. The trendlines illustrate that the average cost of SRA operations in each region is increasing every year. This may be due to inflation. In addition, Figure 2 shows the R-square value of the average annual costs of all SRAs trendline, which is 0.95.

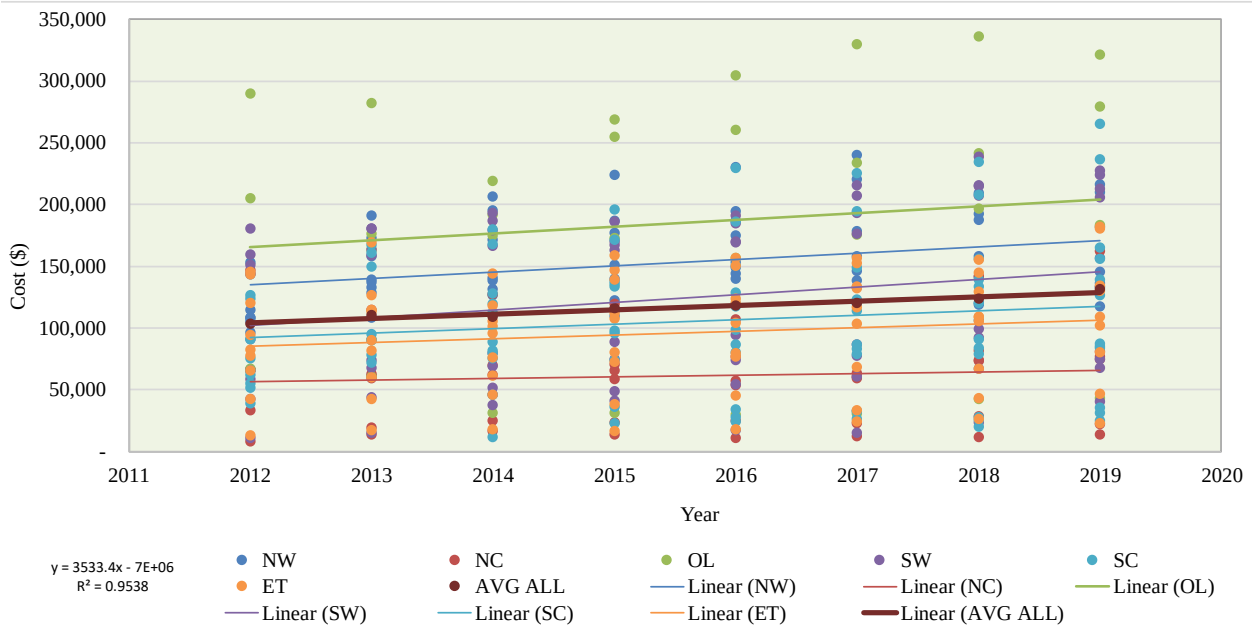

Figure 2. The SRAs operation costs with trendlines in six regions of Washington (in-house)

Figure 3 compares the average annual operation cost of SRAs using the in-house workforce (in Washington) and the PBC (in Arizona, Texas, and Virginia) approaches. Figure 3 shows that the cost in Washington using the in-house method is much lower than that of using the PBC method. When the cost data were adjusted, the cost using the in-house workforce method and using the PBC approach were $148,198.22 and $289,883.09, respectively. A study also showed that transitioning to the PBC method increased the operation cost of SRAs in the state of Nebraska [8]. Various factors might have impacted the costs including SRA size, amenities offered, the number of visitors, level of service delivered, etc. Transitioning to the PBC method might have brought other benefits as well including states' risk transfer to the PBC contractors, increased quality of work, bundling of maintenance activities, etc. [16,17,18,19], which were not in the scope of this study.

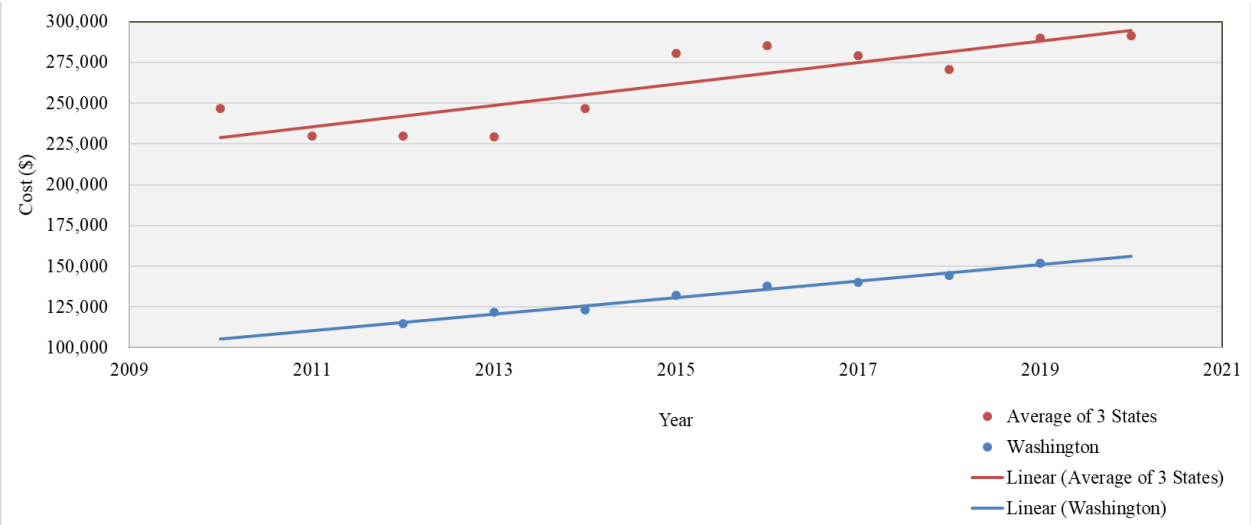

Figure 3. The average annual operation cost of Washington versus other three PBC states

4. CONCLUSIONS AND RECOMMENDATIONS

The Safety Rest Areas (SRAs) are the highway roadside infrastructures that provide a break to take a physiological and mental rest for the highway users. They contribute to reducing fatigue-related crashes on highways. States used various methods to operate their SRAs: Washington used the in-house workforce, whereas Arizona, Texas, and Virginia switched to Performance-Based Contracting (PBC). Cost-saving was the key reason for switching to the PBC method. However, this method was also used to increase the quality of work, to transfer risk to contractors, etc. [6,16,17,18,19]. The main objective of this study is to see if the states that used the PBC saved costs by outsourcing to the PBC contractors.

This study conducted a survey and gathered in-house workforce cost data from Washington state and PBC cost data from three states'. The collected raw data were categorized into four main cost categories: 'Labor', 'Materials and Supplies', 'Equipment, and 'Other Services'. The total cost of these four categories was calculated for each SRA for each year from 2010 to 2020. The data analysis of cost categories shows that 'Labor' is the major cost category, which comprises over half of the total SRA operation cost for each year. The 'Labor' category was followed by the 'Other Services', which includes key expenditures on utility, sewage pumping, testing, garbage collection, etc. They were followed by 'Materials and Supplies' and 'Equipment'. When a T-test is conducted, the result shows that the 'Labor' cost category is significantly higher as compared to other categories.

This study calculated and compared the average annual operation cost of Washington SRAs (used in-house workforce) with states that used the PBC method. The findings showed that the adjusted average annual cost using the in-house workforce method is much lower as compared to the average annual cost using the PBC approach: $148,198.22 and $289,883.09, respectively. Thus, the PBC approach has not saved costs as compared to Washington's in-house workforce method. When Nebraska moved from the in-house workforce to the PBC approach, the SRA operation cost was also increased there [8]. In Nevada, when other highway assets were outsourced to private contractors, that also did not save cost [20]. One of the limitations of this study is limited responses. This is due to the reason that there are limited states who use the PBC approach for operating their SRAs. Some factors that might have affected the costs (about 5-10 percent), such as the difference in the number of visitors, quality of work delivered [21], SRA size, amenities offered, etc. The staffing hour is similar in states. The study findings add to the body of knowledge that outsourcing

SRA operation work does not always save cost, especially when states are using the PBC approach for the first time. The findings may help states choos a cost-effective method of operating SRAs.

For future studies, it is recommended to collect cost data from more states and to conduct cost analysis considering the factors mentioned above.

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