Chapter 4. Safety, Traffic & Regulatory Needs Assessment

The analyses for the safety, traffic and regulatory components are quite different from those for the pavement needs; regression techniques are employed instead.

A total of 246 survey responses were received, of which 188 were partial responses and 58 were complete responses. Agencies were asked to provide specific information on the inventory and replacement cost for their safety, traffic and regulatory components:

- Miles of pipelines for storm drains
- Other storm drain components (lump sum)
- Linear feet of curb and gutter
- Square feet of sidewalk
- Number of curb ramps
- Number of traffic signals
- Number of street lights
- Square feet of sound/retaining walls
- Traffic signs
- NPDES requirements (lump sum)
- ADA compliance needs (lump sum)
- Other (lump sum)

Additionally, mileage information (rural and urban centerline miles) was available from the Highway Performance Monitoring System (HMPS) and used in this analysis.

4.1 Data Quality Assurance

Before any analysis was performed, the survey responses were checked for errors and to make sure that all units were consistent. Unit costs were calculated based on the inventory and total cost data in order to compare the range of values. Where inconsistencies were found, the agencies were contacted and asked to clarify. Most agencies contacted responded either with corrections or further explanations that justified their responses. Examples of common errors were:

- Wrong units – response was in miles instead of linear feet.
- Typos – additional zeros
- Calculated units costs were too high or too low – most due to typos; some due to specific agency circumstances.

One issue of interest is the submission of partial responses. Most agencies left the answers of one or more of the twelve components blank. It could be assumed that these agencies are not responsible for such components; however, there is also the possibility that they do maintain those components but did not have accurate information to provide. To use the most accurate data, only complete responses were used in the analysis.

4.2 Regression Analysis

The costs of all 12 safety, traffic and regulatory components listed above were added to obtain the total replacement cost. This cost was used as the response variable. The objective of this analysis was to find a statistical model to predict the total replacement cost using either the mileage data from HPMS or the data from the survey responses as predictors. Numerous models were considered:

- Cost vs. Total Miles
- Cost vs. Urban Miles, Rural Miles
- Cost vs. Urban Miles
- Log Cost vs. Urban Miles
- $\sqrt{\ }$ Cost vs. Urban Miles
- Cost vs. Storm Drain, Curb & Gutter, Sidewalk, Curb Ramps, Traffic Signals, Street Lights, Sound/Retaining Walls, Traffic Signs
- Log Cost vs. Storm Drain, Curb & Gutter, Sidewalk, Curb Ramps, Traffic Signals, Street Lights, Sound/Retaining Walls, Traffic Signs
- Log Cost vs. Curb & Gutter, Street Lights, Sound/Retaining Walls
- Log Cost vs. Curb & Gutter, Street Lights

However, none of these models were adequate for various reasons. A more detailed discussion on the statistical analyses used is included in Appendix D.

4.2.1 Final Model

The final model considered total replacement cost as the response variable and total miles, agency type and climate type as predictors and was as follows:

$$\log \text{Cost} = 17.9 + 0.00189 \text{ Total Miles} - 2.09 \text{ Type\_Rural} + 0.682 \text{ Climate\_Central}$$

where:

Cost = total replacement cost, $
Total miles = total centerline-miles
Type_Rural = indicator variable and is equal to 1 if agency is rural, 0 otherwise
Climate_Central = indicator variable and is equal to 1 if agency is along the central coast, south coast or inland valley (see Figure D.1 in Appendix D).

It should be noted that:

- If the agency type is "Urban" or "Combined" or if the climatic region is other than "Central" the indicator variables will have a value of zero and the model will depend only on total miles.
- "log" refers to the natural logarithm

Conceptually, the model indicates that the replacement costs are decreased if an agency is considered rural (defined as an agency with less than 25% urban miles) and increased if it is within the central or south coast or inland valley regions. Intuitively, this makes sense, as rural agencies tend to have less safety, traffic and regulatory components. In addition, since the majority of the urban population resides in the central/south coast and inland valley, these agencies will have more safety, traffic and regulatory components and therefore, higher costs.

A more detailed discussion of the regression analysis is included in Appendix D.

As a check, the predicted or estimated replacement cost was compared with those provided by the survey respondents. Table 4.1 shows that the proposed equation provides a good estimate of the total replacement cost.

Table 4.1 Comparison of Reported and Calculated Costs

Total Replacement Cost ($ Million Reported)	Total Replacement Cost ($ Million Calculated)	Difference*
24,726	27,992	13%

*Comparison based on data from 58 complete responses.

4.3 Determination of Safety, Traffic and Regulatory Needs

The regression model obtained above estimates the total replacement cost for the safety, traffic and regulatory components. To estimate the needs, this cost needs to be converted to an annual amount based on the estimated service life of the different non-pavement assets.

Figure 4.1 shows the distribution of the replacement costs by asset. For agencies with no data, the total replacement cost will be calculated with the regression model and the replacement cost of each asset will be assigned using the percentages in Figure 4.1. For agencies that provided complete or partial data, the actual percentages will be used in the analysis.

Note that both ADA (0.4%) and NPDES (0.3%) categories are very small percentages of the total replacement cost. We believe that both of these are under-estimated because both costs are usually included in the pavement rehabilitation costs during a resurfacing or reconstruction contract, and few agencies actually extract this from the data that were provided.

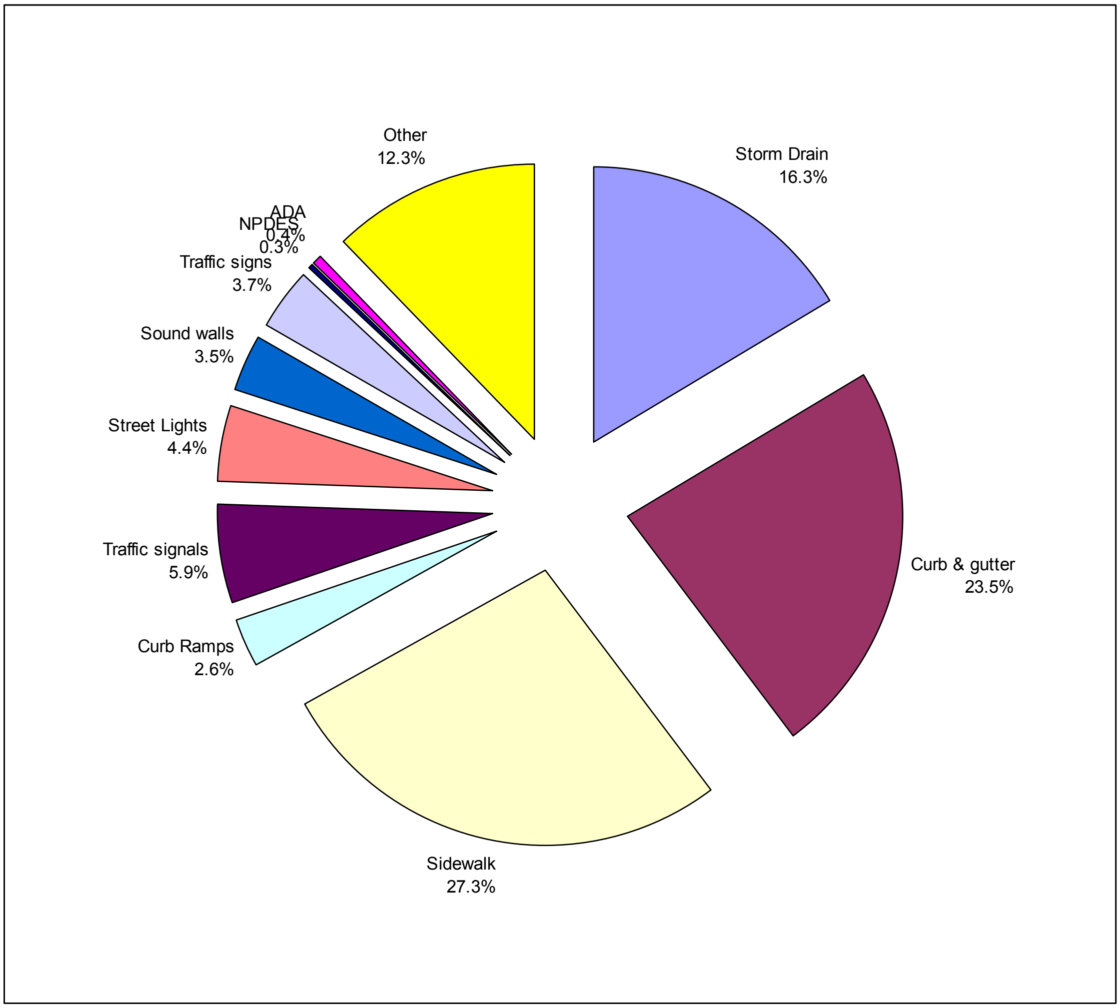

Figure 4.1 Distribution of Replacement Cost by Safety, Traffic and Regulatory Category

Table 4.2 shows the estimated service life of each asset based on industry standards[9]. The replacement costs of each asset will be divided by their respective service life to obtain the annual needs by asset category. The sum of all the needs will be the total annual needs. An example calculation is included in Appendix D.

Table 4.2 Service Lives of Safety, Traffic and Regulatory Components[9]

Asset	Service Life (Yrs)
Storm Drain	50
Curb & Gutter	35
Sidewalk	35
Curb Ramps	35
Traffic Signals	40
Street Lights	30
Sound/Retaining Walls	30
Traffic Signs	10

[9] Sources: Portland Transportation Assets Management, Handbook of Facility Assessment, Plastics Pipe Institute.

4.4 Results

The analysis to determine the available funding for safety, traffic and regulatory components is similar to that performed for the pavement analysis in Chapter 3. The average funding for cities was $21,712/centerline mile for cities and $1,402/centerline-mile for counties. The large difference between the two is expected, since it is the cities (mostly urban in nature) that have the most inventories in these categories.

However, there were a few agencies that reported revenues that were greater than their needs. In these cases, the shortfall was reported as zero (see Appendix E). Table 4.3 summarizes the results. Again, there is a significant shortfall of $19.7 billion. Appendix E contains the detailed results by county.

Table 4.3 Safety, Traffic and Regulatory Needs and Shortfall (2008 Dollars)

	10 year Needs ($ billion)	10 year Revenues ($ billion)	Shortfall ($ billion)
Safety, Regulatory & Operational Components	$ 32.1	$ 12.4	$ (19.7)

* Data from San Francisco Bay area provided by MTC.