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April 6, 2009

Mr. Philip Brun, P.E.
Deputy Director of Public Works
City of Napa
1600 First Street
Napa, CA 94559

Sent via e-mail

Subject: Refuse Vehicle Street Maintenance Cost Analysis - Final Report

Reference Number: S2004

Dear Mr. Brun:

HF&H Consultants, LLC (HF&H) was engaged by the City of Napa (City) to analyze the impact of solid waste, recycling, and yard waste vehicles (Refuse Vehicles) on street maintenance costs (i.e., maintenance, rehabilitation, and reconstruction costs).

Our analysis is based on available information related to street maintenance costs, funding sources, street design specifications, and vehicle profiles for the types of Refuse Vehicles providing service in the City, their weights, axle configurations, and service frequency. Should there be any future material changes to that information, the City should review the results of the analysis and change the calculated impacts and any associated fees that might be established.

Objectives

The objectives of the engagement were to:

1. Calculate the City's Average Annual Expenditures for pavement-related street maintenance net of Restricted Funding Apportionments (Average Annual Expenditures); and,
2. Allocate the Average Annual Expenditures based on the percentage impact of Refuse Vehicles, other trucks, and automobiles on the City's streets.

Findings

As shown in the following table and based on the approach described below:

1. We calculate Average Annual Expenditures of $10,590,000 based on actual pavement-related spending as demonstrated in the City's Streets and Roads Report to the State of California Controller's Office for Fiscal Years Ending (FYE) 2004 through 2008; and,
2. Refuse Vehicles account for approximately 15.1% of the total impact that a typical street experiences.

Assuming this percentage of the Average Annual Expenditures can be attributed to Refuse Vehicles, the share of the Average Annual Expenditures attributable to Refuse Vehicles is $1,595,000.

TABLE 1: SUMMARY FINANCIAL IMPACTS

Vehicle Type	Street Maintenance Cost Impact	Percent of Total Impacts
Solid Waste Vehicles	$ 460,000	4.3%
Recycling Vehicles	$ 482,000	4.6%
Yard Waste Vehicles	$ 653,000	6.2%
REFUSE VEHICLE SUBTOTAL	**$ 1,595,000**	**15.1%**
Other Trucks	$ 8,370,000	79.0%
Automobiles	$ 625,000	5.9%
TOTAL	**$ 10,590,000**	**100.0%**

Note: Numbers may not sum precisely due to rounding

It should be noted that reasonable ranges exist for various key assumptions used in our analysis, and that the analysis is highly sensitive to changes in certain key assumptions. A discussion of key assumptions and sensitivities is provided later in this report. In a number of cases, this report relied on City records and City staff's representations (which we assumed to be informed and reliable).

Overview

Road maintenance is based on deterioration. While roads will deteriorate if simply left unused, most deterioration is associated with use. The damage caused by vehicles increases much more than proportionately with size and weight. Hence, maintenance costs are greater for trips made by heavy vehicles. A single, large truck can cause as much damage as thousands of automobiles, and a truck's configuration can affect the amount of damage as well. If the load is spread over more axles, allowing for less weight on each wheel, then damage is reduced.[1] Refuse Vehicles are generally some of the heaviest vehicles regularly operating on city streets. Accordingly, these vehicles contribute significantly to the cost of maintaining those streets.

The unit of measure used to rate the condition of pavement is the Pavement Condition Index (PCI), which rates pavements on a score of 0 to 100. Local roads within the Bay Area have an average PCI of 65. The City has reported that its streets have an average PCI of 58, which falls in the category of "Fair" (45-59). Pavements in this range are deteriorated and require immediate attention, including rehabilitative work. Rapid deterioration of pavement typically

[1] Rufolo, Cost-Based Road Taxation, Cascade Policy Institute, Policy Perspective #5, November 1995.

occurs after roadways drop to a PCI score of 60 or lower; therefore, assuring adequate funding for an effective pavement management program for the City's streets is critical and is one of the most financially prudent steps the City can take. Delays in preventative maintenance increase the quantity and severity of pavement defects, and result in higher costs during pavement life. Consequently, using only a routine and reactive approach will considerably increase the life cycle costs of the pavement.[2]

Background

Napa Recycling and Waste Services (Company) provides solid waste, recycling, and yard waste services in the City. Residential solid waste, recycling, and yard waste services are provided weekly with side-loading vehicles that generally make a single pass down each side of a street to provide service for each material type collected (i.e., each truck services one side of the street on each pass). Commercial solid waste and recycling service is provided in varying frequencies to customers by front- and side-loading vehicles. Based on information provided by the Company and the City, HF&H has calculated that these vehicles service the average: commercial solid waste container approximately 2.5 times per week; commercial recycling container approximately 3.0 times per week; and, commercial yard waste container approximately 3.5 times per week.

Approach

Our analysis is based on the City's projected Average Annual Expenditures and allocates the Average Annual Expenditures attributed to the impacts of Refuse Vehicles on the City's streets. The basis for allocating the Average Annual Expenditures is made by calculating the Equivalent Single Axle Load (ESAL) of each type of vehicle traveling on the City's streets, as described below.

The underlying premise for the analysis is that the weight and loading of Refuse Vehicles impose a particular, specific, and quantifiable impact on City streets. The analysis is based on the fact that the City's streets are designed to handle a certain amount of vehicle traffic (loading) over their design life. That loading is a function of both the number and weight of vehicles. The lifetime "vehicle loading" that a street can accommodate can be expressed as the total number of ESALs. Each vehicle type (e.g., Refuse Vehicles, other trucks and automobiles) can be converted into an associated ESAL, based on the vehicle's weight and its distribution among the vehicle's axles. By projecting the type and number of vehicles that will travel on a street over its design life, the total number of ESALs can be calculated, and the street designed to handle that projected loading. Similarly, the relative impact of each type of vehicle on that street can be calculated, based on the percentage of the total ESALs attributed to each vehicle type.

[2] A Pavement Preventative Maintenance Program; Larry Galehouse, P.E., L.S.; Michigan Department of Transportation.

HF&H has calculated the ESALs associated with each vehicle type on residential, collector, and arterial streets throughout the City based upon the: vehicle weight and loading; weight distribution; and, number of trips associated with each vehicle type. From this HF&H has calculated that the ESALs associated with Refuse Vehicles represent approximately 15.1% of the total ESALs experienced by City streets.

Methodology

The methodology used to project the impact of Refuse Vehicles can be summarized as follows:

Determine Number of Vehicle Trips by Vehicle Type

HF&H worked with the City to develop an understanding of the number of average daily vehicle trips by vehicle type (Refuse Vehicles, other trucks, and automobiles). During this process, HF&H:

- Reviewed information provided by the City and Company to determine the number of trips Company vehicles took on each street within the city;
- Reviewed information provided by the City that reported average daily traffic counts; and,
- Reviewed the City's design standards for each functional classification (i.e. residential, collector, and arterial) of streets.

Determine the Impact of Each Vehicle Type

HF&H collected from the City and through independent investigation, vehicle weights and profiles for the various vehicles being studied in this analysis. Each vehicle type was modeled based on weight, vehicle specifications, axle profile, and average payload. This modeling produced an average ESAL for each vehicle type, which was then used to assess the direct impact of each vehicle trip by each vehicle type.

Project Maintenance Costs Associated with Each Vehicle Type

- The City provided their annual Streets and Roads Report data for the period FYE 2004 through FYE 2008. These annual costs were escalated by the five-year average of the Engineering News Record California Construction Cost Index to bring the costs into current 2009 dollars. This data was used to calculate the percentage of funding that was dedicated to pavement versus non-pavement related activities. This calculation was used as the basis for the Average Annual Expenditures at the current spending level;
- The Average Annual Expenditures were allocated among residential, collector, and arterial streets in proportion to the percentage of lane miles for each of those street classifications; and,

- The residential, collector, and arterial street portions of the Average Annual Expenditures were allocated among the various vehicle types in proportion to the calculated impact of each vehicle type, as determined above.

Sources of Data

The analysis relied on the following data sources:

- Annual Street and Roads Reports submitted to the State of California Controller's Office – These reports were used to determine the pavement related expenses (e.g. street reconstruction, patching, overlay and sealing) as separate from the non-pavement related expenses (e.g. lights, signals, safety devices, storm drains, pedestrian ways, bike paths, etc.) and to determine the share of overhead expenses (e.g. property, plant, equipment, engineering and administration, etc.) to be allocated to pavement and non-pavement related activities. The report also provides information on restricted funding sources (e.g. gas taxes, traffic congestion relief fund, etc.) that have been removed from the funding analysis to prevent double-counting.
- Transfer Station and Material Recovery Facility Reports – These reports provided information on the weight of each vehicle, by type and material, used by the Company in providing collection services to the City.
- Monthly Collection Reports – These reports provided information on the number of accounts and tonnage of materials collected within the City.
- NRWS Cost Review Report – This report provided information on the number of times that each container within the City is serviced by the Company, providing the basis for determining the number of trips that each truck collecting each material type takes on City streets.
- Engineering News Record California Construction Cost Index – This data source provided the information necessary to adjust historical spending to current (2009) dollar equivalents.
- Pavement Management Program Update – This report provided the information regarding the number of miles of each street type within the City as well as the current pavement condition of streets within the City.
- City of Napa Public Works Standard Specifications – This report was used to determine the design standards of each type of street within the City.
- City of Napa Traffic Counts – This data, derived from routine studies performed by the City, was used to determine the average volume of vehicles traveling on each street type within the City as well as the percentage of vehicles that are trucks, as opposed to passenger vehicles.

Key Assumptions/Inputs

The analysis relied in part on the following key assumptions, provided largely by the City and the Company (supplemented with data from other sources as noted):

- Residential streets account for approximately 53.0% of the total residential, collector, and arterial lane miles in the City;
- Collector streets account for approximately 26.2% of the total residential, collector, and arterial lane miles in the City;
- Arterial streets account for approximately 20.8% of the total residential, collector, and arterial lane miles in the City;
- Residential streets experience an average daily traffic volume of approximately 283 vehicles with approximately 3.5% of that volume being truck traffic;
- Collector streets experience an average daily traffic volume of approximately 4,404 vehicles with approximately 6.0% of that volume being truck traffic;
- Arterial streets experience an average daily traffic volume of approximately 12,512 vehicles with approximately 6.0% of that volume being truck traffic;
- Residential solid waste, recycling, and yard waste services are provided weekly;
- Refuse Vehicles servicing residential solid waste, recycling, and yard waste containers typically travel on each residential street segment twice to provide service for each material collected (i.e., they service one side of the street on a single pass);[3]
- Commercial Refuse Vehicles service the average solid waste container 2.5 times per week;
- Commercial Refuse Vehicles service the average recycling container 3.0 times per week;
- Commercial Refuse Vehicles service the average yard waste container 3.5 times per week;
- Refuse Vehicle tare weight and payload weight data was provided by the City, and was based on actual data for loads entering the City's material recovery facility and transfer station;
- Refuse Vehicle axle weight distribution profiles were based on data provided by vehicle manufacturers for the same or similar vehicle types;
- Axle weight data for other trucks and automobiles was based on data compiled from a variety of sources including vehicle manufacturers and industry publications;
- The impact of other activities (e.g. trench cutting), which may degrade the quality of streets, is sufficiently mitigated by the parties engaging in those activities;

[3] The analysis does not account for any additional passes due to vehicle routing (e.g., "dead-heading" over a previously serviced street).

- The negative impacts of weather or other natural conditions are considered a routine part of the lifecycle cost of streets and are not analyzed separately; and,
- The City's Average Annual Expenditures are approximately $10,590,000.

Using the assumptions noted above, the portion of the City's Average Annual Expenditures associated with Refuse Vehicles was calculated following the previously described methodology.

Limitations

- Our analysis is based on the various assumptions noted, including the total number of vehicle trips and average ESALs associated with the various vehicle types. Changes to these assumptions may have a material impact on the analysis.
- Annual street maintenance costs can vary widely, both in total and specific to pavement- and non-pavement-related expenses as well the amount spent on residential versus collector and arterial streets. Our analysis is based on the City's actual street maintenance costs and funding data for FYE 2004 through 2008 and the noted assumptions regarding those factors. Changes to those assumptions may have a material impact on the associated projections.

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We appreciate the opportunity to be of service to the City. If you have any questions regarding this submittal, please do not hesitate to call me directly at (925) 977-6959.

Very truly yours,
HF&H CONSULTANTS, LLC

Robert C. Hilton
Project Manager

cc: Kevin Miller, City of Napa
Eric Whan, P.E., City of Napa
Robert D. Hilton, President, HF&H Consultants
HF&H Client Files