

2009 Nevada Highway Cost Allocation Study

FINAL REPORT


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Prepared for
Nevada Department of Transportation
Carson City, Nevada

March 2009



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Executive Summary

This report presents the findings of the 2009 Nevada Highway Cost Allocation Study (HCAS), which examines the equity of Nevada’s highway user tax structure. An HCAS is a study that is designed to determine the fair share of costs that each road user class should pay for the construction, operation, maintenance, and related costs of highways, roads, and bridges in a state. By comparing highway user payments to cost responsibilities estimated within the HCAS, the 2009 Nevada HCAS seeks to answer such questions as:

- How do broad highway user classes, differentiated based on vehicle type and weight category, compare with each other in terms of paying their share of highway costs? How much is each class under- or overpaying?
- How could existing tax rates be changed to bring about a closer match between payments and cost responsibilities for each vehicle class?

In addition to addressing these questions, the 2009 Nevada HCAS and the Federal Highway Administration (FHWA) State HCAS Model, which was refined for this study, can be used to examine the impact on equity of making adjustments to the current tax and fee structure, such as: a) adjusting current tax or fee rates, b) substituting a new set of vehicle miles of travel (VMT) fees for part of the current user charges, or c) the re-introduction of a weight-mile tax with appropriate adjustments to other taxes and fees.

Tables S.2 and S.3 present the results of the equity analysis comparing cost responsibilities computed for each vehicle class to attributed revenues. The vehicle classes examined in this report are presented in Table S.1. Table S.4 and Figure S.1 examine equity from the standpoint of registered gross weight (RGW) classes.

Table S.1. 2009 Nevada HCAS Vehicle Types

Vehicle Class	Acronym	Description
1	Auto	Automobiles, vans, light trucks with 2-axles and 4 tires and motorcycles
2	Bus	Buses (all larger types)
3	SU2	Single unit 2-axle, 6-tire trucks
4	SU3+	Single unit trucks with 3 or more axles
5	CB3&4	Combination trucks with 3 or 4 axles
6	CB5	Combination trucks with 5 axles
7	CB6+	Combination trucks with 6 or more axles
8	DS5	Tractor-double semitrailer combinations with 5 axles
9	DS6	Tractor-double semitrailer combinations with 6 axles
10	DS7+	Tractor-double semitrailer combinations with 7 or more axles

The findings of this analysis are expressed in terms of equity ratios. The equity ratio is the share of highway user revenues paid by a user group to the share of cost responsibility imposed by that group. A user group that meets 110 percent of its cost responsibility would be assigned an equity ratio of 1.1. Equity ratios above 1.0 are assigned to user groups who are paying more than their cost responsible share while payments from user groups assigned equity ratios of less than 1.0 fall short of the costs imposed by the group. An adjusted equity ratio accounts for differences between total revenues attributed and total costs allocated to all vehicle classes. If highway user payments exceed total cost responsibility, the equity ratios for each vehicle class would be adjusted downward so that total shares of allocated costs equal total shares of revenues and the overall equity ratio for all users equals 1.0. For example, if total highway user revenues exceeded total cost responsibilities by 50 percent, each unadjusted equity ratio would be divided by 1.5 to get the adjusted equity ratio. This procedure is necessary for examining equity in tax structures with highway user revenues collected for non-road purposes, as is done in Nevada with the vehicle sales tax and ad-valorem governmental service tax (GST), or when non-user sources (e.g., general fund revenues) are used to pay for part of the highway program.

Table S.2 presents vehicle miles, state revenue, and state cost responsibility for each vehicle class considered in this study. In all cases throughout this report, these values represent the average of the 2009 Nevada HCAS study time horizon, which runs from 2009 through 2016. Based on the findings presented in Table S.2, revenues from passenger vehicles exceed the cost responsibility calculated for that class by 163 percent. The adjusted equity ratio for passenger vehicles is 1.50, representing an overpayment of 50 percent. The heavier vehicle classes, such as tractor-double semitrailer combinations, face significant shortfalls in terms of revenues vs. allocated costs, with unadjusted equity ratios reaching as low as .37. When all levels of government (federal, state, and local) are included in the analysis (Table S.3), the unadjusted equity ratio for passenger vehicles falls to 1.45 while the equity ratios for heavy trucks are reported in the 0.29 to 0.52 range.

Tables S.2 and S.3 also demonstrate that at the state-level annual highway user payments are forecast to exceed state highway-related expenditures by 75 percent (\$532.4 million annually) over the study time horizon. Thus, \$532.4 million in forecast annual state highway user payments are diverted from the highway fund for other, non-road uses. This diversion results from the state's reliance on vehicle sales taxes and the ad-valorem GST fee. This diversion is almost entirely counterbalanced at the local level where annual expenditures are forecast to exceed highway user payments by \$497.8 million.

Table S.4 presents vehicle miles, state revenue, and state cost responsibility by RGW class. For vehicles weighing 8,000 pounds or less, unadjusted equity ratios are 2.62 with adjusted equity ratios reaching 1.50. Equity ratios drop considerably as weights increase, reaching as low as 0.40 in unadjusted terms for the heaviest vehicles and 0.55 for vehicles weighing 75,001 to 80,000 pounds. This point is further illustrated in Figure S.1, which charts RGW class against unadjusted equity ratios. The figure clearly illustrates the negative relationship between increased weight and equity ratios. That is, unadjusted equity ratios fall consistently as registered gross weights increase. Without exception, all vehicle classes below 64,000 pounds RGW register unadjusted equity ratios in excess of 1.0 while unadjusted equity ratios for all RGW classes above 64,000 pounds fell short of 1.0.

Table S.2. Annual Vehicle Miles, State Revenue, and State Level Cost Responsibility by Vehicle Class

Vehicle Class	Vehicle Miles (Millions)	State User Revenue (Thousands)	State Cost Responsibilities (Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psg'r Veh	23,699	998,140	380,178	2.63	1.50
Bus	122	22,354	17,483	1.28	0.73
SU2	570	47,844	31,841	1.50	0.86
SU3+	123	22,267	15,391	1.45	0.83
CS3&4	105	11,917	9,679	1.23	0.70
CS5	950	108,770	188,944	0.58	0.33
CS6+	27	3,421	6,091	0.56	0.32
DS5	67	7,679	20,517	0.37	0.21
DS6	24	3,020	5,474	0.55	0.31
DS7+	114	14,774	32,172	0.46	0.26
Total	25,800	1,240,185	707,769	1.75	1.00

Table S.3. Annual Vehicle Miles, Revenue, and Cost Responsibility by Vehicle Class All Levels of Government

Vehicle Class	Vehicle Miles (Millions)	Highway User Revenue (\$Thousands)	Total Cost Responsibilities (\$Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psg'r Veh	23,699	1,440,928	992,496	1.45	1.33
Bus	122	34,447	48,525	0.71	0.65
SU2	570	68,313	74,938	0.91	0.84
SU3+	123	37,913	35,918	1.06	0.97
CS3&4	105	21,396	23,961	0.89	0.82
CS5	950	201,241	384,083	0.52	0.48
CS6+	27	6,308	14,607	0.43	0.40
DS5	67	14,207	48,336	0.29	0.27
DS6	24	5,567	15,373	0.36	0.33
DS7+	114	27,539	67,011	0.41	0.38
Total	25,800	1,857,859	1,705,247	1.09	1.00

Table S.4. Annual Vehicle Miles, State Revenue, and State Cost Responsibility by Registered Gross Weight (RGW) Class

RGW Class	Vehicle Miles (Millions)	State User Revenue (\$Thousands)	State Cost Responsibilities (\$Thousands)	Equity Ratios	
				Unadjusted	Adjusted
0-8,000	23,636	994,984	379,131	2.62	1.50
8,001-16,000	441	29,568	19,472	1.52	0.87
16,001-26,000	221	29,053	18,293	1.59	0.91
26,001-40,000	126	19,338	15,483	1.25	0.71
40,001-55,000	132	21,204	14,778	1.43	0.82
55,001-75,000	73	9,496	9,229	1.03	0.59
75,001-80,000	1,020	116,746	210,358	0.55	0.32
80,001-90,000	28	3,622	6,144	0.59	0.34
90,001-100,000	20	2,772	5,388	0.51	0.29
100,001-105,500	103	13,360	29,390	0.45	0.26
105,501-150,000	0	42	103	0.40	0.23
Total	25,800	1,240,185	707,769	1.75	1.00

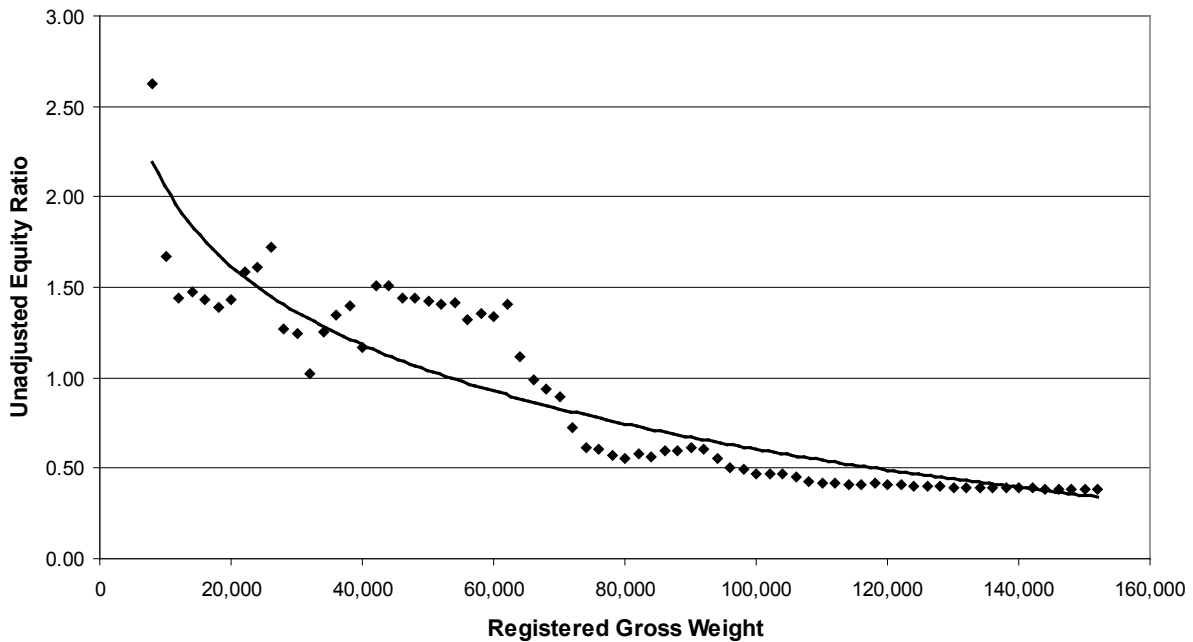


Figure S.1. State-Level Unadjusted Equity Ratios by Registered Gross Weight Class

Table S.5 compares state highway user revenue to cost responsibility for basic and heavy vehicles. As shown, payments from basic vehicles are estimated to exceed cost responsibility by 161 percent while the heavy vehicle class falls roughly 27 percent short of its cost responsibility. Using adjusted equity ratios, the basic vehicle overpayment lowers to 49 percent while the heavy truck class meets approximately 42 percent of its cost responsibility. To make payments from the heavy vehicle class equal its cost responsibility would require an increase in annual payments of \$87.6 million. The annual increase for heavy vehicles required to modify the adjusted equity ratio until it reached 1.0 would exceed \$606.1 million.

Table S.5. Annual Revenue and Cost Responsibility for Basic and Heavy Vehicle (Nevada State Highway User Revenues and Cost Responsibilities Only)

Vehicle Class	State User Revenue (Thousands)	State Cost Responsibilities (Thousands)	Equity Ratios	
			Unadjusted	Adjusted
Basic Vehicles	1,005,462	385,396	2.61	1.49
Heavy Vehicles	234,723	322,373	0.73	0.42
Total	1,240,185	707,769	1.75	1.00

When compared to the 1999 Nevada HCAS, the heavy truck share of cost responsibility grew from 39.1 percent to 45.5 percent, reflecting: a) several improvements in the accuracy of newer cost allocation procedures, most notably the National Pavement Cost Model (NAPCOM) developed by FHWA, b) use of more accurate weigh-in-motion (WIM) data on the operating weights of all vehicle classes (including use of ranges of operating weights instead of averages), c) a shift of emphasis in the highway program to a higher proportion of expenditures being required for rehabilitation and resurfacing of pavements and bridges, and d) the inclusion of the substantial future costs of the backlog of pavement and bridge preservation projects.

In the 1999 Nevada HCAS, heavy trucks were forecast to pay 27.4 percent. The 2009 Nevada HCAS attributes 18.9 percent to heavy trucks. The difference between the current study and the 1999 Nevada HCAS is almost entirely driven by the inclusion of vehicle sales taxes used for general government purposes and GST fees, which are nearly entirely paid by basic vehicles. In previous HCASs, only funds used on Nevada highways were included in the revenue attribution process. Excluding all sales taxes, title and GST fees not used for highways would raise the heavy vehicle revenue share to 31.1 percent. See Section 1.2 for a more thorough examination of previous Nevada HCASs.

Historically, the results of HCASs conducted in other states have varied widely with heavy truck responsibility, reaching as low as 18.9 percent in the 1987 California HCAS and as high as 64.5 percent in the 1979 Florida HCAS. The majority of the state HCASs conducted to date have allocated between 30 percent and 55 percent of the costs to the heavy truck class. The heavy truck share varies due to a number of factors, including the scope and type of expenditures included in the HCAS, the definition of the heavy truck class (the heavy truck class is generally defined by some weight threshold or vehicle configuration), the methods used in the study, and the types of expenditures examined.

Section 1.3 of this report presents the results of 22 HCASs conducted from 1982 to 2007 with respect to the equity ratios for the heavy truck class. The definition of the heavy truck class is differentiated among states but generally includes all vehicles weighing in excess of a certain weight threshold (e.g., 10,000 pounds) or is identified based on vehicle characteristics (e.g., all vehicle configurations having more than two axles). The heavy truck vehicle class typically includes buses, single-unit trucks, and combination trucks. Of the 22 studies referenced in Section 1.3, 19 found that payments from the heavy truck class fell short of cost responsibility. Thus, the findings of the 2009 Nevada HCAS are generally consistent with the findings of HCASs conducted in most other states.

These findings suggest that the current tax structure does not accurately reflect the additional damage caused to Nevada roadways by heavier vehicles. That is, the rate structure is not effectively graduated to reflect the nearly exponential relationship between axle weight and pavement damage. In Nevada, per-mile state highway user revenues grow slightly as weights increase but not in a manner sufficient to reflect the cost responsibilities of the heavier vehicle classes. Within the heavy vehicle class, highway user payments from some light single-unit truck vehicle classes exceed cost responsibility while payments from heavier combination trucks are falling well short of cost responsibility.

Acronyms and Abbreviations

ADT	Average Daily Traffic
AMT	Axle Miles of Travel
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DPS	Department of Public Safety
ESAL	Equivalent Single Axle Load
FHWA	Federal Highway Administration
FY	Fiscal Year
GST	Governmental Services Tax
GVW	Gross Vehicle Weight
HCAS	Highway Cost Allocation Study
HPMS	Highway Performance Monitoring System
HVUT	Heavy Vehicle Use Tax
LEF	Load Equivalency Factor
LOS	Level of Service
MPG	Miles per Gallon
NAPCOM	National Pavement Cost Model
NCHRP	National Cooperative Highway Research Program
NDOT	Nevada Department of Transportation
NHS	National Highway System
PCE	Passenger Car Equivalent
RGW	Registered Gross Weight
SERC	State Emergency Response Commission
STIP	Statewide Transportation Improvement Program
TIUS	Truck Inventory and Use Survey
TRB	Transportation Research Board
VMT	Vehicle Miles of Travel
US	United States
US DOT	United States Department of Transportation
VIUS	Vehicle Inventory and Use Survey
VMT	Vehicle Miles of Travel
WIM	Weigh in Motion

Glossary

Ad Valorem Tax. A tax based on the assessed value of real or personal property.

Arterial. A road or highway used primarily for through traffic.

Attributable Costs. Costs that are a function of vehicle size, weight, or other operating characteristics and therefore can be attributed to vehicle classes based on those characteristics.

Average Daily Traffic. The average number of vehicles passing a given point or using a given highway per day.

Average Daily Truck Traffic. The average number of trucks passing a given point or using a given highway per day.

Axle Miles of Travel. Vehicle miles of travel multiplied by number of axles. Since trucks, on average, have roughly twice as many axles as cars (i.e., four versus two), their share of the total axle miles of travel on any given highway system will be about double their share of the vehicle miles of travel on that system.

Axle Weight or Axle Load. The gross load carried by an axle.

Collector. A road that connects local roads with arterial roads.

Common Costs. Expenditures that are independent of vehicle size, weight, or other operating characteristics and so cannot be attributed to any specific class of vehicles. These expenditures must therefore be treated as a common responsibility of all vehicle classes and are most typically assigned to all classes on the basis of a relative measure of use such as VMT.

Cost Allocation. The analytical process of determining the cost responsibility of highway system users.

Cost Occasioned Approach. An approach that determines responsibility for highway expenditures/costs based on the costs occasioned or caused by each vehicle class. Such an approach is not based solely on relative use, nor does it attempt to quantify the benefits received by different classes of road users.

Cost Responsibility. The principle that those who use the public roads should pay for them and, more specifically, that payments from road users should be in proportion to the road costs for which they are responsible. The proportionate share of highway costs legitimately assignable to a given vehicle class user group.

Cost-Based Approach. An approach in which the dollars allocated to the vehicle classes are measures of the costs imposed during the study period, rather than expenditures made during the study period. The difference between the cost-based and expenditure-based approaches is most evident when considering large investments in long-lived structures and when deferred maintenance moves the costs associated with one period's use into another period.

Dead Load. The load on a bridge when it is empty.

Debt Financing. Funding current activities by issuing debt to be repaid in the future.

Debt Service. Funds used for the repayment of previously incurred debt (both principal and interest.)

Deck. The roadway or surface of a bridge.

Depreciation. The amount of decrease in value of a physical asset due to ageing in a time period.

Efficiency. The degree to which potential benefits are realized for a given expenditure.

Efficient Pricing. Setting prices for the use of highway facilities so that each vehicle pays the costs it imposes at the time and place it is traveling. Efficient pricing promotes the most efficient use of existing facilities and generates the right amount of revenue to build the most efficient system and perform the optimal amount of maintenance.

Equity. Generally interpreted as the state of being just, impartial, or fair. Horizontal equity refers to the fair treatment of individuals with similar circumstances. Vertical equity refers to the fair treatment of individuals in different circumstances.

Equity Ratio. The ratio of the share of revenues paid by a highway user group to the share of costs imposed by that group. A user group that meets 110 percent of its cost responsibility would be assigned an equity ratio of 1.1. Equity ratios above 1.0 are assigned to user groups who are paying more than their cost responsible share while payments from user groups assigned equity ratios of less than 1.0 fall short of the costs imposed by the group.

Equivalent Single Axle Load. The pavement stress imposed by a single axle with an 18,000-pound axle load. ESAL-Miles are equivalent single-axle loads times miles traveled. Research has concluded that the relationship between axle weight and ESALs is an approximate third or fourth-power exponential relationship; ESALs therefore rise rapidly with increases in axle weight.

Excise Tax. A tax levied on the production or sale of a specific item such as gasoline, diesel fuel, or vehicles.

Federal Highway Funds. Funds collected from federal highway user fees and distributed to states by FHWA for spending on transportation projects by state and local governments.

Functional Classification. The classification of roads according to their general use, character, or relative importance. Definitions are provided by FHWA for Rural Interstate, Rural Other Principal Arterial, Rural Minor Arterial, Rural Major Collector, Rural Minor Collector, Rural Local, Urban Interstate, Urban Other Expressway, Urban Other Principal Arterial, Urban Minor Arterial, Urban Collector, and Urban Local.

Gross Vehicle Weight. The loaded weight for a vehicle.

Highway Cost Allocation Study. A study that estimates and compares the costs imposed and the revenues paid by different classes of vehicles over some time period.

Highway Performance Monitoring System. FHWA collects and reports data about a sample of road segments in every state in a common format.

Highway User. A person responsible for the operation of a motor vehicle in use on highways, roads, and streets. In the case of passenger vehicles, the users are the people in the vehicles. In the case of goods-transporting trucks, the user is the entity transporting the goods.

Incremental Cost. The additional costs associated with building a facility to handle an additional, heavier (or larger) class of vehicle.

Incremental Method. A method of assigning responsibility for highway costs by comparing the costs of constructing and maintaining facilities for the lightest class of vehicles only and for each increment of larger and heavier vehicles. Under this method, vehicles share the incremental cost of a facility designed to accommodate that class as well as the cost of each lower increment.

Light (or Basic) Vehicles. The lightest vehicle class, usually including passenger cars, vans, and pickups.

Live Load. The additional load on a structure by traffic (beyond the dead load imposed by holding itself up).

Load-Related Costs. Costs that vary with the load imposed by traffic on a facility.

Marginal Cost. The increase in total cost that results from producing one additional unit of output. With respect to highway use, the marginal cost is the increase in total highway costs that results from one additional vehicle trip. Economic efficiency is achieved when the price charged to the user is equal to the marginal cost.

National Highway System. A set of highways throughout the United States that have been designated as National Highways by the federal government. FHWA sets design and maintenance standards and provides funding for national highways, but the highways are owned by the states.

National Pavement Cost Model. A model of pavement costs that incorporates the wear-and-tear costs imposed by vehicle traffic of different weights and configurations as well as deterioration from age and environmental factors, taking into account the soil type, road base depth, pavement material, pavement thickness, and climate zone.

Non-Divisible Load. Non-divisible loads are large pieces of equipment or materials that cannot be feasibly divided into smaller individual shipments. All states issue special permits for nondivisible loads that would otherwise violate state and federal gross vehicle weight, axle weight, and bridge formula limits.

Operating Weight. The actual weight of a vehicle at a particular time

Overhead Costs. Costs that vary in proportion to the overall level of construction and maintenance activities but are not directly associated with specific projects.

Passenger Car Equivalent. A measure of road space effectively occupied by a vehicle of a given type under given terrain, vehicle mix, road type, and congestion conditions. The reference unit is the standard passenger car operating under the conditions on the road category in question.

Registered Weight. The weight that determines the registration fee paid by a single-unit truck or a tractor. For a tractor, it is typically the highest of that vehicle's declared weights.

Revenue Attribution. The process of associating revenue amounts with the classes of vehicles that produce the revenues.

Right of Way. The strip of land, property, or interest therein, over which a highway or roadway is built.

Seismic Retrofit. Work on an existing structure intended to increase its resistance to earthquakes.

Social (or Indirect) Costs. Costs that highway users impose on other users or on non-users. Costs typically included in this category are those associated with noise, air and water pollution, traffic congestion, and injury and property damage due to traffic accidents.

Span. A section of a bridge.

State Highway System. Roads under the jurisdiction of state agencies.

Statewide Transportation Improvement Program. Each state, following guidelines in federal law, produces and regularly updates a list of intended future transportation improvements.

Truck. A general term denoting a motor vehicle designed for the transportation of goods. The term includes single-unit trucks and truck combinations.

User Charge. A fee, tax, or charge that is imposed on facility users as a condition of usage.

User Revenues. Highway revenues raised through the imposition of user charges or fees.

Vehicle Class. Any grouping of vehicles having similar characteristics for cost allocation, taxation, or other purposes. The number of vehicle classes used in a cost responsibility (allocation) study will depend on the needs, purpose, and resources of the study. Potential distinguishing characteristics include weight, size, number of axles, type of fuel, time of operation, and place of operation.

Vehicle Miles of Travel. The sum over vehicles of the number of miles each vehicle travels within a time period.

Vehicle Registration Fees. Fees charged for being allowed to operate a vehicle on public roads.

Weight-Mile Tax. A graduated fee based on the weight of a vehicle and the miles it travels.

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1.0 Introduction

This report presents the findings of the 2009 Nevada Highway Cost Allocation Study (HCAS), which examines the equity of Nevada's highway user tax structure. The report compares federal, state, and local revenues to cost responsibilities for a number of vehicle classes differentiated based on type (e.g., passenger vehicle, single-unit truck, bus) and registered gross weight (RGW). This report contains the following sections:

- 1.0 Introduction. This section presents an overview of the purpose and scope of this study, and a review of previous Nevada HCASs and HCASs conducted in other states.
- 2.0 Data Elements. This section documents the revenue, expenditure, and travel data used to support the analyses presented in this report.
- 3.0 Cost Allocation. This section presents cost allocation procedures and the estimated cost responsibilities by detailed vehicle classes.
- 4.0 Revenue Attribution. This section provides an overview of the procedures used in attributing highway user payments to vehicle classes and presents revenue attribution results.
- 5.0 Equity Analysis. This section compares the revenues paid to cost responsibility and in so doing develops equity ratios for each vehicle class.

This report also contains a list of references, acronyms, and a glossary.

1.1 Purpose and Scope

An HCAS is a study that is designed to determine the fair share of costs that each road user class should pay for the construction, operation, maintenance, and related costs of highways, roads, and bridges in a state. By comparing highway user payments to cost responsibilities estimated within the HCAS, the 2009 Nevada HCAS examines the equity in Nevada's highway user tax system. Thus, the 2009 Nevada HCAS seeks to answer such questions as:

- How do broad highway user classes, differentiated based on vehicle type and weight category, compare with each other in terms of paying their share of highway costs? How much is each class under- or overpaying?
- How could existing tax rates be changed to bring about a closer match between payments and cost responsibilities for each vehicle class?

In addition to addressing these questions, the 2009 Nevada HCAS and the Federal Highway Administration (FHWA) State HCAS Model, which was refined for this study, can be used to examine the impacts on equity of making adjustments to the current tax and fee structure in Nevada, of developing alternative tax and fee schedules such as vehicle miles of travel (VMT) fees, or of re-introducing a weight-mile tax.

The 2009 Nevada HCAS uses a small number of key parameters:

- Definition of vehicle classes. The 12 vehicle classes established by the Highway Performance Monitoring System (HPMS) were contracted into 10 classes by combining four-wheel light trucks with passenger cars and combining single-unit three axle and single-unit four axle vehicles together into a single vehicle class. Vehicle classes are further differentiated in the FHWA State HCAS Model based on weight in 2,000-pound increments above 8,000 pounds.
- Functional class of road system. Travel and expenditures data are broken down according to the following standard highway functional classes:
 - Rural
 - Interstate
 - Other Principal Arterials
 - Minor Arterials
 - Major Collectors
 - Minor Collectors
 - Local
 - Urban
 - Interstate
 - Other Freeways and Expressways
 - Other Principal Arterials
 - Minor Arterials
 - Collectors
 - Local.
- Study time period. This study uses the eight-year time period beginning in 2009 and ending in 2016.
- Levels of government examined. The analysis presented in this report includes analysis of all levels of government (i.e., federal, state, and local).

1.2 Previous Nevada Highway Cost Allocation Studies

Nevada HCASs were completed in 1984, 1986, 1988, 1990, 1992, 1994, and 1999. Historically, Nevada HCASs have used the modified incremental approach to assigning responsibility for highway costs to vehicle classes. The modified incremental approach allocates a base component of the costs of constructing and maintaining facilities to all vehicle classes and incrementally allocates costs for each additional design element required to accommodate wider and heavier vehicles to specific vehicle classes. Under this method, the heaviest vehicles incur the incremental cost of a facility designed to accommodate that class and share the cost of each lower increment.

In 1994, the Nevada Department of Transportation (NDOT) commissioned an outside audit of its HCAS (Sydec 1994). The audit was conducted in response to questions and comments by stakeholders,

and included a thorough review and assessment of the procedures and analyses used by NDOT in the first four Nevada HCASs, resulting in recommendations for refinements, including those relating to:

- Scope of programs
- Scope of revenue, registration, and related data covered
- Use of two vehicle classes analyzed
- Analysis limited to revenues and expenditures from the State Highway Fund
- Excessive gas tax revenue being credited to trucks.

While most of the recommendations relating to these issues were addressed in the 1999 Nevada HCAS, the study continued to classify vehicles according to broad weight categories (basic vehicles weighing 10,000 pounds or less and heavy vehicles weighing in excess of 10,000 pounds) and identified the total value of diverted highway user funds (e.g., federal highway user funds used to support mass transit programs and ad-valorem taxes passed through to counties) but did not allocate them. The recommendations of the 1994 audit regarding these issues were implemented in the 2009 Nevada HCAS.

Table 1.1 presents the findings of the past Nevada HCASs as they relate to highway user fee contributions vs. cost responsibility. In each of the previous Nevada HCASs, basic vehicles were found to be more than meeting their cost responsibility while the heavy vehicle class was found to be underpaying. In 1989, Nevada replaced its weight-mile tax with a diesel tax and increased registration fees. As shown in Table 1.1, since that time the heavy truck shortfall has expanded significantly, reaching \$133.7 million in the 1999 Nevada HCAS.

Table 1.1. History of Highway User Fee Contributions vs. Responsibility in Nevada

Study Year	Vehicle Class	Contribution (\$Millions)	Percent Contribution	Responsibility (\$Millions)	Percent Responsibility	Equitable Increase Required (\$Millions)
1999	Basic	\$502.8	72.6%	\$421.5	60.9%	\$0
	Heavy	\$189.4	27.4%	\$270.7	39.1%	\$133.7
1994	Basic	\$383.5	74.4%	\$302.2	58.7%	\$0
	Heavy	\$131.7	25.6%	\$212.9	41.3%	\$138.5
1992	Basic	\$282.9	68.6%	\$246.6	59.8%	\$0
	Heavy	\$129.2	31.4%	\$165.5	40.2%	\$60.6
1990	Basic	\$209.2	62.4%	\$206.9	61.7%	\$0
	Heavy	\$125.9	37.6%	\$128.2	38.3%	\$3.7
1988	Basic	\$186.5	59.4%	\$185.9	59.2%	\$0
	Heavy	\$127.5	40.6%	\$128.2	40.8%	\$1.2
1986	Basic	\$148.0	65.5%	\$143.8	63.6%	\$0
	Heavy	\$78.0	34.5%	\$82.2	36.4%	\$6.6
1984	Basic	\$275.0	71.2%	\$275.0	64.0%	\$0
	Heavy	\$111.1	28.8%	\$154.6	36.0%	\$43.5

Source: Nevada Department of Transportation (1999)

1.3 Results in Other States

The first HCAS was performed in Oregon in 1937. Since that time, at least 84 additional HCASs have been performed in 30 states. The results and basic methods used in these states are summarized in Table 1.2. The data were originally based on information presented in the *2005 Oregon Highway Cost Allocation Study* (EcoNW 2005) but were updated in the National Cooperative Highway Research Program (NCHRP) Synthesis Report #378, *State Highway Cost Allocation Studies* (Balducci and Stowers 2008). In total, 85 HCASs are known to have been performed in the United States.

Table 1.2 identifies each state that has performed an HCAS (Column 1) and the years in which the studies were completed (Column 2). Based on the data presented in Column 3, the incremental and federal methods have been the principal methods used historically in the United States. These methods collectively fall under the umbrella of the cost-occasioned approach, which determines cost responsibility based on the costs occasioned by various highway user classes. The cost-occasioned approach attempts to allocate cost responsibility based on the costs imposed on the highway network by each class of highway users, as opposed to allocating costs simply based on relative use.

In Table 1.2, Column 4 presents the heavy truck responsibility found in each study. Historically, HCAS results have varied widely with heavy truck responsibility reaching as low as 18.9 percent in the 1987 California HCAS and as high as 64.5 percent in the 1979 Florida HCAS. The heavy truck share varies due to a number of factors, including the scope and type of expenditures included in the HCAS, the definition of the heavy truck class (the heavy truck class is generally defined by some weight threshold or vehicle configuration), the methods used in the study, and the types of expenditures examined.

The fifth column in Table 1.2 identifies the key allocators used in the state HCASs conducted to date. The allocator, or measure used to allocate costs to highway user classes, is generally tied to either travel (e.g., VMT), the space vehicles take up on roads (e.g., passenger car equivalents [PCEs]), vehicle loads (e.g., equivalent single axle loads [ESALs]) or a combination of these measures (e.g., ESAL-miles, ton-miles, axle-miles, and PCE-VMT).

Table 1.2. State Highway Cost Allocation Study Methods and Results

State	HCAS Years Completed	Method	% Heavy Vehicle Cost Responsibility	Key Allocators	Types of Revenues Examined
Arizona	1993, 1999, 2000, 2001, 2002, 2005	Federal	31.4% (1999)	VMT, Axle-Load, Gross weight	State, federal and local funds combined
Arkansas	1978	Incremental / Cost Function			
California	1987, 1997	Federal and Incremental	18.9%	ESAL-Miles	State, federal and local funds analyzed separately
Colorado	1981, 1988	Federal	37%	VMT, Truck-VMT, ESALs, Ton-Miles	
Delaware	1992, 1993	Federal and Incremental	20.33%	VMT, PCE-miles, ESALs, Axle-Miles, Registrations	State and federal funds combined only
Florida	1979	Incremental	64.5%	VMT, ESALs, Axle-Miles, Registrations	State and federal
Georgia	1979, 1982	Incremental	51.2% (1979)	VMT, GVW, ESALs, Axle Miles Traveled (AMT)	State and federal
Idaho	1987, 1994, 2002	Prospective Cost-Occasioned	37.29%	VMT	State, federal and local funds combined
Indiana	1984, 1988, 1989, 2000	Incremental / Consumption	53.2%	ESAL	State, federal and local
Iowa	1983, 1984	Federal	48.94%	ESAL, Ton-miles, AMT, PCE, VMT	
Kansas	1978, 1985	Hybrid	41.85%	Number of vehicles, VMT, AMT, Ton-miles, PCE-VMT, ESAL-miles	State funds
Kentucky	1992, 1994, 1996, 1998, 2000	Federal	54.92%	VMT, ESAL-VMT, PCE-VMT, Axle-Miles	State and federal funds combined
Maine	1956, 1961, 1982, 1989	Hybrid / Expenditure Allocation	35.6%	VMT, ESALs, PCE, Delphi, TMT, Standard Vehicle Equivalent	State and federal funds

Table 1.2. (contd)

State	HCAS Years Completed	Method	% Heavy Vehicle Cost Responsibility	Key Allocators	Types of Revenues Examined
Maryland	1989				State and local funds
Minnesota	1990	Federal and incremental	19.2%	VMT, Truck-VMT	
Mississippi	1980	Incremental	36%	VMT, Truck-VMT	
Missouri	1984, 1987, 1990	Federal		Vehicle size, Vehicle weight, VMT	
Montana	1992, 1999	Federal	33%	VMT, ESAL-MT, AMT	
Nevada	1984, 1985, 1988, 1990, 1992, 1994, 1999	Modified Incremental	39.3%	ESALs, VMT, Axle-miles, Ton-miles	State, federal and local separately and combined
New Mexico	1972				
North Carolina	1983	Federal		PCE, ESALs, VMT, Weight axle-miles	State and federal funds
Ohio	1982	Federal / Incremental		VMT	
Oregon	1937, 1947, 1963, 1974, 1980, 1984, 1986, 1990, 1992, 1994, 1999, 2001, 2003, 2005, 2007	Cost occasioned with NAPCOM for pavement costs (since 1999)	34.1%	Congested PCE, VMT, Uphill PCE, Truck-VMT, Basic Vehicle VMT,	State, federal and local combined for cost allocation purposes but state only for revenue attribution purposes
Pennsylvania	1989, 1990	Federal / Cost Occasioned			
Texas	1984, 1985, 1994, 2002				
Vermont	1990, 1993, 2006	Federal	25.7%	VMT, ADT, ESAL	State and federal funds
Virginia	1991, 1992	Federal	21.7%	ESALs, VMT, ADT	State and federal funds combined
Washington	1977	Incremental			
Wisconsin	1982, 1992	Federal (1982)	31.7%	ESAL, VMT, PCE, Ton-miles	State and federal funds combined
Wyoming	1981, 1999	FHWA State HCAS model	55.8%	VMT, Vehicle size, Horsepower, Weight	

Source: Balducci and Stowers (2008)

Table 1.3 presents the results of 22 HCASs conducted from 1982 to 2007 with respect to the equity ratios for the heavy truck class. As noted previously, the definition of the heavy truck class is differentiated among states but generally includes all vehicles weighing in excess of a certain weight threshold (e.g., 10,000 pounds) or is identified based on vehicle characteristics (e.g., all vehicles with more than two axles). The heavy vehicle class typically includes buses, single-unit trucks, and combination trucks. The equity ratio is measured as the revenues attributed to the highway user class divided by its cost responsibility. An equity ratio of less than 1.0 would indicate that payments from the highway user class have fallen short of its cost responsibility, while an equity ratio in excess of 1.0 would indicate that tax payments exceed cost responsibility.

Of the 22 studies referenced in Table 1.3, 19 found that payments from the heavy truck class fell short of cost responsibility. In three states (Delaware, Montana, and Oregon), heavy truck payments were equal to or greater than their cost responsibilities. A large part of the explanation of the results is tied to the differences in the state tax structures. Note, for example, that one of the three states (Oregon) in the over 1.0 equity ratio category had weight-distance taxes at the time of the study, and another (Delaware) collected a high proportion of its heavy truck revenues fees from out-of-state based trailers.

Table 1.3. State HCAS Findings on Equity of Tax Structure for Heavy Vehicles (1982-2007)

Equity Ratio for Heavy Vehicles	State and Year of Study
<0.60	Maryland (1982), Colorado (1988), Georgia (1991), Texas (1994), Nevada (1999), Vermont (2006)
0.60-0.80	Connecticut (1982), Missouri (1984), Indiana (1988), Minnesota (1990)
0.80-1.00	Wisconsin (1982), North Carolina (1983), Kansas (1985), California (1987), Maine (1989), Pennsylvania (1990), Arizona (1999), Kentucky (2000), Idaho (2002)
>1.00	Delaware (1992), Montana (1992), Oregon (2007)

Source: Balducci and Stowers (2008)

2.0 Data Elements

This section presents an overview of the data used within the 2009 Nevada HCAS. To conduct the cost allocation and revenue attribution analyses, the study relies on forecasts of three major types of data:

- Revenue Data. Receipts from highway users from Nevada's tax and fee structure principally comprised of registration fees, ad-valorem (Governmental Service Tax [GST] fees) taxes, motor fuel taxes, driver's license fees, and vehicle sales taxes.
- Expenditure Data. Expenditure data for the construction, preservation, maintenance, and administration of highway programs in Nevada. The data also include expenditures by the Department of Motor Vehicles (DMV) and Department of Public Safety (DPS).
- Travel Data. Total VMT and VMT distributions by ten vehicle classes and 12 road classifications.

This section presents forecasts developed for this study. In each case, the data presented covers the average of the eight-year (2009-2016) study time horizon or the average of the values estimated for fiscal years (FYs) 2012 and 2013.

2.1 Revenue Data

The research team received detailed revenue data from NDOT for the 2007-2009 time period and revenue forecasts for all highway fund revenues through 2016. The revenues analyzed in this study include all highway user taxes and fees collected at the federal, state, and local levels in Nevada, including those deposited in the State Highway Fund and those used to fund activities unrelated to highways. In Nevada, highway user fees are principally comprised of registration fees, ad-valorem taxes (GST fees), motor fuel taxes, driver's license fees, and vehicle sales taxes. Rates for these taxes are presented in Table 2.1.

Table 2.1. Transportation Tax Rates in Nevada

<u>Federal</u>	
Federal Gasoline Tax	18.4 cents per gallon
Federal Special Fuels Tax	24.4 cents per gallon
Heavy Vehicle Use Tax	Below 55,000 lbs., no tax. From 55,000-75,000 lbs. \$100 plus \$22 per 1,000 lbs. over 55,000 lbs. Over 75,000 lbs., \$550.
Trucks and Trailer Sales Tax	12 percent of a retailer's sales price for tractors and trucks over 33,000 lbs. GVW and trailers over 26,000 lbs. GVW.
Tire Tax	0-40 pounds No Tax Over 40 pounds to 70 pounds 15¢ per pound in excess of 40 Over 70 pounds to 90 pounds \$4.50 plus 30¢ per pound in excess of 70 Over 90 pounds \$10.50 plus 50¢ per pound in excess of 90
<u>State</u>	
State Gasoline Tax	18.455 cents per gallon
State Special Fuel Tax	27.75 cents per gallon
State Registration Fee	\$ 33.00 per year for automobiles \$ 39.00 per year for motorcycles \$ 27.00 per year for travel trailers \$ 33.00 per year for trucks, truck tractors and buses weighing less than 6,000 pounds GVW \$ 38.00 per year for trucks, truck tractors and buses weighing 6,000-8,499 pounds GVW \$ 48.00 per year for trucks, truck tractors and buses weighing 8,500-10,000 pounds GVW \$ 12.00 per 1,000 lbs. for units between 10,001 and 26,000 lbs. GVW \$ 17.00 per 1,000 lbs for motor carrier units between 26,001 and 80,000 lbs. GVW (maximum fee is \$1,360)
Annual Permit Fees	\$ 60.00 per 1,000 lbs. for motor carrier units exceeding 80,000 lbs. for reducible-load units between 80,00 and 129,000 lbs. GVW (maximum fee is \$2,940)
Overlength vehicles	\$ 10.00 for overlength vehicles (longer than 70') carrying reducible loads not exceeding 80,000 lbs. GVW
Governmental Services Tax (Ad Valorem)	4% of a vehicle's depreciated assessed valuation
Driver's License Fees (Renewed Every Four Years)	\$ 22.00 for operating passenger cars \$ 17.00 for persons 65 or older \$ 5.00 for motorcycles \$ 87.00 commercial vehicle driver's license
Title Fees	\$ 28.25 for all vehicles
<u>Local</u>	
County Mandatory Tax (Applied in All Counties)	6.35 cents per gallon
Local Option Gasoline Tax	Ranges by county from 4-11.2 cents per gallon
GST Fee Supplemental (Ad Valorem)	1% of a vehicle's depreciated assessed value
Source: Nevada Department of Transportation (2009a) and Federal Highway Administration (2007).	

NDOT long-range forecasts of state highway funds were used to project the FYs 2007-2009 revenue data out to the end of the study time period (FY 2016). Once forecast, revenues were assigned to the categories used in the 1999 Nevada HCAS to allow for comparison between studies. Estimated revenues for the average of the FYs 2012-2013 time period are presented in Tables 2.2-2.4.

Table 2.2 presents forecasts of federal revenues attributable to highway users in Nevada. These estimates are based on data prepared by FHWA and presented in its annual publication, *Highway Statistics* (FHWA 2007). Estimates prepared by FHWA were forecast forward using Nevada State Highway Fund forecasts prepared by NDOT. Motor fuel taxes comprise the vast majority of the federal highway user taxes collected in Nevada (\$332.4 million or 85.3 percent). The heavy vehicle use tax (HVUT), trucks and trailers tax, and tire tax, which collectively comprise \$57.2 million or 14.7 percent of total federal highway user revenues, are all paid by heavy vehicles in Nevada. This forecast includes highway user fees deposited in the Mass Transit Account of the Federal Highway Trust Fund.

Table 2.2. Federal Highway User Revenues in Nevada (Average Annual, FYs 2012-2013 Period)

User Fee	Revenues (\$)
Gasoline Tax	223,124,879
Special Fuels Tax	109,250,633
Heavy Vehicle Use Tax	11,127,028
Trucks and Trailers Tax	41,076,989
Tire Tax	<u>4,970,521</u>
Total Federal	389,550,049

Table 2.3 presents forecasts of state revenues attributable to highway users in Nevada. The revenues included in the 1999 Nevada HCAS were only those used on public highways whereas this study includes all revenues collected regardless of their use. Thus, the 2009 Nevada HCAS includes \$266.9 million in GST revenue that is passed through to counties and used for both road and non-road purposes. The GST is an ad-valorem tax assessed on the depreciated value of the motor vehicle. The forecast also includes vehicle sales taxes, which are used for general governmental purposes. In total, state revenues are forecast at \$1.2 billion. The largest revenue sources are the vehicle sales tax (\$453.3 million), GST fee (\$266.9 million), gasoline tax (\$208.6 million), registration fee (154.5 million), and special fuels tax (\$105.6 million). The forecasts of some user fees (e.g., fuel taxes, registration fees, and sales taxes) reflect current trends reported by NDOT and DMV, which reflect recent declines in collections.

Table 2.3. State Highway User Revenues in Nevada (Average Annual, FYs 2012-2013 Time Period)

User Fee	Revenues (\$)
Gasoline Tax	208,625,677
Special Fuels Tax	105,563,252
Regular Registration	122,955,078
Driver's Licenses and Permits	14,905,178
Commercial Driver's Licenses and Permits	1,620,879
Governmental Services Tax	266,874,008
Motor Carrier Fees	8,021,978
Motor Carrier Registration	31,514,377
HazMat Fees	4,980,782
Vehicle Records Fees	11,811,209
Emissions Certificates	9,060,930
Vehicle Sales Tax	453,278,155
Miscellaneous Fees	<u>973,683</u>
Total State	1,240,185,188

Local revenues attributable to highway users in Nevada are presented in Table 2.4. These revenues include the county mandatory and option gasoline tax (\$181.2 million) and the local GST fee component (\$46.9 million). In total, local highway user revenues in Nevada were forecast at \$228.1 million.

Table 2.4. Forecast Local Highway User Revenues in Nevada (Average Annual, FYs 2012-2013 Period)

User Fee	Revenues (\$)
Gasoline Tax	181,203,732
Government Services Tax (Ad Valorem)	<u>46,920,387</u>
Total Local	228,124,118

2.2 Expenditure Data

Expenditure data were obtained from NDOT and examined according to the following cost categories:

- New Pavements
- Rehab Pavements
- New Bridge
- Replacement Bridge
- Repair Bridge
- Grading
- Other Construction
- Maintenance
- Administration and Other Expenditures.

Most of these data are forecasts of most likely expenditures by each level of government (federal, state, and local) over the next eight years based on recent trends and anticipated revenues. Expenditure data were also obtained from the Statewide Transportation Improvement Program (STIP).

In addition to expenditure data, another basic input is the cost of the backlog of deferred pavement and bridge work that has been increasing as tabulated in NDOT’s draft 2009 Preservation Report. These add up to over \$539.5 million, including over \$388 million for pavement and \$150 million for bridge rehabilitation, replacement, and repair (NDOT 2009b). To allocate these costs, we first subtracted out \$130 million due to the forecast impact of federal stimulus funds on preservation investment in Nevada. Federal stimulus funds were spread proportionally across the two major preservation cost categories (72.1 percent pavements and 27.9 percent bridges). The remaining costs of deferred preservation (\$295.1 million for pavements and \$114.4 million for bridges) were spread evenly over the eight-year study time horizon. Annual preservation cost values were then inflated at 3.5 percent annually, representing the state’s construction cost inflation rate. Using these assumptions generates an average annual preservation cost of \$43.2 million for pavements and \$16.7 million for bridges during the 2009-2016 study time horizon.

2.3 Travel Data

The basic assumptions and procedures used in developing the projections of VMT by vehicle class and functional class of highway shown in the table are as follows:

- We accepted an NDOT projection of 25.8 billion for overall Nevada VMT for 2012-2013, as shown in the table. This projection is based on a long-term correlation between Nevada population and statewide VMT (8,170 annual miles per person) and a recent official Nevada population forecast through our study's projection period.
- Supporting this projection, we analyzed trends for 2003 through 2007, the most recent five years for which complete data are available, and found that urban VMT has been growing at a steady average rate of 650 million per year, but that rural VMT has been declining at a steady average rate of 72 million per year. When we ran these trends through our project period, we arrived at a figure that was very close (1.7 percent less) than the NDOT forecast. We were inclined to think it likely that the rural rate of decline would tend to level off over this projection period so we accepted the slightly higher NDOT projection of VMT.
- We used these steady trends in urban growth and rural decline to project the percentage split between urban and rural for our projection period.
- Finally, we used (a) the 2007 splits for VMT by detailed functional classes, and (b) a weighted average of percentage splits for VMT for the last five years for each functional class to obtain the breakdowns of projected VMT for both urban and rural by functional class shown in the table.

Table 2.5. Vehicle Miles of Travel on Nevada’s Highways and Streets (Average Annual for 2009 – 2016 Time Period) – Thousands of Miles

Functional Class	Pass. Cars	Buses	Single-Unit Trucks		Single-Trailer Combinations		Multi-Trailer Combinations			
			2 axle, 6 tire	3 axles or more	4 axles or less	5 axle	6 axles or more	5 axles or less	6 axles	7 axles or more
Interstate – U	4,067,563	20,071	72,773	27,821	15,529	208,017	6,027	15,529	3,266	17,280
Other Freeway and Expressway – U	2,249,313	7,564	35,774	9,847	9,562	48,443	2,220	3,742	1,713	10,386
Other Principal Arterials – U	3,215,742	19,227	55,721	13,547	12,690	47,809	2,389	4,666	2,186	7,078
Minor Arterials – U	5,332,927	26,362	95,239	24,729	21,127	40,138	3,564	7,018	4,047	14,258
Collectors – U	1,679,193	7,093	30,112	2,710	4,244	2,053	219	2,122	1,211	819
Local Roads – U	3,128,322	12,449	95,989	18,018	1,310	15,070	983	328	328	3,276
Total Urban	19,673,059	92,766	385,607	96,672	64,462	361,530	15,403	33,404	12,751	53,097
Interstate – R	1,340,365	12,673	72,790	9,524	17,232	386,338	5,549	18,845	7,048	34,401
Other Principal Arterials – R	1,227,780	7,727	62,143	8,382	15,365	138,976	3,883	10,299	3,099	13,319
Minor Arterials – R	443,128	2,780	18,833	4,750	3,619	33,625	966	2,354	491	4,695
Major Collectors – R	416,135	1,973	12,258	2,675	3,753	20,772	885	1,768	497	4,759
Minor Collectors - R	149,905	127	1,965	356	301	1,666	134	134	72	1,128
Local Roads - R	448,291	3,691	16,536	767	527	6,806	-	383	144	2,157
Total Rural	4,025,605	28,971	184,525	26,454	40,797	588,183	11,418	33,783	11,351	60,458
Total All Road Systems	23,698,664	121,737	570,132	123,126	105,259	949,713	26,821	67,187	24,101	113,555

3.0 Cost Allocation

This section allocates the construction, preservation, maintenance and other expenditures by level of government to the various vehicle classes. Section 3.1 presents an overview of the procedures used in the cost allocation process. Section 3.2 presents the results of the cost allocation analysis.

3.1 Cost Allocation Procedures

The cost responsibility for each vehicle class was estimated using the FHWA State HCAS Model as a framework, updated to reflect Nevada's highway system and the vehicles using the system.

3.1.1 Pavements

Our most important updates focused on vehicle characteristics. We used a large amount of weigh-in-motion data collected by Nevada DOT during 2005-2006 and reported to FHWA as part of an ongoing traffic monitoring program. We subjected slightly over 9 million individual observations to the study team's previously developed evaluation and editing algorithm and found that slightly under eight million passed the edit tests and seemed valid. These observations have been used in the refinements to the HCAS model inputs.

The weight observations provided excellent distributions of vehicle operating weights for the ten vehicle classes, as well as detailed information on axle weights—two vital components needed for accurate allocation of pavement, bridge, and other highway costs.

The research team also relied on a very recent run of the National Pavement Cost Model (NAPCOM), using 2007 highway section data reported by Nevada DOT to FHWA under the HPMS. NAPCOM, one of the most important HCAS innovations developed by FHWA, estimates how much pavement deterioration in a given state results from each type and weight of axle. Thus, the pavement cost responsibility component of this study is a significant improvement over the work done in all previous Nevada HCASs, reflecting the current better understanding of how NDOT pavement design, pavement condition, weather, soils, motor vehicle axle weights, and chemical deterioration of pavements interact with each other in Nevada.

3.1.2 Bridges

The bridge cost allocation procedures used in this study are based on research and methods developed by FHWA for the 1982 and 1997 Federal HCASs. Three types of bridge expenditures were considered: new bridges, bridge replacement, and bridge rehabilitation.

New bridge costs are allocated based on an incremental analysis of the costs of constructing bridges using different design loadings. These loadings are based on hypothetical vehicles, for which stresses in the load-bearing members of bridges are calculated and compared with permissible stress levels. As loadings become heavier, the size of bridge members (and, consequently, bridge costs) must be increased to remain within permissible stress levels. All vehicles share the cost of the first increment (i.e., that

associated with the lightest design loadings). Only heavier vehicles share the cost of subsequent increments. The determination of which vehicles share the costs of which increments depends upon a comparison of the stresses produced by the vehicles with those produced by the design loadings used in the incremental analysis.

Bridge replacement costs are allocated based on estimates of the percentage of these costs that are incurred because the load-bearing capacity of existing bridges are deficient. Those costs due to deficient load-bearing capacity are allocated to vehicles that operate at weights over the load-bearing capacities of the replaced bridges. The percentage of bridge replacement costs that are incurred as a result of deficient load-bearing capacities was estimated using FHWA's Bridge Sufficiency Rating Formula.¹ Under the Bridge Sufficiency Rating Formula, bridges lose points if their load-bearing capacity is inadequate or if they have other non-load-related problems such as scouring around piers or being too narrow for current traffic levels. For bridges to be replaced, points lost due to inadequate load-bearing capacity are expressed as a fraction of total points lost to determine the share of bridge replacement costs to be allocated to vehicles that operate at weights over the load-bearing capacities of the bridges to be replaced.

Bridge rehabilitation costs are allocated based on estimates of the fraction of these costs associated with different types of bridge rehabilitation projects and the extent to which expenditures for each type of project are load-related. The allocation was based on information from FHWA's Bridge Needs and Investment Process. The primary input required is an analysis of a representative sample of bridge repair projects to determine the overall percentage of such projected costs that are expected to be load-related as opposed to non-load related costs. This split, broken down by functional class of street and highway, is then used to determine the split between costs that should be allocated by vehicle mile of travel broken down by weight category and the costs that should be allocated only by vehicle miles of travel for each vehicle class.

3.1.3 Maintenance

State highway maintenance cost allocation procedures are based on very detailed reporting by NDOT maintenance crews for thousands of projects completed over the course of 2004-2008, the most recent complete years for which such data on the cost of each of these projects were available. The first main task was to assign each of the dozens of different types of projects to one of seven cost allocation categories:

- Travel related – maintenance costs that relate only to the amount of traffic, independent of weight
- Wear-related flexible pavements – maintenance costs for asphalt pavements that are based on axle weights, as measured by equivalent single-axle loads (ESALs) or local equivalency factors (LEFs)
- Wear-related rigid pavements – same for concrete pavements
- Axle-related surface wear – maintenance costs that are independent of weight but are dependent on the number of axles
- Truck-related – truck facilities – costs of maintenance for truck-only facilities, such as weigh stations
- Light vehicle-related facilities – costs for facilities used only by light vehicles, such as lanes or routes from which trucks are prohibited

¹ This formula is described in Appendix A of FHWA's *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*.

- Rest areas – facilities where portions are truck-only and portions are for light vehicles only.

The second main task was to sum up the totals of all costs for each of these seven types, broken down by functional class of highway.

The appropriate allocators are then used for each of these seven classes to obtain maintenance costs by allocator for each functional class, which are then translated into cost responsibility by vehicle class based on each class's use of each functional class of highway.

3.1.4 Preservation

Estimates of the backlog of preservation costs have been updated in a January 2009 draft preservation report. This report estimated the current pavement preservation backlog to be \$389,788,000 and the same for bridge preservation to be \$150,720,000, for a total of \$539,508,000. After expected reductions of these backlogs are made through the federal funds programmed under the stimulus program, this backlog total is anticipated to be reduced to \$409,508,000.

The cost responsibility for the pavement backlog was estimated using the same allocators as were used for pavement repair. The cost responsibility for the bridge backlog was estimated using the same allocators as were used for bridge replacement and bridge repair. A more detailed breakdown of these by functional class was based on a limited breakdown by major functional class in the preservation report and on more detailed breakdowns by specific functional class developed as part of the construction cost allocation.

3.1.5 Federal Stimulus

NDOT currently plans to divide the total stimulus funding for Nevada highways (\$201 million) into two categories: reduction of preservation backlog (\$130 million), and other short-term improvement priorities on the National Highway System (NHS) and urban portions of the State Transportation Improvement Program (STIP Urban).

With guidance from NDOT staff we assumed that the preservation portion of the stimulus improvements would be divided proportionally between pavement and bridge improvements estimated in the 2009 draft preservation report, and that the other high-priority improvement projects would be programmed in the same proportion as are currently programmed projects in the capital improvement projects on the NHS and STIP Urban. The allocation factors used for these funds were the same as those used in the preservation and capital improvement programs.

3.1.6 Department of Motor Vehicles

Detailed review of DMV's budget for its various program categories reveals that: a) essentially all of its costs are highway-related, and b) only the Motor Carrier program is uniquely related to heavier vehicles. Accordingly, we have allocated about 4.5 percent of projected DMV expenditures solely to heavy vehicles based on their share of travel on Nevada highways. The rest of DMV expenditures have been allocated to all vehicle classes based on their shares of travel on Nevada highways.

3.1.7 Department of Public Safety

Detailed review of DPS's budget for its various program categories reveals that a) essentially all of its costs are highway-related, and b) only the State Emergency Response Commission (SERC) is uniquely related in significant part to heavy vehicles. We estimate that about half of SERC's costs should be considered the cost responsibility of heavy vehicles, in large part because emergency responses to incidents caused by heavy vehicles more often involved fatalities and serious injuries, major property damage and clean-up efforts, and more time and costs for police direction and emergency vehicles.

Accordingly, we have allocated half of DPS's projected expenditures for SERC, or about 1 percent of total DPS expenditures, to heavy vehicles based on their share of overall travel on Nevada highways. The rest of DPS expenditures have been allocated to all vehicle classes based on their shares of travel on Nevada highways.

3.1.8 Administration

Essentially all NDOT expenditures except capital and maintenance expenditures are support or management services for these two large components of NDOT programs. They include such things as payroll, computer services, equipment services, field and headquarters offices, executive offices, the transportation board, and various other units of state government that serve the highways.

Accordingly, all of these costs have been allocated as an overhead on the sum of the costs of capital and maintenance programs of NDOT – i.e., cost responsibility has been allocated among all vehicle classes in the same proportion as the sum of the costs of these two major components of NDOT programs.

3.1.9 Bonds

The costs of projected bond expenditures for both capital expenditures and debt service have been allocated in the same manner as the costs of other capital expenditures on the Urban Interstate system where the bond-financed projects are located.

3.1.10 Local Expenditures

Local expenditures were stratified according to the following seven expenditure categories:

- Capital outlay
- Maintenance
- Traffic control operations
- Snow and ice removal
- General administration
- Highway law enforcement and safety
- Bond obligations / debt service.

Expenditures by category were forecast out to 2016 based on growth rates used by NDOT to project State Highway Fund revenues. This study uses the average of the expenditures over the 2009-2016 time horizon, which totaled \$726 million.

Capital outlay, traffic control operations, general administration and bond obligations were allocated across functional highway systems and construction category using NDOT estimated breakdowns for local expenditures. Maintenance and snow and ice removal were allocated across functional highway systems using the detailed maintenance breakdowns obtained from NDOT maintenance expenditure worksheets. They were allocated as a travel-related maintenance cost. Highway law enforcement and safety expenditures were allocated as a police traffic management cost.

3.2 Cost Allocation Results

Table 3.1 summarizes the result of the allocation of all costs by vehicle class, taking into account all the factors affecting cost responsibility, such as those listed in the preceding section. Vehicle classes are defined in Section 4.1 of this report. As shown, the cost allocation methods used in the 2009 Nevada HCAS resulted in \$380.2 million or 53.7 percent of all costs being allocated to passenger vehicles weighing 8,000 pounds or less. Fewer than half of the costs (\$327.6 million or 46.3 percent) have been allocated to vehicles weighing in excess of 8,000 pounds.

Table 3.1. Summary of State Highway Fund Cost Allocation Results (\$Thousands Annually)

Vehicle Class	New Pavements	Rehab Pavements	New Bridge	Replacement Bridge	Repair Bridge	Grading	Other Construction	Total Construction	Maintenance	Admin & Other ^(a)	Total
Psgr Veh	6,531	33,673	8,029	12,224	16,867	13,286	52,413	143,023	74,680	162,475	380,178
Bus	2,748	5,082	513	1,145	705	868	481	11,543	1,849	4,092	17,483
SU2	3,981	8,557	810	1,318	1,427	2,544	1,715	20,351	5,612	5,877	31,841
SU3+	2,588	5,756	437	793	603	996	574	11,748	1,374	2,269	15,391
CS3&4	1,188	2,855	322	556	523	802	447	6,693	1,125	1,861	9,679
CS5	24,542	70,127	7,255	16,960	7,268	11,112	6,857	144,121	23,125	21,699	188,944
CS6+	670	1,861	320	871	275	359	174	4,529	461	1,101	6,091
DS5	2,829	5,541	1,360	4,439	911	853	470	16,404	1,546	2,567	20,517
DS6	479	1,310	286	883	278	229	142	3,606	411	1,457	5,474
DS7+	4,301	12,208	1,160	3,670	960	1,435	808	24,542	4,391	3,239	32,172
Total	49,855	146,971	20,492	42,859	29,817	32,485	64,081	386,559	114,574	206,636	707,769

(a) “Administrative & Other” category includes \$88.3 million in DMV expenditures, \$72.2 million in DPS expenditures, \$41.0 million in administrative and support services expenditures, and \$5.1 million in transfers to other funds.

Table 3.2 breaks down the findings of the cost allocation analysis by vehicle class and level of government. As shown, \$93.3 million and \$519.0 million of all federal and local expenditures were allocated to passenger vehicles, respectively. The passenger vehicle cost responsibility is proportionally higher on the local systems due to the higher share of VMT the class represents on urban and local roads. In total, \$992.5 million or 58.2 percent of all expenditures were allocated to passenger vehicles.

Table 3.2. Cost Responsibility by Vehicle Class and Level of Government (\$Thousands)

Vehicle Class	State	Federal	Local	Total
Psgr Veh	380,178	93,329	518,989	992,496
Bus	17,483	7,141	23,901	48,525
SU2	31,841	13,153	29,944	74,938
SU3+	15,391	7,370	13,157	35,918
CS3&4	9,679	4,427	9,855	23,961
CS5	188,944	112,227	82,912	384,083
CS6+	6,091	3,046	5,469	14,607
DS5	20,517	11,137	16,682	48,336
DS6	5,474	2,495	7,404	15,373
DS7+	32,172	17,182	17,658	67,011
Total	707,769	271,506	725,972	1,705,247

4.0 Revenue Attribution

The revenue attribution process involves the splitting of revenue forecast for a future time period, in this case the average of FYs 2012-2013, among vehicle classes and weight groups. In this process, revenues are attributed to vehicle classes separately for each tax and fee. Section 4.1 presents an overview of the procedures used in the revenue attribution process. Section 4.2 presents the results of the revenue attribution analysis.

The output of the revenue attribution process, which is an assignment of revenues collected by vehicle class, serves as the numerator in the equity ratio calculation. The equity ratio is the share of revenues paid by a highway user group to the share of costs imposed by that group. A user group that meets 110 percent of its cost responsibility would be assigned an equity ratio of 1.1. Equity ratios above 1.0 are assigned to user groups who are paying more than their cost responsible share while payments from user groups assigned equity ratios of less than 1.0 fall short of the costs imposed by the group.

4.1 Revenue Attribution Procedures

The revenue attribution procedures assigned federal, state, and local user revenues to the vehicle classes detailed in Table 4.1 and to RGW classes in 2,000-pound increments above 8,000 pounds. For reporting purposes, however, these RGW classes have been contracted into 10 classes.

Table 4.1. 2009 Nevada HCAS Vehicle Types

Vehicle Class	Acronym	Description
1	Auto	Automobiles, vans, light trucks with 2-axles and 4 tires and motorcycles
2	Bus	Buses (all larger types)
3	SU2	Single unit 2-axle, 6-tire trucks
4	SU3+	Single unit trucks with 3 or more axles
5	CB3&4	Combination trucks with 3 or 4 axles
6	CB5	Combination trucks with 5 axles
7	CB6+	Combination trucks with 6 or more axles
8	DS5	Tractor-double semitrailer combinations with 5 axles
9	DS6	Tractor-double semitrailer combinations with 6 axles
10	DS7+	Tractor-double semitrailer combinations with 7 or more axles

In conducting the revenue attribution process, the research team supplemented NDOT travel and miles per gallon (MPG) data with data collected from other states and national databases, such as the vehicle inventory and use survey (VIUS). With assistance from representatives of NDOT, the research team also replaced several elements of the default data contained within the FHWA State HCAS model with Nevada-specific inputs. The various sources of data examined for this study, combined with the

default data already contained within the HCAS model, enabled the estimation of numerous vehicle characteristics for each detailed vehicle class, including:

- Vehicle miles of travel
- Percentage of mileage outside of Nevada
- Annual mileage per vehicle
- Gallons per mile
- Number of vehicles registered.

The travel, MPG, registration, and other data were input into the HCAS model, thus enabling the attribution for each tax from each vehicle class. The following procedures were used when developing estimates of revenues for the primary taxes from each vehicle class:

- Fuel tax revenues (gasoline and special fuels) were attributed based on estimates of VMT on Nevada highways and gallons per mile for each vehicle class.
- Registration fees were attributed based on the number of vehicles registered in each vehicle class.
- GST fees and vehicle sales taxes were attributed based on the number of vehicles registered in each vehicle class and default data on prices and depreciation schedules for vehicles in each RGW class.

Total collections for the average of FYs 2012 and 2013 were then applied as controls to the estimates derived from the revenue attribution procedures. This step ensured that total revenues attributed to all vehicle classes were equal to the forecast revenue totals for each level of government.

4.2 Revenue Attribution Results

This section summarizes the output of the revenue attribution process. Tables appearing in this section present total and per-mile state, federal, and local revenues paid by each vehicle and RGW class considered in this study. State highway user payments by type of tax are also presented for each vehicle and RGW class.

Table 4.2 presents the total and per-mile state, federal, and local revenues attributed to each vehicle class considered within this study. When only state highway user fees are included, passenger vehicle operators are paying 4.2 cents per mile. When all levels of government are considered, the per-mile fee for passenger vehicles rises to 6.1 cents. Per-mile state user fees increase gradually, reaching 13.0 cents per mile for tractor-double semitrailer combinations with 7 or more axles (DS7+). When taxes paid to all levels of government are considered, per-mile payments for the DS7+ vehicle category reach 24.3 cents.

Table 4.3 present the total and per-mile state, federal, and local revenues by RGW class. Based on the data presented in Table 4.3, one preliminary finding of this study is that the current tax structure does not accurately reflect the additional damage caused to Nevada roadways by heavier vehicles. That is, the rate structure is not effectively graduated to reflect the nearly exponential relationship between axle weight and pavement damage. In Nevada, per-mile state highway user revenues grow slightly as weights increase but not in a manner sufficient to capture the cost responsibilities of the heavier vehicle classes. See Section 5.0 for the comparison of revenues paid to cost responsibilities for each vehicle class.

Table 4.2. Total and Per-Mile State, Federal, and Local Revenues Attributed to Each Vehicle Class (Average Annual, FYs 2012-2013)

Vehicle Configuration	Vehicle Miles (Millions)	State		Federal		Local		Total	
		Revenue (\$Thousands)	Per Mile (Cents)	Revenue (\$Thousands)	Per Mile (Cents)	Revenue (\$Thousands)	Per Mile (Cents)	Revenue (\$Thousands)	Per Mile (Cents)
Psgr Veh	23,699	998,140	4.2	223,776	0.9	219,012	0.9	1,440,928	6.1
Bus	122	22,354	18.4	10,212	8.4	1,881	1.5	34,447	28.3
SU2	570	47,844	8.4	14,251	2.5	6,218	1.1	68,313	12.0
SU3+	123	22,267	18.1	15,374	12.5	271	0.2	37,913	30.8
CB3&4	105	11,917	11.3	9,340	8.9	140	0.1	21,396	20.3
CB5	950	108,770	11.5	92,001	9.7	471	0.0	201,241	21.2
CB 6+	27	3,421	12.8	2,871	10.7	16	0.1	6,308	23.5
DS5	67	7,679	11.4	6,494	9.7	33	0.0	14,207	21.1
DS6	24	3,020	12.5	2,533	10.5	14	0.1	5,567	23.1
DS7+	114	14,774	13.0	12,698	11.2	68	0.1	27,540	24.3
Total	25,800	1,240,185		389,550		228,124		1,857,859	

Table 4.3. Total and Per Mile State, Federal, and Local Revenues by Registered Gross Weight Class (Average Annual, FYs 2012-2013)

Registered Gross Weight (Pounds)	Vehicle Miles (Millions)	State		Federal		Local		Total	
		Revenue (\$Thousands)	Per Mile (Cents)	Revenue (\$Thousands)	Per Mile (Cents)	Revenue (\$Thousands)	Per Mile (Cents)	Revenue (\$Thousands)	Per Mile (Cents)
0-8,000	23,636	994,984	4.2	222,651	0.9	218,400	0.9	1,436,035	6.1
8,001-16,000	441	29,568	6.7	8,344	1.9	4,628	1.0	42,540	9.6
16,001-26,000	221	29,053	13.2	6,778	3.1	3,168	1.4	39,000	17.7
26,001-40,000	126	19,338	15.3	13,765	10.9	1,025	0.8	34,128	27.1
40,001-55,000	132	21,204	16.1	14,811	11.2	243	0.2	36,258	27.5
55,001-75,000	73	9,496	12.9	7,546	10.3	63	0.1	17,106	23.3
75,001-80,000	1,020	116,746	11.4	98,775	9.7	505	0.0	216,026	21.2
80,001-90,000	28	3,622	13.2	2,993	10.9	17	0.1	6,633	24.1
90,001-100,000	20	2,772	13.7	2,345	11.6	14	0.1	5,131	25.4
100,001-105,500	103	13,360	12.9	11,504	11.1	61	0.1	24,925	24.1
105,501-150,000	0	42	13.3	36	11.5	0	0.1	78	24.9
Total	25,800	1,240,185		389,550		228,124		1,857,859	

Tables 4.4 and 4.5 present estimated annual Nevada highway user revenues attributed to each vehicle and RGW class for each state highway user fee. These tables do not include federal or local highway user fees. The highway user revenues highlighted in Table 2.3 have been compressed into the seven categories examined in Tables 4.4 and 4.5. The vast majority of the revenues from operators of passenger vehicles are collected through vehicle sales tax and title fees (\$393.1 million), GST fees (\$249.4 million), gasoline taxes (\$201.7 million), and registration fees (\$112.8 million). The diesel or special fuels tax collections (\$105.6 million) are net after the tax revenue is redistributed among states through the International Fuel Tax Agreement. When comparing registration fees presented in these tables to levels forecast by NDOT, note that these values include revenues kept for DMV operations and other miscellaneous fees paid when registering a vehicle in Nevada, such as specialized plate fees. Further, these revenues include those collected from highway users but ultimately used for non-road purposes. In Nevada, the majority of revenues from heavy trucks are those tied to diesel taxes and motor carrier registration fees.

Table 4.6 breaks down annual state highway user revenues attributed to basic vehicles (vehicles weighing less than 10,000 pounds) and heavy vehicles (vehicles weighing 10,000 pounds or more) by user fee for the average of FYs 2012 and 2013. Basic vehicles are forecast to pay \$1.0 billion (81.1 percent) in state highway user revenues, while heavy vehicles are forecast to pay \$234.7 million (18.9 percent). In the 1999 Nevada HCAS, heavy trucks were forecast to pay 27.4 percent. The difference between the current study and the 1999 Nevada HCAS is almost entirely driven by the inclusion of vehicle sales taxes used for general government purposes and GST fees, which are nearly entirely paid by basic vehicles. In previous HCASs, only funds used on Nevada highways were included in the revenue attribution process. Excluding all sales taxes, title and GST fees would raise the heavy vehicle revenue share to 31.1 percent.

Table 4.7 presents highway user revenues attributed to basic and heavy vehicles for all levels of government. At the federal level, tire taxes, the HVUT, and truck and trailer fees enhance collections from heavy vehicles, which were attributed \$163.8 million (42.1 percent) in Nevada. At the local level, basic vehicles generate the vast majority of the revenue (96.5 percent) through GST fees and gasoline taxes. When all levels of government are included in the analysis, \$406.5 million (21.9 percent) are attributed to heavy vehicles while \$1.5 billion (78.1 percent) are attributed to basic vehicles.

Table 4.4. Nevada State Highway User Revenue by Type of Tax and Vehicle Class, Average Annual of FYs 2012-2013 (\$Thousands)

Vehicle Configuration	Gasoline	Diesel & Other Fuel Tax	Registration Fees	GST Fees	Vehicle Sales Tax and Title Fees	Other Permits and Fees	Drivers' Licenses	Total
Psg'r Veh	201,667	7,820	112,815	249,424	393,066	18,763	14,585	998,140
Bus	1,492	3,865	4,145	3,325	8,831	695	-	22,354
SU2	5,223	6,914	8,720	9,563	16,233	741	451	47,844
SU3+	125	7,332	5,057	925	7,130	1,279	418	22,267
CB3&4	87	5,690	1,721	366	2,820	1,094	139	11,917
CB5	29	59,060	17,003	2,535	19,534	9,869	739	108,770
CB 6+	0	1,696	638	90	693	279	25	3,421
DS5	2	4,172	1,196	179	1,379	698	52	7,679
DS6	0	1,517	551	78	602	250	22	3,020
DS7+	-	7,496	2,624	388	2,990	1,180	96	14,774
Total	208,626	105,563	154,469	266,874	453,278	34,849	16,526	1,240,185

Table 4.5. Nevada State Highway User Revenue by Type of Tax and Registered Gross Weight Class, Average Annual of FYs 2012-2013
(\$Thousands)

Registered Gross Weight (Pounds)	Gasoline	Diesel & Other Fuel Tax	Registration Fees	GST Fees	Vehicle Sales Tax and Title Fees	Other Permits and Fees	Drivers' Licenses	Total
0-8,000	201,096	7,323	112,516	248,764	392,025	18,713	14,546	994,984
8,001-16,000	3,986	3,943	3,950	6,633	10,453	350	252	29,568
16,001-26,000	2,405	4,065	6,489	6,139	9,674	175	107	29,053
26,001-40,000	984	4,859	3,517	970	7,472	1,309	227	19,338
40,001-55,000	110	7,621	4,444	838	6,455	1,368	368	21,204
55,001-75,000	15	4,427	1,705	286	2,200	763	100	9,496
75,001-80,000	30	63,432	18,220	2,720	20,954	10,598	793	116,746
80,001-90,000	-	1,736	725	97	750	286	27	3,622
90,001-100,000	-	1,303	558	78	602	210	20	2,772
100,001-105,500	-	6,832	2,338	348	2,683	1,073	85	13,360
105,501-150,000	-	22	7	1	9	3	0	42
Total	208,626	105,563	154,469	266,874	453,278	34,849	16,526	1,240,185

Table 4.6. State Highway User Fee Payments by Vehicle Class, Average of FYs 2012-2013
(\$Thousands)

User Fee	Basic Vehicles	Heavy Vehicles	Total
Gasoline	202,649	5,977	208,626
Diesel & Other Fuel Tax	8,676	96,887	105,563
Registration Fees	113,627	40,842	154,469
GST Fees	251,178	15,696	266,874
Vehicle Sales Tax and Title Fees	395,829	57,449	453,278
Other Permits and Fees	18,851	15,998	34,849
Drivers' Licenses	14,652	1,874	16,526
Total	1,005,462	234,723	1,240,185
	81.1%	18.9%	

Table 4.7. Highway User Fee Payments by Vehicle Class and Level of Government, Average of FYs 2012-2013 (\$Thousands)

	State Revenues	(%)	Federal Revenues	(%)	Local Revenues	(%)	Total Revenues	(%)
Basic Vehicles	1,005,462	81.1	225,711	57.9	220,173	96.5	1,451,346	78.1
Heavy Vehicles	234,723	18.9	163,839	42.1	7,951	3.5	406,513	21.9
Total	1,240,185		389,550		228,124		1,857,859	

5.0 Equity Analysis

Tables 5.1-5.3 present the results of the equity analysis, which compares cost responsibilities estimated for each vehicle class to attributed revenues. The equity ratio is a concept that has already been discussed in this report (See Section 4.0) but this section introduces the concepts of adjusted and unadjusted equity ratios. An unadjusted equity ratio is the type described previously in this report, which is revenues divided by cost responsibility for each vehicle class. The adjusted equity ratio accounts for differences between revenues attributed and costs allocated to all vehicle classes. If total highway user payments exceed total cost responsibility, the equity ratios for each vehicle class would be adjusted downward so that the total shares of allocated costs equal total shares of revenues and the overall equity ratio equals 1.0. For example, if highway user revenues exceeded cost responsibilities by 50 percent, each unadjusted equity ratio would be divided by 1.5. This procedure is necessary for examining equity in tax structures with highway user revenues collected for non-road purposes, as is done in Nevada with the vehicle sales tax and ad-valorem GST fee, and when non-user sources (e.g., general fund revenues) are used to pay for part of the highway program.

Table 5.1 presents vehicle miles, state revenue, and state cost responsibility for each vehicle class considered in this study. Based on the findings presented in Table 5.1, revenues from passenger vehicles exceed the cost responsibility estimated for that class by 163 percent. The adjusted equity ratio for passenger vehicles is 1.50. The larger vehicle classes, such as tractor-double semitrailer combinations, face significant shortfalls in terms of revenues vs. allocated costs, with unadjusted equity ratios reaching as low as 0.37.

Tables 5.2 through 5.5 present vehicle miles, revenue, and cost responsibility for the federal, federal and state combined, local, and all levels of government combined, respectively. At the federal level, revenues exceed cost responsibility by 43 percent and the unadjusted equity ratio for passenger vehicles is 2.40 while the unadjusted equity ratios for heavy trucks exceeds 1.0 in several vehicle classes. At the local level, revenues are equal to 31 percent of total expenditures due to the heavy reliance on local, non-highway-user revenue sources. When all levels of government are included in the analysis (Table 5.5), the unadjusted equity ratio for passenger vehicles falls to 1.45 while the equity ratios for heavy trucks is reported in the 0.29 to 0.52 range.

Tables 5.1 demonstrates that at the state level, annual highway user payments are forecast to exceed state highway-related expenditures by 75 percent (\$532.4 million) over the study time horizon. Thus, \$532.4 million in annual state highway user payments would be diverted from the highway fund for other, non-highway-related uses. This diversion results from the state's reliance on vehicle sales taxes and the ad-valorem GST fee. This diversion is almost entirely counterbalanced at the local level where annual expenditures are forecast to exceed highway user payments by \$497.8 million (Table 5.4).

Table 5.6 presents vehicle miles, state revenue, and state cost responsibility by RGW class. For vehicles weighing 8,000 pounds or less, unadjusted equity ratios are 2.62 with adjusted equity ratios reaching 1.50. Equity ratios drop considerably as weights increase, reaching as low as .40 in unadjusted terms for the heaviest vehicles and 0.55 for vehicles weighing 75,001 to 80,000 pounds.

Table 5.7 compares state highway user revenue to cost responsibility for basic and heavy vehicles. As shown, payments from basic vehicles are estimated to exceed cost responsibility by 161 percent while payments from heavy vehicles fall roughly 27 percent short of their cost responsibility. Using adjusted equity ratios, the basic vehicle overpayment lowers to 49 percent while the heavy truck class meets approximately 42 percent of its cost responsibility. To make payments from the heavy vehicle class equal its cost responsibility would require an increase in annual payments of \$87.6 million. The annual increase required to modify the adjusted equity ratio until it reached 1.0 would exceed \$606.1 million.

Table 5.1. Annual Vehicle Miles, State Revenue, and State Cost Responsibility by Vehicle Class

Vehicle Class	Vehicle Miles (Millions)	State User Revenue (Thousands)	State Cost Responsibilities (Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psgr Veh	23,699	998,140	380,178	2.63	1.50
Bus	122	22,354	17,483	1.28	0.73
SU2	570	47,844	31,841	1.50	0.86
SU3+	123	22,267	15,391	1.45	0.83
CS3&4	105	11,917	9,679	1.23	0.70
CS5	950	108,770	188,944	0.58	0.33
CS6+	27	3,421	6,091	0.56	0.32
DS5	67	7,679	20,517	0.37	0.21
DS6	24	3,020	5,474	0.55	0.31
DS7+	114	14,774	32,172	0.46	0.26
Total	25,800	1,240,185	707,769	1.75	1.00

Table 5.2. Annual Vehicle Miles, Federal Revenue, and Federal Cost Responsibility by Vehicle Class

Vehicle Class	Vehicle Miles (Millions)	Federal User Revenue (Thousands)	Federal Cost Responsibilities (Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psgr Veh	23,699	223,776	93,329	2.40	1.67
Bus	122	10,212	7,141	1.43	1.00
SU2	570	14,251	13,153	1.08	0.76
SU3+	123	15,374	7,370	2.09	1.45
CS3&4	105	9,340	4,427	2.11	1.47
CS5	950	92,001	112,227	0.82	0.57
CS6+	27	2,871	3,046	0.94	0.66
DS5	67	6,494	11,137	0.58	0.41
DS6	24	2,533	2,495	1.01	0.71
DS7+	114	12,698	17,182	0.74	0.52
Total	25,800	389,550	271,506	1.43	1.00

Table 5.3. Annual Vehicle Miles, Federal and State Revenue, and Federal and State Level Cost Responsibility Combined by Vehicle Class

Vehicle Class	Vehicle Miles (Millions)	Federal and State User Revenue (Thousands)	Federal and State Cost Responsibilities (Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psgr Veh	23,699	1,221,916	473,507	2.58	1.55
Bus	122	32,566	24,624	1.32	0.79
SU2	570	62,095	44,994	1.38	0.83
SU3+	123	37,641	22,761	1.65	0.99
CS3&4	105	21,257	14,105	1.51	0.91
CS5	950	200,771	301,171	0.67	0.40
CS6+	27	6,292	9,138	0.69	0.41
DS5	67	14,174	31,654	0.45	0.27
DS6	24	5,553	7,969	0.70	0.42
DS7+	114	27,471	49,353	0.56	0.33
Total	25,800	1,629,735	979,276	1.66	1.00

Table 5.4. Annual Vehicle Miles, Local Revenue, and Local Level Cost Responsibility by Vehicle Class

Vehicle Class	Vehicle Miles (Millions)	Local User Revenue (Thousands)	Local Cost Responsibilities (Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psgr Veh	23,699	219,012	518,989	0.42	1.34
Bus	122	1,881	23,901	0.08	0.25
SU2	570	6,218	29,944	0.21	0.66
SU3+	123	271	13,157	0.02	0.07
CS3&4	105	140	9,855	0.01	0.05
CS5	950	471	82,912	0.01	0.02
CS6+	27	16	5,469	0.00	0.01
DS5	67	33	16,682	0.00	0.01
DS6	24	14	7,404	0.00	0.01
DS7+	114	68	17,658	0.00	0.01
Total	25,800	228,124	725,972	0.31	1.00

Table 5.5. Annual Vehicle Miles, Revenue, and Cost Responsibility by Vehicle Class, All Levels of Government

Vehicle Class	Vehicle Miles (Millions)	Highway User Revenue (\$Thousands)	Total Cost Responsibilities (\$Thousands)	Equity Ratios	
				Unadjusted	Adjusted
Psgr Veh	23,699	1,440,928	992,496	1.45	1.33
Bus	122	34,447	48,525	0.71	0.65
SU2	570	68,313	74,938	0.91	0.84
SU3+	123	37,913	35,918	1.06	0.97
CS3&4	105	21,396	23,961	0.89	0.82
CS5	950	201,241	384,083	0.52	0.48
CS6+	27	6,308	14,607	0.43	0.40
DS5	67	14,207	48,336	0.29	0.27
DS6	24	5,567	15,373	0.36	0.33
DS7+	114	27,539	67,011	0.41	0.38
Total	25,800	1,857,859	1,705,247	1.09	1.00

Table 5.6. Annual Vehicle Miles, State Revenue, and State Cost Responsibility by Registered Gross Weight (RGW) Class

RGW Class	Vehicle Miles (Millions)	State User Revenue (\$Thousands)	State Cost Responsibilities (\$Thousands)	Equity Ratios	
				Unadjusted	Adjusted
0-8,000	23,636	994,984	379,131	2.62	1.50
8,001-16,000	441	29,568	19,472	1.52	0.87
16,001-26,000	221	29,053	18,293	1.59	0.91
26,001-40,000	126	19,338	15,483	1.25	0.71
40,001-55,000	132	21,204	14,778	1.43	0.82
55,001-75,000	73	9,496	9,229	1.03	0.59
75,001-80,000	1,020	116,746	210,358	0.55	0.32
80,001-90,000	28	3,622	6,144	0.59	0.34
90,001-100,000	20	2,772	5,388	0.51	0.29
100,001-105,500	103	13,360	29,390	0.45	0.26
105,501-150,000	0	42	103	0.40	0.23
Total	25,800	1,240,185	707,769	1.75	1.00

Table 5.7. Annual Revenue and Cost Responsibility for Basic and Heavy Vehicles (Nevada State Highway User Revenues and Cost Responsibilities Only)

Vehicle Class	State User Revenue (Thousands)	State Cost Responsibilities (Thousands)	Equity Ratios	
			Unadjusted	Adjusted
Basic Vehicles	1,005,462	385,396	2.61	1.49
Heavy Vehicles	234,723	322,373	0.73	0.42
Total	1,240,185	707,769	1.75	1.00

6.0 References

Balducci, P. and J. Stowers, *National Cooperative Highway Research Program Publication #378, State Highway Cost Allocation Studies*, Prepared for the National Cooperative Highway Research Program, Washington, D.C., 2008.

ECONorthwest with Jack Faucett Associates, HDR, Inc. and R.D. Mingo and Associates, *Highway Cost Allocation Study: 2005-2007 Biennium*, Prepared for Oregon Department of Administrative Services, Office of Economic Analysis, Portland, Oregon, 2005.

Federal Highway Administration, *Highway Statistics 2007*, Washington, D.C. October 2008.

Nevada Department of Transportation, *2009 State of Nevada Transportation Facts and Figures*, Prepared by the Operations Analysis Division of the Nevada Department of Transportation, Carson City, NV. January 2009 (2009a).

Nevada Department of Transportation, *Draft State Highway Preservation Report*, Carson City, NV, January 2009 (2009b).

Nevada Department of Transportation, *1999 Highway Cost Allocation Study*, Carson City, NV, September 1999.

Sydec Incorporated, Cambridge Systematics, Inc. and R.D. Mingo and Associates, *Cost Allocation Study Audit*, Final Report, submitted to Nevada Department of Transportation, September 1994.