

# Joint Legislative Audit and Review Committee (JLARC)



E-mail: [neff\\_ba@leg.wa.gov](mailto:neff_ba@leg.wa.gov)  
 Web site: <http://jlarc.leg.wa.gov>

LEGISLATIVE AUDITOR  
 Cindi Yates  
 506 16<sup>th</sup> Avenue SE  
 Olympia, WA 98501-2323  
 Campus Mail: PO Box 40910  
 Phone: 360-786-5171  
 FAX: 360-786-5180  
 TDD: 1-800-635-9993

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July 1, 2004

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JUL 06 2004

BUDGET & FISCAL  
 WSP

TO: JLARC Executive Committee  
 Senator Jim Horn, Chair, Senate Highways and Transportation Committee  
 Representative Ed Murray, Chair, House Transportation Committee

FROM: Cindi Yates, *CY* Legislative Auditor

RE: Washington State Patrol Pursuit Vehicle Lifecycle Cost Model

## BACKGROUND

The 2003-05 Transportation Budget (Chapter 360, Laws of 2003) requires the Washington State Patrol (WSP), under the direction of the Legislative Auditor, to update the model that determines the lifecycle costs of their pursuit vehicles. This model is a product of the 1999 JLARC audit of WSP. The updated model is to be the basis for determining the cost impacts of increasing mileage above 110,000.

JLARC, WSP, and legislative analysts determined that using a new model was preferable to updating the old model. WSP has now selected a new model and completed their work on the impact of increasing mileage above 110,000.

**This memo provides analysis of WSP's work and concludes that the basic model is sound and can be used by WSP, OFM, and legislative analysts to review the cost impacts of increasing mileage above 110,000. It must be noted that the model is by design sensitive to changes in assumptions on maintenance intervals and costs.**

## VEHICLE LIFECYCLE COST MODEL

The basis of vehicle lifecycle costing is to determine when the cost of operating and maintaining an old vehicle exceeds the cost of purchasing, operating, and maintaining a new vehicle. Vehicle lifecycle cost analysis models are a tool to assist in making that determination.

JLARC suggested that the WSP focus on three areas in developing a new model:

1. **Adaptable:** As priorities change, the model must be able to assess the impacts of those changes. While the budget proviso addressed 110,000 miles, any model must be able to look at a range of alternatives.
2. **Data Driven Assumptions:** When variables such as the cost of repairs are included in the model, they must be based on recent data, preferably obtained from WSP's fleet management system.
3. **Other Organizations:** Since the technique of vehicle lifecycle costing is widely used, WSP should use the knowledge of other organizations and build on that knowledge.



# Joint Legislative Audit And Review Committee

JLARC Update  
WSP Pursuit Vehicle Lifecycle Cost Model  
July 1, 2004  
Page 2

The proposed model meets the three suggested focus areas as follows:

## **Adaptable**

The model that WSP selected was originally developed by the National Association of Fleet Managers (NAFM). It easily allows for changes in assumptions and includes information deemed essential by NAFM to make sound business decisions related to vehicle replacement.

## **Data Driven Assumptions**

The model will be a useful tool to make data driven assumptions in order to project the most cost effective time to replace vehicles. It should be noted that the outcome of the model is valid to the extent that the data used to set the assumptions is accurate. Some information is straightforward: the purchase cost of a new vehicle, oil change intervals, etc. Other information used to set the assumptions can be more difficult, such as when a vehicle may need a transmission rebuilt or a new engine. Assumptions around these large maintenance costs will determine the most cost effective time to replace a vehicle.

WSP states that the information used in the model for “routine” maintenance—ranging from oil changes to break replacements—comes directly from their vehicle fleet management system. They also state that information on less routine maintenance is less certain, particularly related to vehicles in the higher mileage intervals. For example, WSP may know the cost of replacing an engine, but their data does not allow an accurate prediction of when that engine replacement is likely to be required.

## **Other Organizations**

JLARC suggested that WSP review how other organizations approach vehicle lifecycle cost analysis. This is in part why WSP chose the National Association of Fleet Administrators model.

We think this is an important step but strongly urge WSP to continue to refine the model—and the information they use—by looking at the practices of other organizations. This will help decision makers in two important ways:

- Analysis of other organizations’ replacement cycles can establish benchmarks for decision makers. Knowledge of when other states’ highway patrol organizations—or other large police organizations—replace pursuit vehicles will be helpful.
- By reviewing other organizations, WSP will gain a better understanding of critical cost variables to include in the model. For instance, other organizations may have established major repair mileage information that will make the model more accurate.

## **CONCLUSION**

WSP selected a vehicle lifecycle cost analysis model that will provide decision makers with information on when to replace vehicles. The model will be a useful tool to use during the budgeting process to determine the most cost effective time to replace vehicles. Continued analysis by WSP of how other organizations approach lifecycle analysis and decisions on vehicle replacement will help inform the replacement decision.

cc: Bob Maki, Washington State Patrol  
Mike Groesch, Senate Highways and Transportation Committee  
Jerry Long, House Transportation Committee

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The basis of vehicle lifecycle costing is to determine when the cost of operating and maintaining an old vehicle exceeds the cost of purchasing, operating, and maintaining a new vehicle. Vehicle lifecycle cost analysis models are a tool to assist in making that determination.

JLARC suggested that the WSP focus on three areas in developing a new model:

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STATE OF WASHINGTON  
WASHINGTON STATE PATROL

General Administration Building, PO Box 42600 • Olympia, Washington 98504-2600 • (360) 753-6540

July 9, 2004

Ms. Patsy Ellis  
Office of Financial Management  
PO Box 43113  
Olympia WA 98504-3113

Dear Ms. Ellis:

Please find enclosed three copies of the final version of the Pursuit Vehicle Lifecycle Cost Report for OFM to review prior to submission to the Legislature. This report to the Legislature regarding the Washington State Patrol pursuit vehicle lifecycle cost model is mandated in Washington Laws 2003, (ESHB 1163), Section 209 (1):

*Under the direction of the legislative auditor, the Patrol shall update the pursuit vehicle lifecycle cost model developed in the 1998 Washington State Patrol performance audit (JLARC Report 99-4). The Patrol shall utilize the updated model as a basis for determining maintenance and other cost impacts resulting from the increase to pursuit vehicle mileage above 110 thousand miles in the 2003-05 biennium. The Patrol shall submit a report that includes identified cost impacts, to the transportation committees of the senate and house of representatives by December 31, 2003.*

If you have any questions, please contact Mr. Robert L. Maki, Budget and Fiscal Services, at (360) 753-0588. Thank you.

Sincerely,

CHIEF LOWELL M. PORTER

A handwritten signature in cursive script that reads "Diane C. Perry".

Ms. Diane C. Perry  
Management Services Bureau

DCP:cf

Enclosures

cc: Mr. Les S. Brodie, Property Management Division  
Captain Frederick R. Fakkema, Government and Media Relations  
Mr. Robert L. Maki, Budget and Fiscal Services





***Pursuit Vehicle  
Lifecycle Cost Report***

***Washington State Patrol***

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***July 1, 2004***

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## Executive Summary

The 2003-05 Transportation Budget directed the Washington State Patrol (WSP) to update a 1998 lifecycle cost model to determine the maintenance and other cost impacts resulting from driving pursuit vehicles over 110,000 miles.

Following are highlights contained in this report:

- The State Patrol, with the agreement of legislative and JLARC staff, used an "off-the-shelf" software model from the National Association of Fleet Administrators (NAFA) that can be easily updated in the future.
- The cost per mile for operating a pursuit sedan has risen an average of 12.5 cents since 1998.
- After inputting a set of the defined variable data into the model, the optimum replacement mileage for pursuit vehicles remains at 110,000, as was concluded in the 1998 JLARC study.
- The lifecycle cost of a Washington State Patrol pursuit sedan that averages 25,000 miles per year drops from \$0.596 per mile at 50,000 miles to \$0.473 per mile at 110,000 miles.
- This cost per mile increase will result in an additional estimated expense of \$235,000 to \$294,000 to the State Patrol's maintenance budget during the 2003-05 biennium with the assumption that 208 vehicles will reach 120,000 miles during the period.

This report to the legislature is a culmination of effort by the State Patrol's Property Management and Budget and Fiscal Services Divisions, with technical input and feedback from JLARC and legislative staff.

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## Introduction

This report to the legislature regarding the State Patrol pursuit vehicle lifecycle cost model is mandated in Washington Laws 2003, (ESHB 1163), Section 209 (1):

*Under the direction of the legislative auditor, the Patrol shall update the pursuit vehicle lifecycle cost model developed in the 1998 Washington State Patrol performance audit (JLARC Report 99-4). The Patrol shall utilize the updated model as a basis for determining maintenance and other cost impacts resulting from the increase to pursuit vehicle mileage above 110 thousand miles in the 2003-05 biennium. The Patrol shall submit a report that includes identified cost impacts, to the transportation committees of the senate and house of representatives by December 31, 2003.*

Budget Note - 2003-05 Transportation Budget: The agency will realize \$2,318,000 in expenditure savings by delaying purchase of pursuit vehicles. Average pursuit vehicle mileage will accrue to between 116,000 and 124,000 in the 2003-05 biennium. Maintenance costs resulting from the increased mileage will be between \$25,000 and \$106,000 in the 2003-05 biennium. (*State Patrol Highway Account – State, (\$2,318,000)*)

Representatives from the State Patrol met with staff from JLARC and the Senate and House Transportation Committees in early January 2004 to review draft lifecycle cost numbers and solicit feedback concerning the model.

## Background

In fulfillment of its traffic safety mission, Washington State Patrol traffic law enforcement officers drive about 20,000,000 miles annually—an average of about 25,000 miles for each pursuit vehicle. Over the past three biennia, the increasing cost of managing its vehicle fleet has mandated closer scrutiny of vehicle purchase, equipping, maintenance and fuel costs as well as fleet management practices.

Prior to 1995, pursuit vehicles were generally replaced at 75,000 miles. However, due to rapid inflationary vehicle costs, reduced salvage values, and authorized agency staffing increases (for example, the merging of the Fire Protection Bureau into the WSP), and an increasing number of budget emergencies (unavoidable overtime due to weather, fire, and civil disobedience events) some vehicle funding was diverted toward addressing other critical issues. By 1997, the average vehicle replacement mileage had risen to over 112,000 miles.

In 1998, the Joint Legislative Audit and Review Committee (JLARC) conducted a performance audit of the Washington State Patrol (JLARC Report 99-4). The agency's pursuit vehicle replacement and budgeting strategy was one of nine subject areas that JLARC examined. As part of the audit, JLARC developed a lifecycle cost model to establish an appropriate target replacement mileage goal for pursuit vehicles in the State Patrol fleet. The model indicated total lifecycle costs declined with increases in replacement cycle from 50,000 miles to 110,000 miles. Decreases in cost per mile became quite small beyond 100,000 miles. The analysis took into account initial vehicle and equipping costs, maintenance costs over the cost of the vehicle, and its salvage value at sale to determine the most cost-effective mileage target was 110,000 miles. At the time, the agency was replacing vehicles at about 112,500 miles, largely due to funding constraints.

In response to a JLARC recommendation to centralize pursuit vehicle purchase and operating funds in a dedicated account, the 1999 Legislature directed the State Patrol to consolidate existing carry-forward funding for Field Force pursuit vehicles in the agency's Fleet Section. Field Operations Bureau carry-forward funds for vehicle maintenance were also consolidated within the agency's Fleet Section. Ultimately, the agency chose to centralize all other vehicle funding away from individual division operating budgets to ensure accurate information about costs associated with purchase, replacement, fuel and maintenance activities could be managed in one place.

Due to increased funding from the legislature during 2001-03, more aggressive fleet management, and efficiencies gained through centralized fleet administration, all pursuit vehicles were below 110,000 miles as of June 30, 2003.

The 2003 Legislature, in consultation with the agency, reduced funding to the pursuit vehicle fleet by \$2.3 million because of constraints in State Patrol Highway Account revenue. Along with this one-time funding reduction, the State Patrol was directed to update the 1998 vehicle lifecycle cost model and determine the resulting cost impacts to the fleet's maintenance budget due to higher replacement mileages.

## **Analysis – How the Model Works**

Vehicle fleet management is a balancing act. As a vehicle ages, maintenance costs increase and ownership costs decrease. The challenge in lifecycle cost analysis is to achieve the optimum balance, and done well, becomes a method of lowering overall vehicle related costs.

In simple terms, the purpose of a vehicle lifecycle cost analysis is to determine the optimum point where the total cost of owning, operating, and maintaining a vehicle is the least expensive. The point where the lowest average cost per mile is reached represents the most cost-effective replacement schedule.

Because of JLARC and State Patrol staffing changes, it was not feasible to simply update the original lifecycle cost model--a complex Microsoft Excel spreadsheet developed in-house. Instead, consensus was reached with the State Patrol, JLARC, and legislative staff to purchase a "stand-alone" fleet lifecycle cost analysis program to develop the data for the required update to the original 1998 study. There were several key reasons why the State Patrol arrived at the choice of a fleet analysis program developed by the National Association of Fleet Administrators (NAFA), and deemed to be very similar to the original model:

- The program was developed according to industry standards by knowledgeable "third party" fleet professionals;
- The program determines cost impacts of increasing mileage increments above 110,000;
- The program accurately identifies changes in operating costs as vehicles age;
- The program accurately identifies the trade-offs between capital and operating costs; and
- The program is relatively easy to update as cost information is revised through vehicle fleet management information.

The *Lifecycle Cost Analysis for Fleets* software purchased by the State Patrol in January 2004 calculates replacement cycle alternatives by considering all relevant cost variables, including:

#### Capital Costs

- Purchase cost
- Equipping costs
- Decommissioning costs
- Trade-in value

#### Operating Costs

- Repairs
- Service intervals per warranty standards
- Insurance
- Fuel and oil, based on average annual mileage

The model allows consideration of a wide range of scenarios based on using key variables within a range of predicted or actual values. The values can be changed to determine the sensitivity of each of the values to the order of results. For example, increasing the per-gallon cost of fuel does not change the outcome of a particular mileage interval, but adjusting the timing of key maintenance and repair elements does. Additional information describing the derivation of the financial variables used in the model is contained in the Appendix to this document.

While the original model was predicated on mileage intervals up to 110,000 miles (reflecting the maximum mileage experience at that time), the new model accommodates mileage intervals up to 150,000 miles, thus predicting the increased lifecycle costs associated with driving vehicles at even higher mileages. Since the agency has limited maintenance cost data for pursuit vehicles above 110,000, actual experience may differ from the model results. The costs are expressed in current dollars, since a replacement cycle of three to five years makes net present value analysis unnecessary.

## Findings

The results of the economic analysis performed by the NAFA fleet model are summarized below in Exhibit 1. As in the 1998 model, summarized in Exhibit 2, the results confirm that the total lifecycle cost per mile declines as the replacement interval mileage increases. The decreases in the cost per mile level off quickly and become quite small after the 100,000 mile interval, **with the lowest lifecycle cost per mile reached at 110,000 miles.** Between 100,000 and 150,000, the cost-per-mile differences at each interval are less than two pennies.

It is important to note that the State Patrol still lacks significant historical data concerning the timing of certain repairs along with regular additional expenses that might become necessary as pursuit vehicle age beyond 120,000 miles.

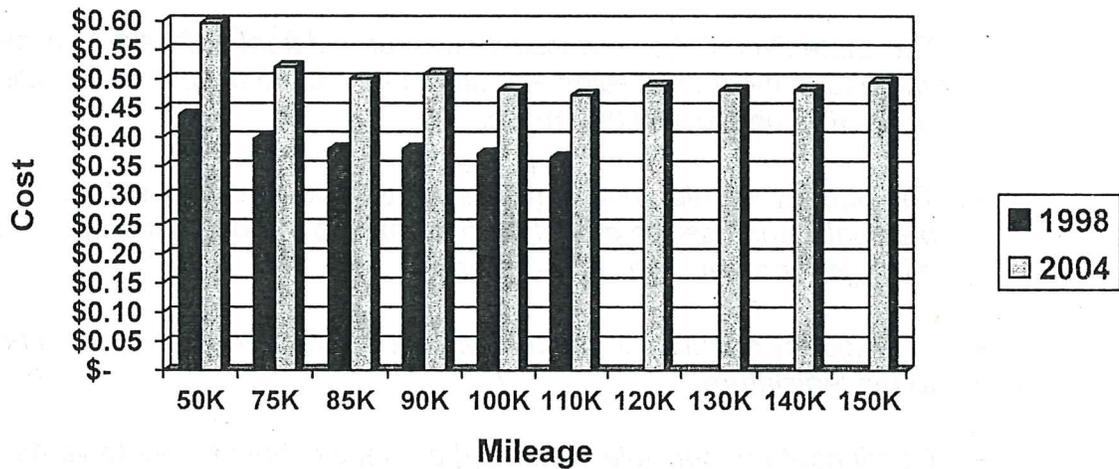
**Exhibit 1**  
**Annual Cost Per Mile Based on Mileage Intervals**  
**2004**

Replacement Cycle	Annual Cost	Cost Per Mile	Capital	Operating	Increased Annual Cost Over Optimum Replacement	Cost Percent Above Optimum Replacement
50,000	\$14,897	\$0.596	\$0.378	\$0.218	\$2,394,044	26.0%
75,000	13,025	0.521	0.274	0.247	954,919	10.4%
85,000	12,534	0.501	0.257	0.244	564,540	6.1%
90,000	12,735	0.509	0.243	0.266	723,940	7.9%
100,000	12,051	0.482	0.222	0.260	181,076	2.0%
<b>110,000</b>	<b>11,824</b>	<b>0.473</b>	<b>0.213</b>	<b>0.260</b>		<b>0.0%</b>
120,000	12,213	0.489	0.198	0.291	309,709	3.4%
130,000	12,014	0.481	0.185	0.296	151,090	1.6%
140,000	12,032	0.481	0.173	0.308	165,455	1.8%
150,000	12,383	0.495	0.163	0.333	444,590	4.8%

**Exhibit 2  
Annual Cost Per Mile Based on Mileage Intervals  
Original 1998 JLARC Report**

Replacement Cycle	Annual Cost	Cost Per Mile	Capital	Operating	Increased Annual Cost Over Optimum Replacement	Cost Percent Above Optimum Replacement
50,000	\$10,941	\$0.438	\$0.312	\$0.126	\$1,508,701	20.0%
75,000	9,916	0.397	0.258	0.139	659,755	8.7%
85,000	9,505	0.380	0.237	0.143	319,906	4.2%
90,000	9,495	0.380	0.234	0.146	311,168	4.1%
100,000	9,311	0.372	0.221	0.151	158,980	2.1%
110,000	9,119	0.365	0.215	0.150	0	0.0%

**1998 vs. 2004 Cost-Per-Mile Comparison**



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## Conclusions and Recommendations

The lifecycle cost model indicates that vehicles will experience \$2,825 in additional service and repair costs for vehicles not replaced at 110,000 miles and driven to 120,000 miles. Based on the April 2004 mileage status of the pursuit fleet and monthly mileage accumulation amounts, the agency estimates that 208 vehicles will reach 120,000 miles at some time during the 2003-05 biennium. Since many of the vehicles reaching 120,000 miles during the biennium will be replaced soon thereafter, it is estimated that only 40 to 50 percent of the additional service and repairs at the 120,000 mile level will actually occur. Based on this assumption, an additional \$235,000 to \$294,000 in repair costs will be incurred during the biennium as a result of higher mileage vehicles.

Increased maintenance costs due to higher mileage vehicles will result in the purchase of 9 to 11 fewer replacement vehicles. In addition, due to the vehicle funding reduction, 144 fewer vehicles will be replaced. Vehicle replacement purchasing power during the 2003-05 biennium will also be eroded due to unfunded fuel increases and "totaled" vehicle replacements.

Based on the process of fulfilling the legislative requirement and the results of the new vehicle lifecycle cost model, the State Patrol makes the following recommendations.

- *The State Patrol should revise its web-based fleet software to allow easy updates of model variables and summary historical costs – including those costs at or above 120,000 miles.*
- *The agency should update the pursuit vehicle lifecycle cost model biennially and use the model for determining the optimum replacement mileage for other types of vehicles.*
- *The agency should use the model as a basis for vehicle funding requests to the legislature.*
- *Contingent on available funding, the agency should work towards replacing vehicles at the optimum mileage identified in the model.*

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## Appendix

### Pursuit Vehicle Lifecycle Cost Model

#### Summary of Model

The model used for this report, developed by the National Association of Fleet Administrators, includes all projected costs for Washington State Patrol (WSP) pursuit vehicles between 50,000 and 150,000 miles, covering six years of operation. Mileage intervals included were 50,000, 75,000, 85,000, 90,000, 100,000, 110,000, 120,000, 130,000, 140,000, and 150,000. The following cost elements were included in the analysis.

#### Vehicle Purchase and Commissioning

The actual cost of a Ford Crown Victoria Police Interceptor sedan in 2003 (with sales tax and Department of General Administration purchasing fees) was \$23,100.

Over twenty equipment items must be added to the vehicle before it can be assigned to a commissioned officer. Many of these items can be recycled two or three times; based on the recommended replacement schedule, the pro-rated cost of these items when a new vehicle is purchased is about \$1,873. Labor costs for the commissioning process total another \$1,400, bringing the total cost of a new vehicle to an average of \$26,400.

#### Vehicle Salvage Value

A critical variable included in the total capital cost of each vehicle is a calculation of the salvage value of the vehicle being replaced. The lifecycle cost model uses industry standard trade-in values developed by the National Automobile Dealers Association (NADA) based on the appropriate model year at each mileage interval. The NADA trade-in values are further adjusted to reflect the actual auction proceeds received by WSP during FY 2004—about 73% of NADA's published values.

#### Repairs, Routine Maintenance, Gas and Oil and Insurance

The State Patrol uses fleet management software to provide extensive repair and maintenance records by vehicle, as well as gas and oil consumption data.

The model contains a list of predictive repairs and maintenance activities, identifies the costs of performing them according to actual invoices, and uses the

warranty-recommended schedule as mileage accumulates to calculate the cost of keeping an aging vehicle on the road.

A legitimate cost of managing a large vehicle fleet is the cost of insurance. The model includes a calculation of the total annual costs for body repair plus the value of totaled vehicles (net of any restitution) during CY 2003 distributed across all vehicles.