EPA-902/5-84-003
August 1984

United States
Environmental Protection
Agency

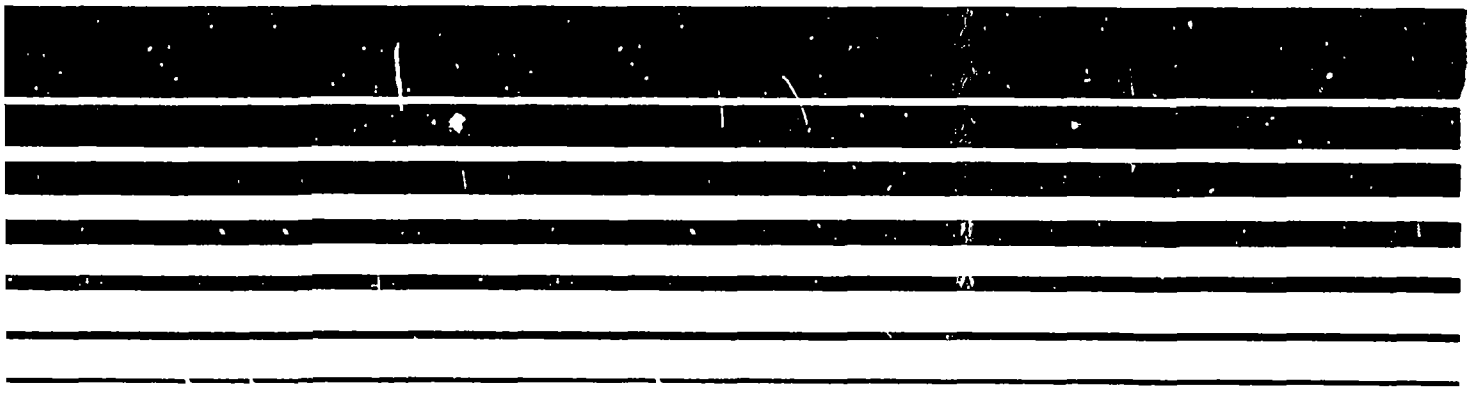
Region II Office
26 Federal Plaza
New York, N Y 10007

Air

EPA

PB85-104305

Cost-Benefit Analysis:
Heavy Duty Gasoline Truck Inspection And Maintenance Program New York City Metropolitan Area



COST-BENEFIT ANALYSIS:
HEAVY DUTY GASOLINE TRUCK INSPECTION AND MAINTENANCE PROGRAM
NEW YORK CITY METROPOLITAN AREA

AUGUST 1984

Prepared By
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For
Environmental Protection Agency - Region II
Air & Waste Management Division
Air Programs Branch
Project Manager: John Filippelli

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-902/5-84-003	2	3. RECIPIENT'S ACCESSION NO. PB85-104305
4. TITLE AND SUBTITLE Cost-Benefit Analysis: Heavy Duty Gasoline Truck Inspection and Maintenance Program, New York City Metropolitan Area		5. REPORT DATE July 1984 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Roger S. Figura, John F. DiRenzo		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Peat, Marwick, Mitchell & Co. 1990 K Street, N.W. Washington, D.C. 20006		10. PROGRAM ELEMENT NO 11. CONTRACT/GRANT NO 68-02-3506
12. SPONSORING AGENCY NAME AND ADDRESS United States Environmental Protection Agency Region II, Air Programs Branch 26 Federal Plaza New York, New York 10278		13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

The New York City metropolitan area (New York City, Nassau, Suffolk, Westchester, and Rockland Counties) must implement air quality improvement strategies which, by 1987, will enable it to achieve national ambient air quality standards for carbon monoxide and ozone. One of these strategies is a heavy duty gasoline truck (HDGT) exhaust inspection and maintenance (I/M) program.

The primary object of this project is to quantify and assess the costs and benefits associated with embarking on an I/M program for HDGTs. The cost-benefit analysis considers the economic effects on the trucking industry, inspection stations and the general public.

The data used for the cost-benefit analysis is extended to provide the basis for cost-effectiveness comparisons. This enables policy makers to view and HDGT I/M program in relation to other air quality improvement strategies.

17 KEY WORDS AND DOCUMENT ANALYSIS		
a DESCRIPTORS	b IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
ambient air quality, air pollution, automotive emissions, carbon monoxide, cost analysis, environmental impact, environmental policy, hydrocarbons, ozone, transportation, trucks	air pollution control, New York City, transportation costs	fields 5,6,8,13

18 DISTRIBUTION STATEMENT	19 SECURITY CLASS (This Report)	21 NO OF PAGES
Release Unlimited	Unclassified	69
	20 SECURITY CLASS (This page) Unclassified	22 PRICE

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INTRODUCTION

The New York City metropolitan area (New York City, Nassau, Suffolk, Westchester, and Rockland Counties) must implement air quality improvement strategies which, by 1987, will enable it to achieve national ambient air quality standards for carbon monoxide and ozone. Attainment of the national ambient air quality standards for carbon monoxide and ozone has proved difficult in the New York City metropolitan area. Attainment of the standards by December 31, 1987, can only be demonstrated through reliance upon air quality improvement strategies not normally necessary in other metropolitan areas. One of these strategies is a heavy duty gasoline truck (HDGT) exhaust I/M program.

The New York City Taxi and Limousine Commission and the New York City Department of Environmental Protection have been conducting a thrice annual emissions inspection of medallion taxis since October 1977. The State of New York implemented a light duty vehicle (LDV) emissions inspection program on January 1, 1981. The program became an emissions inspection/maintenance program on January 1, 1982, when failed vehicles were required to be repaired and successfully retake the test. The present program officially extends to December 31, 1986. It is likely, however, that the program will be continued beyond 1986. The proposed HDGT I/M program also extends to an official date of December 31, 1986. Therefore, the evaluation period covers two years, i.e., 1985 and 1986. All cost and benefit estimates apply to a program running to December 31, 1986.

STUDY OBJECTIVES AND SCOPE

The primary objective of this project is to quantify and assess the costs and benefits associated with embarking on an I/M program for HDGT. The cost-benefit analysis considers:

- effects on the trucking industry;
- effects on inspection stations; and
- effects on the general public.

The data used for the cost-benefit analysis is extended to provide the basis for cost-effectiveness comparisons. This enables policy makers to view an HDGT I/M program in relation to other air quality improvement strategies.

This study examines the likely costs imposed and benefits derived from extending the light duty vehicle emissions inspection/maintenance program to heavy duty gas-powered trucks. Light duty vehicles are those up to 8,500 pounds gross vehicle weight (GVW). Heavy duty gas-powered trucks are considered as those vehicles exceeding 8,500 pounds GVW.

The likely costs and benefits that would surface upon implementation of an HDGT I/M program are classified in Exhibit E-1. The first column of the exhibit lists the cost and benefit items which would most likely surface if an HDGT I/M program were implemented. The entries in the exhibit depict the incidence of the costs and benefits. Where two entries appear for a row (e.g., inspection fees), the item is incurred as a cost by one party and generated as a benefit to the second party.

The development of costs and benefits was based on four program options. These options were selected by the Heavy Duty Gas Truck Task Force and are outlined in Exhibit E-2.

COSTS AND BENEFITS TO MOTOR CARRIERS

The impacts of a proposed HDGT I/M on motor carriers were assessed through direct contact with carriers, which enabled an understanding of their operations. The contacts were made during March 1984. Personal contacts were developed with 19 operators, and the remaining 10 operators were contacted by telephone.

The 29 operators had fleets ranging in size from one to 1,991 trucks. These operators possessed a total of 4,899 heavy duty gas-powered trucks. Successful contacts included operators of the smallest order (one truck) to the largest fleet (1,991 trucks), with representatives from all sizes in between.

Motor carriers can be expected to incur costs in four areas due to an HDGT I/M program. These are identified as:

- inspection fees;
- repairs necessary to pass reinspection;
- truck rental costs necessary to maintain operations; and
- lost revenues resulting from truck downtime.

Benefits should be generated in the form of fuel economy improvements and downtime avoided because of repairs to pass the emissions test.

EXHIBIT E-1

COST AND BENEFIT ITEMS

BENEFITS AND COSTS	INCIDENCE		
	MOTOR CARRIERS	INSPECTION STATIONS	GENERAL PUBLIC
. GOVERNMENT COSTS			X
. CAPITAL COSTS OF EMISSIONS ANALYZER		X	
. MAINTENANCE FEE OF EMISSIONS ANALYZER		X	
. LABOR COSTS		X	
. INSPECTION FEES	X	X	
. REPAIR COSTS	X	X	
. LOST VEHICLE PRODUCTIVITY	X		
. IMPROVEMENTS IN FUEL ECONOMY	X		
. REDUCED DOWNTIME	X		
. IMPROVEMENTS IN HEALTH, ESTHETICS, PRODUCTIVITY			X

EXHIBIT E-2

PROPOSED HDGT I/M PROGRAM OPTIONS

Characteristic	Option 1	Option 2	Option 3	Option 4
Institutional structure	Decentralized: use existing LDV I/M stations	Same	Same	Same
Testing equipment	Existing Hamilton Test Systems	Existing Hamilton Test Systems	Single Source New Equipment	Existing Hamilton Test Systems
Timing of I/M inspection	Same time as safety inspection	Same	Same	Same
Provisions for fleet inspection	Unit housed at one location	Same	Same	Same
Applicable HDGT weight categories	All HDGT exceeding 8,500 lbs. GVW	Same	Same	Same
Age of HDGT	All model years	Exempt for pre-1970 HDGTs	All model years	All model years
Cut points CO HC	None specified	None specified	None specified	None specified
Failure rates (anticipated in first year of program)	40 percent	40 percent	40 percent	20 percent
Waiver policy	Waiver based on completion of reasonable repairs	Same	Same	Same

Costs and benefits to motor carriers were estimated using two scenarios. The first scenario refers to current service levels whereby it is assumed that the number of inspection stations currently doing HDGT safety inspections will enter the HDGT I/M program. A second scenario estimates costs and benefits to motor carriers under conditions of reduced service levels. Specifically, it is assumed that a large number of stations currently providing HDGT safety inspections will not enter the HDGT I/M program.

The magnitude of costs and benefits is largely determined by the failure rates imposed and the ease or difficulty in getting an emissions inspection or the repairs required to pass a reinspection. The failure rates for the analysis were provided by the HDGT Task Force:

- Option 1--40 percent;
- Option 2--40 percent with pre-1970 vehicles exempt;
- Option 3--40 percent; and
- Option 4--20 percent.

Exhibit E-3 provides an estimate of costs and benefits to motor carriers in a scenario where current service levels are maintained.

Net cost per truck for program options 1, 2, and 3 is $116 per year. For option 4 this cost is $60 per year. Net cost per failed truck is $286 for all proposed program options.

Costs and benefits to motor carriers were also estimated in a scenario that specified reduced service levels. In this scenario stations which currently do HDGT safety inspections but do not have an emissions analyzer do not participate in an I/M program.

Exhibit E-4 provides the cost-benefit estimates to motor carriers in a scenario with reduced service levels. The cost and benefit dollar estimates in Exhibit E-4 apply to a single year. The amounts are stated in current dollars as of the first quarter of 1984.

Net cost per truck for program options 1, 2, and 3 is $208 per year. For option 4 this cost is $106 per year. Net cost per failed truck is $518 for all proposed program options.

Faced with net cost impacts from a proposed HDGT I/M program, motor carriers can react in any of several ways. First, they can attempt to escape the costs through relocating. Second, they can internalize the costs. Third, they can attempt to pass costs on to consumers.

EXHIBIT E-3

ECONOMIC BURDEN ON MOTOR CARRIERS
CURRENT SERVICE LEVELS MAINTAINED*

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
INSPECTION FEES	$ 314,860	$ 261,196	$ 314,860	$ 314,860
REINSPECTION FEES	125,944	104,478	125,944	62,972
REPAIRS	2,371,160	1,967,002	2,371,160	1,185,580
RENTALS/LOST REVENUES	6,471,872	5,368,758	6,471,872	3,235,936
TOTAL COSTS	$9,283,836	$7,701,434	$9,283,836	$4,799,348
BENEFITS				
FUEL SAVINGS	1,227,424	1,018,212	1,227,424	613,712
NET COSTS OF FAILURES	$8,056,412	$6,683,222	$8,056,412	$4,185,636

* Current service levels refers to the number of inspection stations currently doing HDGT safety inspections.

EXHIBIT E-4

ECONOMIC BURDEN ON MOTOR CARRIERS
REDUCED SERVICE LEVELS*

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
INSPECTION FEES	$ 314,860	$ 261,196	$ 314,860	$ 314,860
REINSPECTION FEES	125,944	104,478	125,944	62,972
REPAIRS	2,371,160	1,967,002	2,371,160	1,185,580
RENTALS/LOST REVENUES	12,943,744	10,737,516	12,943,744	6,471,872
TOTAL COSTS	$15,755,708	$13,070,192	$15,755,708	$8,035,284
BENEFITS				
FUEL SAVINGS	1,227,424	1,018,212	1,227,424	613,712
NET COSTS OF FAILURES	$14,528,284	$12,051,980	$14,528,284	$7,421,572

* Reduced service levels refers to stations which currently have an HTS analyzer and do 50 or more HDGT safety inspections yearly.

Costs to motor carriers incurred as a result of an HDGT I/M program will likely be passed on to consumers. The demand for intracity truck service is inelastic, i.e., over a range of prices, changes in price will not have much effect on the quantity of service demanded.

This situation occurs because there are no close substitutes for intracity trucking services. Other modes such as rail, air, and water do not compete with trucks for short haul goods movement. Additionally, performance of specialty services (e.g., plumbing, electrical work, telephone installations) requires special purpose trucks for which there are no substitutes.

COSTS AND BENEFITS TO INSPECTION STATIONS

New York State Department of Motor Vehicles' records indicated that 530 public and fleet inspection stations are certified to do emission tests on LDV and safety inspections on HDGT. This list was used to develop personal and telephone contacts with personnel at the inspection stations. An interview guide was developed to discuss similar issues with each contact.

Key issues developed in the contacts centered on:

. station capacity to perform inspections;

. current inspection volumes; and

. interest in participating in an HDGT I/M program.

The contacts were made during February 1984. Personal contacts were made with 35 public inspection stations and 12 fleets which self-inspect. Telephone contacts resulted in 76 additional completed interviews. An additional 17 stations certified to do HDGT safety inspections but not LDV I/M emission inspections were contacted by telephone.

Estimates of Station Participation

The most plausible estimate of fleet station participation in a proposed HDGT I/M program is 100 percent of those stations which currently have and use the HTS analyzer and do truck safety inspections. These stations have no incentive to send trucks out for an emissions inspection as they have the equipment and physical layout to perform HDGT emissions inspections in-house.

There are three bases for estimating participation of existing public inspection stations in a proposed HDGT I/M program. Each estimate is accompanied by the average number of

truck safety and emissions inspections the stations reported they could do to derive a capacity figure for the inspection station network.

Perhaps the most straightforward approach to estimating participation by existing public inspection stations is based on the proportion of those stations contacted that currently have and use an HTS analyzer and do truck safety inspections. Of the 111 public inspection stations contacted, all had and used an HTS analyzer, and 85 reported doing truck safety inspections. This produces an estimate that 77 percent of the existing public inspection stations could participate in an HDGT I/M program. Based on the census of stations developed by NYSDMV, this translates into participation by 327 stations.

A second basis for estimating participation considers only those stations that currently perform a threshold number of truck inspections. Using 50 per year as the threshold value eliminates 35 of the 85 inspection stations surveyed that have and use an HTS analyzer and currently do truck safety inspections. This produces an estimate of a 45 percent participation rate among existing public inspection stations. This translates into a participation estimate of 191 existing public inspection stations in an HDGT I/M program.

The third basis for estimating participation relates to that proportion of stations stating that the proposed $6.50 emissions inspection fee was sufficient to perform emissions inspections on HDGT. Of 98 stations responding to this issue, 36 percent stated they would be willing to participate in an HDGT I/M program with a fee of $6.50 for emissions inspections. Applying the 36 percent participation rate to the existing inspection stations produces an estimate of 153 stations participating in an HDGT I/M program.

The estimates of participation imply reduced service levels. Current service levels are estimated at 920 stations performing HDGT safety inspections. This consists of 327 public stations performing HDGT safety and LDV I/M inspections, 105 fleet stations certified to perform HDGT safety and LDV I/M inspections, and 488 public and fleet stations performing HDGT safety inspections.

The current and reduced service levels were used to estimate costs to motor carriers of a proposed HDGT I/M program. Reduced service levels affect truck downtime for inspections and the attendant maintenance repairs necessary to pass a reinspection.

Quantification of Cost Benefit Estimates

The inspection stations incur major costs in participating in an emissions inspection program in terms of equipment cost

and a monthly maintenance fee. Participation in an HDGT I/M program results in small incremental equipment and maintenance fee costs, if any. Benefits derive from inspection fees and added revenues from repairs.

Exhibit E-5 provides estimates of costs and benefits to inspection stations in a scenario where current service levels are maintained. Equipment costs were estimated by multiplying the number of machines necessary to maintain current service by the annualized cost per machine. Net costs are:

- $2,038,120 for Option 1;
- $1,669,374 for Option 2;
- $5,236,032 for Option 3; and
- $2,224,614 for Option 4.

Exhibit E-6 provides the estimates of costs and benefits to inspection stations in a scenario of reduced service levels. Stations which currently do HDGT safety inspections but do not have an analyzer are regarded as non-participants in an HDGT I/M program. Net benefits (costs) are:

- $687,848 for Option 1;
- $570,612 for Option 2;
- ($542,001) for Option 3; and
- $501,354 for Option 4.

COST EFFECTIVENESS ESTIMATES FOR HDGT PROGRAM

Cost-effectiveness analysis is performed in instances where the prime benefit defies quantification in monetary terms. In this instance, the prime benefits are health effects stemming from reductions in the HC and CO loads in the nine-county metropolitan area. The cost-effectiveness measure is formed by dividing net costs by tonnage reductions in pollution. This results in an estimate of the cost per ton to achieve the reduction in specific pollutants (i.e., HC and CO).

EXHIBIT E-5

COSTS AND BENEFITS TO INSPECTION STATIONS
CURRENT SERVICE LEVELS MAINTAINED

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
Equipment Costs (HTS) to Maintain Current Service Levels for Truck Inspections	$2,725,968	$2,239,986		$2,725,968
Equipment Costs (New) to Maintain Current Service Levels for Truck Inspections			$5,923,880	
BENEFITS				
Fees for: Inspections	$314,860	$261,196	$314,860	$314,860
Reinspections	$125,944	$104,478	$125,944	$62,972
Profit Margin (15 Percent) on Repairs	$247,044	$204,938	$247,044	$123,522
Net Cost	$2,038,120	$1,669,374	$5,236,032	$2,224,614

EXHIBIT E-6

COSTS AND BENEFITS TO INSPECTION STATIONS
REDUCED SERVICE LEVELS

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
Equipment Costs (New) with Reduced Service Levels			$1,229,849	
BENEFITS				
Inspection Fees	$314,860	$261,196	$314,860	$314,860
Reinspection Fees	$125,944	$104,478	$125,944	$ 62,972
Profit Margin (15 Percent) on Repairs	$247,044	$204,938	$247,044	$123,522
Net Benefits (Costs)	$687,848	$570,612	$(542,001)	$501,354

The following presents the estimated cost-effectiveness of the four HDGT I/M options:

COST-EFFECTIVENESS
($/ton)[1]

Options	Current Service Levels		Reduced Service Levels	
	HC	CO	HC	CO
1	$1,835	$124	$2,507	$169
2	1,835	124	2,512	169
3	2,409	162	2,728	184
4	2,348	158	2,531	170

Cost-effectiveness estimates for various pollution control strategies are compared with the LDGT I/M option in Exhibit E-7. Comparisons among control strategies should be made with caution. First, the cost-effectiveness values do not address the size of pollution reductions afforded by the various measures. Thus, a measure with a low dollar per ton may not realize significant reductions in pollutants. Additionally, untried strategies are associated with unknown costs.

Second, the cost-effectiveness values have been estimated using varied methodologies. Some estimates are naturally more rigorous than others.

The cost-effectiveness estimates for the proposed HDGT I/M program were in the range of $1,800 to $2,700 per ton of HC reduced and $120 to $180 per ton of CO reduced. These ranges cover both scenarios, i.e., current and reduced levels of services from inspection stations, across the four program options.

These cost-effectiveness estimates relate to a program running to December 31, 1986. A program with a longer time horizon would result in declining costs which would improve the cost-effectiveness values. These declining costs would be a result of adjustments by motor carriers of operations and scheduled maintenance to ease compliance with an HDGT I/M program and increased service through incremental additions to the number of stations participating in an inspection program.

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[1] Total cost includes net costs (benefits) to motor carriers and inspection stations and $130,000 in government costs as estimated by New York State Department of Motor Vehicles and supported by information from New York State Department of Environmental Conservation.

EXHIBIT E-7

COST-EFFECTIVENESS OF OTHER POLLUTION CONTROL STRATEGIES

Measure	Cost-Effectiveness (dollars/ton) HC	CO
HDGT Inspection/Maintenance in NY	1,835-2,728	124-184
LDV Inspection/Maintenance in NY[1]	372	34
LDV Inspection/Maintenance[2]	1,286-1,508	-
1981 Pass. Car Emission Stds.[3]	470	41
1984 Gas Truck Stds.[4]	253	8
Traffic Controls[5]	617	51
Transit Improvements[5]	14,599	1,382
Auto Coatings[6]	1,205	-
Fabric Coatings[6]	40	-
Bulk Plants[6,7]	net savings	-
Gas Stations[6]	327	-

Notes:

[1] U.S. Environmental Protection Agency, "Update on the Cost-Effectiveness of I/M," April 1981, p. 10.

[2] Cambridge Systematics, Inc., "The Cost-Effectiveness of Vehicle Emissions Inspection and Maintenance Programs," January 1982, p.7.

[3] Cost of 1981 new passenger car emission standards compared to 1975 standards; Source: USEPA, "Regulatory Analysis and Environmental Impact of Final Emission Regulations for 1984 and Later Model Year Heavy Duty Engines." December 1979, p. 159.

[4] Ibid., p. 6. Value shown is gasoline-powered heavy duty trucks greater than 8,500 GVW.

[5] Source: 1979 SIP for Pima County, Arizona.

[6] Source: "Phase I Air Quality and Economic Impacts for the New York Metro/Hartford Regional Study," Contract 13-AQ-7718, GCA Corp., Bedford, MA, October 1980, prepared for the National Commission on Air Quality. Of the 13 stationary source control measures listed in the referenced document, only the four measures shown in this paper account individually for more than 1 percent of 1987 expected emission requirements.

[7] Net savings means cost of recovering emissions is less than the value of the recovered product.

I. INTRODUCTION

The New York City metropolitan area (New York City, Nassau, Suffolk, Westchester, and Rockland Counties) must implement air quality improvement strategies which, by 1987, will enable it to achieve national ambient air quality standards for carbon monoxide and ozone.

Exhaust emissions from light duty vehicles in the New York City metropolitan area are being reduced steadily through the Federal Motor Vehicle Control Program and the State's own exhaust inspection and maintenance (I/M) program for light duty vehicles. According to studies by the New York State Department of Environmental Conservation (DEC), as emissions from light duty vehicles are reduced, emissions from heavy duty gasoline-powered trucks (HDGT) are becoming responsible for an increasing percentage of carbon monoxide and, to a lesser extent, hydrocarbon emissions. This trend is expected to continue into the foreseeable future.

Attainment of the national ambient air quality standards for carbon monoxide and ozone has proved difficult in the New York City metropolitan area. Attainment of the standards by December 31, 1987, can only be demonstrated through reliance upon air quality improvement strategies not normally necessary in other metropolitan areas. One of these strategies is a heavy duty gasoline truck (HDGT) exhaust I/M program.

OBJECTIVES

The primary objective of this project is to quantify and assess the costs and benefits associated with embarking on an I/M program for HDGT. The cost-benefit analysis considers:

- effects on the trucking industry;
- effects on inspection stations; and
- effects on the general public.

The data used for the cost-benefit analysis is extended to provide the basis for cost-effectiveness comparisons. This enables policy makers to view an HDGT I/M program in relation to other air quality improvement strategies.

SCOPE

This study examines the likely costs imposed and benefits derived from extending the light duty vehicle emissions inspection/maintenance program to heavy duty gas-powered

trucks. Light duty vehicles are those up to 8,500 pounds gross vehicle weight (GVW). Heavy duty gas-powered trucks are considered as those vehicles exceeding 8,500 pounds GVW.

The study was directed by the Heavy Duty Gasoline Truck Task Force which has representation from the following:

- United States Environmental Protection Agency - Region II;
- New York State Department of Environmental Conservation;
- New York State Department of Motor Vehicles;
- New York State Department of Transportation;
- New York City Department of Environmental Protection;
- Ne York Chamber of Commerce and Industry;
- B. Simon Inc.; and
- Natural Resources Defense Council, Inc.

Estimates of costs and benefits were developed and analyzed for three principal groups: the trucking industry including fleet operations, inspection stations, and the general public. Direct contacts were used to develop an understanding of costs imposed and benefits generated for the truck and inspection station groups. In addition, the two states currently operating an HDGT I/M program, Arizona and Oregon, were contacted to collect data regarding the experiences of existing programs.

The development of costs and benefits was based on four program options. These options considered the following program characteristics:

- institutional structure;
- testing equipment;
- timing of proposed I/M inspection;
- provisions for fleet inspection;
- applicable HDGT weight categories;
- applicable HDGT model year categories;
- cut points for HC and CO emissions;
- failure rates; and

. waiver policy.

The study relies on data from the New York State Department of Motor Vehicles regarding a census of existing inspection stations and a count of HDGT(s) registered in the nine-county study area. Additionally, the study analyses are driven to a considerable extent by the estimated failure rates proposed by the New York State Department of Environmental Conservation and agreed to for analysis purposes by the Heavy Duty Gasoline Truck Task Force.

Estimates of costs and benefits are based upon economic conditions of the first quarter of 1984. The report expresses costs and benefits in terms of two scenarios for capturing likely values.

Data for other air pollution control strategies and health effects were developed from other sources. It was not the intent of this study to analyze all available air pollution control strategies but to place a proposed HDGT I/M program in a context which allows a cost-effectiveness comparison to other known and quantified alternative strategies.

LIMITATIONS

The primary purpose of this report is to provide estimates of the economic impacts which may arise from implementation of an HDGT I/M program. These estimates were developed largely from information provided by personnel at inspection stations and trucking operations. Although Peat Marwick personnel made extensive numbers of contacts with both groups, the coverage was not exhaustive. Parties who may have provided added information were not contacted owing to the time and budget constraints of the study. Other parties were contacted who did not wish to offer any information or insights they may have possessed. Lastly, those individuals who did participate were requested to offer opinions on the effects of a program which did not, at the time, exist.

No original research was conducted to assess the costs and benefits of other air quality improvement strategies. Thus, to compare cost-effectiveness across alternative strategies implicitly assumes that the studies assessing costs and benefits were conducted with similar rigor.

The economic burden on truck operators is a function of the repairs which may be required for trucks failing an emissions inspection and the resulting downtime. Although a failure rate has been specified for the study, there is no method to specify the extent of repairs needed for any or all trucks. Instead, a typical repair is specified based on prior analyses.

Estimates of the number of inspection stations that may participate in an emissions inspection program are based primarily on existing stations which currently have an emissions analyzer and perform safety inspections on trucks. Additionally, stations which do safety inspections on trucks were contacted regarding possible participation in an emissions inspection program. These later stations unanimously stated they would not purchase an analyzer in order to participate in an HDGT I/M program. Faced with potential loss of business, however, this firm refusal may change.

The benefits to the general public in terms of the reduction in HC load and abatement of CO hot spots is based entirely upon estimates supplied by the New York State Department of Environmental Conservation from a previous study.

REPORT OVERVIEW

The remainder of this report consists of five sections. Section II describes the options studied for the proposed HDGT I/M program. Section III details cost and benefit classifications differentiating resource costs (and benefits) from transfer items. Section IV provides an assessment of the costs and benefits to the trucking industry as a result of a program. Section V assesses the costs and benefits to inspection stations. Section VI discusses the cost-effectiveness of a proposed program and presents the cost-effectiveness comparisons of the proposed HDGT I/M program to other air quality improvement strategies.

II. HEAVY DUTY GAS-POWERED TRUCK INSPECTION/ MAINTENANCE PROGRAM OPTIONS

This section describes the current emissions inspection/ maintenance program in New York State, and programs in other states. The section concludes with a discussion of the proposed program options selected for study.

PRESENT PROGRAM

The State of New York implemented an emissions inspection program on January 1, 1981. The program became an emissions inspection/maintenance program on January 1, 1982, when failed vehicles were required to be repaired and successfully retake the test. The present program officially extends to December 31, 1986. It is likely, however, that the program will be continued beyond 1986.

The program covers gas-powered vehicles weighing 8,500 pounds GVW or less registered in the nine-county New York metropolitan area. Inspections are conducted using a decentralized institutional approach. Over 4,000 inspection stations scattered throughout the New York metropolitan area are certified to perform emissions inspections.

The inspections are conducted annually using a Hamilton Test Systems emissions analyzer. The analyzer can accommodate up to six different settings for HC and CO limits. The analyzer can be reset to enable the State to alter stringency factors. The results of the test are computer-delivered on a tape printout. A permanent record is recorded on a master tape which is removed by Hamilton Test Systems personnel for delivery to the New York State Department of Motor Vehicles.

If there are no complications with the analyzer and the car is warm, the test takes from five to ten minutes. The fee for a combined LDV safety and exhaust emissions inspection is $12.50, of which the emissions portion is allocated as $6.50.

A light duty vehicle (LDV) may be issued an emissions inspection waiver. A waiver is granted for those vehicles which fail the emissions test and undertake specified repair procedures to attempt to bring the vehicle into compliance with the HC and CO standards. The light duty program allows fleets to self-inspect. Any person, association, or corporation, having more than 25 motor vehicles registered in his or its name can qualify as a fleet inspection station.

An additional emissions inspection program is operated by New York City. This program, initiated in October 1977 by the New York City Taxi and Limousine Commission and the New York

City Department of Environmental Protection, consists of thrice yearly inspections of medallion taxis.

PROGRAMS IN OTHER STATES

A number of states have emissions inspection programs for light duty vehicles, most notably the neighboring states of New Jersey and Connecticut. Only two states, however, have exhaust emissions inspection programs covering all gas-powered trucks. Arizona has a program in Maricopa County (Phoenix) and Pima County (Tucson). The program started in 1977. Oregon has a program in Multinomah, Clackamas, Washington, and Medford counties.

The Arizona program is a centralized institutional type run by a contractor. The test fee as of July 1983 was $5.75. Vehicles for the last 13 model years are included in the program. The Oregon program is centralized, run by the state. The test fee as of July 1982 was $7.00. Vehicles from the 1942 model year and later are included in the program. Exhibit II-1 provides the cut-points for heavy duty gas-powered vehicles established by Arizona and Oregon.

Oregon tests approximately 15,000 heavy duty gas trucks per year under its emissions inspection program. Historically, 65 percent of the heavy duty gas trucks pass the emissions inspection. Data on average repair costs are reported for combined LDV and HDGT. The average repair cost for those vehicles which fail was $26.92.[1]

Arizona does not report statistics for LDV and HDGT separately. A recent survey covering 1,700 vehicles indicates an average repair cost of $30.25 for vehicles which failed the emissions test.[2]

The neighboring state of New Jersey is currently developing the necessary amendments to include HDGT in its emissions inspection program. All weights and all years of HDGT would be covered. Trucks will be inspected at the inspection stations run by the state. The effective date of implementation is targeted at January 1, 1985. Exhibit II-2 provides the proposed cut-points for HDGT for the New Jersey program.

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[1] Environmental Quality Comission, Report on Motor Vehicle Emission Inspection Program 1981-1982, State of Oregon, February 1983.

[2] Fred Iacobelli, Arizona Department of Health, Bureau of Vehicle Emissions Inspection. Telephone conversation of January 19, 1984.

EXHIBIT II-1

CUT-POINTS FOR ARIZONA AND OREGON HDGT I/M PROGRAMS

Arizona

Model Year	Conditioning Mode HC PPM	Conditioning Mode CO %	Idle Mode HC PPM	Idle Mode CO %
Reconstructed	700	5.25	1,200	7.50
1968-1971	380	3.50	750	6.50
1972-1974	300	3.00	400	5.50
1975-1978	300	3.00	350	5.00
1979 and later	300	3.00	350	5.00

Oregon

Pre-1970	x	4.0	900	6.5
1970-1973	x	3.0	700	5.0
1974-1978	x	3.0	500	4.0
1979 and later	x	3.0	350	3.0

EXHIBIT II-2

CUT-POINTS FOR THE PROPOSED NEW JERSEY
HDGT I/M PROGRAM

Model Year	Idle Mode HC PPM	Idle Mode CO %
Pre-1970	1,200	8.5
1970-1973	700	6.0
1974-1978	500	4.0
1979 and later	300	3.0

Connecticut currently requires emissions inspections on vehicles up to 10,000 pounds GVW. There are no plans to extend the program to include larger gas-powered trucks.

OPTIONS SELECTED BY TASK FORCE

In order to assess the impacts of a proposed HDGT I/M program, operating characteristics of a program had to be postulated. The following program characteristics were considered:

- institutional structure;
- type of testing equipment;
- timing of I/M inspection;
- provisions for fleet inspections;
- applicable HDGT weight categories;
- applicable HDGT model year categories;
- cut-points for CO and HC emissions;
- failure rates; and
- waiver policy.

Four options were selected for the study. Cut-points for CO and HC emissions were not specified by the Task Force. While cut-points are a critical characteristic of any I/M program they are not necessary to assess economic impacts of a proposed program. The important factors regarding cut-points are the failure rates which result. The Task Force was able to provide those estimates. Exhibit II-3 summarizes the four proposed HDGT I/M program options selected as the bases for the subsequent economic impact anayses. The proposed HDGT I/M program extends to December 31, 1986. Therefore, the evaluation period covers two years, i.e., 1985 and 1986.

EXHIBIT II-3

PROPOSED HDGT I/M PROGRAM OPTIONS

Characteristic	Option 1	Option 2	Option 3	Option 4
Institutional structure	Decentralized: use existing LDV I/M stations	Same	Same	Same
Testing equipment	Existing Hamilton Test Systems	Existing Hamilton Test Systems	Single Source New Equipment	Existing Hamilton Test Systems
Timing of I/M inspection	Same time as safety inspection	Same	Same	Same
Provisions for fleet inspection	Unit housed at one location	Same	Same	Same
Applicable HDGT weight categories	All HDGT exceeding 8,500 lbs. GVW	Same	Same	Same
Age of HDGT	All model years	Exempt for pre-1970 HDGTs	All model years	All model years
Cut points CO HC	None specified	None specified	None specified	None specified
Failure rates (anticipated in first year of program)	40 percent	40 percent	40 percent	20 percent
Waiver policy	Waiver based on completion of reasonable repairs	Same	Same	Same

III. COST AND BENEFIT CLASSIFICATIONS

This section discusses the cost and benefit impacts of the implementation of an HDGT I/M program. Two cost and benefit categories are discussed, resource items and pecuniary items. These categories then serve as a classifying device to describe the types of costs and benefits which will likely surface if an HDGT I/M program is implemented.

RESOURCE ITEMS

Generally, resource costs occur in instances when the labor, capital, materials, and/or entrepreneurial skills used in an activity could be used in a different manner. Stated another way, these costs surface when a resource has an alternative use with a positive value. This alternative use is referred to as an opportunity cost. Vehicle out-of-service time is a prime example of this cost category. When a vehicle is out-of-service, delivery time is lost, translating into lost revenues as a result of the lost opportunities.

Benefits are classified as a resource item when labor, capital, materials, or entrepreneurial skills are saved or made more productive as a result of an activity. This adds to the resource base of the economic entity. Fuel savings are a prime example of this benefit.

PECUNIARY ITEMS

Pecuniary items refer to transfers of money. Although one party benefits and another incurs costs as a result of the exchange, there is no net gain or loss to society. Government programs, especially those primarily intended to redistribute wealth, are the prime examples of pecuniary items.

CLASSIFYING COSTS AND BENEFITS

The likely costs and benefits that would surface upon implementation of an HDGT I/M program are classified in Exhibit III-1. The first column of the exhibit lists the cost and benefit items which would most likely surface if an HDGT I/M program were implemented. Real resource costs (and benefits) and pecuniary costs (and benefits) are entered in the cells of the exhibit. The entries in the exhibit depict the incidence of the costs and benefits. Where two entries appear for a row (e.g., inspection fees), the item is incurred as a cost by one party and generated as a benefit to the second party.

EXHIBIT III-1

COST AND BENEFIT ITEMS

BENEFITS AND COSTS	INCIDENCE		
	MOTOR CARRIERS	INSPECTION STATIONS	GENERAL PUBLIC
. GOVERNMENT COSTS			X
. CAPITAL COSTS OF EMISSIONS ANALYZER		X	
. MAINTENANCE FEE OF EMISSIONS ANALYZER		X	
. LABOR COSTS		X	
. INSPECTION FEES	X	X	
. REPAIR COSTS	X	X	
. LOST VEHICLE PRODUCTIVITY	X		
. IMPROVEMENTS IN FUEL ECONOMY	X		
. REDUCED DOWNTIME	X		
. IMPROVEMENTS IN HEALTH, ESTHETICS, PRODUCTIVITY			X

The costs and benefits entered in Exhibit III-1 are described as follows:

- Government costs are measured by resources used, taken as the increment above the LDV I/M program, and incurred by the general public.

- Pecuniary benefits and costs for testing equipment cancel out as a wealth transfer. Real costs relate to alternative uses of productive resources, approximated by the price of equipment. Cost is incurred by inspection stations in the form of a capital expense.

- Pecuniary benefits and costs for testing equipment cancel out as a wealth transfer. Real costs relate to alternative uses of resources, approximated by a monthly fee. Cost is incurred by inspection stations.

- Labor costs are a real cost incurred by society and directly borne by the inspection stations. This cost relates to the labor time necessary to perform inspections. It is stated as an opportunity cost.

- Inspection fees are a strict wealth transfer counted as a benefit to inspection stations and a cost to motor carriers, the magnitude of which is determined by the number of yearly inspections times the proposed fee.

- Repairs to comply with an HDGT I/M program create a wealth transfer from motor carriers to stations. In addition, real costs in terms of labor and materials which could be put to other uses are incurred at the station, real costs approximated by the extent and number of repair bills. Costs incurred by motor carriers are the full extent of repair bills. The benefit to inspection stations is the profit margin on repairs.

- Vehicle out-of-service time is a real cost in terms of lost truck productivity, approximated by the number of rental days required times the rental prices for truck replacements or lost revenues. The cost is borne by the motor carrier.

- Improvements in gas mileage cause a wealth transfer of lost revenues from stations to decreased expenses for motor carriers. The real benefit to society surfaces in terms of resources saved, approximated by improved mileage factored by estimated gas prices. The benefit is felt, however, by motor carriers.

- Reduced downtime is a real benefit captured by motor carriers in the form of improved productivity, which would be approximated by ton-miles gained times revenue per ton-mile.

- Health, esthetics, life expectancy, productivity, and well-being are the real benefits to society, items which defy quantification.

While from a societal view a transfer of wealth from motor carriers to inspection stations has no impact on the resource base, it has an impact on the future operations and profitability of motor carriers, and largely determines the extent to which inspection stations will participate in any proposed HDGT I/M program. Since transfers of wealth have potentially enormous associated effects, as described in the example above, they will be incorporated in subsequent analyses.

IV. COSTS AND BENEFITS TO MOTOR CARRIERS

This section discusses the impacts of the proposed HDGT I/M program on motor carriers. Three major issues are addressed in this section: responses from contacts with motor carriers are reported, estimates of costs and benefits to motor carriers are developed, and likely economic impacts on the general public are discussed.

METHOD OF APPROACH

Peat Marwick was unable to obtain a master list of owner/operators of HDGT. A list was constructed from phone directories, contacts with various associations, and referrals to fleet inspection facilities provided by the New York State Department of Motor Vehicles. A total of 191 contacts were made, though several contacts did not result in compilation of useful data. Exhibit IV-1 summarizes contacts with motor carriers.

The contacts were made during March 1984. Personal contacts were developed with 19 operators, and the remaining 10 operators were contacted by telephone. Details of the results of the interviews are described below.

INTERVIEW RESULTS

The 29 operators had fleets ranging in size from one to 1,991 trucks. In total, these operators had 4,899 heavy duty gas-powered trucks. Successful contacts included operators of the smallest order (one truck) to the largest fleet (1,991 trucks), with representatives from all sizes in between.

The farthest any motor carrier travels for a safety inspection is 15 miles. Most of the carriers stated they traveled five miles or less to the inspection station. Safety inspections took the truck out-of-service all day for nine of the motor carriers. The remaining respondents gave this distribution of responses regarding the length of time the vehicle was out-of-service due to a safety inspection:

- six hours--one respondent;
- four hours--six respondents;
- two hours--four respondents; and
- one hour--six respondents.

EXHIBIT IV-1

MOTOR CARRIER CONTACTS

CATEGORY	NUMBER
Personal and Telephone Interviews	29
Motor Carriers Who Refused to Participate	27
Motor Carriers Contacted Who Had Trucks Exempt from Proposed Program	135
TOTAL CONTACTS	191

Motor carriers were asked what they do to maintain operations when vehicles are out-of-service for safety inspections or for repairs required to pass inspection. Most respondents (11) said they attempted to schedule inspections during slack time, nine said they maintained spares, seven rented vehicles, and two said they cut back operations.

The motor carriers were asked what might be the major costs they would incur due to an exhaust emissions inspection/maintenance program. The responses were:

- more frequent service/repairs--14;
- truck downtime--10;
- inspection fee--nine;
- other costs such as purchase of analyzer--four; and
- no added cost--three.

Multiple costs were mentioned in some cases, which accounts for the total of 40 responses. When asked if they would move operations out of the nine-county metropolitan area to avoid compliance with an HDGT I/M program, 26 respondents stated they would not consider moving.

ECONOMIC BURDEN ON MOTOR CARRIERS

Motor carriers can be expected to incur costs in four areas due to an HDGT I/M program. These are identified as:

- inspection fees;
- repairs necessary to pass reinspection;
- truck rental costs necessary to maintain operations; and
- lost revenues resulting from truck downtime.

Benefits should be generated in the form of fuel economy improvements and downtime avoided because of repairs to pass the emissions test.

Costs

The initial emissions inspection fee of $6.50 is imposed on all trucks. Those trucks failing the emissions test will be assessed with a reinspection fee, also $6.50.

A major cost faced by those who own trucks which fail the inspection is the repairs necessary to pass reinspection. This analysis uses a tune-up as the typical repair necessary to pass an emissions reinspection. A tune-up was selected to coincide with the emissions reductions reported in a prior study.[1] This prior study based its estimates of emissions reductions and the resulting decreases in HC and CO loads on work done by the New York Department of Environmental Protection, which tested and at the least tuned 181 HDGT.[2] The cost of the average tune-up was set at $85. This estimate was derived from a poll of inspection stations familiar with truck repairs.

As noted in the responses from motor carriers, many stated they would use rental trucks to maintain operations while their vehicles were being tested or repaired. An average rental rate of $90 per day was given by the motor carriers contacted. This rental rate applies to straight trucks used for goods delivery and does not reflect rates for special purpose vehicles.

Lost revenues reflect the lost opportunities of firms having trucks out-of-service because of an emissions inspection or a repair to pass reinspection. Typically, this direct impact on operations falls most heavily on service firms in which the truck is a special purpose vehicle (e.g., electrician, telephone service, plumber) which causes direct loss of revenues when out-of-service. Lost revenues were reported from $45 to $120 per hour. The lost revenues apply to cases in which the service personnel as well as the special purpose vehicle are idled due to the vehicle being out-of-service.

When lost revenues are combined with rentals, the weighted average is $232 per day per truck out-of-service. This weighted average was calculated from data supplied by 15 motor carriers. These data covered 4,062 trucks. The fleet sizes of the operators providing data ranged from one to 1,991.

Benefits

Trucks receiving a tune-up to pass reinspection would be expected to derive fuel economy benefits and possibly avoid downtime occasioned by an I/M-related failure. The fuel economy

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[1] Radian Corporation, "An Assessment of Emission Reduction Strategies for Heavy Duty Gasoline Powered Trucks," June 9, 1981.

[2] Pinto, John J., "Study of Control Strategies for In-Use Heavy Duty Vehicles," New York City Department of Environmental Protection, May 1981.

benefit is estimated at $44 per year. This estimate is based on fuel savings of 35 gallons per year at $1.25 per gallon.[1]

The amount of downtime avoided would be determined by estimating that portion of the truck population that fails the emissions test and is given a tune-up, and which, without the tune-up, would have incurred an I/M-related downtime failure on or before December 31, 1986. A benefit estimate requires specifying a joint probability statement. The first probability concerns failing the emissions test. This is a given at 40 percent. The second probability concerns a vehicle not tuned that suffers a breakdown before December 31, 1986. This second probability could not be estimated given available data.

Downtime avoided is thus a meaningful benefit but one which escapes quantification. In comparing alternative control strategies this benefit could be entered in the form of a sensitivity analysis. Various probabilities (e.g., 10 percent, 20 percent, 75 percent) could be applied to the breakdown occurrence. If a relatively small probability (e.g, 10 percent) determines HDGT I/M to be a prime candidate as a control alternative based on cost-effective comparison measures, it should be seriously considered.

QUANTIFICATION OF COSTS AND BENEFITS

Costs and benefits to motor carriers were estimated using two scenarios. The first scenario refers to current service levels whereby it is assumed that the number of inspection stations currently doing HDGT safety inspections will enter the HDGT I/M program. A second scenario estimates costs and benefits to motor carriers under conditions of reduced service levels. Specifically, it is assumed that a large number of stations currently providing HDGT safety inspections will not enter the HDGT I/M program.

Costs and Benefits: Current Service Levels Maintained

The magnitude of costs and benefits is largely determined by the failure rates imposed and the ease or difficulty in

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[1] Radian, p. 5-11.

getting an emissions inspection or the repairs required to pass a reinspection. The failure rates for the analysis were provided by the HDGT Task Force:

. Option 1--40 percent;

. Option 2--40 percent with pre-1970 vehicles exempt;

. Option 3--40 percent; and

. Option 4--20 percent.

The ease or difficulty in getting an emissions inspection or the repairs required to pass a reinspection is determined by the number of stations participating in a proposed HDGT I/M program. The extent of service determines the amount of downtime a truck is subject to for an inspection and associated repairs.

Exhibit IV-2 provides an estimate of costs and benefits to motor carriers in a scenario where current service levels are maintained.[1] Inspection fees were estimated by multiplying the number of commercial trucks by the proposed fee.[2] Reinspection fees were estimated by multiplying the number of commercial trucks that fail the initial inspection by the proposed fee. Repair costs were derived by multiplying the number of commercial and fleet trucks that fail the initial inspection by the price of a tune-up. Rentals/lost revenues were estimated by multiplying the weighted average for truck rental costs and operators' lost revenues by the number of commercial and fleet trucks that fail the initial inspection. The rental/lost revenue is assessed at one day per truck failure. Exhibit IV-3 depicts the failure sequence with a schematic demonstrating how the one-day downtime was estimated.

The cost and benefit dollar estimates in Exhibit IV-2 apply to a single year. The amounts are stated in current dollars as of the first quarter of 1984.

Net cost per truck for program options 1, 2, and 3 is $116 per year. For option 4 this cost is $60 per year. Net cost per failed truck is $286 for all proposed program options.

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[1] The estimate of current and reduced service levels is fully discussed in Section V of this report. Current service levels translates into 920 inspection stations, public and fleet.

[2] New York State Department of Motor Vehicles estimates that there are 69,740 HDGT in the New York metropolitan area, and 21,300 of these trucks are owned/operated by fleets.

EXHIBIT IV-2

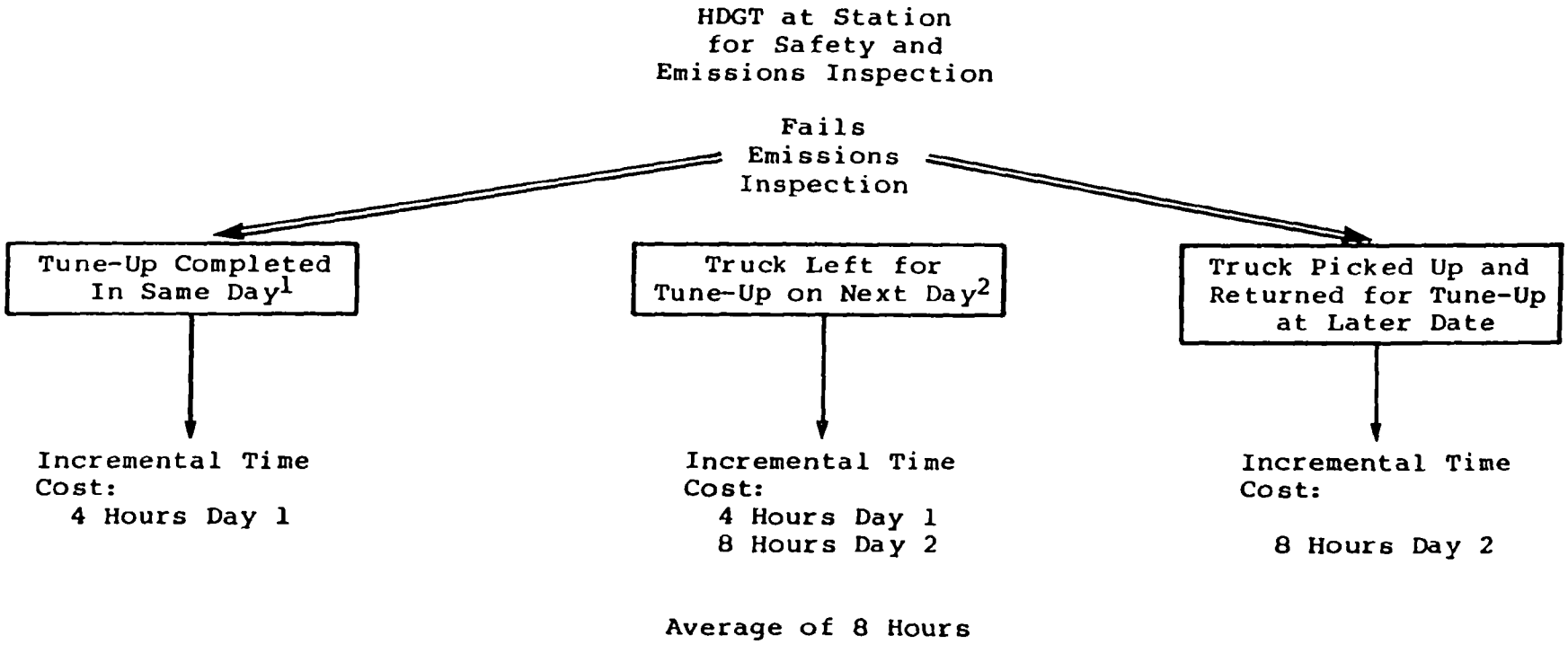
ECONOMIC BURDEN ON MOTOR CARRIERS
CURRENT SERVICE LEVELS MAINTAINED*

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
INSPECTION FEES	$ 314,860	$ 261,196	$ 314,860	$ 314,860
REINSPECTION FEES	125,944	104,478	125,944	62,972
REPAIRS	2,371,160	1,967,002	2,371,160	1,185,580
RENTALS/LOST REVENUES	5,471,872	5,368,758	6,471,872	3,235,936
TOTAL COSTS	$9,283,836	$7,701,434	$9,283,836	$4,799,348
BENEFITS				
FUEL SAVINGS	1,227,424	1,018,212	1,227,424	613,712
NET COSTS OF FAILURES	$8,056,412	$6,683,222	$8,056,412	$4,185,636

* Current service levels refers to the number of inspection stations currently doing HDGT safety inspections.

EXHIBIT IV-3

FAILURE SEQUENCE OF EVENTS WITH
CURRENT SERVICE LEVELS



Notes:

1 Least Probable Unless All Inspections First Thing A.M.

2 Most Probable.

Costs and Benefits: Reduced Service Levels

Costs and benefits to motor carriers were also estimated in a scenario that specified reduced service levels. In this scenario stations that currently do HDGT safety inspections but do not have an emissions analyzer do not participate in an I/M program.

In a case of reduced service levels, costs relating to inspection fees, reinspection fees, and repairs do not change. The inspection fee is $6.50 regardless of the number of participating stations, and the repair cost refers to an $85 tune-up. The rental/lost revenue cost doubles to two days downtime. Fuel economy benefits do not change.

Exhibit IV-4 provides the cost-benefit estimates to motor carriers in a scenario with reduced service levels. Exhibit IV-5 depicts the failure sequence and resulting truck downtime for the reduced service level scenario.

The cost and benefit dollar estimates in Exhibit IV-4 apply to a single year. The amounts are stated in current dollars as of the first quarter of 1984.

Net cost per truck for program options 1, 2, and 3 is $208 per year. For option 4 this cost is $106 per year. Net cost per failed truck is $518 for all proposed program options.

The costs and benefits to motor carriers depicted in Exhibits IV-2 and IV-4 represent conditions where 920 and 191 stations respectively are available to perform HDGT emission inspections. The 920 stations represent a condition where current service levels in regard to HDGT safety inspections are maintained, resulting in a net cost per failed truck of $286. The 191 stations represent a condition of reduced service as compared to the present station availability to conduct HDGT safety inspections. In this case, the net cost per failed truck is $518.

The economic burden on motor carriers is inversely related to the number of stations which participate in a proposed HDGT I/M program. For example, if a station's participation in the proposed program settled at a midpoint between the current and reduced levels of service (i.e., 556 stations) the net cost per failed truck would be $402.

ECONOMIC IMPACTS

Faced with net cost impacts from a proposed HDGT I/M program, motor carriers can react in any of several ways. First, they could attempt to escape the costs through

EXHIBIT IV-4

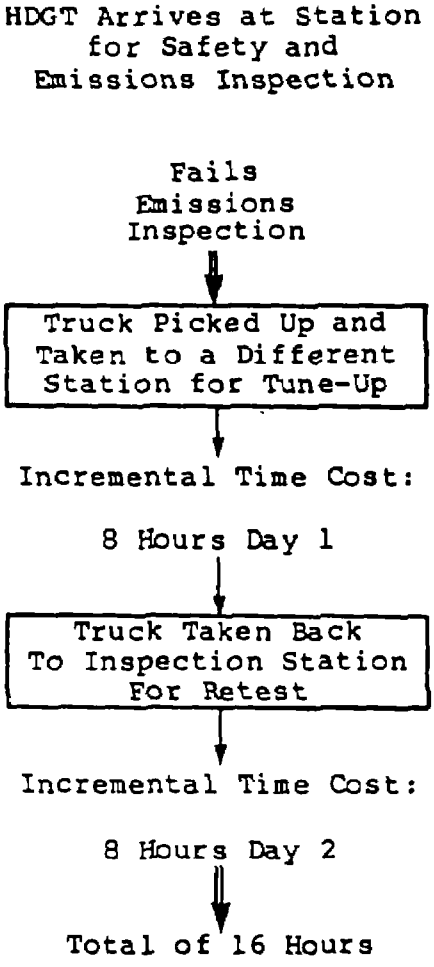
ECONOMIC BURDEN ON MOTOR CARRIERS
REDUCED SERVICE LEVELS*

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
INSPECTION FEES	$ 314,860	$ 261,196	$ 314,860	$ 314,860
REINSPECTION FEES	125,944	104,478	125,944	62,972
REPAIRS	2,371,160	1,967,002	2,371,160	1,185,580
RENTALS/LOST REVENUES	12,943,744	10,737,516	12,943,744	6,471,872
TOTAL COSTS	$15,755,708	$13,070,192	$15,755,708	$8,035,284
BENEFITS				
FUEL SAVINGS	1,227,424	1,018,212	1,227,424	613,712
NET COSTS OF FAILURES	$14,528,284	$12,051,980	$14,528,284	$7,421,572

* Reduced service levels refers to stations which currently have an HTS analyzer and do 50 or more HDGT safety inspections yearly.

EXHIBIT IV-5

FAILURE SEQUENCE OF EVENTS WITH
REDUCED SERVICE LEVELS



relocating. Second, they could internalize the costs. Third, they could attempt to pass costs on to consumers.

If a motor carrier could serve the nine-county metropolitan area from a location without an HDGT I/M program, the compliance costs could be avoided. With New Jersey's proposed HDGT I/M program scheduled to take effect January 1, 1985, the relocation option is less feasible. A carrier could relocate in Connecticut where an I/M program covers vehicles up to 10,000 pounds GVW. Connecticut has no plans to extend its I/M program to include heavier trucks.

The daily transport costs from a Connecticut location are extremely high. As Exhibit IV-6 shows, extra cost per one-way trip can be as high as $82.89 to serve sections of the nine-county metropolitan area. Hence, cost savings from avoiding compliance with an HDGT I/M program are quickly eroded by relocating outside the nine-county program jurisdiction.

The cost analysis clearly shows relocation is not a viable option when the markets served are the nine-county metropolitan area. This conclusion is bolstered by responses from motor carriers; only three of 29 stated they would consider moving to avoid compliance.

Motor carriers would turn to the option of internalizing costs only as a last resort. Unless they are faced with lower cost competition they will attempt to pass costs on to consumers.

Costs to motor carriers incurred as a result of an HDGT I/M program will be passed on to consumers. The demand for intracity truck service is inelastic, i.e., over a range of prices, changes in price will not have much effect on the quantity of service demanded.

This situation occurs because there are no close substitutes for intracity trucking services. Other modes such as rail, air, and water do not compete with trucks for short-haul goods movement. Additionally, to perform specialty services (e.g., plumbing, electrical work, telephone installations) requires special purpose trucks for which there are no substitutes.

The net costs estimated represent a situation in which motor carriers do not have time to adjust operations to respond to an I/M program. Ideally, motor carriers would schedule tune-ups and other I/M-related maintenance or repairs immediately before the I/M inspection, thus improving the pass/fail rate as well as reducing the HC and CO load. By improving the pass/fail rate, the costs associated with truck rental/lost revenues are lessened. Additionally, if the tune-up and other I/M-related maintenance or repairs performed prior to

EXHIBIT IV-6

HIGHWAY MILEAGE AND COSTS INCURRED BY MOTOR CARRIERS
RELOCATING TO A BOUNDARY LOCATION (CT) TO
AVOID COMPLIANCE WITH HDGT I/M PROGRAM

ORIGIN	DESTINATION CITY/COUNTY	CO-ORDINATE	ACTUAL HWY MILEAGE	COST/ MILE[1]	COST/ TRIP
GLENVILLE, CT.	SCARSDALE/ WESTCHESTER	White Plains—Post Road and Popham Road	10.8 mi.	$1.1876	$12.83
	NANET/ROCKLAND	Middletown Road & Church Street	22.9 mi.	1.1876	27.20
	BRONX	Broox River Parkway/Bronx Pelham Parkway	18.7 mi.	1.1876	22.21
	QUEENS/NY CO.	Jamaica—RT. 678/Interborough Parkway	26.9 mi.	1.1876	31.95
	BROOKLYN/KING CO.	Flatbush Boulevard/Linden Boulevard	36.8 mi.	1.1876	43.70
	NASSAU CO.	Westbury—Merrick Avenue and Old Country Road	38.0 mi.	1.1876	45.13
	MANHATTAN	96th and Riverside	28.0 mi.	1.1876	33.25
	STATEN ISLAND	New Springville—Travis and Richmond Avenues	51.9 mi.	1.1876	61.64
	SUFFOLK	Farmingville—Long Island Expressway and Patchoque Road	69.8 mi.	1.1876	82.89

[1] Hertz, Public Affairs Department, "Hertz Truck Cost Studies," May 31, 1982.

the exhaust emissions test for purposes of passing the test were performed on an annual basis (or at least more frequently) without an HDGT I/M program, costs would diminish.

The cost estimates, however, refer to a program with a short life--two years. Motor carriers will not be able to react to the I/M program in the first year simply because they won't have any reliable history on which to base their behavior. Most will approach the exhaust emissions test as risk-takers. Without prior knowledge of the stringency of the test and the attendant failure rates, rational behavior dictates that the typical motor carrier will have trucks tested that have not been specifically maintained or repaired in anticipation of the test. Those carriers on a strict maintenance schedule will be the exception in their attempts to schedule tune-ups to conform with the exhaust emissions test.

As the program acquires a history, motor carriers will react differently. Prior knowledge of probable failure rates will stimulate pre-test maintenance and repairs. To acquire this knowledge of probable failure requires an initial period in which the I/M program imposes substantial economic burdens on motor carriers, burdens which the motor carriers should act to avoid in the future.

A member of the HDGT I/M Task Force has suggested that the costs to motor carriers resulting from the proposed emissions inspection program may be overstated. Specifically, the comment addresses the possibility of using spare trucks or scheduling inspections during slack time instead of renting equipment or losing operating revenue due to truck downtime for I/M-related repairs. Based on points cited above and elaborated on below, it is doubtful that costs are overstated.

Generally, a spares policy is employed by larger fleets that also conduct periodic maintenance. Trucks from these fleet operators are less likely to fail an HDGT emissions inspection than vehicles belonging to small operators that do not conduct periodic maintenance and cannot afford to maintain spares. Thus, the higher incidence of failures is likely to fall on those operators who do not maintain spares and will be required to rent a replacement vehicle to maintain operations or incur operating revenue losses.

Further, a spares policy on the part of motor carriers requires a significant amount of capital expenditure. These capital outlays cannot be separated to reflect allocations for such items as:

. inspection requirements;

. unanticipated downtime of the regular fleet; and

unanticipated demands for trucking services.

The cost, in economic terms, is referred to as non-separable.

In order to allocate a cost of this sort, a sensible allocation scheme must be devised. In this analysis, this cost of truck downtime to complete the necessary repairs to pass an emissions reinspection is approximated by the average daily rental rate/lost revenue that applies to heavy duty gas-powered trucks in the metropolitan area.

A second issue arises in regard to the potential for scheduling inspections during slack time. Since the emissions inspection itself was assessed at zero cost, other than the $6.50 fee, the analysis implicitly assumes all inspections are scheduled for slack time.

The assumption that unanticipated repairs occasioned by failure of the emissions inspection will also occur during slack time is not reasonable. The fact that the failure is not anticipated implies that the timely remedial action required may not conveniently coincide with further slack time.

V. COSTS AND BENEFITS TO INSPECTION STATIONS

This section discusses the impacts of the proposed HDGT I/M program on inspection stations. Three major issues are addressed in this section: responses from contacts with inspection stations are reported, estimates of station participation in a proposed program are provided, and the estimated costs and benefits are discussed in quantitative and qualitative terms.

METHOD OF APPROACH

The New York State Department of Motor Vehicles (NYSDMV) certifies stations to perform emissions and/or safety inspections on a variety of vehicle groups. NYSDMV maintains information on the number of stations that perform exhaust emissions tests as well as safety inspections on various sizes of trucks. These stations were considered prime candidates to participate in any proposed HDGT I/M program because they currently have a Hamilton Test System Analyzer, and they currently do truck safety inspections. As such, they were considered knowledgeable regarding the economic impacts any program might have.

Since the stations currently had an analyzer, they would not incur the costs of purchasing the analyzer and entering into a monthly maintenance agreement with Hamilton Test Systems. Later in this report there is a financial analysis quantifying the number of inspections necessary to offset the cost of the analyzer and the monthly maintenance fee.

By focusing on stations that are certified to do truck inspections, it is highly probable that most of the stations have a physical layout which can accommodate trucks of various sizes. Additionally, if the stations currently do truck safety inspections, they should be knowledgeable regarding the potential economic impacts resulting from extending the LDV I/M program to include HDGT.

NYSDMV was able to identify 530 public and fleet inspection stations certified to do emission tests on LDV and safety inspections on HDGT. This list was used to develop personal and telephone contacts with personnel at the inspection stations. An interview guide was developed to discuss similar issues with each contact.

The contacts were made during February 1984. Personal contacts were made with 35 public inspection stations and 12 fleets which self-inspect. Telephone contacts resulted in 76 additional completed interviews. Interviews were completed with personnel at stations from all five New York City boroughs and the four counties in the metropolitan area. The results of the interviews are described below.

An additional 17 stations certified to do HDGT safety inspections but not LDV I/M emission inspections were contacted by telephone. While this group had no experience with an I/M program they were contacted to determine their interest in participating should an I/M program be initiated for HDGT.

INTERVIEW RESULTS

The results of the interviews are reported for public inspection stations. Exhibit V-1 provides a summary of interview responses.

Public Inspection Stations

A total of 35 personal interviews and 76 telephone interviews were conducted with public inspection stations. Results of the personal contacts will be reported first, as these personal contacts resulted in more comprehensive coverage of the issue areas.

Personal Interviews

Of the 35 inspection stations where personnel were interviewed, all currently performed exhaust emissions inspections. They ranged from 50 emissions inspections per year up to 3,500, with an average of 826.

Safety inspections of trucks were performed by 31 of the stations. Trucks of all sizes can be accommodated by 18 of the stations. The stations did from four to 550 truck safety inspections per year with an average of 139. Almost all of the stations schedule inspections whenever possible, rather than on specific days or during specific hours or on demand.

The stations reported that truck safety inspections required from 15 minutes to 60 minutes. The average time was calculated at 38 minutes. The exhaust emissions inspections were reported to take from two to 30 minutes, with an average of 13 minutes.

Of those responding, 24 reported that no modifications would be necessary to accommodate HDGT for an emissions test. The eight stations that stated a modification was necessary could get by with the non-structural procedure of moving the machine nearer the overhead door and bringing the nose of the truck in to be tested.

EXHIBIT V-1

SUMMARY OF PERSONAL AND TELEPHONE INTERVIEWS
WITH INSPECTION STATIONS

ISSUE AREA	RANGE OF RESPONSES PERSONAL	RANGE OF RESPONSES TELEPHONE	AVERAGE OF RESPONSES PERSONAL	AVERAGE OF RESPONSES TELEPHONE	COMBINED AVERAGE	COMBINED TOTAL
Number of Exhaust Emissions Tests Done Per Year	50-3,500	42-3,600	826	780	794	
Number of Truck Safety Inspections Done Per Year	4-550	2-1,200	139	138	139	
Number of Truck Safety and Exhaust Emissions Inspections that Station Could Do Per Year	0-6,240	0-3,600	760	315	482	
Are Station Modifications Necessary to Perform Emissions Inspections on HDGT?	8-Yes 24-No	34-Yes 42-No				42-Yes 66-No
Is the LDV I/M Program Profitable?	14-Yes 17-No	38-Yes 35-No				52-Yes 52-No
How Much Extra Business Does the LDV I/M Program Generate?	0-75%	0-25%	11%	9%	9%	
Is a Proposed $6.50 Fee Adequate for an HDGT Emission Inspection?	12-Yes 20-No	23-Yes 43-No				35-Yes 63-No
What Would Be an Adequate Fee for an HDGT Emissions Inspection?	$13-35	$10-20	$16	$13	$15	
What Would Be an Adequate Fee for a Combined Safety and Emissions Inspection of an HDGT?	$20-40	$18-75	$30	$26	$27	
Would You Participate in a Program Which Required Purchase of New Emissions Test Equipment?	0-Yes 17-No	0-Yes 69-No				0-Yes 86-No
What Problems Do You Foresee in an HDGT I/M Program Using HIS Equipment?	10-No Problems 24-Cited One or More Problems	26-No Problems 49-Cited One or More Problems				36-No Problems 73-Cited One or More Problems

Under the current LDV I/M program, 19 stations reported that a carburetor adjustment was necessary for those LDVs which failed an initial inspection. Other typical repairs reported were:

. tune-up--three stations;

. replace PC valve--five stations;

. replace air filter--five stations.

The cost of repairs for an LDV failing the initial emissions inspection fell into the following ranges:

. $1 to $10, reported by 12 stations;

. $11 to $25, reported by 10 stations;

. $26 to $50, reported by five stations;

. $51 to $100, reported by seven stations; and

. $100 plus, reported by two stations.

In addition, two of the stations stated that they did not generally charge for repairs which were minor in nature (e.g., turning an idle screw) performed on an LDV belonging to a regular customer. A vast majority of the stations reported that 90 percent of the repairs required for an LDV to pass a reinspection were completed within the day.

The stations are almost evenly divided regarding the profitability of the LDV I/M program, with 14 considering the program as profitable and 17 regarding the program as not profitable. Of those able to provide an estimate, 12 of 18 stations thought the LDV I/M generated extra business.

In terms of the fee structure, 20 stations reported the proposed fee for an HDGT I/M was not adequate, and 12 said they were satisfied with a $6.50 fee. The stations were also asked what the fee should be. Those with an opinion offered the following:

. $13, five stations;

. $15, three stations;

. $16, one station; and

. $35, one station.

A number of stations had an opinion relating to a fair fee for a combined HDGT emissions and safety inspection:

- $20, two stations;
- $25, two stations;
- $28, one station;
- $30, one station;
- $35, two stations; and
- $40, two stations.

Based on the above, the average fee for an emissions inspection only was $16, and $30 was the average fee quoted for the combined HDGT inspection.

Not many stations were able to provide an estimate of the fee required if new analyzer equipment had to be purchased. Eight stations offered a fee ranging from $20 to $60 for an emissions inspection requiring new equipment, with an average of $31. Five other stations set the fee for a combined inspection at a range of $30 to $100, with an average of $54. The stations overwhelmingly rejected the idea of establishing a fee premium for on-demand service.

The inspection stations were asked what problems they could foresee in starting an HDGT I/M program (1) using existing HTS equipment and (2) using new test equipment. Only one station expressed any interest in participating in a program requiring new equipment. That station stated it would need a guaranteed minimum secured by a protected geographical franchise to even consider participation. All of the other stations stated they would not participate in an HDGT I/M program requiring new test equipment due to the cost of the machine.

If the proposed HDGT I/M program was initiated using the HTS analyzer, 10 stations stated that they could foresee no problems in the program. Many more stations, 24, had specific comments regarding problems with an HDGT I/M program. The chief concerns were:

- The time involved in doing inspections would mean that the service would not be profitable.
- Trucks won't pass and the program will chase truckers out of the city.
- We would be interested in serving only our existing accounts.
- To do an adequate safety and emissions inspection takes close to one hour, which necessitates a fee in the $30 to $35 range.

- Some stations were unhappy with HTS maintenance services and the $123 monthly charge.

- The analyzer requires too lean a burn to pass. Thus truck carburetors would have to be adjusted to pass test, and then readjusted so the truck will run right.

- Trucks take up too much room in the shop.

- They would have to do emissions inspections on large trucks outside.

- The analyzer was not mobile.

Telephone Interviews

A total of 76 public inspection stations were contacted by telephone. These stations did 42 to 3,600 LDV exhaust emissions inspections per year, with an average of 780.

Safety inspections of trucks were performed at 54 of the stations: 24 inspect trucks of all sizes, and 27 stations report inspections of trucks up to 18,000 pounds GVW. These stations report doing from two to 1,200 truck safety inspections per year, with an average of 138.

The stations reported that it could be possible to do up to 3,600 combined truck safety and emissions inspections per year, with an average of 315 per year per station. Over half the stations, 42, reported that no modifications to the shop would be required to accommodate trucks for emissions inspections. The remaining 34 stations would require structural modifications, (e.g., higher overhead door(s), deeper bays) or non-structural procedures (e.g., moving the HTS analyzer to the front of the bay).

The LDV exhaust emissions inspection program was viewed as profitable by 38 of the stations and unprofitable by 35. Most of the stations thought the program generated extra business, in the ranges cited below:

- 1 to 5 percent, 11 stations;

- 6 to 10 percent, 16 stations;

- 11 to 20 percent, 17 stations; and

- 21 plus percent, three stations.

Of those responding, 11 reported no increase in business volume due to the LDV I/M program.

A vast majority, 43 of the stations, felt the proposed $6.50 fee for an HDGT emissions inspection was not adequate. The remainder of those responding, 23, thought the proposed $6.50 was adequate. Those who felt the fee was too low pegged the fee for an HDGT emissions inspection at something between $10 and $20, with an average of $13. Others responded in terms of a fair fee for a combined safety and emissions inspection, a fee ranging between $18 and $75, with an average of $26.

Those who responded stated a $10 to $30 fee for an emissions inspection would be necessary if they had to purchase a new machine. The average was $17. Those who were able to estimate a fee for a combined inspection using a new machine were in a range of $16 to $50, with an average of $32.

When asked to comment on any problems of starting an HDGT I/M program, all of the stations stated they would not participate in a program which required the purchase of new emissions testing equipment. When the question referred to program problems using existing HTS equipment, 26 stations stated they could not see any problems with extending the emissions testing program to HDGT, while 49 stations cited problems similar to those quoted from the personal interviews.

Exhibit V-1 summarizes the responses of the personal and telephone contacts with inspection stations. An additional column has been entered to combine the personal and telephone results.

AMORTIZING EQUIPMENT COST

The personal and telephone contacts with inspection stations that currently possess an HTS analyzer provide a basis for estimating the number of stations likely to participate in an HDGT I/M program. A prime indication of willingness to participate is the potential profitability of an inspection program.

This subsection contains a financial analysis relating revenues from inspections to equipment cost. This produces an estimate of the number of inspections a station must do annually to cover equipment expenses. The analysis is useful in confirming (or disputing) the mixed reports by inspection stations regarding the profitability of the LDV I/M program. More importantly, this financial analysis can help estimate the number of stations without an HTS analyzer which currently do truck inspections that may participate in an HDGT I/M program.

Financial Analysis

To develop the financial analysis determining the profitability of the LDV I/M program, costs and revenues must be expressed in the same time frame. For purposes of this analysis, the time frame is the most recent year.

The following data set of costs drives the analysis:

. cost of HTS analyzer = $6,900

. analyzer/program life = six years

. monthly maintenance fee = $123

. opportunity cost for labor = 0

. interest (discount) rate = 11 percent

The annualized costs are the sum of the analyzer cost amortized over six years with a capital recovery factor applied at 11 percent plus the yearly total of the monthly maintenance fees.

The calculation is as follows:

(cost of analyzer x capital recovery factor) + sum of monthly maintenance fees = total annualized cost

therefore:

($6,900 x .23638) + (12 months x $123) = $3,107

This $3,107 is an absolute minimum cost as a labor cost has not been assigned. The assumption is that inspections are worked in during slack time, implying that other business is not turned away to do inspections.

Using this framework, a break-even point would be 497 emissions inspections per year. Of the stations we contacted, 54 reported doing more than 500 emissions inspections per year with 50 doing fewer than 500 per year. This corroborates our finding in which 52 stations reported that the LDV I/M program was profitable while 52 stated it was not.

Turning to those stations that might enter the program, their cost parameters would be identical except they would have to recoup the cost of the HTS analyzer in two years. The yearly cost to those entering the program to serve HDGT (and probably siphon off LDV inspections from existing stations) would be $5,586.

To cover the $5,586 yearly cost would require 894 inspections. Not suprisingly, the 17 stations Peat Marwick contacted that currently do truck safety inspections but do not have an HTS analyzer all stated that they would not consider purchasing an HTS analyzer in order to participate in an HDGT I/M program.

ESTIMATES OF STATION PARTICIPATION

The NYSDMV developed a list of stations certified to do LDV emissions inspections and truck safety inspections. This list contained 530 stations, 425 public inspection stations, and 105 fleet inspection stations. Peat Marwick personnel contacted 111 public and 12 fleet inspection stations. Personal contact was made at 35 of the public and all 12 of the fleet inspection stations; telephone interviews were conducted with the remaining 76 public inspection stations.

Estimates of station participation in an HDGT I/M program may be developed in various ways. Separate estimates must be developed for fleets and for public inspection stations.

Estimates of Fleet Participation

While a sample size of 12 fleet inspection stations may appear small, it provides coverage of over 11 percent of the known HDGT population. Further, there was no variance in the key responses from the fleet operators. All 12 had an HTS analyzer and used it to do emissions inspections on LDV. All 12 currently do safety inspections on trucks.

The most plausible estimate of fleet station participation in a proposed HDGT I/M program is 100 percent of those stations which currently have and use the HTS analyzer and do truck safety inspections. These stations have no incentive to send trucks out for an emissions inspection as they have the equipment and physical layout to perform HDGT emissions inspections in-house.

Estimates of Participation of Public Inspection Stations

There are three bases for estimating participation of existing public inspection stations in a proposed HDGT I/M program. Each estimate is accompanied by the average number of truck safety and emissions inspections the stations reported they could do to derive a capacity figure for the inspection station network.

Perhaps the most straightforward approach to estimating participation by existing public inspection stations is based on the proportion of those stations contacted that currently have and use an HTS analyzer and do truck safety inspections. Of the 111 public inspection stations contacted, all had and use an HTS analyzer, and 85 reported doing truck safety inspections. This produces an estimate that 77 percent of the existing public inspection stations could participate in an HDGT I/M program.

Based on the census of stations developed by NYSDMV, this translates into participation by 327 stations. The average number of truck emissions and safety inspections the stations reported they could do was 482 per year. Multiplying those who could participate by the average number of possible combined inspections yields 157,614 per year. This is an upper estimate of the capacity to perform inspections. This estimate implicitly assumes that all the stations that reported they do LDV emissions inspections and truck safety inspections will do truck emissions inspections for all types and sizes of trucks if an HDGT I/M program is started.

A second basis for estimating participation considers only those stations that currently perform a threshold number of truck inspections. Using 50 per year as the threshold value eliminates 35 of the 85 inspection stations surveyed that have and use an HTS analyzer and currently do truck safety inspections. This produces an estimate of a 45 percent participation rate among existing public inspection stations. This translates into a participation estimate of 191 existing public inspection stations in an HDGT I/M program.

Those stations that did 50 or more truck safety inspections per year reported that they could do an average of 588 combined truck emissions and safety inspections per year. The capacity of the existing station network using this basis for estimation would be 112,308 combined HDGT inspections per year.

The third basis for estimating participation relates to that proportion of stations stating that the proposed $6.50 emissions inspection fee was sufficient to perform emissions inspections on HDGT. Of 98 stations responding to this issue, 36 percent stated they would be willing to participate in an HDGT I/M program with a fee of $6.50 for emissions inspections. Applying the 36 percent participation rate to the existing inspection stations produces an estimate of 153 stations participating in an HDGT I/M program.

This group of stations stated they could do an average of 564 combined HDGT emissions and safety inspections per year. The estimate of capacity is 86,292 combined HDGT inspections per year.

NYSDMV has provided a count of 69,740 gas-powered trucks over 8,499 pounds in the New York metropolitan area. Trucks registered to fleets constitute 21,300 of this total. Thus, the minimum number of HDGTs requiring emissions inspection at a public facility is 48,440. Exhibit V-2 summarizes the estimates of participation by existing inspection stations in an HDGT I/M program serving the New York metropolitan area truck population.

The participation estimates shown in the exhibit would mean reduced service levels. Current service levels are estimated at 920 stations that perform HDGT safety inspections. This consists of 327 public stations performing HDGT safety and LDV I/M inspections, 105 fleet stations certified to perform HDGT safety and LDV I/M inspections, and 488 public and fleet stations performing HDGT safety inspections.

The current and reduced service levels were used to estimate costs to motor carriers of a proposed HDGT I/M program. Reduced service levels affect truck downtime for inspections and the attendant maintenance repairs necessary to pass a reinspection.

QUANTIFICATION OF COST BENEFIT ESTIMATES

The inspection stations incur major costs in participating in an emissions inspection program in terms of equipment cost and a monthly maintenance fee. To participate in an HDGT I/M program results in a small incremental equipment and maintenance fee cost, if any. Benefits arise in terms of inspection fees and added revenues from repairs.

Cost Estimates

The HTS analyzer is a one-time sunk cost to the inspection stations. There is no added capital cost to do added inspections whether they are for an HDGT or LDV.

The monthly maintenance fee is set by Hamilton Test Systems. Stations contract with Hamilton Test Systems to perform scheduled monthly maintenance and provide a service response on an as needed basis. The fee currently does not vary across stations according to the number of emissions inspections performed. There is currently no reason to assume that Hamilton Test Systems would impose a two-tiered maintenance fee. Thus, for Options 1, 2, and 4, the inspection stations which currently have an analyzer would not incur any equipment-related cost.

Under Option 3, the scenario calls for new equipment. With an analyzer cost of $8,500 and a two-year program life, this results in an annualized capital cost of $4,963 when an 11 percent interest rate is assumed. If a similar maintenance fee was imposed on the new equipment, i.e., $123 per month, this results in an annualized maintenance fee cost of $1,476, and a total annualized cost of $6,439.

EXHIBIT V-2

PARTICIPATION ESTIMATES OF EXISTING STATIONS
IN A PROPOSED HDGT I/M PROGRAM

BASIS FOR ESTIMATE	ESTIMATE OF PARTICIPATION: NUMBER OF STATIONS	ESTIMATE OF CAPACITY: NUMBER OF INSPECTIONS YEARLY	NUMBER OF TIMES TRUCK POPULATION IS COVERED
Stations Which Have and Use an HTS Analyzer and Do HDGT Safety Inspections	327	157,614	3.25
Stations Which Have and Use an HTS Analyzer and Do 50 Or More HDGT Safety Inspections Per Year	191	112,308	2.32
Stations Which Have and Use An HTS Analyzer, Do HDGT Safety Inspections, and Report a $6.50 Fee Is Sufficient Compensation to Conduct an HDGT Emissions Inspection	153	86,292	1.78
Stations Would Be Required to Purchase a New Emissions Analyzer	0	0	0

Costs and benefits to inspection stations were estimated for the two scenarios developed to analyze impacts on motor carriers--scenarios involving current and reduced service levels. Cost estimates were derived using the following parameters:

- Equipment costs reflect maintenance of current service levels. Currently, there are an estimated 920 inspection stations which do truck safety inspections, and 432 have an HTS analyzer. To maintain the existing service level would require purchase of 488 machines.

- If new equipment is required, 920 analyzers would have to be purchased.

- If service levels are reduced, no HTS equipment is purchased. For Option 3, it is assumed 191 new analyzers would be purchased. This represents stations which have an HTS analyzer and do 50 or more HDGT safety inspections per year.

Benefits

Benefits to inspection stations occur in two forms. First, they receive the inspection and reinspection fees paid by commercial motor carriers. The proposed fee is set at $6.50.

Second, they derive economic benefits from repair work. The benefits from repairs are the profit margin on repairs, which is pegged at 15 percent. The remaining 85 percent of the $85 tune-up goes toward parts, labor, and overhead.

Exhibit V-3 provides estimates of costs and benefits to inspection stations in a scenario where current service levels are maintained. Equipment costs were estimated by multiplying the number of machines necessary to maintain current service by the annualized cost per machine.

Benefits in the form of fees for inspections and reinspections are the costs incurred by motor carriers. Profit margin on repairs are estimated as 15 percent of the repair costs incurred by motor carriers.

Exhibit V-4 provides the estimates of costs and benefits to inspection stations in a scenario of reduced service levels. Stations which currently do HDGT safety inspections but do not have an analyzer are regarded as non-participants in an HDGT I/M program.

With reduced service levels, equipment costs are nil except for Option 3. Under this option, it is assumed that 191 stations will purchase new non-HTS equipment. This represents

EXHIBIT V-3

COSTS AND BENEFITS TO INSPECTION STATIONS
CURRENT SERVICE LEVELS MAINTAINED

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
Equipment Costs (HTS) to Maintain Current Service Levels for Truck Inspections	$2,725,968	$2,239,986		$2,725,968
Equipment Costs (New) to Maintain Current Service Levels for Truck Inspections			$5,923,880	
BENEFITS				
Fees for: Inspections	$314,860	$261,196	$314,860	$314,860
Reinspections	$125,944	$104,478	$125,944	$62,972
Profit Margin (15 Percent) on Repairs	$247,044	$204,938	$247,044	$123,522
Net Cost	$2,038,120	$1,669,374	$5,236,032	$2,224,614

EXHIBIT V-4

COSTS AND BENEFITS TO INSPECTION STATIONS
REDUCED SERVICE LEVELS

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
COSTS				
Equipment Costs (New) with Reduced Service Levels			$1,229,849	
BENEFITS				
Inspection Fees	$314,860	$261,196	$314,860	$314,860
Reinspection Fees	$125,944	$104,478	$125,944	$ 62,972
Profit Margin (15 Percent) on Repairs	$247,044	$204,938	$247,044	$123,522
Net Benefits (Costs)	$687,848	$570,612	$(542,001)	$501,354

stations which have an HTS analyzer and do 50 or more HDGT safety inspections per year. The benefit measures are identical to those shown in Exhibit V-3.

VI. COST-EFFECTIVENESS OF A PROPOSED HDGT I/M PROGRAM

This section evaluates the cost-effectiveness of a proposed HDGT I/M program. Quantified costs and benefits are combined with reductions in HC and CO emission loads to produce the cost-effectiveness estimates. Non-quantified societal benefits are discussed. The section concludes with a discussion of the limitations of the cost-effectiveness estimates.

COST-EFFECTIVENESS ESTIMATES FOR HDGT PROGRAM

Cost-effectiveness analysis is performed in instances where the prime benefit defies quantification in monetary terms. In this instance, the prime benefits are health effects stemming from reductions in the HC and CO loads in the nine-county metropolitan area.

The cost-effectiveness measure is formed by dividing net costs by tonnage reductions in pollution. This results in an estimate of the cost per ton to achieve the reduction in specific pollutants (i.e., HC and CO).

Exhibit VI-1 provides estimates of annual reductions in HC and CO loads stemming from an HDGT I/M program for the nine-county metropolitan area. The estimates for Program Options 1 and 3 refer to an HDGT I/M program covering all HDGT vehicles in the nine-county area. Program Options 1 and 3 have an implied 40 percent failure rate.

Program Option 2 exempts pre-1970 vehicles from the proposed HDGT I/M program. The adjustment to reductions in HC and CO was assumed to be linear. This estimation procedure may be optimistic since the pre-1970 HDGTs may be the heaviest polluters.

Program Option 4 is linked to a 20 percent failure rate. The adjustment in HC and CO was again assumed to be linear. This estimation procedure is probably conservative since a lower failure rate, i.e., 20 percent versus 40 percent, probably would have the greatest impact on those vehicles which were the heaviest polluters. Unfortunately, without a history of test trials, it is impossible to estimate with any precision the impact of changing the failure rate to 20 percent on the reduction of HC and CO loads.

EXHIBIT VI-1

ANNUAL REDUCTIONS IN HC AND CO LOAD[1]

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
REDUCTION IN HC (TONS)	2,786	2,311	2,786	1,393
REDUCTION IN CO (TONS)	41,369	34,318	41,369	20,685

[1] Source: "An Assessment of Emission Reduction Strategies for Heavy-Duty Gasoline Powered Trucks," Radian Corporation, June 9, 1981, Table 6-7.

Exhibits VI-2 and VI-3 provide cost-effectiveness estimates for the four HDGT I/M program options. Exhibit VI-2 addresses the scenario where current service levels are maintained. Exhibit VI-3 relates to the reduced service level scenario.

Total cost in all cases is the combined quantified net costs to motor carriers and inspection stations, and the costs to government of planning, implementing, administrating, and monitoring the program.[1] Total cost is apportioned half to HC and half to CO. It has been noted in some studies that total costs should be attributed to HC emissions exclusively.[2] This is appropriate in certain situations. For the New York case, however, significant CO hot-spot pollution problems exist which are directly addressed via the proposed HDGT I/M program. Hence, an equal portion of cost is attributed to CO abatement.

The cost per ton measures are derived by dividing half of total costs by tonnage reductions in HC and CO loads, respectively. This procedure was repeated for the four program options.

If current inspection service levels could be maintained, it would result in a lower cost per ton. Thus, a major cost burden on motor carriers would be reduced--truck downtime for testing and repair. However, to maintain current service levels assumes that inspection stations will invest in HTS equipment for a program which may be in place for as brief a period as two years.

CAVEATS, LIMITATIONS, AND FURTHER DISCUSSION OF COST-EFFECTIVENESS ESTIMATES

Developing cost-effectiveness estimates for a program with no history requires certain judgments and assumptions which influence results. This subsection discusses those elements of the study which may be classed as judgmental or backed by assumptions.

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[1] Exhibit VI-2 combines data from Exhibits IV-2, V-3, and VI-1. Exhibit VI-3 combines data from Exhibits IV-4, V-4, and VI-1.

[2] Faulkner, F. Barrett, "The Cost-Effectiveness of Vehicle Inspection and Maintenance Programs," Cambridge Systematics, January, 1982.

EXHIBIT VI-2

COST EFFECTIVENESS ESTIMATES
CURRENT SERVICE LEVELS MAINTAINED

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
TOTAL COST[1]	$10,224,532	$8,482,596	$13,422,444	$6,540,250
COST/TON HC	$ 1,835	$ 1,835	$ 2,409	$ 2,348
COST/TON CO	$ 124	$ 124	$ 162	$ 158

[1] Total cost is apportioned half to HC and half to CO to arrive at cost/ton estimates. Total cost includes $130,000 in government costs as estimated by New York State Department of Motor Vehicles and supported by information from New York State Department of Environmental Conservation.

EXHIBIT VI-3

COST EFFECTIVENESS ESTIMATES
REDUCED SERVICE LEVELS

	OPTION 1	OPTION 2	OPTION 3	OPTION 4
TOTAL COST[1]	$13,970,436	$11,611,368	$15,200,285	$7,050,218
COST/TON HC	$ 2,507	$ 2,512	$ 2,728	$ 2,531
COST/TON CO	$ 169	$ 169	$ 184	$ 170

[1] Total cost is apportioned half to HC and half to CO to arrive at cost/ton estimates. Total cost includes $130,000 in government costs as estimated by New York State Department of Motor Vehicles and supported by information from New York State Department of Environmental Conservation.

Estimates of HC and CO Reduction

The reduction in HC and CO load used in this study were taken as the recorded and reported reductions based on New York City Department of Environmental Protection work and later reworked and reported by Radian Corporation.[1] The total reductions from an HDGT I/M program are calculated by Radian and shown as 2,786 tons per year for HC and 41,369 tons per year for CO. Radian reduces these estimates by 44 percent to account for repair and deterioration factors. The repair factor relates to a judgment that repairs for the test vehicles were performed by experts, that repairs were more extensive than the typical I/M repair, and that the test fleet was dirtier. The deterioration factor relates to the diminishing effectiveness of the repairs.

This study uses total reductions because a tune-up is used as the typical repair. If reductions are overstated, costs are also overstated, meaning that a balance is struck in producing the cost-effectiveness estimates.

Unquantified Benefits

Section IV identified and discussed the benefit to motor carriers of avoiding truck downtime. This benefit may arise when I/M-related repairs or maintenance is undertaken and results in avoidance of breakdowns. This benefit was not quantified because of the lack of data for developing a probability estimate of breakdowns avoided and the resultant downtime avoided. Admittedly, by not quantifying this item, benefits to motor carriers are understated, resulting in an overstatement of the cost-effectiveness estimates.

Non-Market Benefits

The societal benefits relating to improvements in health, job productivity, esthetic improvements, and reduced medical expenditures form the basis for a program, but are not addressed in any quantitative sense. These benefits are not traded in the economy and thus dollar values cannot be conveniently attached to them. There have been efforts to attach shadow prices to certain of these benefits; however, these attempts are frequently confounded by intervening variables. For example, a neighborhood free of air, water, and noise pollution may command

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[1] Pinto, John T., "Study of Control Strategies for In-Use Heavy Duty Vehicles," New York City Department of Environmental Protection, May 1981.

Radian Corporation, "An Assessment of Emission Reduction Strategies for Heavy Duty Gasoline Powered Trucks," June 9, 1981.

higher residential rents and prices. Additionally, the neighborhood may have excellent schools, ample recreational opportunities, convenient transportation, varied shopping, etc. These additional factors confound attempts to make comparisons based solely on environmental considerations and to affix shadow prices to the values derived.

Station Participation Rates

The economic burdens imposed on motor carriers by an HDGT I/M program are related to the extent of service provided by inspection stations. If a large number of stations participate in a program it will be easier to schedule inspections, arrange for timely repairs to pass a reinspection, and perform the reinspection test. Conversely, with fewer inspection stations in the proposed program, it becomes difficult for motor carriers to schedule inspections, arrange timely repairs, and get reinspected.

The estimates of this study rely heavily on responses from station personnel. The extent of participation by stations which currently perform HDGT safety inspections but do not have an HTS analyzer is especially important in minimizing disruptions of extensions to the present HDGT inspection program.

While representatives of these stations unanimously stated that they would not purchase an analyzer in order to participate in an HDGT I/M program, deeds may be different than words. The extent of participation will ultimately depend upon the station size, client base, and business volume. For instance, a station which has 10 truck bays, six full-time mechanics, a number of fleet accounts, and over $500,000 in volume is unlikely to risk loss of business associated with non-participation in an HDGT I/M program.

Our findings from the LDV I/M program indicate that stations will participate to retain business. Customers require one-stop shopping, and will switch garages if emissions inspections cannot be provided along with regular repairs and maintenance. Unfortunately, there is no evidence at this time to infer the extent of participation in a proposed HDGT I/M program by stations which currently do HDGT safety inspections and would have to acquire an emissions analyzer.

Vehicle Downtime Associated with Inspection

A significant cost to motor carriers is the truck downtime for inspection/repair/reinspection. Experience from the LDV program indicates this downtime is minimal. It is a function of the repairs needed to pass a reinspection. In the LDV case most repairs are carburetor adjustments.

The proposed HDGT I/M program was evaluated using a tune-up as the typical repair. A tune-up was used as the typical repair because this procedure served as the basis for the estimation of reductions in HC and CO. Since a tune-up is much more complicated and time consuming than a carburetor adjustment it creates truck downtime.

Should a program be implemented, a variety of repairs will be required for failing vehicles. The average cost and time required to do the repairs will probably be less than a tune-up. Unfortunately, the reductions in HC and CO pollutants probably will be less also.

Linear Assumptions

Program Option 4 features a 20 percent failure rate. It was assumed that this option would affect a 50 percent reduction in HC and CO loads as compared to a program with a 40 percent failure rate. This assumption of linearity is admittedly tenuous.

COST-EFFECTIVENESS COMPARISONS WITH OTHER CONTROL MEASURES

This section presents summary cost-effectiveness comparisons among alternative pollution control stategies. Cost-effectiveness estimates for various pollution control strategies are provided in Exhibit VI-4. Comparisons among control strategies should be made with caution.

First, the cost-effectiveness values do not address the size of pollution reductions afforded by the various measures. Thus, a measure with a low dollar per ton may not realize significant reductions in pollutants. Additionally, untried strategies are associated with unknown costs.

Second, the cost-effectiveness values have been estimated using varied methodologies. Some estimates naturally employ more rigor than others. For example, the cost-effectiveness estimate of $372/ton of HC for the LDV I/M in New York is based on an inspection cost, repair cost, and fuel saving benefit. The LDV I/M cost-effectiveness estimate of $1,286 to $1,508/ton of HC considers the above mentioned elements and factors in driver (owner) time of taking the vehicle to the inspection stations and waiting for necessary repairs in the event of an I/M failure.

The cost-effectiveness estimates for the proposed HDGT I/M program were in the range of $1,800 to $2,700 per ton of HC reduced and $120 to $180 per ton of CO reduced. These ranges cover both scenarios, i.e., current and reduced levels of services from inspection stations, across the four program options.

EXHIBIT VI-4

COST-EFFECTIVENESS OF OTHER POLLUTION CONTROL STRATEGIES

Measure	Cost-Effectiveness (dollars/ton) HC	CO
HDGT Inspection/Maintenance in NY	1,835-2,728	124-184
LDV Inspection/Maintenance in NY[1]	372	34
LDV Inspection/Maintenance[2]	1,286-1,508	-
1981 Pass. Car Emission Stds.[3]	470	41
1984 Gas Truck Stds.[4]	253	8
Traffic Controls[5]	617	51
Transit Improvements[5]	14,599	1,382
Auto Coatings[6]	1,205	-
Fabric Coatings[6]	40	-
Bulk Plants[6,7]	net savings	-
Gas Stations[6]	327	-

Notes:

1 U.S. Environmental Protection Agency, "Update on the Cost-Effectiveness of I/M," April 1981, p. 10.

2 Cambridge Systematics, Inc., "The Cost-Effectiveness of Vehicle Emissions Inspection and Maintenance Programs," January 1982, p.7.

3 Cost of 1981 new passenger car emission standards compared to 1975 standards; Source: USEPA, "Regulatory Analysis and Environmental Impact of Final Emission Regulations for 1984 and Later Model Year Heavy Duty Engines." December 1979, p. 159.

4 Ibid., p. 6. Value shown is gasoline-powered heavy duty trucks greater than 8,500 GVW.

5 Source: 1979 SIP for Pima County, Arizona.

6 Source: "Phase I Air Quality and Economic Impacts for the New York Metro/Hartford Regional Study," Contract 13-AQ-7718, GCA Corp., Bedford, MA, October 1980, prepared for the National Commission on Air Quality. Of the 13 stationary source control measures listed in the referenced document, only the four measures shown in this paper account individually for more than 1 percent of 1987 expected emission requirements.

7 Net savings means cost of recovering emissions is less than the value of the recovered product.

These cost-effectiveness estimates relate to a program running to December 31, 1986. A program with a longer time horizon would result in declining costs which would improve the cost-effectiveness values. These declining costs would be a result of adjustments by motor carriers of operations and scheduled maintenance to ease compliance with an HDGT I/M program and increased service through incremental additions to the number of stations which participate in an inspection program.

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