CENTRALIZED I/M PROGRAM
COST CALCULATION WORKSHEET

August 1979

Centralized I/M Program
Cost Calculation Worksheet

This worksheet is designed to allow I/M program administrators to project total costs of a centralized program at early stages of planning. The factors involved in initial and annually recurring costs are systematically organized to compute an annual inspection fee which will cover all program costs for the total length of the program. Options are provided which allow this worksheet to be used for either a state-or a contractor-operated program. There is a separate package for projecting costs of a decentralized, private garage based program. Costs of separate fleet inspections as part of the I/M program are not considered in any of the worksheets. It is assumed that costs of administering such a fleet inspection program would be covered by permit fees to fleet owners.

The worksheet computations obviously depend heavily upon assumptions made by the user. Since in many cases users will not have detailed information, estimates have been provided which may be substituted to allow rough calculations. An example is worked through in the text of the instructions using those estimates. It is absolutely essential that users recognize that the suggested estimates are not intended to apply to every program. They merely provide a reasonable approximation where no better data is available, and worksheet users are expected to use their own best judgement in applying or adjusting them to their own program. Users should adapt the worksheet to meet their own program's unique structure.

To use the worksheet set, remove it as a unit from the back of this instruction package. Set the pages alongside the instructions, for easy cross-referencing as progress is made through the calculations. Flip through the pages while reading the following introductory summary. This will allow a sense of the overall organization of the worksheet and make the logic of the calculations more coherent. It is also a good idea to make several copies of the worksheet itself, particularly if users want to compare several program options or various basic assumptions for their effect on the inspection fee.

The organization of the worksheet set is as follows: First, assumptions which are basic to the cost calculations are enumerated and coded for easy reference as progress is made through the worksheet (section I.A.). From some of these assumptions, basic program parameters are calculated (I.B.). For example, the annual average auto population (AAP) is calculated on the basis of the current population (POP), the estimated annual growth rate (GRT), and the program length (PRL). This result is used as the basis for the program requirements, since provision must be made for more than the current population.

Initial costs to the program operator are then calculated (section II). Inspection facility requirements are estimated for land, construction, and personnel (II.A.), and from these requirements, costs are calculated for those and other facility investment costs (II.B.). Administrative startup costs are estimated for personnel and other elements (II.C.). Inspection facility and administrative initial costs are then organized into categories of length of depreciation period, and summed for total initial costs (II.D.).

Recurring costs are calculated in separate categories for personnel costs of central administrative staff and inspection facility staff (III.A.), and other annually recurring costs (III.B.). These are calculated on a present dollar basis.

Both initial and recurring costs to the program operator are then "annualized" to take into account inflation and interest costs (section IV.). Recurring costs are multiplied by a factor which provides for the average effect of a constant rate of inflation (IV.A.). Initial costs are amortized on the basis of the assumed depreciation periods and interest rate on borrowed capital (IV.B.). The annualized costs are summed to present total average annual cost to the program operator (IV.C.).

From this point on procedures are different for contractor-operated programs than for state-operated. For the state-operated option, the total annualized costs are divided by the annual average vehicle population, to yield the cost-covering inspection fee for the life of the program (V.A.). For the contractor-operated option, the contractor's net return must be added to the contractor's costs of operating the program (V.B.), and costs to the state for administration and monitoring of the program must also be added (section VI).

Additional costs to the state for a contractor-operated program are computed in three stages: First, the state's requirements for field personnel to monitor inspection facilities is evaluated (VI.A.). This evaluation includes both the estimate of _recurring_ annual salary costs and of initial training and hiring costs. These initial field personnel costs are added to other startup costs to yield total initial costs to the state (VI.B.). The recurring field personnel costs are added to other recurring costs to yield total recurring costs to the state (VI.C.). Initial and recurring costs to the state are then annualized and summed (VI.D.), as costs to the contractor were in section IV.

Finally, total annualized costs to the contractor and those to the state are combined, and divided by the average annual auto population (section VII), to yield the cost covering inspection fee for a contractor-operated program.

The example worked through in the instruction text is that of an imaginary city called "Smogville". The Smogville program will employ an idle mode

test and will be operated by a private contractor. Other assumptions made by the Smogville program administrators will be pointed out in the instructions.

I. PROGRAM PARAMETERS

   A. Assumptions

   1. Present Auto Population (POP): This will be a function of the geographic areas to be covered by the program and their population densities, commuting patterns relative to neighboring jurisdictions, and concentrations of vehicles subject to the inspection program. Subject vehicle classes may be defined by weight and model year ranges, or other characteristics, or by exclusion from exempt vehicle categories. The information needed to derive this figure can usually be provided by the area planning commission, highway patrol or motor vehicle authority. In Smogville, the current auto population is 750,000.

   2. Annual Auto Population Growth Rate (GRT): This can be determined over the projected life of the program by use of motor vehicle department records, census data, transportation planning data, survey information, etc. The Smogville auto population is growing at the rate of 2.6% per year.

   3. Annual Inflation Rate (INF): Economists' estimates range anywhere from 5% to 10% or more. Smogville administrators anticipate a rate of 8%.

   4. Annual Interest Rate (INT): Lending institutions typically set interest rates about 3.5% higher than the inflation rate, subject to the constraints of the market. Ten to twelve percent is a reasonable estimate at present, if area-specific information is not available. Occasionally, public projects can obtain slightly lower than commercial rates, e.g., through bond issues. "Smogtesters, Inc.," the contractor for the Smogville program, is expecting to pay a rate of 12%.

   5. Program Length (PRL): Estimates will vary for each program. The program may be set up in segments of five years if it is not clear how long the program will be required. In that case, use the length of the planning segment. Smogville is using a five-year planning segment.

   6. Annual Operating Hours (HRS): This is the number of operating hours per year for the inspection facility lanes. Eight hours daily for 250 days per year would yield 2,000 operating hours. Ten hours daily would yield 2,500 hours. The Smogville program intends to make optional use of its facilites, and will keep each lane open twelve hours per day, six days per week, for fifty weeks per year, totaling 3,600 hours per lane per year.

Centralized Lane Program: State of (Contractor) Operated

SMOGVILLE, USA

I. PROGRAM PARAMETERS

A. Assumptions

1. POP = Present Auto Population = **750,000**
2. GRT = Annual Auto Population Growth Rate (%) = **2.6 %**
3. INF = Annual Inflation Rate (%) = **7 %**
4. INT = Annual Interest Rate (%) = **12 %**
5. PRL = Program Length (yrs) = **5 YRS**
6. HRS = Annual Operating Hours = **3600 HRS**
7. Cars/hr = Hourly Lane Throughput = **12 CARS/HR**
8. STR = Stringency Factor (%) = **30 %**
9. XTR = Annual Percent Additional Tests (%) = **5 %**
10. $LAND/ft^2 = Land Acquisition Cost per square foot = **$2.50/FT²**
11. $CONS/ft^2 = Construction Costs per square foot = **$26/FT²**
12. $PAVG/ft^2 = Paving Costs per square foot = **$1/FT²**
13. Mech/1,000 = Mechanics Required per 1,000 autos = **3**
14. $MCH = Training Cost per Mechanic = **$30 EA.**
15. $IPI = Initial Public Information Costs = **$125,000 TOTAL**
16. $RPI = Recurring Public Information Costs = **$.10/AUTO**
17. $IDE = Initial Program Design, Eng. & Eval. = **$150,000 TOTAL**
18. $RDE = Recurring Program Design, Eng. & Eval. = **$0**
19. CPT = Computer Processing Cost Per Test = **$0**
20. PRT = Property Tax Rate per Full Value (contractor program only) = **3 %**

B. Parameter Calculations

1. Average Annual Auto Population = AAP

$$(POP) \times \frac{\sum\limits_{i=0}^{PRL-1} (1+GRT)^i}{PRL} = \mathbf{787,500} = AAP$$

2. Average Annual Tests Performed = TST

$$AAP\ (1 + STR + XTR) = \mathbf{1,063,125} = TST$$

3. Annual Lane Capacity = CAP

$$HRS \times Cars/hr = \mathbf{43,200} = CAP$$

4. Total Test Lanes Required = LAN

$$\frac{TST}{CAP} = \mathbf{25} = LAN$$

(I.A., cont.)

7. **Hourly Lane Throughput (Cars/hr.)**: Factors to be taken
into account in projecting the number of autos each lane can
inspect per hour include test mode employed (loaded vs. idle,
use of tachometer, parameter or safety inspection, etc.), data
handling techniques (automated vs. manual, etc.), ineffi-
ciencies of scheduling, personnel, weather, mechanical diffi-
culties, and so forth. Table 1 suggests hourly lane through-
puts for three general test formats, including ranges of
efficiency. Smogville planners expect a throughput of around
12 cars per hour.

Table 1

Vehicle Throughput (Cars per hour) by Program Format

Program Format	Optimal Throughput	Efficiency	Projected Throughput
State/City - operated idle- mode test using tachometer	20-25	50-63%	10-16
State/City - operated idle mode test with safety inspection no tachometer	30-36	50-64%	15-23
Contractor - operated loaded mode test	20-22	61-65%	12-14

8. **Stringency Factor (STR)**: The stringency factor to be
applied is derived from EPA's MOBILE1 program for calculating
program benefits. It corresponds to the percent of autos that
would be expected to fail the emissions criteria if there were
no I/M program. In Smogville the stringency factor is set for
30%.

9. **Annual Percent Additional Tests (XTR)**: In addition to
first-time failures (projected by stringency factor), extra
tests will be run for second-time failures, change-of-owner-
ship situations, free retests, post-repair checkups, etc.
Smogville projects that this will amount to about 5% of the
vehicle population.

10. **Land Acquisition Costs per Square Foot ($LAND/ft^2)**: Land
acquisition costs vary widely from locale to locale. Local
estimates should be obtained including possibilities of leasing
site acreage. Table 2 gives an idea of the variation in land

(I.A., cont.)

costs among several existing programs and proposals. Ob-
viously, where program operators can utilize land they already
own or can convert existing facilities, these costs will be
much lower. In Smogville, Smogtesters Inc. will be able to
purchase commercial land at $2.50 per square foot.

Table 2

Price Variation in Land Acquisition Costs

Location	Year	Cost per Square Foot
Chicago	1974	$4.00
Denver	1974-75	$2.00-3.00
Portland	1975	$2.75
New Jersey	1975	$1.00-9.00
Cincinnati	1976	$0.92
St. Louis	1976	$1.00-30.00
Kansas	1978	$3.15
Iowa	1978	$0.93
Nebraska	1978	$0.81

11. Construction Costs per Square Foot (CONS/ft^2): Construc-
tion of testing facilites should include office, storage and
lab areas, and should account for possible expansion of
facilities or changes in test mode. Specifications considered
should include:

Steel Frame   Overhead Doors   Forced Air MVAC
Concrete Floor   Painted Walls   Underfloor and Roof
Finished Office   Small Restrooms   Exhaust System

Estimates of construction costs range around $26 - $35 per
square foot. Again, use of existing facilites will lower
these costs. In Smogville, such construction can be performed
for $26 per square foot.

12. Paving Costs per Square Foot ($PAVG/ft^2): Present estimates
range around $1.00 per square foot. Smogville will use this
estimate.

13. Mechanics Required per 1,000 Autos (Mech/1,000): Estimates
range from 2-6 mechanics required per 1,000 autos. These are
private mechanics who will perform emissions-related repairs
on vehicles failing the inspection. Smogville anticipates the
need of 3 mechanics for every 1,000 autos.

14. Training Cost per Mechanic ($MCH): Current estimates
suggest a range of about $15-20 for supplies, teaching equip-
ment and instructor salary for an 8-10 hour course, and admin-
istration of the examination and certification process by the

(I.A.14, cont.)

state. It would not include mechanics' wages for the period
of the course. In programs where mechanic training costs are
not completely paid by the state, this figure should include
only that part paid by the state. Smogville planners are
considering a more extensive course, to be sponsored by the
state, at $30 per mechanic.

15. Initial Public Information Costs ($IPI): These may include
expenditures for testing clinics or demonstrations, media
spots, mailings, advertisements, literature, workshops, contact
with public interest groups and officials, and so on. Some
consultants have suggested that this may amount to up to $.29
per vehicle, although most existing programs allocate quite a
bit less to public information. Still, public information
continues to gain greater credit for its role in enabling
programs to succeed. Many planners would prefer to budget
this item as a lump sum rather than as a per-auto cost.
Either format is usable for the worksheet. Smogville planners
prefer to budget a lump sum of $125,000.

16. Recurring Public Information Costs ($RPI): Public Infor-
mation efforts should be maintained throughout the program,
including several of the items listed above, such as mailings
and advertisements. To some extent it may be possible to
minimize these costs by, for example, including I/M program
information in other motor vehicle department mailings. Some
consultants have suggested $.10 per vehicle annually; and
again this is more than considered necessary by most currently
operating programs. Once more, this assumption can be listed
either as a per-vehicle cost or as a recurring lump sum cost,
which may be calculated as, say, a fraction of initial public
information costs. Smogville planners conceive this cost in
the range of $.10 per auto.

17. Inital Program Design, Engineering and Evaluation ($IDE):
This item accounts for functions beyond those of the normal
administrative staff, which are handled elsewhere in the
worksheet. Such functions as research and development,
program planning, system design and analysis, etc., are often
contracted or subcontracted out to a separate firm, or can be
performed by a small auxiliary or temporary staff. This item
may also include software development. On a per vehicle
basis, $.15 to $.25 is suggested for this item. Smogville
planners prefer to consider this as a lump sum, and are
budgeting $150,000 for this purpose.

18. Recurring Program Design, Engineering and Evaluation ($RDE):
This is the extension and updating of initial program design
functions and evaluation performed beyond the scope of the

(I.A.18, cont.)

regular administrative staff. Some programs will prefer to
simply incorporate this item with normal staff functions.
Smogville is taking this approach and budgeting no funds
separately for this function. Other programs will want to
maintain a small extra engineering and evaluation project, and
an estimated cost for this is about $.05 to $.08 per auto.
(Can also be projected as a lump sum).

19. Computer Processing Cost per Test (CPT): This cost category
is provided for situations where costs of software development
and revision, data storage and retrieval, and computer time
are not accounted for separately. For example, if a program
does not purchase its own complete data processing system,
(costs of which are handled elsewhere), this item could account
for fees to a commercial timesharing system. In other cases
costs of computer processing of test results may be distri-
buted among normal duties for the administrative data analysis,
statistical, and clerical staffs, and software development may
be considered part of initial program design. The worksheet
is designed so that any of these planning concepts may be
applied. Smogville planners believe that computer processing
costs are accounted for in other planning categories and are
budgeting no separate funds for this. $.05 to $.15 per test
is estimated for other situations, with costs varying as a
function of the sophistication of the data processing program.

20. Property Tax Rate per Full Value (PRT): This assumption
is necessary only for a contractor-operated program. Property
tax rates generally range from 2% to 4%, sometimes reaching as
high as 5%, of full value of land, improvements and capital
installations. The best information on rates, of course, is
obtainable from the local tax assessor. Keep in mind that the
rate is often fixed for a less than full-value assessment, in
which case the full-value rate is to be derived by taking the
proportion of the millage rate equivalent to the assessed
proportion of full value. Smogville tax rates are 6% of
assessed value, with assessment at 50% of full value. This
yields a full-value rate of 3%.

B. Parameter Calculations

1. Average Annual Auto Population (AAP): The average annual
population, rather than the maximum, is used as the basis for
requirements calculations for a given planning segment. This
will minimize both underutilization and overutilization of
facilities. The function shown on the worksheet yields the

. (I.B.1, cont.)

average annual population by computing the populations for each year of the program, and dividing the sum by the length of the program planning segment. Over-utilization is the conservative approach.

2. **Average Annual Tests Performed (TST)**: This function adds retest rates to the average annual population, to project the average number of tests to be performed annually. Actually this number may slightly overestimate, since in later years auto owners may adjust to more regular maintenance and fail less frequently. However, this effect is unpredictable, and in any event only signifies less over-utilization of facilities in the later years of the planning segment.

3. **Annual Lane Capacity (CAP)**: The hourly throughput rate, times the operating hours per year, yields the annual capacity of each inspection lane.

4. **Total Test Lanes Required (LAN)**: Divide the annual number of tests by the capacity of each lane, to find the total number of inspection lanes required. If test vans or mobile facilities are to be used, simply include these under the category of test lanes for the time being. Since the cost and usage of such facilities varies so widely, this worksheet does not attempt to handle them directly. However, it can be adjusted for that purpose. For example, the Smogville program will use two such mobile vans, each with that capacity of about half that of a normal stationary lane. Thus the Smog-ville requirement is 25 lanes, which will consist of 24 stationary lanes and 2 x 1/2 = 1 mobile lane.

II. INITIAL COSTS TO PROGRAM OPERATOR

A. Estimates of Facility Requirements

1. **Facility Square Footage Requirements**: The table presented provides spaces for listing estimates of square footage requirements for land, office and storage space, the inspection lanes themselves, and external paving. The table is set up for easy computation using an "a(x) + b" formula, where "x" is the number of lanes in a facility, "a" is the amount of square footage in a certain category needed for each lane in the facility, and "b" is a basic square footage requirement needed for each facility, independent of the number of lanes. For construction of dhe inspection lanes themselves, obviously, there is only a per-lane requirement, and no basic facility requirement.

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II. INITIAL COSTS TO PROGRAM OPERATOR

A. Estimates of Facility Requirements

1. Facility Square Footage Requirements

Test Mode	LAND		LANES	OFFICE, ETC.		PAVING	
	Basic per Facility	Additional per Lane	(per Lane)	Basic per Facility	Additional per Lane	Basic per Facility	Additional per Lane
IDLE	10000 ft^2	2000 ft^2	500 ft^2	500 ft^2	100 ft^2	5000 ft^2	1000 ft^2
LOADED	ft^2						

2. Allocation of Lanes and Square Footage Requirements

Lanes per Facility	Mode	# Facilities This Size/Mode	Total Lanes	LAND Each Facility	Total	LANES Each Facility	Total	OFFICE, ETC Each Facility	Total	PAVING Each Facility	Total
2	I	8	16	14000	112000	1000	8000	700	5600	7000	56000
4	I	2	8	18000	36000	2000	4000	900	1800	9000	18000
½	I	2 (MOBILE VANS)	1								
TOTAL		FAC = 10 +1 MOBILE / 11	LAN = 25	LND = 148000		LNS = 12000		OFC = 7400		PVG = 74000	

3. Inspection Facility Personnel Hiring and Training Requirements (REMEMBER 72 HR WORK WEEK)

Position	Facility Requirement	Annual Salary	Duration of Instruction	Direct Costs of Instruction per Trainee	Total Training Cost	Hiring Costs per Employee	Total Training plus Hiring
Station Manager	1 per facility	19263	160 HRS	$400	1882	$25	$1907
Asst. Station Manager	.75 1 per facility or per lane	15920	120	400	1318	25	1343
Inspection Technicians	5.5 per Idle Mode lane	13014	80	400	1150	25	1175
	___ per Loaded Mode lane						
Clerks	.75 per lane	10507	20	80	181	25	206

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(II.A.1, cont.)

Thus, given the estimates shown for the Smogville program, a typical two facility requires (2,000) x (2) + (10,000) = 14,000 square feet of total land. Of this space, (500) x (2) = 1,000 square feet for test lanes, plus (100) x (2) + (500) = 700 square feet for office space, etc., is allocated to construction. Another (1,000) x (2) + (5,000) = 7,000 square feet is allocated to external paving for queuing area, employee parking, etc. The remaining 5300 square feet is allocated to landscaping. A minimum of 5% of the total land must be landscaped for Smogville.

In programs where loaded and idle facilities are both used, planners may want to use different requirement estimates for each mode. Space is provided in the table for such use.

2. <u>Allocation of Lanes and Square Footage Estimates</u>: The table presented in the worksheet is designed to allocate and compute the total square footage requirements in each category among the various size facilities to be built in the program. First, at the bottom of the column marked "Total Lanes", write the number derived in section I.B. (LAN) for the total lanes required. In the first column, list various facility sizes which might be used for the program. Allocate the total number of lanes among the various size facilities. Then add to find the total number of facilities (FAC). In the Smogville program, 25 lanes will be distributed among two- and four-lane facilities, and the mobile vans will count for 1/2 lane apiece. For purposes of other (e.g., personnel) calculations they will also be counted as half-facilities. Thus there are 10 full facilities, plus 2 half-facilities for a total of 11.

Obviously, there are no land and construction square footage requirements for the mobile vans. For each size of stationary facility, the square footage requirements can be found by applying the "a (x) + b" formula from the previous section. Multiply the results for each facility size by the number which will be that size, and enter the totals for all sizes for each category on the bottom line.

3. <u>Inspection Facility Personnel Hiring and Training Requirements</u>: In this table estimates are made of the number, types and costs of personnel needed to operate the inspection facilities. Four basic personnel categories are suggested, for simplicity of calculation. Since Smogville stations will be open 72 hours per week, facility requirements for assistant station managers and inspection technicians are slightly padded. Personnel requirements that will vary with the size of the facility are estimated on a per-lane basis, and fractional estimates can be used to indicate overlapping or part-time scheduling.

(II.A.3, cont.)

In the Smogville program, direct costs of personnel instruction include course materials, overhead and instructors' fees. Costs of the students' time at their hourly wage rate is added to these costs to arrive at total training costs. Smogville planners have chosen to estimate needs for assistant station managers as a function of facility size, rather than merely have one per facility.

B. Calculation of Facility Investment Costs

1. Construction and Land Acquisition Costs:

    a. Multiply the total square footage requirement for (from II.A.2.) by the assumed cost per square foot (from I.A.), to yield total land acquisition cost.

    b. Repeat step a. for paving costs.

    c. The total construction square footage requirement will be the sum of lane construction and office space construction (from II.A.2.). Multiply this sum by the assumed cost per square foot (from I.A.) to yield total construction costs.

    d. Building costs consist of the sum of paving and construction costs. This item is distinguished because its depreciation period will differ from both that of land and that of other initial investments.

2. Inspection Facility Personnel Hiring and Training Costs:

    a. Multiply the total training and hiring cost per employee for station managers, taken from section II.A.3., by the number of facilities (assuming one station manager per facility). For the Smogville program, each mobile lab is counted as 1/2 facility for purposes of this calculation.

    b. Repeat step a. for assistant station managers. Notice that for the Smogville program, however, the number of assistant station managers was made a function of the number of lanes. Therefore, a per-lane requirement is multiplied by the number of lanes as determined in II.A.2., with each mobile van counting as 1/2 lane.

    c. Some programs may mix test modes, and hiring and training costs or requirements may be different for the two modes. Spaces are provided for calculating inspection technician costs separately for the two modes. Otherwise, simply multiply the costs per employee, by the number of

B. Calculation of Facility Investment Costs

1. Construction and Land Acquisition Costs

748000×2.5

a. Land Acquisition = $LANDACQ = LND x $LAND/ft^2 = 370,000

74000×1

b. Paving = $PAVING = PVG x $PAVG/ft^2 = 74,000

(7400 + 12000)×26

c. Construction = $CONSTR = (OFC+LNS) x $CONS/ft^2 = 504,400

d. Total Building = $BUILDING = $PAVING + $ CONSTR = 948,400

2. Inspection Facility Personnel Hiring and Training Costs

a. Station Managers:
$ 1907 x FAC (11) = 20,977

b. Assistant Station Managers:
$ _____ x FAC = _____
or $1343 x .75 x LAN(25) = 25,181

c. Inspection Technicians:
$ 1175 x 5.5 x LAN [IDLE] = 161,562
$ _____ x _____ x LAN [LOADED] = _____

d. Clerks: $ 206 x .75 x LAN = 3862

e. TOTAL INSPECTION FACILITY PERSONNEL
HIRING & TRAINING = FIELDPERS = 211,582

3. Facility Preparation and Equipment Costs

Per (Category)	Number	Site Preparation Each	Site Preparation Total	Test Equipment Each	Test Equipment Total	Office & Other Equipmt. Each	Office & Other Equipmt. Total	Data Processing Equipmt. Each	Data Processing Equipmt. Total	TOTAL
Facility	10 STAT	5000	50000	3000	30000	2500	25000	15000	150,000	255000
Loaded Lane										
Idle Lane	24 STAT	500	12000	4000	96000	200	4800	5000	120,000	232,800
Central Office				VANS @ 30000 ea	60000		150000	150000	210,000
TOTAL			62000		126000		84800		420000	$EQUIP = 692,800

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(II.B.2,c, cont.)

employees per lane, by the total number of lanes for that
mode. Again, Smogville planners count mobile vans as 1/2
lane each.

d. Repeat for clerks. The per lane requirement and per
clerk costs will probably be the same regardless of mode.

e. Sum a. through d. to yield total initial hiring and
training costs for inspection facility personnel.
Remember that the number of employees per lane was increased
(padded) to handle a 72 hour work week.

3. Facility Preparation and Equipment Costs: The table shown
in the worksheet allows for both the listing of assumptions
and the computation of total costs for all inspection facility
investment costs beyond land acquisition, construction, and
personnel. The table is set up on a principle similar to that
of section II.A.2. (for square footage allocation). For each
category there is a basic cost assigned per facility independent
of the number of lanes, and an additional cost per lane to
account for the size of the facility. Other costs not covered
elsewhere in the worksheet may be considered in this table as
Central Office costs.

In the Smogville program, for example, most facility prepara-
tion and equipment costs will apply only to the stationary
facilities, and the mobile vans will be considered separately.
Site preparation costs will include landscaping, hookup of
utilities, etc. Test equipment will include analyzers,
calibration gases, probes, etc., and backup equipment. Under
the category "other equipment", the Smogville program will
list the purchase and outfitting costs of the four mobile
vans. Office equipment for the central administrative staff
will be listed under personnel costs as overhead, although it
could be listed here instead. Data processing equipment will
include terminals for each of the lanes, storage and retrieval
equipment for each facility, and a main central processing
setup, listed under central office provisions.

The total of these costs can be summed by cost category to
simplify an analysis of costs by category. Or all costs per
facility can be summed, that number multiplied by the number
of facilities, and the product added to all per-lane and per
central office costs, to simplify calculation.

C. Start-up Administrative Costs

1. Start-up Personnel: This is the staff that will initially
plan and set up the program. Since planning and set up may
last more or less than one year, personnel requirements are
stated in person-years.

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C. Start-Up Administrative Costs

1. Start-Up Personnel

Position Area	Prs-Yrs	Cost
Program Administrators	1	32442
Technical Officers	2	38526
Data Analysis/Statistical Staff	2	31840
Clerical and Secretarial Staff	1	8366
SUBTOTAL		111174
Overhead, Fringe and Contingency (100%)		111174
TOTAL =	$CSP =	222.348

2. Calculation of Start-Up Administrative Costs

a. Start-up Personnel = $CSP = 222,348

b. Initial Public Information = $IPI

~~or = $IPI x POP~~ = 125000

c. Initial Program Design, Eng. and Eval.
= $IDE

~~or = $IDE x POP~~ = 150 000

d. Mechanic Training (<u>State Operated Program Only</u>)

$$\text{Mech/1,000} \times \frac{POP}{1,000} \times \$MCH = —$$

e. Total Start-up Administrative Costs = 497348

= $ADMIN

D. Total Initial Costs to Program Operator

1. Land Acquisition = $LANDACQ = 370 000 (No Depreciation)

= 748 400 (Depreciation over 20 years)

2. Total Building = $BUILDING

3. Field Personnel Training and
   Hiring = $FIELDPERS = 211 582

4. Facility Preparation and
   Equipment = $EQUIP = 697 800

5. Total Start-up Administrative Costs = $ADMIN = 497 348

6. SUBTOTAL
   $FIELDPERS + $EQUIP + $ADMIN = $STARTUP = 1,406,730 (Depreciation over life of Program)

7. Total Initial Costs
   = $LANDACQ + $BUILDING + $STARTUP = 2,725,130

-15-

(II.C.,cont.)

2. <u>Calculation of Start-up Administrative Costs</u>: These will include all costs which are not facility investment costs.

    a. Take the total figure for central administrative start-up staff from the previous section, II.C.1.

    b. Enter the total cost for initial program design, engineering and evaluation. If this was listed as a lump-sum assumption in I.A., enter that. If it was listed as a per-vehicle assumption, multiply that by the present auto population (POP), and enter the product.

    c. Repeat step b. for initial public information costs.

    d. This item is for a state-operated program only. For a contractor-operated program, this cost will be computed in a separate section for costs to the state, rather than in this section. The number of mechanics needed per thousand autos (Mech/1,000) is multiplied by the number of thousands in the population. Multiplying by the training cost per mechanic ($MCH) yields the total initial cost of the mechanics' training program.

    e. Total a,b and c for a contractor-operated program, or a-d for a state-operated program, for total start-up administrative costs to the program operator.

D. <u>Total Initial Costs to Program Operator</u>

1. Insert Land acquisition costs from II.B.1.a. These can be said to retain full salvage value at the end of the program.

2. Insert building costs from II.B.1.d. These can reasonably be said to depreciate over a period of 20 years.

3. Insert inspection personnel hiring and training costs from II.B.2.e.

4. Insert facility preparation and equipment costs from II.B.3.

5. Insert total administrative start-up costs from II.C.2.e.

6. Add 3, 4, and 5. This sum represents costs that can reasonably be depreciated over five years or, alternatively, the length of the program planning segment.

(II.D., cont.)

7. Total initial costs to the program operator can be obtained by adding 1, 2 and 6.

III. RECURRING COSTS TO PROGRAM OPERATOR

A. Personnel Costs

1. Central Administrative Staff: This is the group coordinating and overseeing the entire program operation. Worksheet users should adapt the table presented to their own conception of the needed administrative staff structure.

2. Inspection Facility Operating Staff: These calculations are made on the basis of estimates made in the table for inspection personnel requirements, section II.A.3. As in calculations for hiring and training costs of these personnel, the Smogville program is introducing a per-lane requirement for assistant station managers. Insert annual salary figures where training and hiring costs had been used in computing start-up costs. Overhead and fringe benefits are calculated at a smaller percentage than for central administrative staff for the Smogville program, because housing is not so elaborate at inspection facilities and because office equipment for the facilities is accounted for separately.

B. Miscellaneous/Total Recurring Costs

1. Support Services to Facilities: These costs may include janitorial service, heating, electricity, linen and so forth, if they are not otherwise covered under overhead costs or equipment maintenance. They may be calculated using the familiar format of a basic figure per facility, independent of the number of lanes, plus a marginal factor for each lane in the facility. In the Smogville program, planners considered these costs to be handled under the categories of overhead and equipment maintenance (see III.B.4.,), and therefore no cost is listed here.

2. Travel: Smogville planners consider that to maintain communication and efficient management, and to transport supplies between the central office and the facilities, it will be necessary to travel approximately 1500 miles per year for each facility. At $.20 per mile, this is projected to cost $300 per facility, including the mobile vans for the Smogville programs.

3. Public Information: List a lump sum as estimated in the assumptions, or multiply a per-vehicle assumption by the annual average auto population (AAP) for recurring public information costs.

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III. RECURRING COSTS TO PROGRAM OPERATOR

A. Personnel Costs

1. Central Operating Staff

Position Area	Number	Cost
Program Administrators	1	32442
Technical Officers	2	38526
Data Analysis/Statistical Staff	2	47760
Clerical and Secretarial Staff	3	25098
SUBTOTAL		143826
Overhead, Fringe and Contingency (100 %)		143826
TOTAL = $CSTAFF		= 287652

2. Inspection Facility Operating Staff

a. Station Managers: $ **19263** x FAC (**11**) = **211,893**

b. Assistant Station Managers: $ _____ x FAC

   or $ **15920** x **.75** x LAN (**25**) = **298,500**

c. Inspection Technicians:

   $ **13014** x (**5.5** x LAN [IDLE] (**25**)

   + **0** x LAN [LOADED]) = **1,789,425**

d. Clerks: $ **10507** x **.75** x LAN (**25**) = **197,006**

e. SUBTOTAL = **2,496,824**

f. Overhead and Fringe Benefits (**50** %) = **1,248,412**

g. TOTAL INSPECTION FACILITY OPERATING STAFF = **3,745,236**

= $FSTAFF

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B. Miscellaneous Total Recurring Costs

IV. ANNUALIZED COSTS TO PROGRAM OPERATOR

A. Average Recurring Costs

Accounting for Inflation

1. Support Services to Facilities

$ _____ basic per facility

$ _____ additional per lane

For each item, take:

$$ \text{ITEM} \quad x \quad \frac{\sum\limits_{i=0}^{PRL-1} (1 + INF)^i}{PRL} \quad \} \ 1.15 $$

TOTAL SUPPORT SERVICES = _____ = $SUPT → _____ = $SUPT$_i$

2. Travel

$ __3̶0̶0̶__ per facility (11) = __3300__ = $TRAV → _____ = $TRAV$_i$

3. Public Information

$RPI

or $RPI x AAP .1 x 785500 = __78750__ = $APUB → _____ = $APUB$_i$

4. Equipment Maintenance

20 % x $EQUIP (697800) = __139560__ = $MAINT → _____ = $MAINT$_i$

5. Annual Program Design,

Engineering and Evaluation = __∅__ = ADESG → _____ = $ADESG$_i$

$RDE

or $RDE x AAP

6. Computer Processing of Tests

CPT x TST = __∅__ = $CMPR → _____ = $CMPR$_i$

7. Insurance Costs (where applicable)

$ __1500__ x LAN + __1000__ x FAC = __48500__ = $INS → _____ = INS_i$

8. Personnel Costs

$CSTAFF + $FSTAFF = __4,032,888__ = $STAFF → _____ = $STAFF$_i$

9. Additional Mechanic Training (State Operated Program Only)

Mech/1,000 x $\frac{AAP-POP}{1,000}$ x $MCH = __∅__ = $AMT → _____ = AMT_i$

10. Property Taxes (Contractor Operated Program Only)

3% PRT x ($BUILDING+$LANDACQ+$EQUIP) = __60486__ = $TAX → _____ = TAX_i$

3% (945700+370000+697800)

11. Total

Recurring Costs = __4363,484__ x 1.15 = __5,018,006__ = $RECUR$_i$

$RECUR →

(Does Not Include Amortization of Initial Costs)

(III.B., cont.)

4. Equipment Maintenance: Recurring equipment maintenance costs are estimated as a percentage of initial equipment costs. Costs of upkeep on landscaping and mobile vans, data processing equipment and so forth are all considered in a single percentage in the Smogville program. 20% is taken of the total initial expenditure derived in section II.B.3.

5. Recurring Program Design, Engineering and Evaluation: Determine these as for public information costs. In the Smogville program, administrators considered these costs to be covered elsewhere in the worksheet.

6. Computer Processing of Test Results: Multiply the assumed cost per test by the annual average number of tests, as determined in section I.B.2. In the Smogville program, these costs are covered under equipment costs and regular staff functions.

7. Insurance Costs: This cost will apply to all contractor-operated programs, but only to those state-operated programs where states are not self-insuring. Insurance costs themselves vary in a manner too complex to be thoroughly represented in a simple worksheet. Elements to be taken into account would include construction materials, location, equipment utilized, and operating hours of the facilities. In the worksheet, this is all reduced to a simple function including a basic factor per facility, independent of the number of lanes, and an additional factor for each lane in the facilities. In the Smogville program, these are estimated at $1,000 per facility and $1500 per lane.

8. Personnel Costs: Insert the recurring costs for personnel, overhead and fringe benefits as determined in section III.A. This includes the total of both central administrative staff and inspection facility staff.

9. Additional Mechanic Training: This item applies to a state-operated program only. The difference between the average annual population (AAP) and the original population (POP) gives the amount of annual increase in the population. Additional mechanics need to be trained to cover this increase, and the cost of training them is found by applying the same formula as for initial training costs: i.e., multiply the per-1,000 auto requirement by the number of thousands of new autos, by the training cost per mechanic.

In some programs recurring costs of mechanic training will include refresher courses for mechanics who have already received special training. Worksheet users must add such costs at their own discretion. In contractor-operated programs, costs of mechanic training are included later under costs to the state (unless the contractor administers the mechanic training program).

(III.B., cont.)

10. Property Taxes: This item applies to a contractor-operated program only. The property tax rate as listed in the assumptions applies only to land, buildings, equipment, and other site improvements. Take these figures from section II.D., lines 1,2, and 4 only. Multiply the sum by the assumed rate per full value.

11. Total Recurring Costs: Sum all of 1-10 above which are applicable to the program in question. This figure represents the present-dollar value of yearly program operating costs, once the initial capital investment is in place.

IV. ANNUALIZED COSTS TO PROGRAM OPERATOR

A. Average Recurring Costs Accounting for Inflation

The formula shown calculates a factor representing the average annual cost differential due to inflation. At a rate of 7%, the Smogville assumption, this factor would be 1.15. For simplicity of calculation, merely multiply this factor by the total arrived at in section III.B., line 11. If the worksheet will be used for more sophisticated analyses of cost elements and their proportion of the inspection fee, multiply this factor by each of the items listed in section III.B. individually.

B. Amortization of Initial Costs

General Formula

The general formula presented consists of a series of equations, broken up so that the computations being made are transparent to the worksheet user. Through this formula, an average annual payment is derived taking into account depreciation, interest, salvage value, and inflation, for each of three items distinguished by their depreciation schedule in section II.D. (i.e., $LANDACQ, $BUILDING, and $STARTUP).

1. The first equation computes a cost item's salvage value at the end of the program, as a proportion of the original cost. The proportion used is that fraction of the item's depreciation period used up over the course of the program.

2. The second equation computes the present discounted value of the item's salvage value at the end of the program. The salvage value is divided by the interest factor compounded over the length of the program.

3. The original value of the item, less the present discounted salvage value, is the current value of the principle to be paid off over the length of the program.

Snobville

B. Amortization of Initial Costs

General Formula

1. DEPR = Depreciation Period of Item

$$\$ITEM \times \frac{DEPR-PRL}{DEPR} = VAE \quad \text{(Value of Item Remaining at end of Program)}$$

2. $$\frac{VAE}{(1+INT)^{PRL}} = PDV \quad \text{(Present Discounted Value of Item Remaining at end of Program)}$$

1.76

3. $\$ITEM - PDV = PRIN$ (Value of Principle to be Paid off Over Length of Program)

.12 × 1.76

4. $$PRIN \times \frac{INT(1 + INT)^{PRL}}{(1+INT)^{PRL} - 1} = \$PMT_{(Item)} \quad \text{(Annual Payment of Initial Loan (Item) Plus Interest)}$$

1.76 - 1

(NOTE: Interest Rate Already Accounts for Inflation)

Calculation for Specific Initial Cost Elements

1. Land Acquisition:

   370000

   No Depreciation; VAE = $LANDACQ

   $\$PMT_{(Landacq)}$ = *44,736*

2. Building: *948400*

   DEPR = 20 Years

   $\$PMT_{(Building)}$ = *152,390*

3. Other Startup *1,406,730*

   DEPR = PRL; VAE = 0; PRIN = $STARTUP

   $\$PMT_{(Startup)}$ = *393,884*

4. Total Annual Payment Plus Interest For Initial Costs = *591,010*

   = $PAYMENT

C. Total Annualized Costs to Program Operator

$RECUR + $PAYMENT = *5,609,016* = $ANNUAL

V. DISTINGUISHING STATE FROM CONTRACTOR OPERATED PROGRAM

A. State Operated Program

Inspection Fee = $\dfrac{\$ANNUAL}{AAP}$ = *N/A*

B. Contractor Operated Program

1. Total Annualized Costs to Contractor

   = $ANNUAL *-5,609,016*

2. Contractor's Net Return = *10* % *560,902*

3. Total Annualized Contractor's Program Costs = $CON *6,169,418*

   = $CONTR

$\dfrac{\$CONTR}{AAP} = 7.83$

(IV.B., cont.)

4. Multiplying the principle value by the factor given
yields the annual payment of principle and interest.

Calculations for Specific Initial Cost Elements

1. Land Acquisition: It is usually assumed that land does
not depreciate in value. The salvage value of the land at the
end of the program would therefore be equal to the original
cost (aside from the inflation factor, accounted for in the
second equation). "$LANDACQ" (from section II.D., line 1) can
thus be directly substituted for "VAE" in equation 2, eliminating
equation 1. In this case, the entire formula collapses into
simply "$LANDACQ x INT".

2. Building: Twenty years is traditionally assumed as the
depreciation period for buildings, although any depreciation
period may be substituted for "DEPR" in equation 1 of the
formula. For the Smogville program, a five year program
planning segment and twenty year depreciation period implies
that the salvage value of buildings ($BUILDING, from section
II.D., line 2) is 75% of initial costs.

3. Other Startup Costs: In the Smogville program, it is
assumed that all other startup costs (including startup admin-
istrative costs and inspection facility site preparation,
equipment, and personnel hiring and training costs) completely
depreciate over the five-year length of the program planning
segment. This implies that the present discounted salvage
value of these items at the end of the program is $0. "$START-
UP" from section II.D., line 6, can therefore be directly
substituted for "PRIN" in equation 4.

4. The sum of the annual payments for each of the three items
listed is the annualized payment of initial costs, including
interest.

C. Total Annualized Costs to Program Operator

Add the annualized recurring costs (from IV.A.) to the annual-
ized initial costs (from IV.B.), for total annualized costs to
the program operator.

V. DISTINGUISHING STATE FROM CONTRACTOR-OPERATED PROGRAMS

A. State-Operated Program

The total annual inspection fee to motorists can now be deter-
mined for a state-operated program. Divide the total annual-
ized costs from section IV.C. by the average annual auto

(V.A., cont.)

population (AAP) from section I.B., line 1.

B. Contractor-Operated Program

The annual net return to the contractor can now be determined
for a contractor-operated program. For the Smogville program,
Smogtesters, Inc., will receive a net return of 10% on the
total annualized costs determined in IV.C. 7% to 12% is
usually considered an equitable range for returns on such
contracts.

The worksheet user can determine at this point the part of the
inspection fee attributable to the contractor's operations, by
dividing the total annualized costs plus return to contractor,
by the annual average auto population.

VI. PROGRAM COSTS TO THE STATE (CONTRACTOR-OPERATED PROGRAM ONLY)

A. Inspection Facility Monitor Requirements

The table presented in the worksheet outlines requirements for
both initial and recurring costs, for state employees monitor-
ing the day to day operation of the contractor's inspection
facilities. Such monitoring will be necessary to guarantee
proper quality control and execution of the public trust. In
the Smogville program, the state plans to assign each monitor
responsibility for about four inspection facilities, and one
more will monitor all four of the mobile vans.

As in the table for training and hiring requirements for in-
spection facility personnel in section II.A.3., direct costs
of personnel instruction include course materials, overhead
and instructors' fees. Costs of the students' time at their
hourly wage rate is added to these costs to arrive at total
training costs.

B. Initial Costs to the State

1. Central Administrative Personnel: The state must oversee
and reinforce many functions covered by the contractor's
administrative staff, to safeguard the public trust and pro-
vide liason with other state offices. As for the contractor's
start-up administrative staff, requirements are stated in
person-years, since planning and set-up may last more or less
than a full year.

2. Total Initial Costs to the State:

a. The total program-wide costs of training and hiring
of inspection facility monitors, from section VI.A., is
inserted.

VI. PROGRAM COSTS TO STATE (Contractor Operated Program Only).

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A. Inspection Facility Monitor Requirements

	Facility Requirement	Annual Salary	Duration of Instruction	Direct Cost of Instruction	Total Training Costs	Hiring Costs	Total Training plus Hiring
Individual basis	.25 per facility	15920	80 HRS	$400	$1012	$25	$1037
Program Total	.25 x FAC = 3	47760 = $FMS					$3111 = $FTRN

B. Initial Costs

1. Central Administrative Personnel

Position Area	Prs-Yrs	Cost
Program Administrators	1	32442
Technical Officers	1	23087
Data Analysis/Statistical Staff	-	
Clerical and Secretarial Staff	1	13014
SUBTOTAL		68543
Overhead, Fringe and Contingency (50 %)		34271
TOTAL $CAPIN =		102814

2. Total Initial Costs to State

a. Inspection Facility Monitor Training and Hiring

= $FTRN = _1037_

b. Central Administrative Personnel

= $CAPIN = 102814

c. Initial Private Mechanic Training

$$\text{Mech}/1,000 \times \frac{POP}{1,000} \times \$MCH$$

$3 \times 750 \times 30$

= 67500

d. Total Initial Costs to State

= 171351

= $STIN

(VI.B.2, cont.)

b. Insert the total cost for the initial central administrative personnel from Section VI.B.1.

c. The cost to the state for initial training of private mechanics is inserted here (rather than in section II.C.2., as it would be for a state-operated program). Multiply the number of mechanics needed per thousand autos, by the number of thousands in the population, by the training cost per mechanic, to yield the total initial cost of the mechanics' training program.

d. Total a through c to yield the total initial costs of the program to the state.

C. Recurring Costs to the State

1. Central Administrative Personnel: In the Smogville plan, it is assumed that the start-up administrative staff will simply continue to function in its role of overseeing the contractor operation.

2. Total Recurring Costs to the State

a. Inspection Facility Monitors: (i) insert the total program-wide annual salary cost from section VI.A. (ii) Add a percentage of total salary for overhead and fringe benefits. (iii) Add a factor for monitors' travel between facilities and the state central office. This can be calculated either on a per-facility or a per-monitor basis. Smogville planners estimate 2,000 miles per year for each monitor. At $.20 per mile, that comes to $400 per monitor.

b. Insert the total cost for the central administrative personnel, from section VI.C.1.

c. The annually recurring cost of training additional mechanics is found by multiplying the assumed training cost per mechanic, by the number of thousands of new autos, by the number of mechanics required per thousand autos. Refer to section III.B.9. for more detailed explanation.

d. Total a through c to yield the total recurring costs of the program to the State.

D. Annualized Costs to the State

1. Amortization of Inital Costs to the State: In the contractor-operated program, the state makes no initial investments which will retain any salvage value at the end of the

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C. Recurring Costs

1. Central Administrative Personnel

Position Area	Number	Cost
Program Administrators	1	32442
Technical Officers	-	
Data Analysis/Statistical Staff	1	19263
Clerical and Secretarial Staff	1	13014
SUBTOTAL		64719
Overhead, Fringe and Contingency (85%)		55011
TOTAL	$CAPAN =	119730

D. Annualized Costs to State

1. Amortization of Initial Costs to State

$$191851 \quad \$STIN \times \frac{INT(1+INT)^{PRL}}{(1+INT)^{PRL}-1} \bigg\} \cdot 25 = 47978 = \$STPT$$

2. Recurring Costs to State Accounting for Inflation

$$191445 \quad \$STRC \times \frac{\sum_{i=0}^{PRL-1}(1+INF)^i}{PRL} \bigg\} 1.15 = 220161 = \$SANN$$

3. Total Annualized Program Costs to State

$$\$STPT + \$SANN = 268139 = \$STATE$$
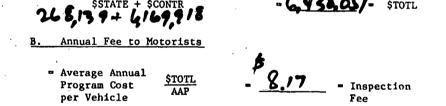
2. Total Recurring Costs to State

a. Inspection Facility Monitors

i) Annual Salary = $FMS = 44760

ii) Overhead, Fringe and Contingency (50%) = 22380

iii) Travel $ 400 per Monitor(3)

or $ N/A x FAC = 1200

b. Central Administrative Personnel

= $CAPAN = 119730

c. Annual Additional Mechanic Training

$$\$MCH \times \frac{AAP-POP}{1,000} \times Mech/1,000 \quad 30 \times 37.5 \times 3 = 3375$$

d. Total Recurring Costs to State = 191445

= $STRC

VII. TOTAL OVERALL PROGRAM COSTS FOR CONTRACTOR OPERATED PROGRAM

A. Total Annualized Program Costs

$$\$STATE + \$CONTR \quad 268,139 + 4,169,918 = 4,438,057 = \$TOTL$$

B. Annual Fee to Motorists

= Average Annual Program Cost per Vehicle $\frac{\$TOTL}{AAP}$ = $8.17 = Inspection Fee

(VI.D.1, cont.)

program. The amount of principle to be paid off over the
period of the program will therefore be just the amount of
total initial costs ($STIN), from section VI.B.2., line d. If
the state is assumed to pay the same interest rate on borrowed
capital as the contractor, this equation will be identical to
equation 4 of the general formula presented in section IV.B.,
with "$STIN" substituted for "PRIN". The Smogville planners
do make that assumption.

2. Recurring Costs to the State Accounting for Inflation:
The inflation factor which is derived in section IV.A. should
be applied to the total recurring costs to the state, from
section VI.C.2., line d.

3. Total Annualized Costs to the State: Add the annualized
initial costs (from VI.D.1.) to the annualized recurring costs
(from VI.D.2.), for total annualized costs to the state.

At this point the worksheet user can determine the part of the
inspection fee attributable to the state's administration of
the contractor-operated program, by dividing the total annual-
ized costs to the state by the average annual auto population.

VII. TOTAL OVERALL PROGRAM COSTS FOR CONTRACTOR-OPERATED PROGRAM

A. Total Overall Annualized Program Costs

Add the total annualized costs plus return to the contractor
(from section V.B.) to the total annualized costs to the state
(from section VI.D.3.), for total overall annualized program
costs.

B. Annual Fee to Motorists

Divide the total overall annualized program costs from VII.A.
by the average annual auto population, to yield the annual
inspection fee for the contractor-operated program.

Cost Calculation Worksheet: I/M Program

Centralized Lane Program: State or Contractor Operated

I. PROGRAM PARAMETERS

A. Assumptions

1. POP = Present Auto Population   = _____
2. GRT = Annual Auto Population Growth Rate (%)   = _____
3. INF = Annual Inflation Rate (%)   = _____
4. INT = Annual Interest Rate (%)   = _____

5. PRL = Program Length (yrs)   = _____
6. HRS = Annual Operating Hours   = _____
7. Cars/hr = Hourly Lane Throughput   = _____
8. STR = Stringency Factor (%)   = _____
9. XTR = Annual Percent Additional Tests (%)   = _____
10. $LAND/ft^2 = Land Acquisition Cost per square foot   = _____
11. $CONS/ft^2 = Construction Costs per square foot   = _____
12. $PAVC/ft^2 = Paving Costs per square foot   = _____
13. Mech/1,000 = Mechanics Required per 1,000 autos   = _____
14. $MCH = Training Cost per Mechanic   = _____
15. $IPI = Initial Public Information Costs   = _____
16. $RPI = Recurring Public Information Costs   = _____
17. $IDE = Initial Program Design, Eng. & Eval.   = _____
18. $RDE = Recurring Program Design, Eng. & Eval.   = _____
19. CPT = Computer Processing Cost Per Test   = _____
20. PRT = Property Tax Rate per Full Value (contractor   = _____
          program only)

B. Parameter Calculations

1. Average Annual Auto Population = AAP

$$(POP) \times \frac{\sum\limits_{i=0}^{PRL-1} (1+GRT)^i}{PRL} = \underline{\hspace{2cm}} = AAP$$

2. Average Annual Tests Performed = TST

$$AAP\ (1 + STR + XTR) = \underline{\hspace{2cm}} = TST$$

3. Annual Lane Capacity = CAP

$$HRS \times Cars/hr = \underline{\hspace{2cm}} = CAP$$

4. Total Test Lanes Required = LAN

$$\frac{TST}{CAP} = \underline{\hspace{2cm}} = LAN$$

II. INITIAL COSTS TO PROGRAM OPERATOR

A. Estimates of Facility Requirements

1. Facility Square Footage Requirements

Test Mode	LAND		LANES	OFFICE, ETC.		PAVING	
	Basic per Facility	Additional per Lane	(per Lane)	Basic per Facility	Additional per Lane	Basic per Facility	Additional per Lane
IDLE	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2
LOADED	ft^2						

2. Allocation of Lanes and Square Footage Requirements

LANE ALLOCATION				LAND		BUILDING					
Lanes per Facility	Mode	# Facilities This Size/Mode	Total Lanes	Each Facility	Total	LANES		OFFICE, ETC		PAVING	
						Each Facility	Total	Each Facility	Total	Each Facility	Total
TOTAL		FAC =	LAN =	LND =		LNS =		OFC =		PVG =	

3. Inspection Facility Personnel Hiring and Training Requirements

Position	Facility Requirement	Annual Salary	Duration of Instruction	Direct Costs of Instruction per Trainee	Total Training Cost	Hiring Costs per Employee	Total Training plus Hiring
Station Manager	1 per facility						
Asst. Station Manager	1 per facility or ___ per lane						
Inspection Technicians	___ per Idle Mode lane						
	___ per Loaded Mode lane						
Clerks	___ per lane						

B.   Calculation of Facility Investment Costs

    1.   Construction and Land Acquisition Costs

        a.   Land Acquisition = $LANDACQ = LND x $LAND/ft^2 = _____

        b.   Paving = $PAVING = PVG x $PAVG/ft^2 _____

        c.   Construction = $CONSTR = (OFC+LNS) x $CONS/ft^2 = _____

        d.   Total Building = $BUILDING = $PAVING + $ CONSTR   = _____

2.   Inspection Facility Personnel Hiring and Training Costs

    a.   Station Managers:
        $ _____ x FAC   = _____

    b.   Assistant Station Managers:
        $ _____ x FAC   = _____

        or $ _____ x _____ x LAN   = _____

    c.   Inspection Technicians:
        $ _____ x _____ x LAN [IDLE]   = _____

        $ _____ x _____ x LAN [LOADED] = _____

    d.   Clerks: $ _____ x _____ x LAN   = _____

    e.   TOTAL INSPECTION FACILITY PERSONNEL
        HIRING & TRAINING = FIELDPERS   = _____

    3.   Facility Preparation and Equipment Costs

Per (Category)	Number	Site Preparation		Test Equipment		Office & Other Equipt.		Data Processing Equipmt.		TOTAL
		Each	Total	Each	Total	Each	Total	Each	Total	
Facility										
Loaded Lane										
Idle Lane										
Central Office										
TOTAL										$EQUIP =

C. Start-Up Administrative Costs

1. Start-Up Personnel

Position Area	Prs-Yrs	Cost
Program Administrators		
Technical Officers		
Data Analysis/Statistical Staff		
Clerical and Secretarial Staff		
SUBTOTAL		
Overhead, Fringe and Contingency (_____%)		
TOTAL =	$CSP =	

2. Calculation of Start-Up Administrative Costs

a. Start-up Personnel = $CSP = _____

b. Initial Public Information = $IPI
   or = $IPI x POP = _____

c. Initial Program Design, Eng. and Eval.
   = $IDE
   or = $IDE x POP = _____

d. Mechanic Training (State Operated Program Only)

   $\text{Mech}/1{,}000 \times \dfrac{\text{POP}}{1{,}000} \times \$\text{MCH}$ = _____

e. Total Start-up Administrative Costs = _____

= $ADMIN

D. Total Initial Costs to Program Operator

1. Land Acquisition = $LANDACQ = _____ (No Depreciation)

2. Total Building = $BUILDING = _____ (Depreciation over 20 years)

3. Field Personnel Training and
   Hiring = $FIELDPERS = _____

4. Facility Preparation and
   Equipment = $EQUIP = _____

5. Total Start-up Administrative Costs = $ADMIN = _____

6. SUBTOTAL
   $FIELDPERS + $EQUIP + $ADMIN = $STARTUP = _____ (Depreciation over life of Program)

7. Total Initial Costs
   = $LANDACQ + $BUILDING + $STARTUP = _____

III. RECURRING COSTS TO PROGRAM OPERATOR

    A. Personnel Costs

        1. Central Operating Staff

Position Area	Number	Cost
Program Administrators		
Technical Officers		
Data Analysis/Statistical Staff		
Clerical and Secretarial Staff		
SUBTOTAL		
Overhead, Fringe and Contingency (____ %)		
TOTAL = $CSTAFF	=	

2. Inspection Facility Operating Staff

    a. Station Managers: $ _____ x FAC   = _____

    b. Assistant Station Managers: $ _____ x FAC

           or $ _____ x _____ x LAN   = _____

    c. Inspection Technicians:
        $ _____ x (_____ x LAN [IDLE]

           + _____ x LAN [LOADED])   = _____

    d. Clerks: $ _____ x _____ x LAN   = _____

    e. SUBTOTAL   = _____

    f. Overhead and Fringe Benefits (____ %)   = _____

    g. TOTAL INSPECTION FACILITY OPERATING STAFF   = _____

                              = $FSTAFF

IV. ANNUALIZED COSTS TO PROGRAM OPERATOR

B. Miscellaneous Total Recurring Costs

A. Average Recurring Costs

Accounting for Inflation

1. Support Services to Facilities

$ _____ basic per facility

$ _____ additional per lane

For each item, take:

$$\text{ITEM} \times \frac{\sum\limits_{i=0}^{PRL-1} (1 + INF)^i}{PRL}$$

TOTAL SUPPORT SERVICES = _____ = $SUPT → _____ = $SUPT$_i$

2. Travel

$ _____ per facility = _____ = $TRAV → _____ = $TRAV$_i$

3. Public Information

$\dfrac{\$RPI}{\text{or }\$RPI \times AAP}$ = _____ = $APUB → _____ = $APUB$_i$

4. Equipment Maintenance

___ % x $EQUIP = _____ = $MAINT → _____ = $MAINT$_i$

5. Annual Program Design,

Engineering and Evaluation = _____ = ADESG → _____ = $ADESG$_i$

$\dfrac{\$RDE}{\text{or }\$RDE \times AAP}$

6. Computer Processing of Tests

CPT x TST = _____ = $CMPR → _____ = $CMPR$_i$

7. Insurance Costs (where applicable)

$ _____ x LAN + _____ x FAC = _____ = $INS → _____ = INS_i$

8. Personnel Costs

$CSTAFF + $FSTAFF = _____ = $STAFF → _____ = $STAFF$_i$

9. Additional Mechanic Training (State Operated Program Only)

Mech/1,000 x $\dfrac{AAP-POP}{1,000}$ x $MCH = _____ = $AMT → _____ = AMT_i$

10. Property Taxes (Contractor Operated Program Only)

PRT x ($BUILDING+$LANDACQ+$EQUIP) = _____ = $TAX → _____ = TAX_i$

11. Total

Recurring Costs = _____ = $RECUR → _____ = $RECUR$_i$

(Does Not Include Amortization of Initial Costs)

B. Amortization of Initial Costs

General Formula

1. DEPR = Depreciation Period of Item

$$\$ITEM \times \frac{DEPR-PRL}{DEPR} = VAE \quad \text{(Value of Item Remaining at end of Program)}$$

2. $$\frac{VAE}{(1+INT)^{PRL}} = PDV \quad \text{(Present Discounted Value of Item Remaining at end of Program)}$$

3. $\$ITEM - PDV = PRIN$ (Value of Principle to be Paid off Over Length of Program)

4. $$PRIN \times \frac{INT(1 + INT)^{PRL}}{(1+INT)^{PRL} - 1} = \$PMT_{(Item)} \quad \begin{array}{l}\text{(Annual Payment} \\ \text{of Initial Loan} \\ \text{Plus Interest)}\end{array}$$

(NOTE: Interest Rate Already Accounts for Inflation)

Calculation for Specific Initial Cost Elements

1. Land Acquisition:

No Depreciation; VAE = $LANDACQ

$$\$PMT_{(Landacq)} = \underline{\hspace{3cm}}$$

2. Building:

DEPR = 20 Years

$$\$PMT_{(Building)} = \underline{\hspace{3cm}}$$

3. Other Startup

DEPR = PRL; VAE = 0; PRIN = $STARTUP

$$\$PMT_{(Startup)} = \underline{\hspace{3cm}}$$

4. Total Annual Payment Plus Interest
    For Initial Costs $= \underline{\hspace{3cm}}$

$$= \$PAYMENT$$

C. Total Annualized Costs to Program Operator

$$\$RECUR + \$PAYMENT = \underline{\hspace{4cm}} = \$ANNUAL$$

V. DISTINGUISHING STATE FROM CONTRACTOR OPERATED PROGRAM

A. State Operated Program

$$\text{Inspection Fee} = \frac{\$ANNUAL}{AAP} = \underline{\hspace{3cm}}$$

B. Contractor Operated Program

1. Total Annualized Costs to Contractor

$$= \$ANNUAL \qquad = \underline{\hspace{3cm}}$$

2. Contractor's Net Return = $\underline{\hspace{1.5cm}}$ % $= \underline{\hspace{3cm}}$

3. Total Annualized Contractor's
    Program Costs = $CON $= \underline{\hspace{3cm}}$

$$= \$CONTR$$

VI. PROGRAM COSTS TO STATE (Contractor Operated Program Only)

A. Inspection Facility Monitor Requirements

	Facility Requirement	Annual Salary	Duration of Instruction	Direct Cost of Instruction	Total Training Costs	Hiring Costs	Total Training plus Hiring
Individual basis	per facility						
Program Total	x FAC =	= $FMS					= $FTRN

B. Initial Costs

1. Central Administrative Personnel

Position Area	Prs-Yrs	Cost
Program Administrators		
Technical Officers		
Data Analysis/Statistical Staff		
Clerical and Secretarial Staff		
SUBTOTAL		
Overhead, Fringe and Contingency (____%)		
TOTAL $CAPIN =		

2. Total Initial Costs to State

a. Inspection Facility Monitor Training
and Hiring

= $FTRN   = _____

b. Central Administrative Personnel

= $CAPIN = _____

c. Initial Private Mechanic Training

$$\text{Mech/1,000} \times \frac{\text{POP}}{1,000} \times \text{\$MCH} \qquad = \underline{\hspace{2cm}}$$

d. Total Initial Costs to State   = _____

= $STIN

C. Recurring Costs

    1. Central Administrative Personnel

Position Area	Number	Cost
Program Administrators		
Technical Officers		
Data Analysis/Statistical Staff		
Clerical and Secretarial Staff		
SUBTOTAL		
Overhead, Fringe and Contingency (_____%)		
TOTAL	$CAPAN =	

D. Annualized Costs to State

1. Amortization of Initial Costs to State

$$\$STIN \quad x \quad \frac{INT (1 + INT)^{PRL}}{(1 + INT)^{PRL} - 1} = \underline{\hspace{1cm}} = \$STPT$$

2. Recurring Costs to State Accounting for Inflation

$$\$STRC \quad x \quad \frac{\sum_{i=0}^{PRL-1} (1 + INF)^{1}}{PRL} = \underline{\hspace{1cm}} = \$SANN$$

3. Total Annualized Program Costs to State

$$\$STPT + \$SANN = \underline{\hspace{1cm}} = \$STATE$$

2. Total Recurring Costs to State

  a. Inspection Facility Monitors

  i)   Annual Salary = $FMS   = _____

  ii)   Overhead, Fringe and Contingency (_____%) = _____

  iii)   Travel $ _____ per Monitor

        or $ _____ x FAC   = _____

  b. Central Administrative Personnel

                 = $CAPAN   = _____

  c. Annual Additional Mechanic Training

$$\$MCH \times \frac{AAP-POP}{1,000} \times Mech/1,000 = \underline{\hspace{1cm}}$$

  d. Total Recurring Costs to State = _____

                                  = $STRC

VII. TOTAL OVERALL PROGRAM COSTS FOR CONTRACTOR OPERATED PROGRAM

A. Total Annualized Program Costs

$$\$STATE + \$CONTR = \underline{\hspace{1cm}} = \$TOTL$$

B. Annual Fee to Motorists

= Average Annual Program Cost per Vehicle $\dfrac{\$TOTL}{AAP}$ $= \underline{\hspace{1cm}} =$ Inspection Fee