Committee in Session at 8:40 A.M. on Wednesday, April 25, 1979.

Senator Keith Ashworth in the Chair.

PRESENT: Chairman Keith Ashworth
Senator Wilbur Faiss
Senator Rick Blakemore
Senator Clifton Young

ABSENT: Vice-Chairman Joe Neal
Senator Jim Kosinski

GUESTS: Dr. Thorne J. Butler, State Board of Health
Mr. Hann Crane, Emission Control Officer, Department of Motor Vehicles
Mr. John Holmes, Jack's Valley - private citizen
Mr. John Sardelli, Department of Motor Vehicles
Mr. Dave Halston, Planning Department, Clark County
Mr. Mike Maynor, Air Pollution Control, Clark County Health District
Mr. Pete Woolley, Petroleum Retailers, Northern Nevada
Mr. Chuck Briese, Washoe Council of Governments, Washoe County

Chairman Ashworth opened the meeting, there being a quorum present. Continuation of the hearing on emissions standards. Chairman Ashworth stated the purpose of looking at Chapters 445.635 through 445.690, there being no bill, is to see how the requirements of the act are tracking with the federal act and what the rest of the state is doing regarding mandatory inspection of automobiles. Senator Blakemore and Chairman Ashworth attended the Western Conference of the Counsel of State Governments in Sacramento, April 20th and 21st. They were in the committee meeting on Transportation and Energy which discussed the auto emissions. On survey of the western states Chairman Ashworth discovered that quite a few of them had not adopted any form of emission standards. Regarding the Nevada pilot project, it was felt this would comply because other states have not done anything because they will not be in session for another two years. They asked an expert from Washington what would happen if Nevada continues with the pilot program. He responded that would probably comply, in view of the fact that there are some other states in the nation that have the same problem. Chairman Ashworth attended a Transportation Committee meeting 4/25 in which he said the representative of the Energy Commission stated that if we kept the same program and do not diminish any program and add to it by "mandating the Motor Vehicle Department have some funds for public announcements on a voluntary compliance on auto emissions, tune-ups, and check-ups," we would be safe, being sanctioned on our highway funds. He further stated that we would comply if we kept the same program that we have. Chairman Ashworth stated this legislature should address the subject of a bill, because by July there will be a problem when they start mandating auto inspections on a yearly basis.

Dr. Thorne J. Butler, State Board of Health, introduced Mr. Crane who would project slides showing the inspection program as it now exists; how it would evolve, assuming the annual inspection for all motor vehicles in Clark and Washoe counties would come about. Representatives from the two counties were present who are involved in the planning of the "Air Quality Implementation Plan" which is currently in existence. Dr. Butler submitted copies of the plans for the record: Exhibit "A", Las Vegas Valley Air Quality Implementation Plan, Clark County, Nevada, December 5, 1978; Truckee Meadows, Air Quality Implementation Plan; Truckee Meadows Transportation Planning Process (Supplement to the Air Quality Implementation Plan); Washoe County Overall Work Program, Washoe County Metropolitan Planning Organization; and 1978 Transit Development Program, Regional Street and Highway Commission of Washoe County. (Reference reports located in the Research Division, Legislative Counsel Bureau).

Dr. Butler stated the slides would give a history of the problem that now exists; what automobile inspections programs have been doing so far; and what the future projection and costs may be. He said it is an idea of the overall picture that now exists in Nevada today, and what would happen if there were an annual inspection program July Ist.

Mr. Hann Crane, Emission Control Officer, Department of Motor Vehicles, projected the slides on the screen while Dr. Butler presented: "Why Pollution", "Effects of Pollution", "Industrial Effect", "Temperature Inversion", "Automobile Role in Pollution", "Legislative History of Implementation and Maintenance", "Emission Trends - Clark County", "Reduction of these carbon monoxides and hydrocarbons", "Strategy to Reduce Pollutants".

Chairman Ashworth questioned putting more emphasis on the voluntary plan. Dr. Butler related that only about 15 percent of the people respond on their own voluntarily, this was an estimate. Senator Blakemore stated that when at the Sacramento meeting the federal man had said the volunteer programs work very well. Senator Faiss stated that bicycles would reduce the pollutants, but we need more bicycle paths.

Dr. Butler continued with the slides: "Trends in Exhaust Emissions", "Clark County, mpg - gasoline use", "Washoe County - mpg - gasoline use", "Light duty vehicles, mpg", "Nevada Implementation and Maintenance", "Effects of Implementation Program", "Cost of Repairs", "Waiver", "Consumer Protection", "Environmental Commission Recommendations", "Evaluation of Current Standards", "Separate Emission Standards". He stated the average cost for the inspection of the car is $13.80, and that 97 percent of the cars required no repair. Used car dealers would not get the waiver provision, this was the commissions recommendation. He further stated that there should be separate emissions standards for catalitic converter equipped vehicles as those vehicles were designed to have very small emissions which are virtually unmeasurable if the converter is working properly.

Dr. Butler said that if the converter has been removed or "poisoned" the emission will go up, but if properly tuned they would still pass inspection. He stated California is going to an annual program, a state operated plan which is an exhaust "stick test".

Chairman Ashworth asked Dr. Butler if, in his own opinion, a voluntary program should be tried before mandating one and see how it works for a two year period, then consider a mandatory program if it did not work. Dr. Butler stated he did not disagree with trying a voluntary program to see if it would work. Chairman Ashworth stated he felt the pilot program should continue, which consists of checking the cars when they change hands. Dr. Butler added also that cars brought in from other states have to be registered and cars that change ownership. Chairman Ashworth stated he thought the voluntary program would work with the rising prices in gasoline. Senator Blakemore stated that Nevada has one of the best inspection systems than any other state, as it stands today without any changes. Dr. Butler felt the tourist economy question had to be addressed, otherwise there were potential problems with pollution. He said the pilot program started in Clark County in 1974, Washoe in 1978 and the Lake Tahoe Basin was separate. Senator Young expressed concern that other counties should be brought into the pilot program as well. Presentation of a handbook entitled, "Vehicle Inspection and Maintenance Program HANDBOOK", and "Prescribed Inspection Test Procedures", Exhibit "A".

Mr. Hann Crane, Emmission Control Program, presented slides of an overview inspection maintenance program in its present operation. He stated at the present time there are 235 licensed inspection maintenance stations with 1,192 approved inspectors and mechanics. The inspectors and mechanics must be qualified, certified with infra-red unit training by the equipment manufacturer. Each station must have the diagnostic computer for inspections. A sign must be displayed listing inspection fee $10, certification fee $ 2, this is basic procedure. It takes approximately one-half hour to do the inspection and usually only minor adjustments are necessary. They do not give a waiver for smoking vehicles, or a vehicle that was manufactured with a catalitic converter that had been removed.

Mr. John Holmes, Jack's Valley, private citizen, presented, "Pollution Free Performance", Exhibit "B". He stated he has had a little experience with the emission program and would like to make a presentation of what the public sees. He stated various examples of inspections that were not complete, where the emission requirements were not met at an emission control station. He stated he felt the mechanics had not been fully trained for inspecting these vehicles. He stated it is difficult to keep a vehicle without the catalitic converter up to standards unless there are frequent tune-ups. He stated he would encourage staying with the pilot program. He felt the people should be educated to better maintenance of their cars. He stated with a better maintenance system it will lean toward a lower pollution level, better gas mileage and the customer will have a better vehicle.

Mr. Holmes stated cars should have a complete tune-up once a year to get the license plates renewed. He felt it should be under the administration of the Department of Motor Vehicles. He stated there should be a tune-up for maximum overall performance, with better gas mileage, once a year. He said if the committee were going with the pollution inspection then he felt the tail pipe inspection would be sufficient.

Mr. John Sardelli, Department of Motor Vehicles, stated there are many stations waiting to go into the emission control inspections; they are waiting to see if this program will go into effect July 1st. Senator Blakemore said he thought the program originally was to go into the tail pipe probe. Mr. Sardelli said that Nevada law says no person shall remove any devices from their vehicle. The Department of Motor Vehicles monitor the stations to see that the equipment is operating. They also have to approve each and every waiver.

Senator Neal entered the meeting at 10:20 A.M.

Chairman Ashworth felt the volunteer program would be better because, with the mandated program on July 1st it would develop an expensive program which he felt was not needed. Mr. Sardelli stated that with the annual program the stations would have to purchase the equipment.

Mr. Dave Halston, Planning Department, Clark County, introduced Mr. Mike Maynor, Air Pollution Control, Clark County Health District. Mr. Halston stated that currently Clark County would not be able to meet the carbon monoxide standards, even with the inspection maintenance program, without additional transportation control measures. In the absence of public transportation they would need wholesale reductions of vehicle miles travelled in Clark County. Senator Blakemore stated he would like a report, in writing, regarding the sanctions as there is a credibility gap between the information in committee meetings and the information obtained from Sacramento. Mr. Halston stated the sanctions are - removal of dollars for federal highway investments, elimination of federal money coming in for water pollution control equipment. Chairman Ashworth asked Mr. Halston to submit a report to the committee. Mr. Halston stated the schedule is in legislation which he will provide to this committee. He further stated the legislature specifically delineates what the penalties or sanctions will be. Senator Neal stated that certain areas need application of the law regarding pollution alerts, such as the Los Angeles area where there is so much smog. Mr. Halston stated the maintenance inspection program does offer a good program, very effective in reducing emissions in Clark County, for carbon monoxide. He further stated that the primary federal air standards are nationwide.

Mr. Mike Maynor, Air Pollution Control, Clark County Health District, stated there were about five smog alert days this past winter and six the previous year and forty alerts three winters ago.

Mr. Halston further stated that the primary federal health standards cannot be met, even with the inspection maintenance program, they will still need transportation control measures. They are trying to encourage car pooling and public transportation at the present time. Mr. Maynor stated there should be a 10 percent increase in speeds with a traffic synchronization program plan with reduction in emissions of 5 percent. Mr. Halston stated the need to reduce emissions through transportation control measures, gas rationing or limit miles travelled. He further stated the best program for Clark County now would be the inspection maintenance program.

Mr. Pete Woolley, Petroleum Retailers, Northern Nevada, stated he is fighting for gasoline in the state of Nevada. He stated with emission control we are improving gas mileage. He said when a car has gone through the emission control center they are going to get better gas mileage. He stated the program should be backed to get more gasoline for the state of Nevada as the stations are out of gas. He stated the sub-committee in the Senate turned down Sunday closure which is Friday afternoon to Sunday midnight. He further stated that he is in favor of emission control.

Mr. Chuck Briese, Washoe Council of Governments, Washoe County, stated they have the same situation as Clark County with respect to their air-quality plan. He stated Washoe County got an early start on air quality in 1978 with the best program being the inspection maintenance program.

There being no further testimony on Emission Control, Chairman Ashworth closed the hearing.

Chairman Ashworth opened the hearing on S.B. 351.

Dr. Thorne J. Butler, State Board of Health, stated he felt the Division of Health has on its staff people who do not understand problems such as one prisoner in the county jail who has to be in a wheelchair. The problem there being that the wheel chair cannot pass in or out, thereby this person had to be put into a county hospital. He stated to keep this kind of thing from happening they should have people involved in plan review whether in prisons, hospitals or adult care units. He stated the proposal in NRS 444.335 which states, "The State Division of Health with the State Board of Health will" helps. He felt it would add an "umbrella" agency to be available, not only to set minimal standards of performance, but also would offer expert assistance in facilities with management, nutritional problems, minimal health and dental care that is necessary. The NRS 444.335 only applies to the state institutions. He further stated he was for the proposal of Section 1, subsection 2, stating "The state board of health shall, with respect to jails, and may, with respect to the other institutions named in subsection 1, adopt and enforce such regulations". Chairman Ashworth questioned involvement with the "safety" requirements of the jail. Dr. Butler said the requirement was also in the health facility statutes. Chairman Ashworth questioned fiscal impact if S.B. 351 were passed. Dr. Butler stated that there may be a relatively minor fiscal impact. Senator Faiss questioned if this type of inspection were mandated by federal law. Dr. Butler said he could not answer

his question factually, as he did not know if they do or not. He went on to say that in Clark County the federal people come in through the courts and mandate the county to do something. He felt the states input would be valuable in the design and management of such facilities, whether a health care center or child care center, as is now being done.

There being no further testimony on S.B. 351 Chairman Ashworth closed the hearing.

Dr. Butler said the proposed change in NRS 445-274, water pollution was somewhat redundant, the language should be changed. He further stated, if you were a developer and the sewage plant is not in compliance with the discharge permits your appeal to the commission would be inappropriate because the commission cannot grant you the permission to tie into that sewage plant. Chairman Ashworth questioned if we could live for the next two years without the language proposed as amended. Dr. Butler said he felt if it were put in it would not do anything to anybody, nor accomplish a goal either because the real appeal is in the wrong place. He feels the appeal should be to the Washoe commissioners.

Senator Young wished to question S.B. 351, stating he had confusion with health authority in the counties of Washoe and Clark, and the rest of the state has the state board of health being the health authority. Chairman Ashworth said that the health authority is the state authority. Dr. Butler stated that Section 444 is full of State Division of Health, State Board of Health and Health Authority and "everyone has a vague and cloudy picture of who is responsible for what". He stated his implication is that the health authority is the State Board of Health and the State Health Division.

There being no further business Vice-Chairman Neal adjourned the meeting at 11:03 A.M.

Respectfully submitted,

Jean Van Nuys

Jean Van Nuys
Committee Secretary

Approved:

Keith Ashworth

Chairman
Keith Ashworth

Further information may be obtained by contacting the following:

Department of Motor Vehicles
Emission Control Section
2701 East Sahara Avenue
Las Vegas, Nevada
(702) 385-0356

or

Department of Motor Vehicles
Emission Control Section
305 Galletti Way
Reno, Nevada
(702) 784-4776

STATE OF NEVADA

DEPARTMENT OF MOTOR VEHICLES

Vehicle Inspection and Maintenance Program

HANDBOOK

NOVEMBER 1977

Prepared for use in the Vehicle Emissions Inspection Program

EXHIBIT "A"

INSPECTION/MAINTENANCE FIGHTS [illegible]

Through . . .

ENGINE TESTING

TUNE-UP

MAINTENANCE

YOUR VEHICULAR EMISSIONS TEST

Purpose:

1. To determine how your vehicle measures up to state standards for the following vehicular emissions:

CARBON MONOXIDE AND HYDROCARBON

2. Provide you with minor maintenance recommendations such as carburetor or timing adjustment. In most cases where the problem is more serious, the inspector will give you possible reasons why your vehicle is a "smoker."

INSPECTION MAINTENANCE GOALS

1. MEASURE EXHAUST EMISSION.
2. IDENTIFY HIGH POLLUTERS.
3. DIAGNOSE THE PROBLEM.
   - Ignition?
   - Electrical?
   - Fuel?
   - Emission Control?
   - Malfunctions . . . or Misadjustments
4. ENCOURAGE OWNERS TO REPAIR OR ADJUST THEIR POLLUTING ENGINES.
   - Correct malfunctions
   - Reduce emissions
   - Comply with standards

VEHICLE INSPECTION PROGRAM

PHASE ONE . . .

A pilot program
County of [illegible]
Started June 1974

For used vehicles on which registration is transferred—passenger vehicles and light duty trucks.

After July 1, 1977 the program is expanded to include all used vehicles registered for the first time.

PHASE TWO . . .

An inspection/maintenance program
County of Washoe
Starts February 1, 1978

For used vehicles on which registration is transferred—passenger vehicles and light duty trucks.

After September 1, 1978 the program is expanded to include all used vehicles being registered for the first time.

PHASE THREE . . .

Both counties

After July 1, 1979 the program is expanded to include all used passenger vehicles and light duty trucks at time of annual renewal.

VEHICLE INSPECTION WILL INCLUDE

Light duty motor vehicles and light duty trucks with a GVW of less than 6,000 pounds.

EXEMPT VEHICLES

New vehicles motorcycles RVs over 6,000 lbs GVW light duty motor vehicles whose model year is 15 years or older transfer of registration or ownership between husband and wife leased vehicles pro-rated registration certificate of compliance issued within 20 days before transfer trucks and [illegible] over 6,000 lbs. GVW diesel or propane powered vehicles and engine displacement of 50 cubic inches or less.

EXHIBIT A

TEST PROCEDURES ARE AS FOLLOWS:

1. Visual inspection for smoke and required emission controls, and that they are operating properly.

2. Mechanic should connect diagnostic equipment and infrared to engine and record HC and CO levels at idle and fast engine speed.

3. Engine RPM, Dwell, Timing and CO level adjusted to manufacturer's specifications.

4. Mechanic should record HC and CO levels at idle and fast engine speed.

5. Mechanic should issue a certificate of compliance if vehicle emissions do not exceed state standards.

6. If your vehicle fails the initial emission inspection you must have it repaired and pass re-inspection or qualify for a waiver.

7. Forms for application of waiver will be supplied all authorized stations and must be submitted to the DMV Emission Control Section for approval.

WAIVER QUALIFICATIONS

The Department of Motor Vehicles may grant a waiver from the certification of compliance provided the application of waiver includes:

1. Receipts or other evidence of parts and/or labor shall be dated after inspection and before registration. The repair parts shall be emission related.

2. If the cost of repair parts, exclusive of a catalytic converter, exceeds $25, provided that evidence is submitted and that $25 has been spent and parts have been installed; or

3. If the combined cost of parts and labor, exclusive of a catalytic converter, for any vehicle, exceeds $75, provided that evidence is submitted, showing that $75 or more has been spent and parts have been installed.

4. A waiver also may be granted for vehicles with missing pollution control devices, provided emission standards or conditions of 2 and 3 have been met.

5. A waiver cannot be granted to model year 1975 or newer if the vehicle was equipped with a catalytic converter and the converter has been removed.

STATE OF NEVADA

INSPECTION PROGRAM

Vehicle Inspection . . .

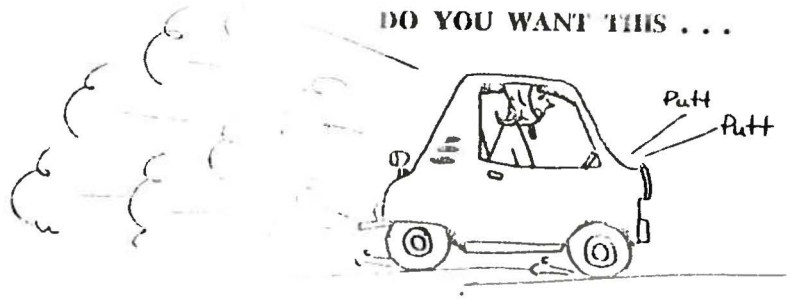
1. Reduce smog.

2. Increase fuel economy.

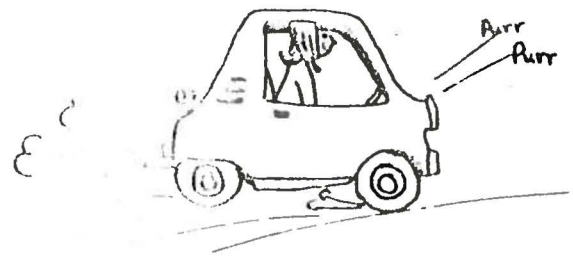
The major source of smog in Clark and Washoe counties is vehicle emissions!

A well tuned, properly maintained engine has lower levels of exhaust pollution . . . and improves fuel economy.

DO YOU WANT THIS . . .



OR THIS . . .



REMEMBER . . . THE CHOICE IS LEFT UP TO YOU!

THE MOTORIST

EXHIBIT A

DEPARTMENT OF MOTOR VEHICLES
REGISTRATION DIVISION
EMISSION CONTROL SECTION

EXHIBIT A

REQUIREMENTS TO OBTAIN A LICENSE AS AN "AUTHORIZED STATION"

1. A statement of facts.
2. An application.
3. Inspection fee approval form.
4. A $1,000 surety bond; or; $1,000 deposit in (a) cash (b) U.S. Bonds (c) State of Nevada Bonds (d) Savings certificate. Forms are provided by the Department.
5. An established place of business:
   a. "Established place of business" means: The permanent structure owned either in fee or leased with sufficient space to test, inspect or adjust, if needed; one or more vehicles which a Certification of Compliance may be issued; and
   b. Large enough to accomodate the office or offices of an authorized station to provide a safe place to keep the books, Certificates of Compliance and all other records of this authorized station at which site or location the principal portion of such licensee's business shall be conducted and the books, records thereof kept and maintained. Such books and records shall be open to inspection during usual business hours by any authorized agent or the Director of the Department of Motor Vehicles.
6. Annual fee of $25.00.
7. City or County license; if required.
8. Have an infra red exhaust analyzer approved by the State and diagnostic equipment. A list of approved exhaust analyzers is maintained in the Emission Control Office at the Department of Motor Vehicles.
9. All stations must have equipment that has span gas calibration capabilities. Equipment shall be calibrated with span gas at least once every 30 calendar days.
10. Must have at least one "Approved Inspector" currently employed.
    a. Rules and regulations adopted pursuant to NRS Chapter 445; 11.16 Section 3; 'No license shall be issued to an applicant unless the applicant employees at least one approved inspector, who may be the station owner.'

APPROVED INSPECTORS ARE LICENSED BY THE DEPARTMENT OF MOTOR VEHICLES

Applicant requirements are:

1. An application.
2. Certificate of Competence signed by applicant's employer.
3. A written test to be completed in the presence of an authorized agent of the Department of Motor Vehicles.
4. Copies of documents pertaining to any automotive repairs or tune-up school.
5. Copies of certifications or copies of other documents attesting to the operation of emission analyzing equipment.

Applications for Authorized Stations and Approved Inspectors may be obtained at and shall be submitted to:

Department of Motor Vehicles
Registration Division
Emission Control Section
305 Galletti Way
Reno, Nevada 89502
784-4776

STEP 1: Consisting of a visual inspection for visible smoke and blowby gases, at idle and fast idle, and a check under the hood making sure all Federal and State required Emission Control devices are connected.

STEP 2: After the motor vehicle has been brought to normal operating temperature, connect motor vehicle to engine diagnostic equipment. The infrared exhaust analyzer shall be adjusted according to the manufacturer's specifications. Place the probe in the tail pipe. With engine running, record the RPM idle and steady HC and CO levels. If dual exhaust, probe both. Increase RPM to 2250, record steady levels of HC and CO.

STEP 3: Adust the following to manufacturer's specifications, including recommended tolerances:

A. Idle speed (±50 RPM) in addition to manufacurer's specifications.
B. Dwell.
C. Air Gap.
D. Timing (±5°) in addition to manufacturer's specifications.

STEP 4: While vehicle is still connected to the diagnostic equipment, record the steady HC and CO levels.at the manufacturer's idle RPM. Increase RPM to 2250, record steady HC and CO levels.

STEP 5: If the vehicle is found not to exceed the maximum levels for HC and CO set forth in these regulations at either the idle or 2250 RPM range, and all Federal and State required EMission Control devices are connected and operating properly, and no blowby or visible smoke are evident, the approved inspector will complete and sign the certificate of compliance.

STEP 6: The following shall be recorded on certificate of compliance:

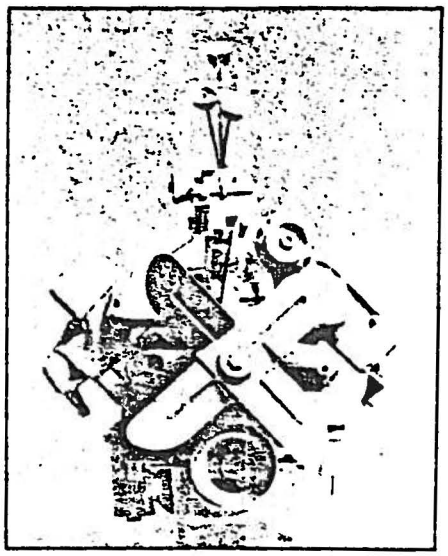
MAKE, MODEL, AND YEAR OF VEHICLE _____
ENGINE TYPE _____ CID _____ CYL
VEHICLE IDENTIFICATION NUMBER _____
ODOMETER READING _____
BEFORE HC AND CO READINGS _____
DWELL OR AIR GAP _____
IGNITION TIMING _____
IDLE SETTING (RPM) _____
AFTER HC AND CO READINGS _____
COST OF ADJUSTMENTS AND PARTS _____

EXHAUST EMISSION STANDARDS

MODEL YEAR OF VEHICLE	CO (%)	HC (PPM)
Up to and including 1967	7.5	1200
1968 to 1969, inclusive	5.0	600
1970 to 1974, inclusive	4.0	400
1975 and later	3.0	300

POLLUTION FREE PERFORMANCE

Part two of the emissions engine story covers the building of our smog-free small-block V8



By Jim McFarland ■ We admit we made a mistake. It took longer than two months to complete, but the results were worth the wait . . . despite the fact that some of the objectives have been changed a little. But in addition to emissions reductions and performance gains, we included a little dope on fuel economy. For a while there, we thought perhaps we were the little dope.

• • •

In the November '73 issue of Hot Rod, half of a two-segment story was begun. Its stated objectives were to combine exhaust emissions reductions with performance gains in the construction of an engine (small-block Chevy V8) using specialty aftermarket engine pieces. Since that time, three things affecting this story have developed: (1) Gasoline availability has decreased and become priced higher than a cat's back, (2) we decided to give you a look at *two* slightly different engine packages instead of one, and (3) we got so interested in some of the project's ramifications that we missed three copy deadlines. What follows is the result of considerable data gathering, and we hope that you will spend enough time to pick out the little tidbits of information, much of which is applicable to engines other than the little-block Chevy.

For simplicity, let's call engine No. 1 the one built with off-the-shelf specialty aftermarket parts and engine No. 2 the one constructed using pieces of a more experimental nature. You'll understand this means of designation after a couple more paragraphs.

Engine No. 1 began as a high-mileage 350-c.i.d. Chevy V8, originally a '67 295-hp option with a Rochester four-barrel carburetor. It was stripped, Magnafluxed, deburred, decked, align-bored, and fitted with new main bearing cap bolts. This was a four-bolt block. To this point, the approach was pretty much standard for sound rebuilding steps.

Piston selection (TRW) was made and the rings (Sealed Power) chosen to be 1/16-inch, 1/16-inch, 1/8-inch (top, second and oil rings). Since the cylinder bores were found to have about .018-inch taper, bore was increased .030-inch, using a Sunnen power hone and 725-grit stones. Piston skirt clearance was set at .005-inch. You might keep in mind that the TRW pistons were listed at a compression ratio of 12.5:1. Subsequent valve notching and blending of combustion surfaces reduced this to a dome volume "ratio" of 11.7:1. Final c.r. (with a slight head resurfacing) worked out to 11.9:1. With the level of octane currently available in commercial pump gasoline, this should probably be reduced to around 10.0:1. Remember, though, we had originally set out to show compatibility among certain emissions levels and vehicle drivability. The fact that somebody changed the length of the playing field is another story.

Cylinder head modification followed along the lines of the data presented in the first segment of this story (November '73 HRM). Particular attention was paid to improving low-lift (valve lift) port flow in both intake and exhaust passages, with time taken to flow these ports backward to determine how much reverse flow (reversion pulsing) could see its way back into the induction system. This phenomenon is, in part, the result of pressure above the piston (during the upstroke or exhaust stroke) passing into the intake port and manifold at the time of intake valve opening. Since it is not practical to open the intake valve at or just after top dead center (exhaust stroke), camshafts are designed to open the intake valves a given number of crankshaft degrees *before* the piston reaches TDC. The pressure pulse (or velocity spike) that strikes back at the incoming mixed air and fuel tends to disrupt efficient cylinder filling and, therefore, becomes the object of attempts to reduce the extent of pulsing that reaches the inlet passages. For this reason, some study was made of both flow toward the cylinder *and* reverse flow. You might check out the first part of the story for details of this work.

It is also of some benefit to build a lot of low-and mid-rpm torque into an engine of this type. Among some of the ways to do this, camshaft design plays an important part. For example, cams of relatively short overlap periods (time when both intake and exhaust valves are unseated) allow combustion pressures to have more time to exert force on the pistons. For street/performance engines, this makes good sense, since you are probably not going to have the engine see much more than 6000-6500 rpm at maximum. Race camshaft design often calls for lobe separation angles (displacement angles) on the order of 105-108° (long overlap periods), while so-called street cams are spread out to about 108-112°.

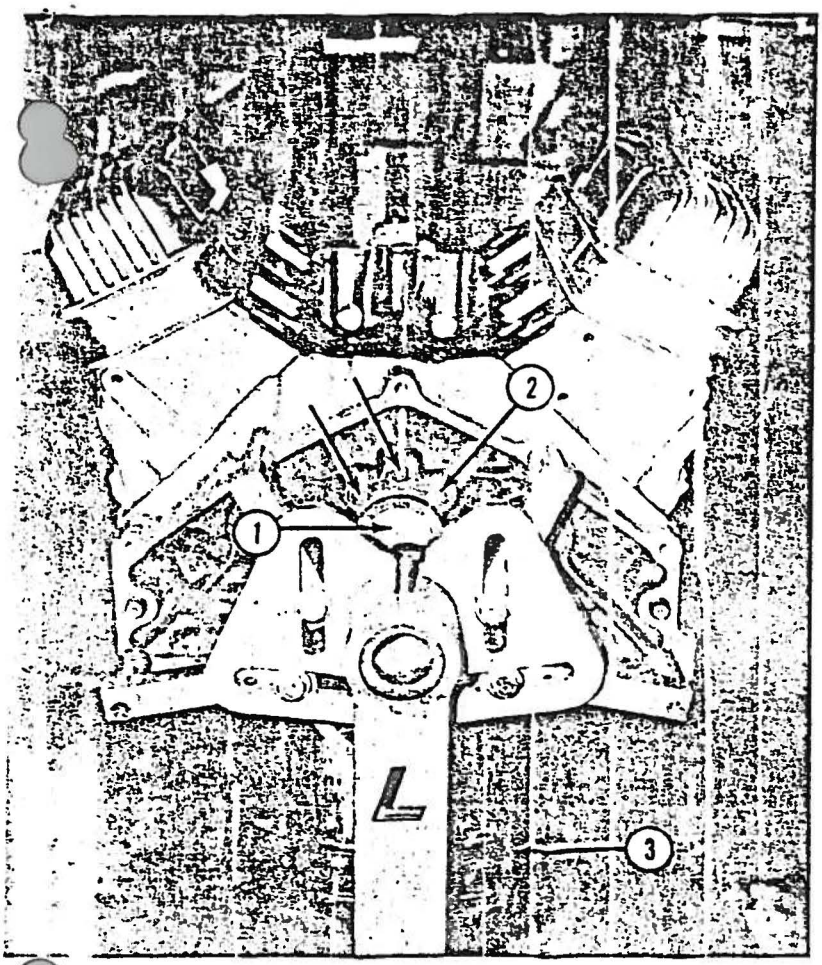
The problem is that for a given intake lobe shape (profile), spreading the displacement angle tends to have the intake valve opening slightly earlier than the same profile on a cam of less displacement angle. This earlier opening offers reversion pulses (velocity spikes) of somewhat higher energy level, since the piston may be traveling faster at this point of intake opening, compared to a later opening intake and a piston that may not be moving quite as fast (nearing its TDC position). Admittedly, it can get a little confusing, but you might think about it for a few minutes, because it is near the ap[illegible] of what makes an engine produce a h[illegible] level of cylinder filling (volumetric ef[illegible]ciency) at some particular range of r[illegible] . . . regardless of engine type or use.

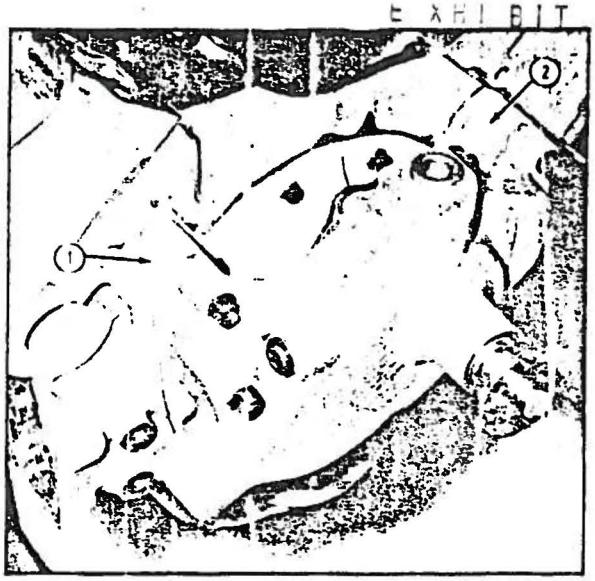
Anyway, the cam selected for engine No. 1 was a Racer Brown SS-H-50. This is a hydraulic-lifter design as specified in the camshaft specs chart (that worked out pretty slick, right?). Later in the testing of engine No. 1, there was a provision made whereby effective valve timing (intake and exhaust) was automatically varied as a function of engine rpm. But that little story will have to wait for future disclosures. In any event, the presented test data was not based on this change in engine parts.

Exhaust headers for this first engine were production Hedman HH-3 for a '67 Chevrolet Camaro. The remainder of the exhaust system was left stock, including the single muffler (double inlet and outlet) design that was OEM on this model Camaro.

A Mallory ZC-310HP vacuum-advance distributor (box stock) was used in conjunction with a standard Mallory hi-po ignition coil. We're listing major pieces of the engine (by brand name) only so you can duplicate its construction, if th[illegible]s becomes a project of your spare time. For that reason, we're jumping around a bit.

The induction system consisted of a production Edelbrock TM-1 Tarantula and a Holley No. 6619 four-barrel, 600-cfm, vacuum secondary carburetor. This particular carburetor comes with a very mixture-sensitive (in terms of adjustment) inverted idle circuit calibrated in Holley's certified emissions laboratories for emissions reductions and drivability. This car-





LEFT—Normal cylinder block preparation should include removal of lifter galley plugs (2) and flushing of possible residue core sand. Install threaded plugs in tapped holes. Rear cam bearing plug (1) should be installed with sealing compound and staked or held in place with set-screws. Stahl 2-inch dropped-sump oil pan helped keep oil in 180-210°F range. ABOVE—Milodon gear drive required installation of water pump spacers. These can be purchased from several manufacturers. Water pump is a B&B Sales unit with impeller diameter reduced for decreased hydraulic friction power loss. BELOW—Installed, TRW top-land ring approaches cylinder block deck. End gap was set at .018-inch (top right) and .015-inch (second ring). Both rings are moly-faced and the top ring features a barrel-faced contour.

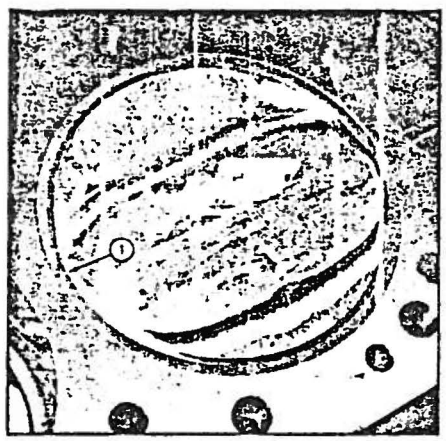
buretor was also used for part of the carburetor testing on engine No. 2. That's coming up next.

The remainder of engine No. 1 pretty well reflected sensible blueprinting practice. Factory torque levels for all rods and mains and cylinder head bolts (45 ft./lbs. on the rods, 65-ft./lbs. on main cap outer bolts and 75 ft./lbs. on the inners. and 65 ft./lbs. on the head bolts) were used and clearances set at .003-inch and .0025-inch for mains and rods respectively.

Once assembled, the engine was installed back in the '67 Camaro and run-in for a period of about 1000 miles. This particular car weighs from 3380 to 3460, depending upon accuracy of scales (where we weighed it) and whether our lunch chili came with or without the chili beans. Rear gearing was 3.5:1, and the gear box was one of the old noisy M-22 2.20 1st-gear four-speed units of days gone by.

We might mention that during the build-up of these engines, we found that rear main bearing oil seal leaks could be largely eliminated by use of the Fel-Pro set No. BS-11829. Also, a tube of Dow Corning No. 732 RTV Silastic used sparingly on such items as water pump gaskets, fuel pump gaskets, oil pan gaskets and similar areas of sealing requirement will keep oil and water "autographs" off the garage floor and driveway.

Following the break-in, engine No. 1



was taken to the strip for our first look at what an engine intended for emissions reductions could do for performance. Through the muffler and with street tires (same rear gear and weight combination mentioned), a three-run average produced an elapsed time of 13.57 at 106.48 mph. Not a racer by any stretch of the imagination, but we'll remind you that this same car (new in '67) was road-tested by Hot Rod to the tune of 14.85/94 . . . also with street tires and through the muffler.

In the emissions lab, the data shown on the accompanying chart and listed by Key-Mode and idle sampling techniques was gathered. We point out that engine No. 1 was not fitted with any traditional emissions device other than a positive crankcase vent (PCV). Insofar as the in-service vehicle is required to pass a no-load idle test (required by California and other states) with all original equipment emissions devices in operation, you might compare the no-load idle emissions levels of engine No. 1 and the current California standards for '67 model year vehicles. For that matter, you can compare it with the 1973 standards, if you want.

Fuel economy? Thought you'd never ask. Before construction of engine No. 1 began, the Camaro was producing mileage figures on the order of 13.4-13.6 miles per gallon. Fuel economy for engine No. 1 was 16.2-16.7 mpg, based essentially on highway driving (both mileages based on these conditions of vehicle operation).

And then we got into engine No. 2. Meanwhile, a couple of people had heard about engine No. 1 and constructed similar packages. Happily, we can tell you that comparable results were obtained. As you might expect, this confirmation was something of a relief, since we had not wanted to think the first attempt had been an accident.

The second engine and its objectives were discussed with some of the manufacturers already in the program, and it was decided that we might extend some of the design criteria found in those off-the-shelf pieces used in engine No. 1 to find

if some sort of aftermarket parts "limit" could be realized. Actually, this sort of let the gate down to some notable departures from conventional parts, and although at the time of this writing some of these pieces are not on the market, you might exert some pressure on your own. Never can tell what will happen.

In the interest of saving a little space, we'll try to condense the major areas of modification or design change for the parts to engine No. 2. This was also a four-bolt main bearing 350 block that was power-honed out to +.030 overbore. This time, however, a set of TRW experimetal pistons (see illustration) was installed; same compression surface design as before. One of the objects of this top ring design is to reduce the amount of crevice volume existing between the cylinder wall, piston surface and upper surface of the conventional top ring.

Part of the problem in the reduction of unburned hydrocarbons (HC) is combustion completeness. If, for some reason, the combustion flame goes out prematurely, there will be some amount of unspent (unoxidized) hydrocarbons left in the cylinder to (1) dilute the incoming charge or (2) be passed out the exhaust system as unburned fuel. Moving the top ring up near the plane of the piston's compression surface and closer to the cylinder block's deck helps reduce this small quench volume that can contribute to a loss in combustion efficiency. There is also a feature whereby combustion gas pressure exerts force behind the ring, aiding ring seal and pressure containment (reduction of blow-by).

In the camshaft department, Racer trimmed up another set of profiles. This time it was felt that we should capitalize on the ability of both intake and exhaust port flow to be high at low lift values, so the flank rates (severity of contact angles) were increased to the point of requiring use of roller valve lifters and a rev kit of the type found in race engines. Obviously, such a design is self-limiting (rpm), but as we pointed out earlier, this was experimentation. Engine No. 2 camshaft specs are included in chart form elsewhere in the story.

To facilitate variation in valve timing, a Milodon gear drive was fitted to the little Chevy block. If the idea of inlet valve opening point (relative to piston position) meant anything, we felt it would be worth including this variation in the data. With the particular unit, cam timing changes are easy as ACB.

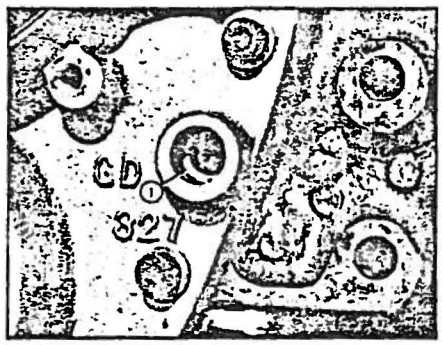
Cutaway drawing of TRW experimental piston design shows fit of top U-ring assembly and barrel face of cylinder bore contact surface. This ring is moly-faced, as is the second compression ring. No expanders are used behind either top or second compression rings. End gaps are set to essentially the same dimensions as those for conventional piston rings.

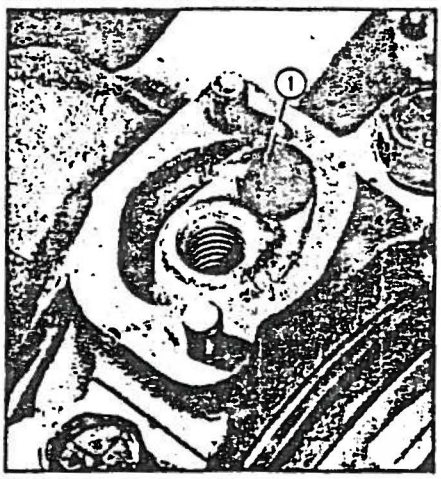
Jere Stahl was brought into the act right about here. It was believed that maximum engine speed was going to be in the vicinity of 6000–6500 rpm, and since the production of torque was one clear-cut objective of this particular engine, Jere fabricated a set of real *street* headers: 1½-inch-diameter pipe, 34-35 inches of primary tube length, 10 inches of collector length made from 2½-inch-diameter collector tubing. All this was built into a set of individual-tube headers. Before you sell the approach too short, think about this: Most headers are built to be run *open* at some time or another. If pipe size and length are a function of torque and rpm (which they are), doesn't it make sense to design a header that will do this but which is not necessarily intended to *ever* be run open at the collector? It's a thought.

Since the cylinder heads used were of the type Cylinder Head America worked out for engine No. 1, little was needed in this department. The intake manifold for engine No. 2 was an Edelbrock Torker, chosen in part because of its maximum power range of about 6500 rpm. Some time on the flow bench was required to match its flow characteristics (not necessarily just amount of flow) to the CHA heads.

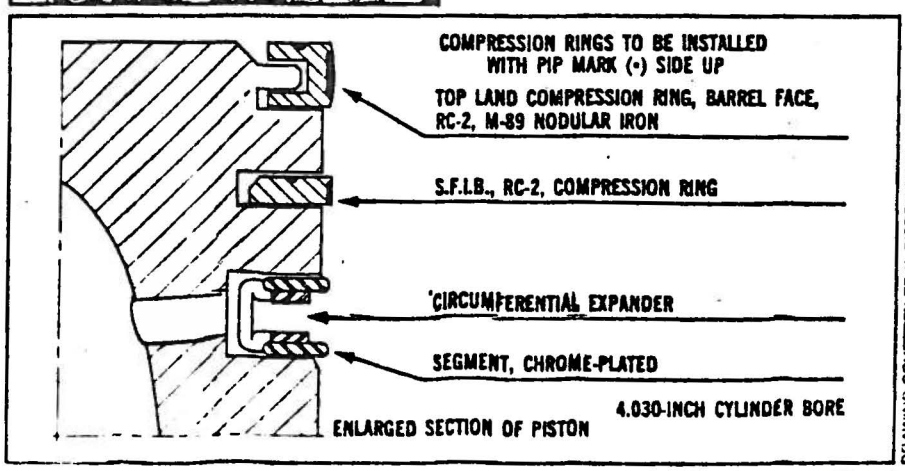
We also threw in a little water pump modification, just to reduce power loss to this little "onboard water dynamometer." A company called B&B Sales modifies stock Chevy water pump impellers for Super Stock and similar race engine

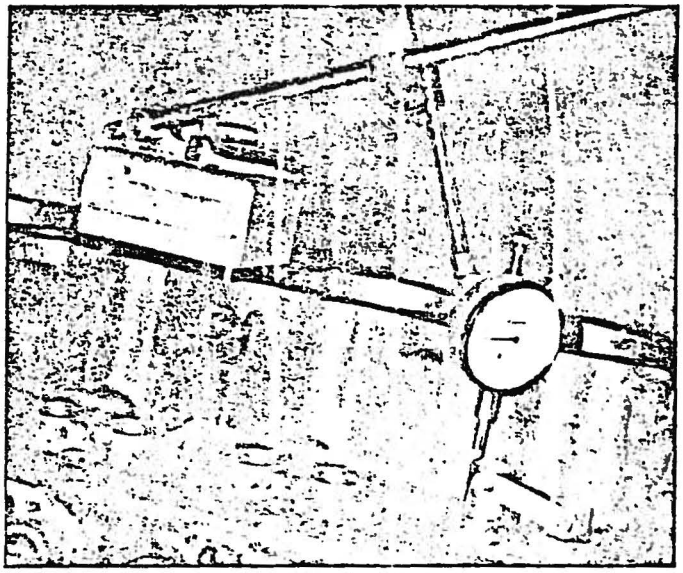
BELOW— This picture shows oil pump modifications for 2-inch dropped Stahl pan involving alteration of pickup tube (note two welded joints) and installation of a flat-stock steel bracket welded to screen housing on one end and bolted to pump housing on the other.



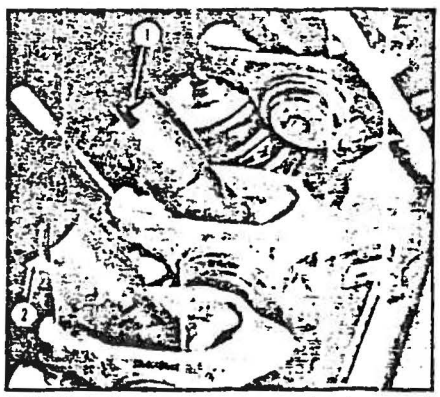


ABOVE LEFT—Milodon gear drive locates on two heat-treated dowel pins installed in block after gear clearances are adjusted by cover location. Subsequent removal of cover does not disturb initial gear clearances with this procedure. LEFT—To avoid mismatch between oil pump discharge and mating hole in rear main bearing cap, slight radiusing of cap hole aids oil flow.



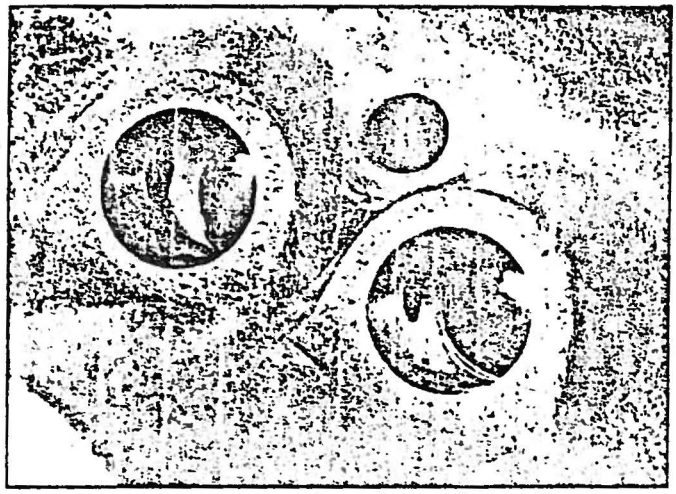


To avoid cam specs errors (during checking) contributed by valvetrain slack (pushrod deflection, rocker arm displacement, etc.), timing should be checked at the valve lifter. For camshaft installations requiring special accuracy, we advise checking both inlet and exhaust timing for every cylinder in the engine. Never can tell when your favorite cam grinder might slip a little.



ABOVE—Severe contact angles (rates of valve lift) of experimental cams suggested provisions for rigid valvetrain. Moroso/Jomar girdle and Gotha rocker arms helped keep deflection to a minimum. Note rounding of corners of adjusting nuts. These ends come near flush with aluminum girdle bar and are less likely to "grab" bar during adjustment if so modified. (This trick courtesy of Mr. Paul Blevins.)

work, so you can either get one of these or do the job yourself. GM parts number for the stock impeller is 3923250. This can be machined to reduce the o.d. by about .250-inch (on a diameter) or you can get one stamped 30170-1M which is the same o.d. as the No. 3923250 but has smaller impeller blades. The 30170-1M can also be reduced in o.d. by about .250 inch, making it the least resistive to hydraulic loading of all three. (This little bit has been included for all you racers who figured an emissions economy engine has nothing to offer you . . . but are mistak-



ABOVE—All oil return (drain back) holes in lifter galley were enlarged and radiused to aid pan supply. Lifter bores were finished with a brake cylinder hone.

IDLE EMISSION STANDARDS FOR LIGHT-DUTY HIGHWAY VEHICLE INSPECTION

The following exhaust emissions standards are currently being enforced by the State of California (comparable ones in other states) and are included to give you some basis of comparison between the required emissions levels of HC and CO and those produced by the project engines. What you might want to keep in mind is that the vehicle used in test was a 1967 model Chevrolet 350-c.i. V8 (not equipped with any device other than a positive crankcase vent valve—PCV). These standards apply to engines of piston displacement greater than 140 cubic inches.

	Unburned Hydrocarbons (HC in ppm)	Carbon Monoxide (CO in %)
Vehicles 1955 to 1965 (inclusive)	1200	8.0
1966 to 1969		
With air injection	400	4.0
With engine modification (clean air packages, etc.)	500	7.0
1970 to 1971 (all)	350	4.0
1972 to 1973		
With air injection	275	2.5
With engine modification (clean air packages, etc.)	350	4.0

As a point of reference, test engine No. 1 had an HC level (at idle) of 105 ppm and a CO level of 1.1 percent. Engine No. 2 was at HC = 125 ppm and CO = 2.1 percent. Remember that both these engines were built to 1967 vehicle requirements, so you can refer to this section of the standards for comparisons.

CAMSHAFT SPECIFICATIONS

Although there are other cam manufacturers now producing parts aimed at emissions reductions and fuel economy benefits, at the time of this project's initiation there were only two who indicated available parts. These were Racer Brown, Inc., and Crane Cams, Inc. Racer was actually involved in the early phases of engine No. 1 and for that reason was used during the complete program. His assistance was valuable. There was also a device in the engine that provided an amount of *automatic* valve timing variation (as a function of engine rpm), but we'll let this device appear at a later date when its legal coverage has been secured. (Data in the story is not based on the performance of this particular method of valve event variation . . . although it was evaluated in conjunction with these tests.)

Camshaft Engine No. 1

RB-SS-H-50: Intake event—27° BTDC open, 67° ABDC close
Exhaust event—71° BBDC open, 23° ATDC close
Operating clearance—.000 (hydraulic valve lifters)
Net valve lift—.480 inch

Camshaft Engine No. 2

RB-00-R-12 (Experimental):
Intake event—22° BTDC open, 62° ABDC close
Exhaust event—63° BBDC open, 18° ATDC close
Operating clearance—.012 inch intake (hot)
.014 inch exhaust (hot)

Get four venturi boosters (Holley part No. 45R-107). You'll also need two primary jet plates from a Holley 3310 (780-cfm four-barrel) and two 6.5-lb. power valves. Put No. 71 jets in both jet plates, and resize the power valve restrictions to .057-inch. If you have difficulty locating these power valves, the part number is 25BP-591A-65. The symmetrical primary and secondary venturis of the 750 (1⅜-inch) make this particular carburetor especially responsive to the high-speed, nozzle-bar 45R-107 booster. Use the green accelerator pump cam for street engines (a Rio pump kit on the secondary for racing) and change the channel restrictions in the main body to .081-inch. Idle feed restrictions should be resized down to .032-inch. What you'll have when this is finished is a street four-barrel that almost acts like fuel injection between off-idle and 6000 rpm. The no-load idle emissions data shown for engine No. 2 was produced with a 750 modified according to these steps.

Performance of engine No. 2? Unfortunately, we were unable to produce track numbers, since engine installation came at about the time we were helping finish the ark required by unseasonal California weather. Fuel economy data, exhaust emissions levels and chassis dynamometer power numbers were obtained, however, and are included in the accompanying tables and charts. We would like to point out, for the sake of credibility, that the fuel economy levels of engine No. 2 (17.3–17.6 mpg) were recorded during use of the No. 6619 Holley (not the 750 double-pumper). Rear wheel power might not seem too high, but we'll add that a 1972 Z-28 Camaro 350-c.i.d. four-barrel Quadrajet engine pumped out only 167 corrected horsepower at 4000 rpm . . . on the same chassis dyno.

In retrospect, we feel that many of the project's objectives were accomplished. Right now, we are faced with the duality of fuel shortages and higher gasoline prices. Even when it becomes more available, gasoline will be priced higher than before the "crisis." For this reason, we expect there will be continued interest in vehicles that reduce fuel consumption, especially if this can be accomplished without penalties in drivability. Both these engines will continue to run and additional data will be gathered. As you consider what could be made better about the various parts of this project, remember that it is combustion efficiency through a broad range of engine speed and loading that helps reduce emissions and provide good fuel economy. Your comments are welcome. Just remember that we have a seven-second attention span.

You might also want to contact some of the manufacturers who have participated in this exercise. These are the kinds of people who are doing something about many of the problems facing the specialty parts industry today. ■■

ABOVE—Front end of cylinder block had lifter galley plugs knocked out, passages flushed for remov. of residual core sand, and was fitted with thread-sealed plugs in tapped holes. Milodon gear drive was se-

CLAYTON KEY-MODE EMISSIONS TESTING RESULTS

The following are exhaust emissions levels as prescribed by the Clayton Manufacturing Company of El Monte, California (the chassis dynamometer people), which are termed "sensible values for rejection that can be met by a vehicle in good repair." These are levels of unburned hydrocarbon (HC) and carbon monoxide (CO) taken at three states of engine operation (idle, low-cruise and high-cruise) during which the vehicle is placed on a chassis dynamometer loaded to provide a resistance (road load) commensurate with the vehicle's weight and run at speeds of about 30 and 50 miles per hour. At idle, there is no effective load. During these conditions, HC and CO are measured and compared to the "sensible values for rejection" Clayton has devised. We point out that these emissions levels are the product of years of study involving thousands of vehicles, and while Clayton emphasizes that the Key-Mode method is not a direct substitute for either 7-mode or constant volume sampling (CVS) schedules, it is a "relatable" test. Key-Mode "standards" are as follows:

	High-cruise	Low-cruise	Idle
Unburned Hydrocarbons (HC)	220 ppm	240 ppm	290 ppm
Carbon Monoxide (CO)	2.0%	2.5%	3.0%

where ppm = parts per million and % = percentage of CO concentration in sample. Also, all values for HC and CO are considered by Clayton to be maximum values of acceptability.

For the two project engines under discussion, the following is Key-Mode data using all parts mentioned, including the Holley No. 6619 carburetor (we make this distinction since some testing was performed with a modified Holley No. 4779).

		High-cruise	Low-cruise	Idle
Engine No. 1	HC	110 ppm	130 ppm	105
	CO	0.75%	0.95%	1.8%
Engine No. 2	HC	140	165	125
	CO	1.3%	1.7%	2.1%

Chassis Dynamometer Results: Rear-wheel horsepower figures SAE-corrected for sea-level atmospheric pressure (14.7 psi) and standard temperature (60°F.). Vehicle rear-wheel speed (vehicle road speed) based on chassis dyno-corrected speedometer of 1 mi./hr. = 48.45 engine rev./min. (or .0206 mi./hr. = 1 rev./min.).

ENGINE RPM	VEHICLE SPEED (MPH)	CORRECTED REAR-WHEEL HORSEPOWER	
		Engine No. 1	Engine No. 2
2500	51.	137	163
3000	61.8	174	189
3500	72.1	209	226
4000	82.4	241	253
4500	92.7	257	278
5000	103.0	(Unable to hold rear tires on chassis dyno rolls due to lack of traction.)	

**Special thanks to Edelbrock Equipment Company for cooperation and use of chassis dynamometer and exhaust emissions testing facility throughout construction and testing of both project engines.

List of participating manufacturers and personnel:

Autotronic Controls Corp.
B&B Sales Company
Cylinder Heads America
Edelbrock Equipment Company
Holley Carburetor Company
Lakewood Industries
Mallory Electric Corporation
Milodon Engineering
Moroso Performance Sales
Racer Brown Cams
Sealed Power Corporation
Jere Stahl
TRW
James McFarland, III*

EXHIBIT B

AMC

	304	304	304 V/8	360	360	360 V/8
Displacement / YEAR	197	197	197		197	197
PCV Positive Crankcase Ventilation	x	x	x	x	x	x
AIR Air Injector Reactor	x	x	x	x	x	x
EEC Evaporative Emission Control	x	x	x	x	x	x
TAC Thermostatic Air Cleaner	x	x	x	x	x	x
CAT Catalytic Converter	x	x	x	x	x	x
EGR/BPS Exhaust Gas Recirculation with Back Pressure Sensor	x			x		
VCV Vacuum Control Valve	x			x		
TCS Transmission Controlled Spark	x	x	x	x	x	x
SCTO Spark Coolant Temperature Override	x			x		
EGR Exhaust Gas Recirculation		x	x		x	x
FVR Fuel Vapor Return System		x	x		x	x
BPS Exhaust Back Pressure Sensor		x	x		x	x
CTO Coolant Temperature Override		x	x		x	x
Warm Up Converter Ahead of CAT	x			x		

EXHIBIT B

CHEVROLET

Displacement	PCV Positive Crankcase Ventilation	AIR Air Injection Reactor	EGR Exhaust Gas Recirculation	EEC Evaporative Emission Control	TAC Thermostatic Air Cleaner	CAT Catalytic Converter	EFE Early Fuel Evaporation	SD Spark Delay	EGR-TVS Exh. Gas Rec. Temperature Vac. Swi	CAI Catalyst Air Injection		YEAR
305	X	X	X	X	X	X	X	X				1977
305 - 2 bbl	X	X	X	X	X	X	X		X			1976
350	X	X	X	X	X	X	X					[illegible]
350 - 4 bbl	X		X	X	X	X	X		X	X		[illegible]
350 - 4 bbl R.P.O. LMI	X		X	X	X	X	X			X		[illegible]
[illegible]0 - 4 bbl R.P.O. L48 & L82	X	X	X	X		X	X					1975
400 - 4 bbl	X		X		X	X	X		X	X		1976
400 - 4 bbl	X		X	X	X	X	X			X		1975

CHRYSLER
(Plymouth/Dodge)

Displacement	PCV Positive Crankcase Ventilation	TAC Thermostatic Air Cleaner	EAC Electric Assist Choke	EGR Exhaust Gas Recirculation	TIC Thermal Ignition Control	OSAC Orifice Spark Advance Control	CAT Catalytic Converter	AAS Aspirator Air System	ELB Electronic Lean Burn	AIR Air Injector Reactor	IES Idle Enrichment System	DSC Dual Stage Electric Assist Choke	EEC Evaporative Emission Control	YEAR
318	X	X	X	X	X	X	X	X	X	X			X	197
318 - 2 bbl	X	X	X	X	X	X	X			X			X	1976
318 - 2 bbl	X	X	X	X	X	X	X			X	X		X	
360 - 2 bbl	X	X	X	X	X	X	X	X					X	
360 - 4 bbl	X	X	X	X	X	X	X	X	X	X			X	
360 - H.P.	X	X	X	X	X	X	X	X		X			X	
360 - 4 bbl	X	X	X	X	X		X			X			X	1976
360 - 4 bbl	X	X		X	X	X	X			X	X	X	X	1975
400 - 4 bbl	X	X	X	X	X		X	X	X				X	1977
400 H.P.	X	X	X	X	X		X	X					X	
400 - 4 bbl	X	X	X	X	X	X	X			X			X	1976
400 - 4 bbl	X	X	X	X	X	X	X			X	X		X	1975
440 - H.P.	X	X	X	X	X	X	X	X					X	197
440 - 4 bbl	X	X	X	X	X	X	X	X	X	X			X	
440 - 4 bbl	X	X	X	X	X	X	X			X			X	1976
440 - 4 bbl	X	X	X	X	X	X	X			X	X		X	1975

DATSUN

Displacement	PCV Positive Crankcase Ventilation	AFC Air Flow Controlled Fuel Injection	BCDD Boost Controlled Deceleration Device	BPT Back Pressure Transducer	EGR Exhaust Gas Recirculation	CAT Catalytic Converter	DV Decel Valve	EEC Evaporative Emission Control	AIR Air Injection System	TAC Thermostatic Air Cleaner	AC Altitude Compensator	CAC Combined Air Control Valve	DP Dash Pot	EAC Electric Assist Choke	FCO Fuel Cut-off Solenoid	ISCS Idle Speed Control System	STCS Spark Timing Control System	TCS Transmission Controlled Spark	CSSA Cold Start Spark Advance		YEAR
280Z	X	X	X	X	X	X		X													1977
280Z	X	X	X		X	X		X										X	X		1976
280Z	X	X			X	X	X	X													1975
620 Pickup	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X				19
620 Pickup	X		X		X	X[1]		X	X	X			X	X							1976
620 Pickup	X				X		X	X	X	X			X	X							1975

[1]Manual Transmission Only

FORD

Displacement	PCV Positive Crankcase Ventilation	TAC Thermostatic Air Cleaner	AIR Air Injection Reactor	CAT Catalytic Converter	EGR Exhaust Gas Recirculation	ABV Air Bypass Valve	DV Delay Valve	PVS Ported Vacuum Switch	VS Vacuum Solenoid	DVVV Distributor Vacuum Vent Valve	TVS (AIR) Thermal Vacuum Switch	CV Check Valve	BPS EGR Back Pressure Sensor	TVV Temperature Vacuum System Valve	VHC Exhaust Vacuum Heat Control Valve	SDV Spark Delay Valve	VR Vacuum Reservoir	EAC Electric Assist Choke	EEC Fuel Evaporative Emission Control	EGR/BPS Exhaust Gas Recirculation with Back Pressure Sensor		YEAR
302	X	X	X	X		X	X	X	X	X	X	X							X	X		1977
All 302:																						1976
CAL 5-10 G&H[1]	X	X	X	X	X		X	X					X	X	X				X			
CAL 5-11 A	X	X	X	X	X		X	X					X		X	X			X			
CAL 5-11 G&M	X	X	X	X	X		X	X					X	X	X				X			
CAL 5-11 P&Q	X	X	X	X	X		X	X					X		X	X	X		X			
CAL 6-11 G	X	X	X	X	X		X	X					X						X			
CAL 6-11 H	X	X	X	X	X		X	X											X			
CAL 6-11 N	X	X	X	X	X		X	X					X		X	X			X			
CAL 6-11 P&Q	X	X	X	X	X		X	X					X		X	X	X		X			
302 M 2 Bbl	X	X	X	X	X			X								X		X	X			1975

[1]Manual Transmission only; all others automatic for 1976

FORD

Displacement	PVC Positive Crankcase Ventilation	TAC Thermostatic Air Cleaner	AIR Air Injection Reactor	EEC Evaporative Emission Control	CAT Catalytic Converter	EGR/BPS EGR with Back Pressure Sensor	TVS (TAC) Thermal Vacuum Switch	ABV Air Bypass Valve	VCV (EGR) Vacuum Control Valve	EGR Exhaust Gas Recirculation	DV Delay Valve	VHC Exhaust Vacuum Heat Control Valve	SDV Spark Delay Valve	PVS Ported Vacuum Switch	VS Vacuum Solenoid	VA Vacuum Amplifier	VRVS Vacuum Reservoir & Solenoid	BPS EGR Back Pressure Sensor	TVV Temperature Vacuum System Valve	RDV Retard Delay Valve	CSSA Cold Start Spark Advance	EAC Electric Assist Choke	YEAR
351 M	X	X	X	X	X	X	X	X	X		X												1977
351 W:																							
CAL 5-12 G	X	X	X	X	X					X		X	X	X	X								
CAL 5-12 N	X	X	X	X	X					X		X			X	X	X						
CAL 5-14 H	X	X	X	X	X					X	X			X				X	X	X	X		
CAL 6-12 N	X	X	X	X	X					X	X			X									
CAL 6-12 H	X	X	X	X	X					X	X			X				X	X				
351 W - 2 bbl	X	X	X	X	X					X		X		X								X	1975
351 M:																							1976
CAL 6-14 K	X	X	X	X	X					X								X	X				
CAL 6-14 P	X	X	X	X	X					X	X			X				X	X	X	X		
351 M - 2 bbl	X	X	X	X	X					X		X		X								X	1975

E XHIBIT

FORD

Displacement	PCV Positive Crankcase Ventilation	TAC Thermostatic Air Cleaner	AIR Air Injection Reactor	EEC Evaporative Emission Control	CAT Catalytic Converter	EGR/BPS Exhaust Gas Recirculation with Back Pressure Sensor	DV Delay Valve	VCV (EGR) Vacuum Control Valve for EGR	EGR Exhaust Gas Recirculation	TVS Thermal Vacuum System	TVV Temperature Vacuum System Valve	SDV Spark Delay Valve	PVS Ported Vacuum Switch	CSSA Cold Start Spark Advance	RDV Retard Delay Valve	VHC Exhaust Vacuum Heat Control Valve	VS Vacuum Solenoid	WOTV Wide Open Throttle Valve	EAC Electric Assist Choke	ABV Air Bypass Valve	BPS Back Pressure Sensor	YEAR
400	X	X	X	X	X	X	X	X		X										X		1977
400 :																						1976
CAL 5-17 G	X	X	X	X			X		X	X	X	X	X	X	X						X	
CAL 5-17 N	X	X	X	X	X				X				X			X	X					
L 6-17 J	X	X	X	X	X		X		X		X							X			X	
L 6-17 N	X	X	X	X	X		X		X		X	X	X	X	X			X			X	
400 2bbl	X	X	X	X	X				X				X			X			X			1975

PONTIAC

Displacement	PCV Positive Crankcase Ventilation	EEC Evaporative Emission Control	TAC Thermostatic Air Cleaner	CAT Catalytic Converter	EGR/BPS EGR Back Pressure Sensor	EFE Early Fuel Evaporation	TVS (SVB) Thermal Vacuum Switch with Secondary Vacuum Break	CV (EFE) Check Valve EFE	VDV (DS) Vacuum Delay Valve Distributor Sp	TVS (SVB/DS) Thermal Vacuum Switch Secondary Vacuum Break Distributor Switch	TVS (EGR) Thermal Vacuum Switch EGR	AIR Air Injector Reactor	TVS (EFE) Thermal Vacuum Switch EFE	TVS (DS) Thermal Vacuum Switch Distributor Spark	TVS (EGR & DS) Thermal Vacuum Switch EGR & Distributor Spark	EGR Exhaust Gas Recirculation	EGR/EFE-PVS EGR/EFE Ported Vacuum Switch	DPVS Distributor Ported Vacuum Switch	EGR/PVS EGR Ported Vacuum Switch	BPS Exhaust Back Pressure Sensor	DS Delay Switch	EFE-PBS EFE Back Pressure Sensor	SDV Spark Delay Valve	YE
350 VIN - P	X	X	X	X	X	X	X	X	X	X	X														19
350 VIN - L	X	X		X	X	X		X			X	X	X												
350 VIN - R	X	X	X	X	X		X				X	X		X	X										
350 - 2 bbl[1]	X	X	X	X		X										X	X								
350 - 2 bbl[2]	X	X	X	X		X										X		X	X						
[illegible] - 4 bbl[1]	X	X	X	X		X										X	X								
[illegible] - 4 bbl[2]	X	X	X	X		X										X	X	X							
350 - 4 bbl	X	X	X	X								X				X				X	X		X		
350 - 4 bbl	X	X	X	X		X						X				X				X					19
403	X	X	X	X	X		X				X	X		X	X										19
400	X	X	X	X	X	X	X	X			X		X	X											19
400 - 4 bbl	X	X	X	X								X				X		X		X			X		19
400 - 4 bbl	X	X	X	X								X				X				X					19
455 - 4 bbl	X	X	X	X		X										X		X		X		X			19
455 - 4 bbl	X	X	X	X		X										X				X					19

[illegible] Air

[2]Ventura With Air

EXHIBIT B

VOLKSWAGEN

Displacement	CIS Continuous Injection System	DDD Dual Diaphragm Distributor	DV Decel Valve	PCV Positive Crankcase Ventilation	AIR Air Injection System	EGR Exhaust Gas Recirculation	CAT Catalytic Converter	FES Fuel Evaporation System	TAC Thermostatic Air Cleaner		YEAR
Dasher	X	X	X	X	X	X	X	X			1977
Dasher	X	X	X	X		X	X	X			1976
Dasher		X		X	X	X	X	X	X		
bit/Scirocco	X	X	X	X	X	X	X	X			1977
Rabbit/Scirocco		X		X	X	X	X	X			1976
Rabbit/Scirocco		X		X	X	X	X	X	X		1975

Truckee Meadows

AIR QUALITY

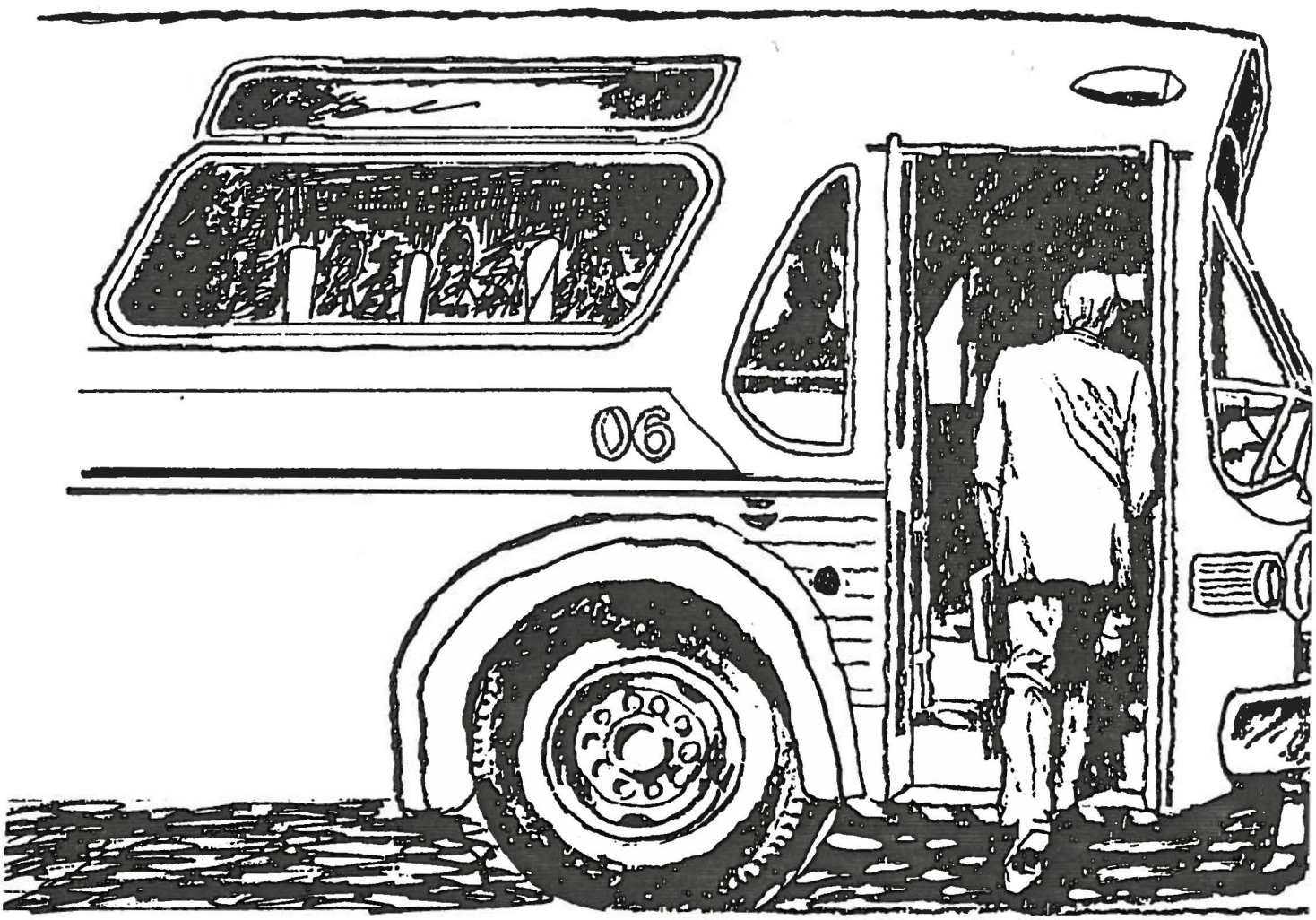
AIR QUALITY

Implementation Plan

WASHOE COUNTY OVERALL WORK PROGRAM

Washoe County Metropolitan Planning Organization

1978
TRANSIT DEVELOPMENT PROGRAM



REGIONAL STREET AND HIGHWAY COMMISSION
OF
WASHOE COUNTY

TRANSPORTATION SYSTEMS

Project Selection and Funding

Prepared by:

State of Nevada
Department of Highways
Planning Survey & Program -
Project Management Divisions

May 1978

Truckee Meadows Transportation Planning Process

(Supplement to the Air Quality (Implementation Plan)

EXHIBIT B

LAS VEGAS VALLEY AIR QUALITY IMPLEMENTATION PLAN

CLARK COUNTY, NEVADA

DECEMBER 5, 1978