

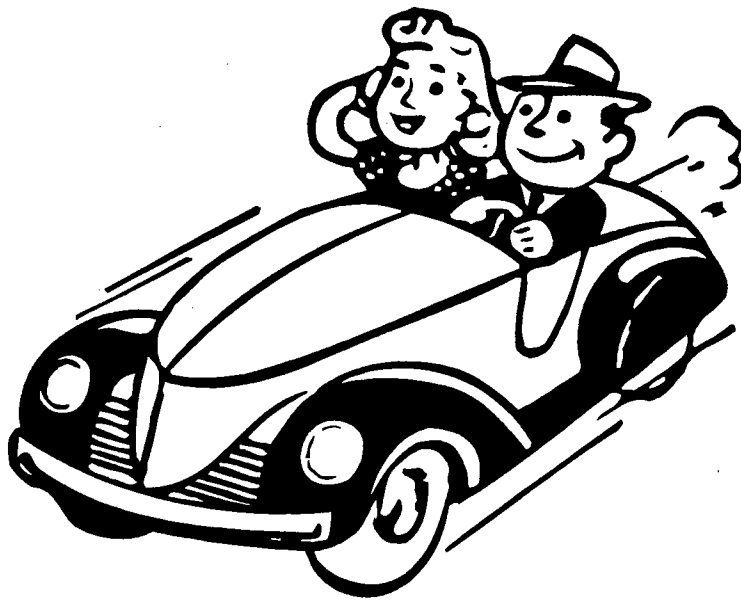
NAME _____

CLUB _____

AGE _____

UNIT 1
THE CAR AND THE HIGHWAY

4-H
AUTOMOTIVE PROJECT IN CARE
AND SAFETY



UNIT 1
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4-H
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OUTLINE OF UNITS

The impact motor vehicles — automobiles and trucks — have made on modern living makes it important that each of us have more opportunities to learn about the safe care and operation of automobiles, and for many of us, light trucks.

Here is one of those opportunities, an invitation to participate in the 4-H Automotive Care and Safety Project, developed especially for the maturing club members, 14 years of age and older. Its purpose is to help you achieve and enjoy being a safer and more efficient automobile driver.

Whether or not you have started to drive, the 4-H Automotive Care and Safety Project offers you an opportunity to share with others in your age group, the advantage of learning more about the automobile, how it should be handled on the road, the cost involved in operating it, and how to maintain the car properly. This project is meant to supplement, not replace, any recognized driver training course your school, or community, may sponsor or endorse.

Following is an outline of the contents of the three Units, of which this manual is Unit 1.

UNIT 1: The Car and the Highway

- Section I. You and the Automobile.
- Section II. Highway Safety.
- Section III. Group Activity — Highway Hazard Hunt.
- Section IV. What Makes a Car Go! and Stop!
- Section V. The Engine in General — Simple Principles of Internal Combustion.
- Section VI. Carkeeping.
- Section VII. Car Costs and Record Keeping.
- Section VIII. Traffic Code and Your Future Responsibilities.
- Section IX. Car Inspection — Safety Checking a Car.

UNIT 2: Maintenance and Operation

- Section I. The Engine as a Power Unit.
- Section II. The Engine Needs Clean Air.
- Section III. How The Fuel System Works.
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- Section I. What Does It Cost to Own and Operate A Car?
- Section II. How Power is Transmitted by the Engine.
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- Section VI. What to Look For in Buying a Used Car.
- Section VII. Operating Your Car Efficiently.
- Section VIII. How to Make Your Community a Safer Place to Drive
- Section IX. Group Activities — Economy Run and Driving Skill.



You like cars. All teenagers like cars, so much so that they can hardly wait to learn to drive, and then to own a car. You've never known a time when there weren't automobiles and trucks. But young folk in most other countries, like your great-grandparents when your age, probably never rode in automobiles.

Getting a driver's license, proving one's ability to operate a car with reasonable safety, is a common goal of all young people. It's really something to look forward to, isn't it? But to earn that right calls for planning and preparation.

As a pre-driver you have time to learn what it-takes to become a good driver, what is required to drive a car safely and more economically. That's the purpose of this Automotive Care and Safety Project. It is designed to help you learn and understand more about the automobile — how the engine works, how each major part of the car operates, and how to keep the car in good condition. Learning to do these things right before you start to drive will help put you a step ahead as a careful operator of a motor vehicle.

Thousands of 4-H'ers have agreed that this is a good idea — and there's fun in it, too.

Why is learning about automobiles important?

For one thing, more than 132 million motor vehicles operate on our streets and highways today. Did you know that 80.5% of all families in the United States own cars?

Another reason is that for most families an automobile represents a large investment of money, both as to initial cost and to upkeep.

But whether a family owns a car or not, and regardless of the cost, motor vehicles are a vital part

of American life. You'd have difficulty naming all the ways they serve you and your family, and it would be just as hard to think what it would be like without these services.

Probably no other invention has had a greater impact on American economy and society. The automobile industry has created millions of jobs, helped raise wages and the standard of living. Cars and trucks play a key role in our modern system of production and distribution of goods and services.

While it is just as far from here to there as it was 50 years ago, motor vehicles have become distance-shorteners and time-savers, as we travel over the greatly improved road and highway systems that have been forced into being.

As a result your school is bigger, better equipped, more centrally located. You can attend educational and sporting events at rival schools because cars and buses provide quick, low-cost transportation. You can take advantage of more vacation and recreational travel because motor vehicles have-greatly reduced the time, and in the case of family units, the cost of getting there and back.

The automobile speeds doctors on calls, brings clinics and hospitals within the reach of all. Everyday needs — food, fuel, medicine, mail — reach you faster and at lower cost.

Trucks move the products of farms, canneries and factories quickly to markets and stores. Almost everything you eat, wear, or otherwise use, travels at least part of its way to you over the highway in trucks or cars.

Many businesses, unknown a few decades ago, have been created because of widespread use of motor-vehicles—motels, drive-in theaters, shopping centers, for example. You may think of a dozen others.





Motor vehicles and highway transportation have helped to make America great. Truly we're a nation on wheels and our economy has prospered because of it. Did you know that Americans own almost two-thirds of all the automobiles in the world, while we make up only one-sixteenth of its population? Primitive forms of transportation in many countries act as a giant brake on the whole economy, because the methods of moving people and goods are cumbersome and costly.

So much for the plus side of motor vehicle use, the benefits. What about the minus side? It needs the attention of every driver and pre-driver, because the matter of motor vehicle accidents is a serious one.

Every year thousands of people are killed, and hundreds of thousands are maimed and injured in accidents on our streets, roads and highways. Property damage alone amounts to billions of dollars; no monetary value could ever be placed on the lives lost.

Traffic accidents need not happen, and most could be prevented if each driver, while behind the wheel, remains aware of the power and potentiality of the motor vehicle he is driving and keeps it under constant control.

Your Automotive Care and Safety Project is designed to help you cultivate the proper attitude toward others on the road, and toward the necessary driving skills, in an effort to greatly reduce the number of traffic mishaps. You will learn how a substantial part of the highway toll can be avoided through proper use and care of your automobile.

You will enjoy your progress from one section to another — from one 4-H meeting to another.

- Do you have a better understanding of the importance of the motor vehicle on the American way of life? This is the primary objective of this section.

- What basic elements of highway safety do you need to know? That's coming up when you have a meeting on highway safety and a hazard-hunt activity.

- Do you have a deep appreciation of traffic and other laws related to the operation and ownership of motor vehicles? That's coming up under "Rules for the Road."

- What principle service and maintenance operations should you be able to perform? These include such elementary tasks of car maintenance as cleaning and polishing, care of tires, checking under the hood, etc.

- How many basic parts of a car can you name? You'll discover some of these when you do activities under "What Makes a Car Go! and Stop!"

- Do you know what principles of force and gravity are at play in safe motor vehicle operation? You'll learn more about these later.

- How much does it cost to own and operate an automobile? Wait, you may be surprised.

- Are you interested in career opportunities in the automotive field? You'll get some insights into these.

With this brief background of the significance of the motor vehicle and the objectives of the Automotive Care and Safety Project, we are ready to launch into what could prove to be one of the most interesting experiences you'll have in 4-H.





UNIT 1, SECTION I

YOU AND THE AUTOMOBILE

LET'S DISCUSS

Read through quickly and check whether you agree or disagree. Then discuss the questions together. You might want to try these on your family also.

- | | <i>Agree</i> | <i>Disagree</i> |
|---|--------------|-----------------|
| 1. My family could get along without an auto..... | _____ | _____ |
| 2. Automobiles are more important to people outside of metropolitan areas, than to city people..... | _____ | _____ |
| 3. Automobiles are too powerful today..... | _____ | _____ |
| 4. For most families the automobile represents a large investment..... | _____ | _____ |
| 5. Motor vehicles have created a need for many businesses unknown a few decades ago..... | _____ | _____ |
| 6. More people are injured or killed in auto accidents than by any other cause..... | _____ | _____ |
| 7. Most automobile accidents could be prevented..... | _____ | _____ |
| 8. Most teen-agers know how to drive properly when they reach legal age..... | _____ | _____ |

LET'S DO

Each member is to do the following:

1. List five main ways the car is used by your family. a. _____
b. _____ c. _____ d. _____ e. _____
2. What changes would have to be made if suddenly there were no automobiles in your community? _____

3. How far do you travel to--the doctor or dentist? _____ miles. Go to church? _____ miles. Go to school? _____ miles. Do the family shopping? _____ miles.
4. What do you do now in the care of your family car? What do you and your family think you could do as a part of this project in caring for the car? _____

5. Find out from your parents what the price range of their car was when new. What year and model is it and how long do they plan to keep it. _____
6. If a person earns \$50 a week, how long would it take at that rate to purchase the average low-priced car, using the entire amount each week? _____
7. Report on the most interesting auto trip that your family has taken in your present automobile. _____

8. Discuss any auto accidents which have occurred in your family during the past year. _____

9. Divide your club into smaller groups and do the following:
 - a. Find out how many cars there are in your county _____
 - b. Talk to an exchange student or a person who has traveled in another country and give information about motor vehicle use in that country. _____

 - c. Talk to three neighbors and find out what concerns each most as a driver in your community. _____



"Traffic accidents don't just happen—they're caused."

No doubt you've heard that slogan a lot of times, but have you ever really thought what it means?

It tells us that accidents are caused, but by whom or what? By carelessness or poor judgment on the part of the driver? By some defect in the car itself? By hazardous road conditions?

Studies show that 17 out of 20, or nearly 85% of the traffic accidents are a result of driving errors; the other 15% are a result of mechanical failure or of road conditions, which may also be somebody's error.

It won't be long now until you will be driving and will be exposed to the possibility of traffic accidents. How you meet the test of everyday driving depends upon; (1) how well you learn to drive before attempting to operate a motor vehicle; (2) how well you know the rules of the road; and (3) how sound an attitude you have towards driving responsibilities.

It is no secret that many adult drivers are "set" in their poor driving habits, because they did not learn to drive the right way. Many of them began to drive with poor attitudes and have not been able to change. Many have already had an accident and probably will have another before their driving career is over.

This is where you can get the jump on them— you have not had time to pick up a lot of bad driving habits. With the proper training and right attitude, you can learn to be a real "pro", to be one of the best drivers on the road. This is why it is important to learn about safe driving BEFORE you start to drive.

Driving is not kid stuff. It requires mature skill and judgment. Unfortunately many young people have not learned that responsibility goes with driving a car.

As a result, they are involved in more than their share of accidents. For example, during a recent year, 10.3% of the licensed drivers were under 20 years old but they were involved in 19.1% of the total motor-vehicle accidents.

Let's take a hard look at the teenage traffic accident situation, and then consider some things we can do to improve it. During a recent 12 month period, teenagers:

Were involved in accidents at the rate of 1 for every 5 licensed drivers.

An average of about 13,300 teenage drivers were involved in accidents per day.

Were responsible for an estimated loss of \$4,300,000,000 in motor vehicle accidents.

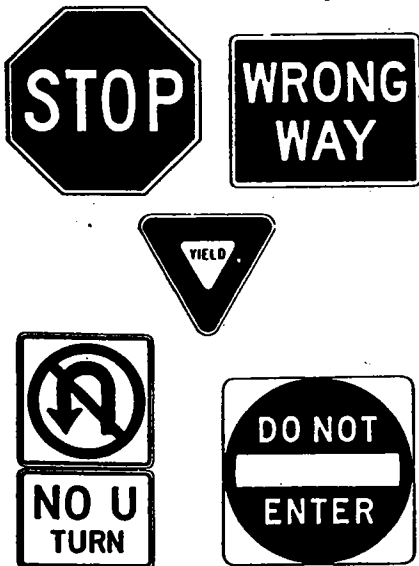
Teenagers have also experienced a large proportion of convictions for traffic offenses when compared with the number of licensed drivers in their age group. For example, in New Jersey, one study showed 14% of the convictions were for teenagers, yet they comprised only 4.4% of the drivers.

Though teenagers have a high accident rate, they are not the only ones that have accidents. In 1975, some 46,000 persons were killed in motor-vehicle accidents and about 1,800,000 suffered disabling injuries. The total estimated cost of these accidents amounted to \$21,200,000,000.

Think of it! During those 12 months, one person was killed on our highways every 11 minutes! And, somebody suffered a disabling injury every 18 seconds!

DO YOU KNOW YOUR SIGNS?

REGULATORY
Red & White Group



WARNING
Yellow & Black Group



Service-Guide-Others
Various colors





Where do most of the fatal motor-vehicle accidents occur? In the city, you think? No. In rural areas! In fact, 65% or almost 2 out of every 3 traffic deaths occur in rural areas. On the other hand, motor-vehicle accidents pile up more non-fatal injuries and property damage in the cities.

Of the 5,800 recent accident fatalities among farm residents, 48% or 2,800 involved a motor-vehicle.

If fact, the traffic accident problem is so serious that at the present rate it is estimated one out of every two Americans face the prospect of being injured or killed in a motor-vehicle mishap during his lifetime.

So you see why it is so important, when you reach driving age, to be a safe driver. By operating your car skillfully and according to the rules of courtesy and good sportsmanship, you will automatically shoulder the responsibilities which go with your privilege of driving.

The best way to get the proper skill for driving is through training in a driver education course. If such a course is offered in your high school, enroll as soon as you become eligible. If it is not offered there, ask your parents to help you get the proper, approved training. In any event you should not start driving until you have been properly trained.

Knowing how to handle a car is all well and good, but there is something else a good driver must have — a knowledge of the rules of the road. This means you must learn and understand the laws about speed, passing, stopping, turning, signalling, right-of-way, parking, and similar traffic regulations.

Not only is this knowledge absolutely necessary to pass a driver's license examination, but also to pass the test of everyday driving.

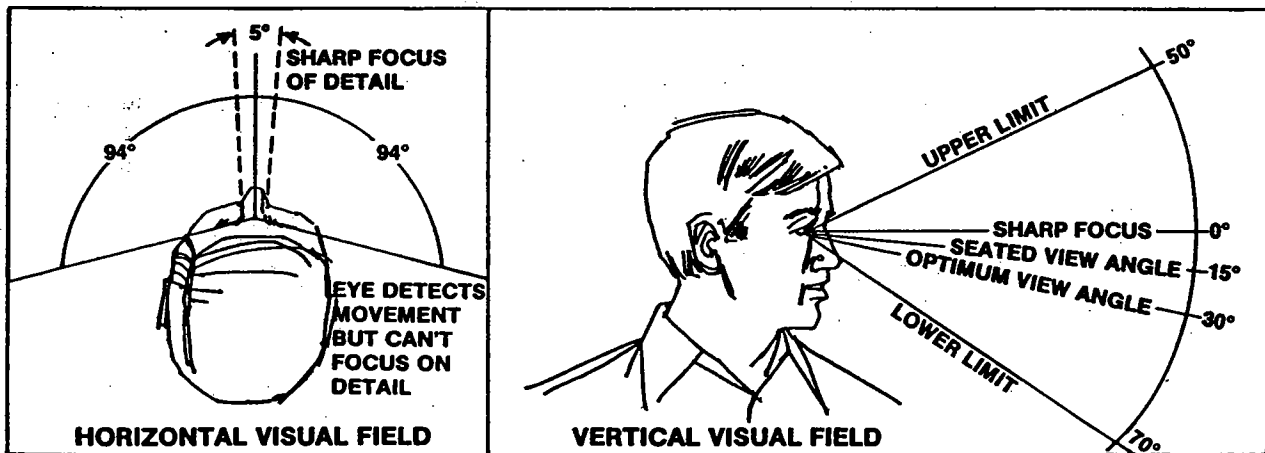
Knowledge of the rules of the road, and the skill of handling a car are key factors in good driving. But better and safer driving also depends upon care, courtesy and caution. In other words, it is achieved by proper driving attitudes which are not defined by law.

A highway safety expert would define it as a willingness to assume responsibility, to respect the traffic laws, to have proper consideration for your fellow driver, and to show a general spirit of cooperation on the road.

In fact, are not these the very same basic qualities that describe a good 4-H'er in all other areas of activity?

A good attitude can be said to extend to just about everything you do when you drive. Even to a rather simple thing like allowing yourself enough time to reach your destination so you won't have to drive faster than you should. It also extends to the duty of keeping your car in a safe operating condition at all times.

Practicing highway safety isn't hard. In driving as in everything else, learning to do things the right way is just plain common sense. It really pays off, too. If you try to do the things discussed in this section — both in pre-driving experiences and after you take the wheel of a car — you will be doing your part.



The normal field of vision is about 188 degrees but the angle of focused vision is narrow. When driving, the eyes should be moved constantly to pick up details both on and off the road.



UNIT 1, SECTION II

HIGHWAY SAFETY

LET'S DISCUSS

Now that you have become aware of the seriousness of the highway accident problem, list some ways that the situation can be remedied. Use a separate sheet of paper where called for.

1. Describe or demonstrate safe passing procedures. _____

2. List "Rules of the Road" for the pedestrian to observe. Diagram a situation showing pedestrian rules.

3. What are attitudes? (Your definition) _____

4. Why are attitudes important in safe driving? _____

5. Identify six good driving habits you have observed in your community. _____

6. What are the opportunities available to you to learn to drive? _____

7. What are safe highways? _____

8. What is the population of your county or city? _____

As a group, select two or more of the following activities:

1. a. Invite an informed person in your area to talk to your club. Ask him to describe a serious accident he has seen. From that, each member can diagram how the accident occurred and what were the major factors causing it. Speakers might include motor club officials, local or state police, judges or traffic court magistrates, driver education instructors, etc.
b. If you have seen an accident, diagram the situation on another sheet of paper. In your own mind, determine the causes and how the accident might have been avoided.
2. Sponsor club exhibits on highway safety at local, county or state shows or in local stores.
3. Prepare and present demonstrations on safety subjects such as: a. Walking on the highway. b. Riding the school bus. c. Riding a bicycle safely.
4. Form team in your club and debate resolutions such as: "Cars in poor condition are responsible for too large a percentage of our highway accidents". "There should be compulsory periodic motor vehicle inspections." There should be periodical re-examination of applicants for operator's licenses."
5. Present a program on some phase of highway safety before school, PTA, service clubs or other organizations, and seek the organization's support in promoting it.
6. Find out if there is a highway safety program or safety council in your area. On a separate sheet of paper, list the ways your club could support it.
7. Check to see that cars, trucks, bicycles, tractors, trailers and farm machinery belonging to your family which travel on the highway at night are properly lighted. Be sure farm machinery carries slow moving vehicle signs (SMV).
8. Establish a shelf or library of free highway safety literature.
9. Promote Dad-to-Daughter and Man-to-Man Good Driving Agreements in your group. Information can be obtained from your Highway Safety Council.
10. Work toward community support for a driver education program in your school through the Student Council and other groups.
11. Clip the daily newspaper for one month for articles on motor-vehicle accidents and highway safety.

UNIT 1, SECTION III



A driver faces a challenge every time he starts out to drive anywhere. His job is to get his automobile from one place to another without an accident.

That doesn't sound too difficult, you think, until you realize that there are many chances for accidents, even on a short trip. Research has shown that under common driving conditions there are an average of 200 potential accident-producing situations per mile.

Many things go into making a good driver, but the most significant of these is the ability to spot hazards (or dangers). It is necessary to sense them before they become obvious — and just as important to know what to do about them in time to avoid an accident. As an example, an alert driver knows that when a ball comes rolling into the street it usually is followed by a child. The good driver's instinctive reaction is to stop immediately.

Let's face it, this is one of the most serious problems you or any new driver will have: to recognize situations that spell trouble and know what to do to avoid them.

Experts usually say that the only reason teenagers have more than their share of accidents is that they lack experience. What they really mean is that they lack experience in recognizing and coping with driving hazards.

Now is the time to start getting that experience before you drive. The ability to recognize hazards can be developed through study and practice.

There are many simple hazards that any driver should be able to spot. Some of them include:

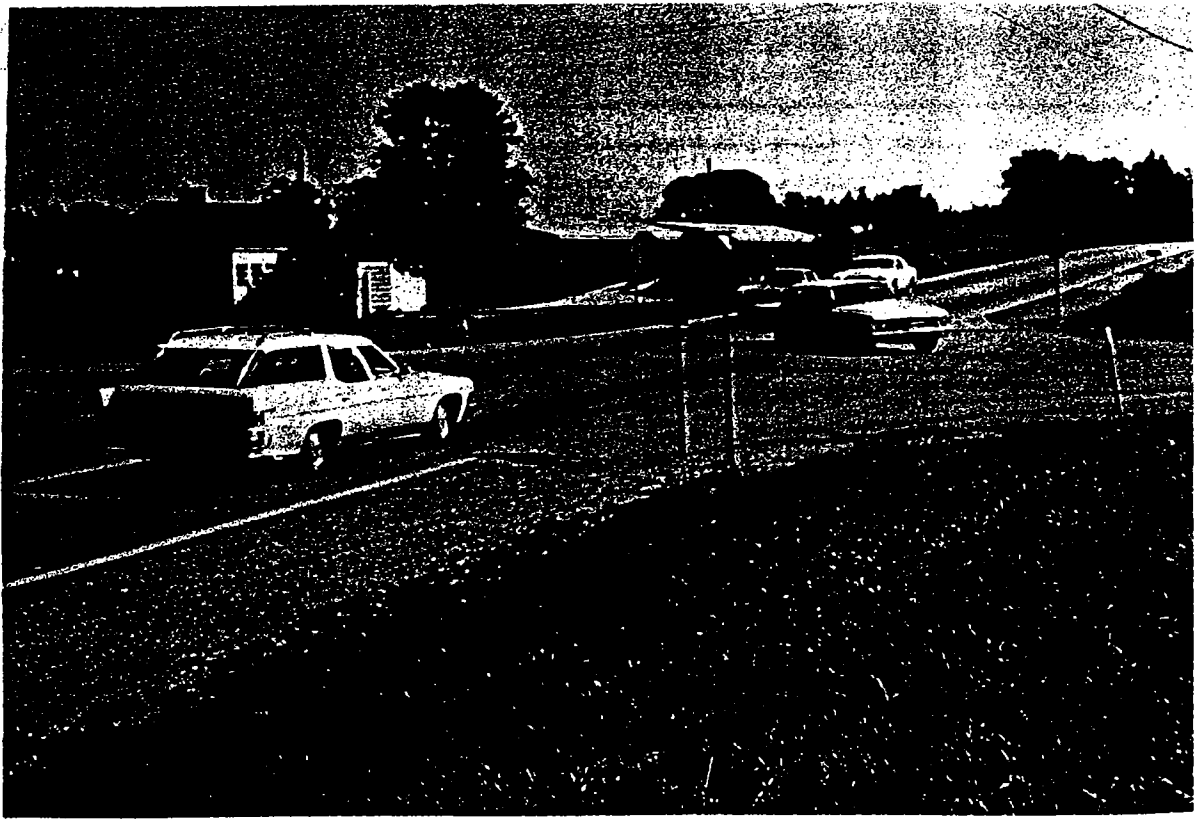
- Hidden driveways leading onto the highway.
- Blind road intersections (you can't see what is coming from either direction).
- Soft road shoulders.
- Blind curves.
- Broken pavement and holes in the road.
- Wet or icy pavements.
- Heavy dust or fog.
- Narrow bridges or culverts.
- Illegible warning signs.
- Slow-moving vehicles.
- Playgrounds and school yards.

A good driver is always on the watch for these common hazards, and for others not so obvious. The ability to spot clues of possible danger may mean the difference between life and death.

Obstruction of vision is often a factor in fatal motor-vehicle accidents. For instance, the National Safety Council reports that on the basis of information from 17 state traffic authorities during a recent year, the driver's vision was obscured in one out of six fatal accidents.

In two out of five cases the obstruction involved the vehicle itself, such as rain, snow or sleet on the windshield. About one-third of the obstructions were trees, buildings and other things along the highway or adjacent to it. In most of the remaining cases the obstructions were other cars, some moving, some parked.







UNIT 1, SECTION III GROUP ACTIVITY — HIGHWAY HAZARD HUNT

LET'S DO

1. Highway Hazard Hunt

Obtain a road map of your community from your county highway commission or your police officials. Carefully study the roads in your community.

After you have studied the map, plan a field trip for the club to make together with the parents, advisory committee members and leader.

The purpose of the trip is to see how many hazards you can locate. As you find hazards, mark their location on your map. Upon your return, use the map to discuss the hazards in detail with your leader, parents and law enforcement officials. Also discuss what your club might do to correct them or help to have them corrected.

2. Accident Location Map

On the same map marked with the hazards, keep a record of where motor-vehicle accidents occurred during a period of at least one month. A sample reporting form is printed below, to be filled out for each accident. Learn why and how each accident happened, and discuss how each might have been prevented.

Ask your local police officials to aid you in collecting and interpreting the facts, and in completing the accident report form. It will make the project more interesting.

Organize a safety committee in your club to coordinate your work. Conduct a community highway safety program based on the facts you learned from studying the accidents and hazards around your community.

LET'S DISCUSS

1. Discuss the hazards found on your field trip. _____

2. What did you find to be the most common hazards? _____

3. How can these hazards be corrected? What can your club do to help correct them? _____



4. There are _____ miles of highways and roads in the county. The leading cause of fatal accidents in the county is _____

The most common highway hazard is _____

5. What community agencies helped in your highway safety program? _____

4-H Highway Safety Project Accident Form

Name of Driver _____ Age _____ Sex _____

Address _____

Occupation _____

Name of Driver (if second car is involved) _____ Age _____ Sex _____

Address _____

Occupation _____

County _____

Location of Accident _____

Date _____ Time _____ No. of Vehicles Involved _____ Property Damage _____

Cause of Accident (speed, passing on hill or curve, mechanical defects, etc.) _____

Violations Indicated _____

Name of Person Killed _____ Address _____ Age _____ Sex _____

Name Of Person Killed _____ Address _____ Age _____ Sex _____

Name of Person Injured _____ Address _____ Age _____ Sex _____

Name of Person Injured _____ Address _____ Age _____ Sex _____

Precautions Which Might Have Prevented Accident: _____



An owner's manual is included with every new car. The manual can help the operator become familiar with the instruments and controls, and can give helpful hints for safe and economical car operation.

Each car has a panel of instruments and gauges on the dashboard immediately in front of the driver for his convenience. These help him check at a glance on the car's operation and speed, and for controlling lights, air and temperature, windshield wipers, radio, etc. All are explained in the owner's manual.

An ignition key is required to start the engine. One key may fit all locks in the car, or there may be one or more keys for the doors, trunk compartment, spare tire lock, besides that for the ignition. Usually a double set of keys is issued with each new car. You will want to learn what lock each key operates and to identify each readily.

What makes a car go? Why, the engine, of course, starting it by inserting and turning the ignition key. But will the car move. No, the wheels must turn to make the car actually "go." And to make the wheels turn a certain gear must be selected, manually or automatically. Thus you need the engine, a gear mechanism, and the wheels to make a car go.

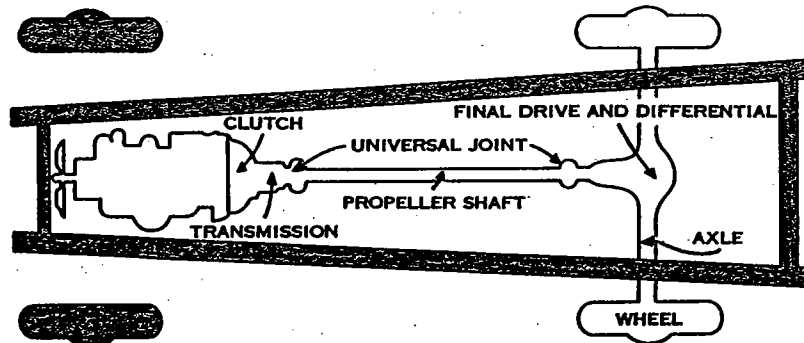
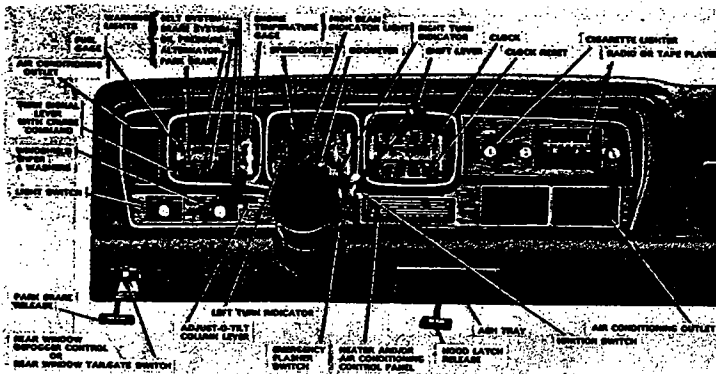
A lot of people forget about the second part of this power chain. While the engine may be running and turning a crankshaft at a certain speed and force, unless that force is transmitted to the rear wheels (some vehicles have a four-wheel drive) through a system of gears, the wheels will not go around and move the car. A lot of things happen between the engine and the wheels.

The first thing behind the engine is the CLUTCH. Its job is to connect or disconnect the engine to or from the rear wheels and the remainder of the power transmission system. The clutch permits starting and stopping the engine and car, and shifting the gears. Many cars have automatic drives in which the clutch pedal is eliminated, and a fluid device serves as the clutch.

Directly behind the clutch is the TRANSMISSION. It is used in automobiles to allow for a change in the speed of the engine in relation to the speed of the rear wheels. The transmission is a system of gears which provide for the engine speed to be "geared down" to get full power at slow speeds; and so the car may be operated in either direction. It provides increased pulling force, and also allows the engine to run faster. This is important because the engine does not develop very much power at low speed.

There are three types of transmissions:

1. Conventional type with three speeds forward and one reverse. Gear shifting is done by the driver using a lever in a prescribed pattern, commonly known as "stick-shift drive."
2. Conventional type with Overdrive feature, which permits a fourth speed after speeds of 20 to 30 miles per hour are reached. To return to conventional high gear the accelerator must be pushed to the floor. In most cases the overdrive may be "locked out" by use of an overdrive control handle.
3. Automatic type which largely eliminates the need for selection of different gear ratios by the driver. Instead, the lever on the steering column is set to the desired ratio for forward movement (or reverse, if desired), and the automatic transmission takes over delivering the proper torque or driving force or effort to the rear wheels in accordance with car speed and power requirements.



The heart of an automatic transmission is a fluid coupling. It couples the engine with the rear wheels, transmitting the power there through a fluid such as oil. A simple fluid coupling demonstration can be made with two electric fans.

If the fans were placed a few inches apart and facing each other, and if one fan were started, the air from it would cause the fan blades of the other fan to turn. In this case the "fluid" is air, but such a coupling would not be very efficient.

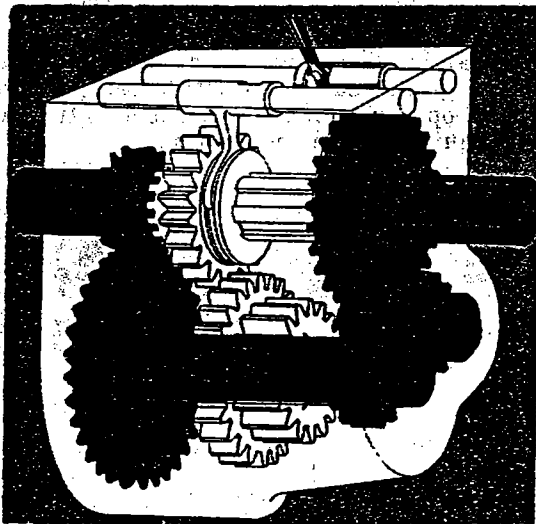
To make a more efficient coupling two fans are used to look much like a hollowed out doughnut sliced in half, with blades called vanes, set in the hollowed halves. Oil is the fluid used in the vanes, making a fluid coupling.

Torque converters and gear systems are used with fluid couplings to deliver power from the engine to the transmission, and at the same time step up the turning effect delivered to the propeller shaft. All automatic transmissions make considerable use of the gear-set known as planetary gears. This name comes from the general appearance of planets rotating in an orbit around a sun. The compactness and versatility of the gear-set has contributed to its wide use.

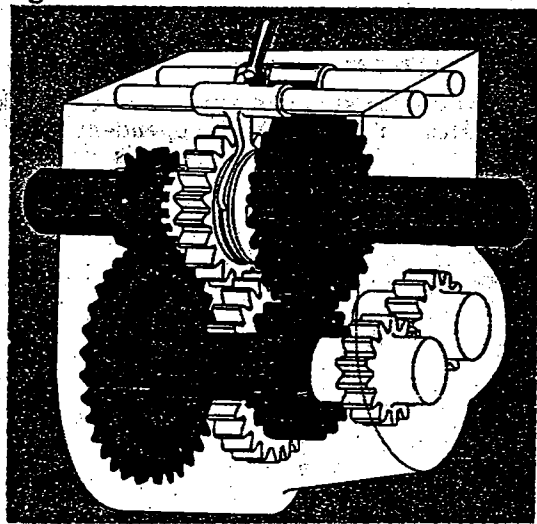
The planetary gear-set or gear train may be used to increase power and decrease speed. It may be used to reduce speed and reverse direction of rotation. It may also be made to function as a coupling in direct drive.

The PROPELLER SHAFT connects the transmission main shaft and the differential, carrying the rotary motion of the main shaft to the differential. From there it is transmitted to the rear wheel axles.

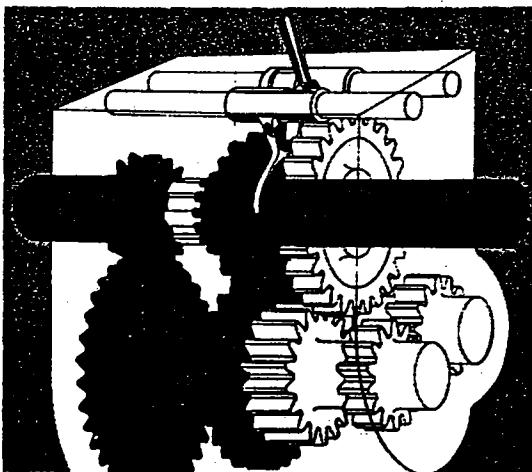
While the engine and transmission are more or less rigidly attached to the car frame, the rear wheels, axles, and differential are attached to the frame by springs. When the wheels go over rough roads, the springs expand or compress as the wheels, axles and differential move up and down. As a result the rear end of the propeller shaft moves up and down, causing the angle between the transmission main shaft and the propeller shaft to change. Also, the distance between the transmission and the differential changes. To take care of these two changes, angle and distance, the propeller shaft includes two different devices. One is the universal joint to permit a change of angle, and the other is a slip joint permitting the length of the shaft to change.



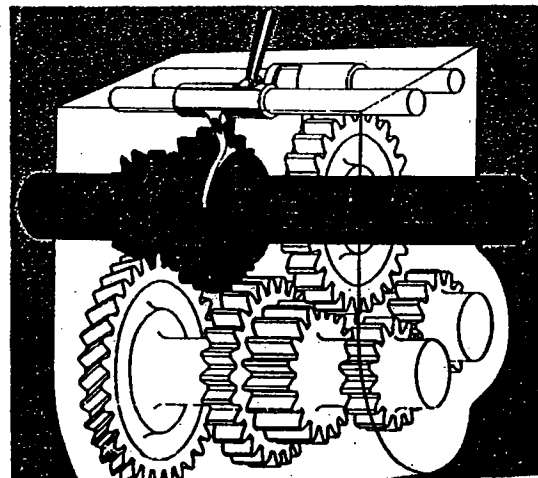
REVERSE



FIRST OR LOW SPEED



SECOND OR INTERMEDIATE



THIRD OR HIGH SPEED

