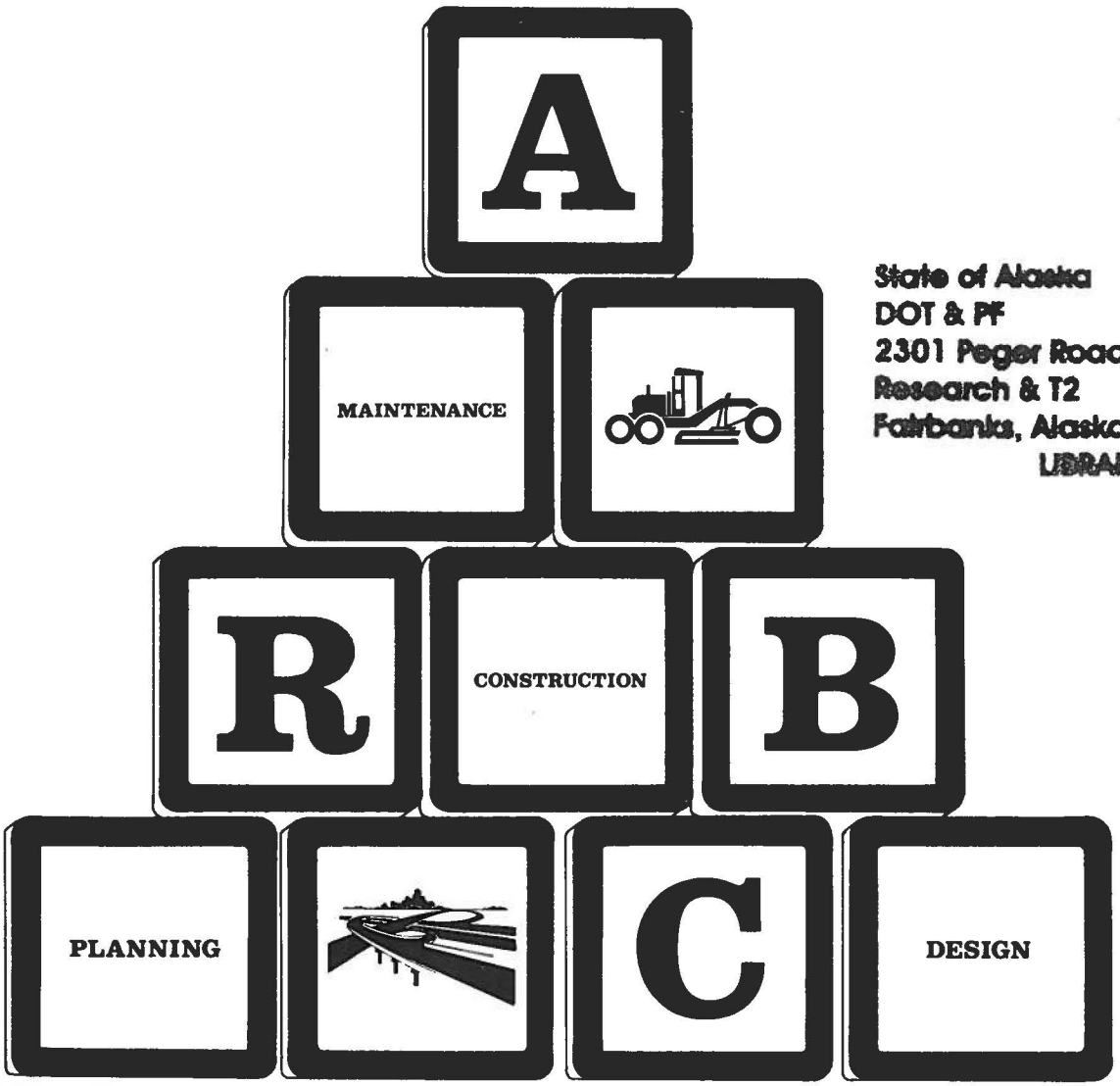
THE HIGHWAY ABCs

Your Missouri Highway System And How It Works



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The Highway ABCs

Prepared by the
Public Information Division
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Missouri Highway and Transportation Commission

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The Missouri Highway and Transportation Department was established in 1921 as the State Highway Department. A four-member commission was chosen to direct the Department's operation of the 7,640 miles in the state highway system at that time.

Since then the Department has grown and changed with the times. Today a six-member commission governs the Department, and the state's highway system is now the nation's seventh largest with more than 32,000 miles of highway.

These highways are important to all Missourians in one way or another, from the food we eat to the car we drive. However, not everyone knows how their highway tax dollars are used to support this system and how it is built and maintained.

The Highway ABCs provides a variety of information, from where the Department's money comes from to how the Department chooses the construction projects. It covers the whole spectrum of highway-related details.

We hope this booklet will help you better understand the Department and its operations. If you have any questions, please ask us. Our mission is to serve you by providing a safe, efficient highway and transportation system.

The Department

Missouri's state Highway and Transportation Department shoulders responsibilities of five viable transportation alternatives available to Missourians—highways, aviation, waterways, transit and railroads. These responsibilities include the total operation of the 32,000-mile highway system, including highway location, design, construction and maintenance.

In addition, the Department cooperates and coordinates with owners and operators of the other four modal systems in the development and improvement of airports, rail facilities, ports and the operational cost of transit systems. Key here also is the administration of state/federal programs and funds available with these modes.

The Highway and Transportation Department became such as of January 1980 when voters decided to merge the previously separate Highway and Transportation Departments by passing Constitutional Amendment No. 2 in November 1979. The Department operates under a decentralized organization with the Headquarters Office in Jefferson City. This office provides staff assistance and functional control for the various Departmental tasks to the 10 geographic Districts of the Department.

The Divisions within the Headquarters Office are responsible for bridge design and highway planning for the state. There are no counterparts for these particular Divisions in the Districts. However, decisions about highway construction, maintenance and operations are made at the District level.

Encompassing about 12 counties, each District contains about 10 percent of the total road mileage in the highway system. A District Engineer is responsible for administering all activities in his District.

Transportation modes other than highways are established as units within the Headquarters Office and report to an Assistant Transportation Director. These units carry out the statewide planning for these modes—there are no counterparts in the Districts.

District offices are located in St. Joseph, Macon, Hannibal, Kansas City, Jefferson City, Kirkwood, Joplin, Springfield, Willow Springs and Sikeston.

Getting to the Heart of Highway Funding

The human circulatory system and the highway funding process are alike in many ways, the foremost being that without blood the body will wither and die, and without funding a highway system will fall into disrepair, and it, too, will die.

As veins and arteries carry blood to and from the heart, a variety of funding avenues carry money to and from the Missouri Highway and Transportation Department, the "heart" that is responsible for constructing and maintaining the nation's seventh largest state highway system.

Traditionally, the funding philosophy of Missourians and the Department has been that operating revenues should be user-generated. Those who use the highway system should pay for its upkeep. This way people who use the system often pay more than those who seldom use it.

In Missouri, nearly half of the total state highway revenue comes from the 7-cent-per-gallon tax on motor fuel. This brings in more than $160 million per year. Missouri's cities and counties also share in this motor fuel tax revenue, with the state receiving 75 percent, the cities 15 percent and the counties 10 percent.

Another large state source of highway revenues comes from licensing motor vehicles, the yearly process through which license plate and renewal stickers are purchased. This funding artery brings in about $145 million per year.

Additional state revenues come from fees charged for drivers licenses, motor vehicle inspections, motor bus and truck registrations, the motor vehicle sales tax and from miscellaneous sources such as interest from deposited funds. Missouri's cities and counties also share in the motor vehicle sales tax revenues and part of the motor vehicle license fees.

The state share of the half of the vehicle sales tax allocated for highway and transportation purposes is 74 percent for highways and 1 percent for transportation. The counties also receive 10 percent of these funds and the cities 15 percent.

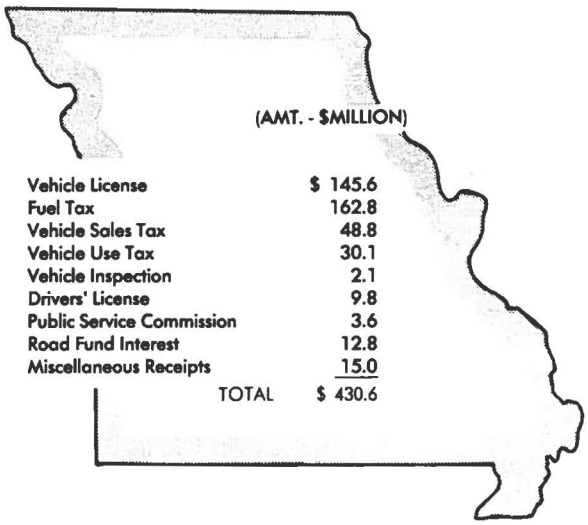
Both state and federal dollars come into the Department at regular intervals during the year. After some of the money has been used to pay administrative costs, fuel tax refunds and other state agencies, such as the Highway Patrol, for highway-related services, and the Department of Revenue, for tax collection services, the rest is distributed for use in the construction and maintenance of the state's 32,000-mile state highway system.

Federal funds are another large source of Missouri highway "blood." These funds provide money for a variety of highway projects and operations. Federal money is allocated for specific types of work and can only be used for those purposes.

While funding for highways is user-generated, funding for other transportation modes comes from general state revenue and federal funds. Both highway and transportation related functions are administered by the six-member Highway and Transportation Commission.

And like blood circulating through the body, the highway funding process is a continual one. Just as blood flows where it is needed most, so highway funds are used where the need is greatest.

STATE INCOME COLLECTED FOR STATE ADMINISTERED HIGHWAYS
1985 Fiscal Year Figures



	(AMT. - $MILLION)
Vehicle License	$ 145.6
Fuel Tax	162.8
Vehicle Sales Tax	48.8
Vehicle Use Tax	30.1
Vehicle Inspection	2.1
Drivers' License	9.8
Public Service Commission	3.6
Road Fund Interest	12.8
Miscellaneous Receipts	15.0
TOTAL	$ 430.6

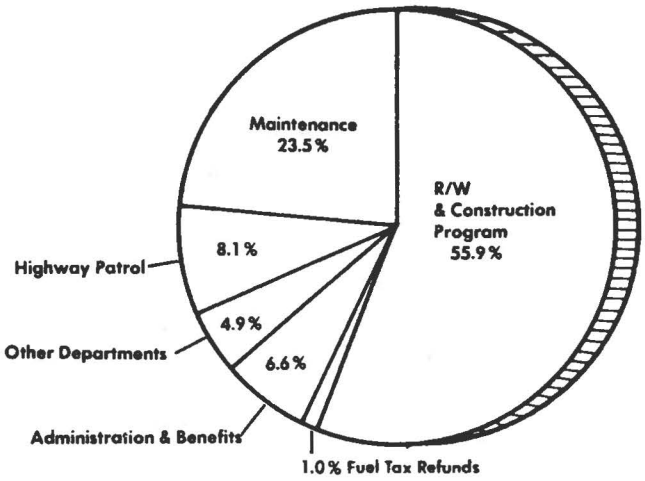
Untying Department Purse Strings

It would be a dream come true to most people if they had more than a half billion dollars to support themselves yearly. For the Missouri Highway and Transportation Department, spending an amount like this to support the highway and transportation system is a reality—and one carefully budgeted, researched and allocated. The Department knows where every penny goes.

The Department's budget has increased to about $700 million annually. So where do all these pennies go?

Consider that about 56 percent of the funding goes toward the right-of-way and construction program. This program sets out the organized construction of

DISBURSEMENT OF TOTAL FUNDS
1986 Fiscal Year



State Funds	$ 430.6 Million
Federal Funds	$ 287.0 Million
Total Highway Funds	$ 717.6 Million

highway improvements that involves millions of highway dollars.

For example, it costs about $2 million to $2.5 million to build just one mile of two-lane primary highway such as U.S. Route 54. Building one mile of eight-lane Interstate highway in an urban area costs from $36 to $40 million.

Most of the construction dollars go to match federal funds made available to states to aid and improve the highway system. This helps Missouri stretch its construction dollars.

Another area Department money heavily supports is maintenance activities. More than 23 percent of the Department's funding is spent protecting and improving the priceless investment Missourians have made in their highway system.

The costs of the various maintenance activities are all affected by the the cost of materials such as aggregate, asphalt, paint and portland concrete cement. When these prices increase, so do maintenance costs.

Construction and maintenance take a large part of the Department's money, but administration and overhead costs get their share, too. About 7 percent of the Department's money goes to these functions. Salaries and Workmen's Compensation payments are just some of the cost factors in this category. Overhead costs include paying for the utilities that operate administration buildings.

While administration, maintenance and construction costs account for most of the flow of monies out of the Department, funds going to support other state agencies that provide services to the Department have a place in the total picture. As the budgets of these agencies go up, the percentage taken out of the state highway fund increases.

In addition, two of these agencies—the State Highway Patrol and the Department of Revenue—have first priority on highway dollars by law for their services rendered. The Patrol polices Missouri's highways, enforcing traffic laws and promoting safety on those highways. The Department pays for operation costs of performing these services. The Patrol receives about 8 percent of the Department's budget for their services.

The Department of Revenue acts as the collecting agency for Highway and Transportation revenue sources. This Department collects gas and vehicle sales tax, as well as the receipts from titling, registering and licensing Missouri's vehicles and drivers.

State agencies, including the Department of Revenue, draw about 5 percent of the Department's money. Other agencies that receive money include the Department of Agriculture—Weights and Measures, which inspects retail gas pumps for accuracy; the Department of Public Safety, which coordinates law enforcement and public safety activities undertaken by the Highway Patrol; and the Department of Economic Development—Public Service Commission, which regulates the intrastate trucking and busing industry.

Other agencies include the Office of Administration, which performs administrative services such as purchasing and coordinating other management functions for state departments; the State Auditor, who is paid for auditing the Department's accounts; the State Treasurer, who is paid for investing the Department's funds and acting as custodian thereof; the Highway Reciprocity Commission, which enters into reciprocal agreements with other states concerning the highways; and the Division of Highway Safety, which receives Highway and Transportation Department dollars for administering and supervising a statewide highway safety program.

Finally, the Highway and Transportation Department also returns money to the taxpayers in the form of motor fuel tax refunds. By law, Missourians who purchase gas for non-highway use, such as farmers would for their operations, are entitled to a refund of the tax paid on that gasoline.

Disbursements such as the Highway and Transportation Department's represent a lot of money to keep track of—especially when it's divvied out to so many different areas and stretched to encompass a whole state's worth of highway operations. But knowing how and where the taxpayers' dollars are spent is a priority for the Department. Missourians can rest assured that they're getting the most for their money.

Sharing the Load In Building the Roads

The Highway and Transportation Department has to budget its funds just like families budget their money. But unlike most families, the Department doesn't have to support itself alone. Missouri and the federal government work together to fund the construction and maintenance of the state's 32,000-mile highway system.

This partnership was established more than 65 years ago and has been an integral part of state highway construction ever since. This method is known as the federal-aid program, and by working with it, Missouri has been able to greatly expand the scope of both its highway and transportation programs.

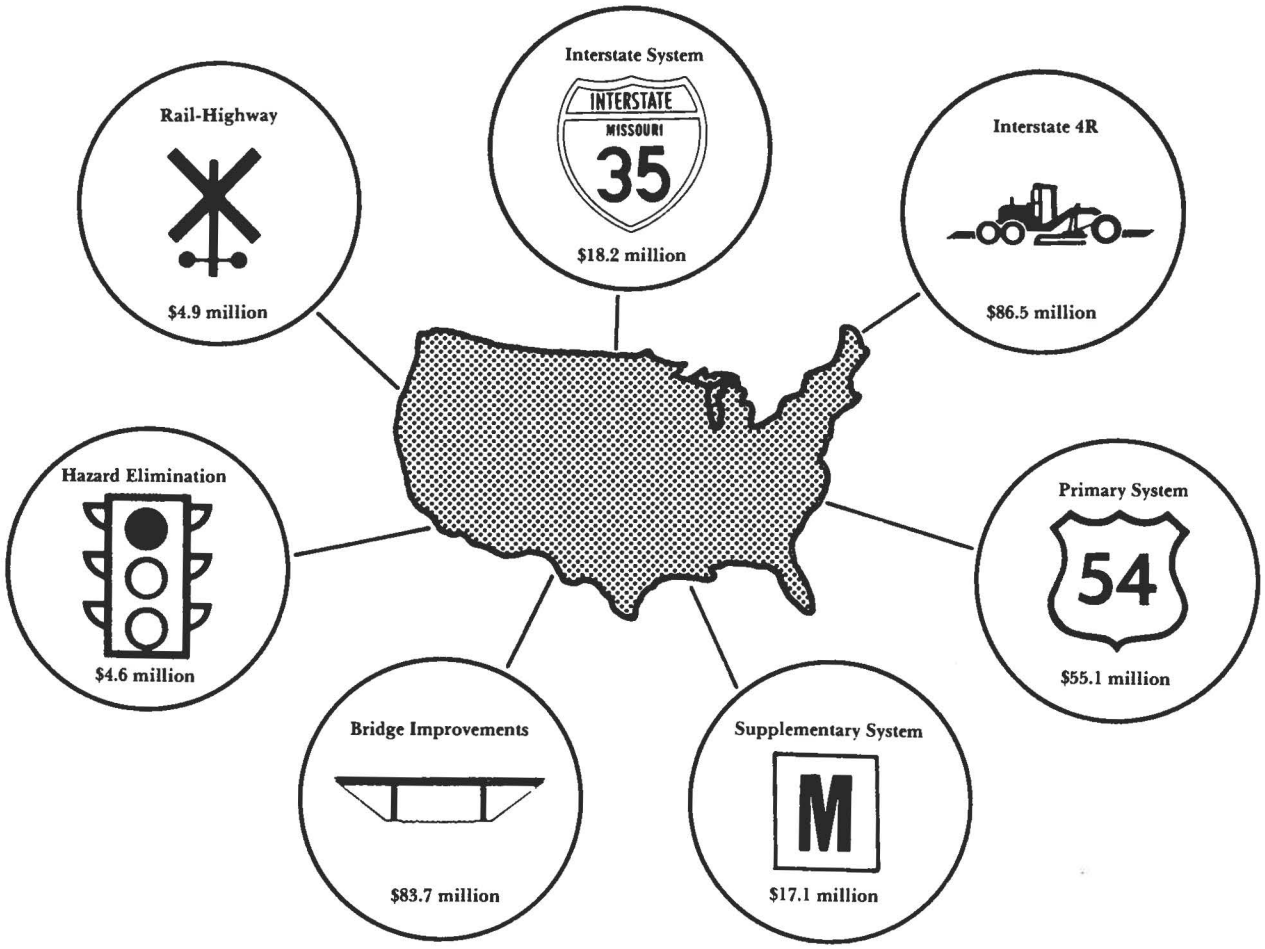
The Missouri highway system depends heavily on federal funds to keep it going. In a typical year, federal funding accounts for 35 to 40 percent of the Highway and Transportation Department's $700 million-plus budget.

But the Department can't spend these federal dollars on just anything! Federal funds coming into the state for highway programs fall into one of 10 categories, each with its own particular use and percentage of federal participation. The degree of federal participation ranges from 100 percent down to 75 percent, with the matching state ratio depending on the type of program.

For example, federal funds used in constructing the Interstate highway system are available on a 90 percent federal, 10 percent state ratio. Funds for use

Missouri's Major Federal Funds

Fiscal Year 1986



on the supplementary roads are available on a 75 percent federal, 25 percent state ratio.

Most of the highway funds fall into two major categories, construction and safety. Federal highway funds for such programs as the Federal-Aid Urban (FAU) Program also pass through the Department on their way to Missouri's cities and counties.

Construction funding is divided among the Interstate system; Interstate 4R—resurfacing, restoration, rehabilitation and reconstruction; primary highways; and supplementary highways. The federal government distributes these funds to each state based on a formula that varies with the individual program. For example, funds for Interstate 4R are distributed among the states based 55 percent on Interstate lane miles and 45 percent on Interstate vehicle miles of travel.

Federal funds directed toward safety are generally used in two areas—bridge replacement and the elimination of hazards. The condition of the bridges and the amount of use by the traveling public generally determine which structures should be given the highest priority for improvements.

Hazard funds are used for projects to improve the worst accident locations throughout the state. The federal government also provides funds for rail-highway crossing improvements.

Discretionary federal funding can also be a factor once a state has obligated all its federal money. These funds are released at the discretion of the Transportation Secretary when Interstate money that other states haven't been able to obligate becomes available. The Department has been successful in obtaining these extra funds because projects have been ready to go when the money has become available.

But federal funds benefit more than just the Department's highway program. This money plays a key part in the development of aviation, rail and transit functions as well.

Federal funds available for helping Missouri develop the airports in its cities and towns come from the Federal Aviation Administration through the Airport Improvement Program. These funds are used to improve such things as airport lights, runways and taxiways.

Federal railroad funds come from the U.S. Department of Transportation through the Federal Railroad Administration. Funds are provided on an 70 percent federal, 30 percent state matching ratio through the Local Rail Service Assistance Act of 1978. These funds are used to help rail lines rehabilitate tracks and help communities keep rail service that otherwise would have been lost through abandonment of rail facilities.

Transit operations are helped by federal funds from the Urban Mass Transportation Administration. Funds are provided to help communities begin bus service or to help defray operating losses incurred by existing transit systems.

Missouri's waterways operations are not directly affected by federal funds, but the Department does help local port authorities obtain this money.

The partnership between the Department and the federal government benefits everyone through the development of Missouri's highway and transportation programs. And you can be sure the Department, just like a family, will continue to make the best use of its money.

The Right-of-Way and Construction Program

Improving and maintaining Missouri's 32,000 miles of highways is a multi-million dollar proposition. But it takes more than just money. Behind all the construction dollars lies untold hours of research and planning.

Each year the Highway and Transportation Department publishes the "Right-of-Way and Construction Program," which is a schedule of improvements to be made on Missouri highways. It's a long road from identifying problems to choosing which projects and improvements should be funded.

To start the journey, the first step in compiling the program is determining the state's needs. But this isn't a once-a-year evaluation. Monitoring takes place throughout the year to determine the most critical problems and their relations to each other.

This continuous monitoring can take different forms. The most important is the service ratings that are taken throughout the year by Department personnel. Engineers evaluate three different areas for road deficiencies when they perform service ratings. First, the engineer looks at the general structural adequacy of the roadway, checking such things as how old is the pavement or what is the estimated remaining surface life of the road. Next, the engineer considers the highway's operational condition. Is there traffic congestion or too few traffic lanes? The third area the Department evaluates is safety. Information can come from monitoring intersections as well as data from accident reports.

The problems uncovered by service ratings are then ranked according to deficiency. Those problems

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with a low service rating indicate more deficiencies than those with a high rating.

One other way to determine the state's needs is through bridge inspections. The Department is responsible for about 9,200 bridges on the designated state highway system. As in service ratings, problems are marked with the most deficient structures indicated.

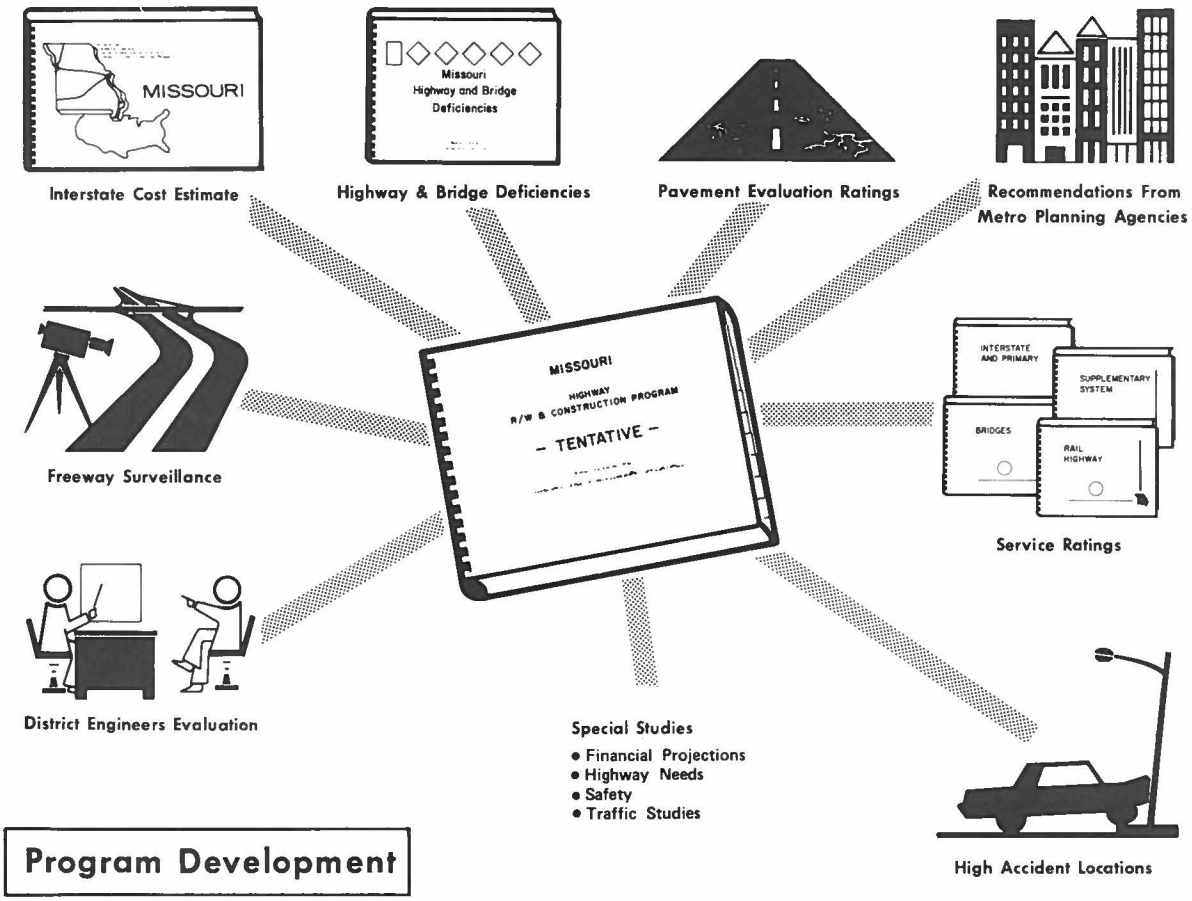
The program's made it up the first hill of its journey. Now it's ready to cruise through the curves. It's time to compile all the problems and determine which deficiencies are the most urgent. The rating information is provided to the 10 Districts. An estimate of available funds tabulated by the Department headquarters is also enclosed. The Districts use the knowledge of their District's needs to recommend program additions to the Main Office.

Citizens or groups who have certain needs or interests in highway projects can make their wishes known during the District process. For example, the transportation planning agencies of metropolitan areas with populations of 50,000 or more are asked to submit a list of what they believe are necessary projects.

After the Districts make their recommendations, the Department Main Office coordinates these into a statewide program. The various recommendations are weighed in perspective to the overall needs of the state. Funding also influences the final choice of priority projects.

When the program is developed, it's divided into three sections depending on the project. First, there are the priority projects on which an anticipated contract will be let or right-of-way obligated before the end of the program's current fiscal year. Next, are standby projects that may be substituted for projects or programmed into the first section if a project should be delayed or in case additional federal money becomes available. Third are projects that are in the location and design studies stages.

Now the program's on the final stretch of its journey. It's time for the review process. The program is reviewed first by all the various Main Office divisions involved in a project from its conception through planning and design. After the program passes this evaluation, it goes to a review of the Chief Engineer and staff from all engineering divisions. Recommendations and revisions may occur at this time. The Highway and Transportation Commission makes the final review.



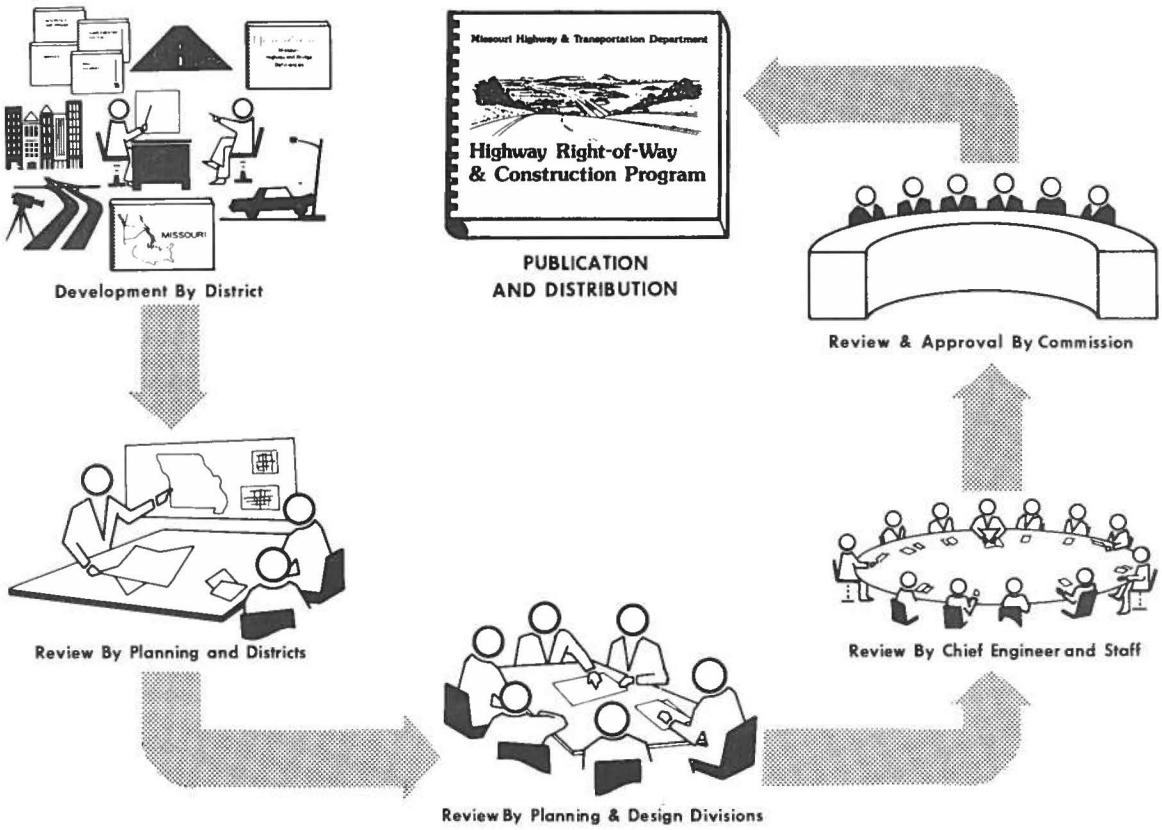
Program Development

After commission approval, the "Right-of-Way and Construction Program" finishes its journey. The program is published and distributed, and the whole journey begins again for next year's program.

But even after it's approved, the program isn't exempt from changes or revisions. For instance, if a bridge or highway is damaged in such a way that it could endanger motorists' lives, repair of that facility would take precedence over scheduled projects of a less critical nature. Special Commission consideration and approval are also necessary in such a situation.

The business of improving and maintaining Missouri's 32,000 miles of highway is ever-changing. The Department is flexible in order to meet the most critical needs of the highway system and Missouri's motorists.

Review & Approval Process



Study and Research Precede Construction

So that lane-widening project you've wanted for years has finally been put on the Highway and Transportation Department's "Right-of-Way and Construction Program," the schedule of highway improvements. But don't get in too much of a hurry! Much more careful research and study must go into the project before a contractor takes over.

After a project has been programmed for improvements, the process starts out with a preliminary engineering study. Here engineers analyze present and future traffic loads of a given project. They base their design criteria on projected traffic estimates to accommodate traffic 20 years down the road.

At this point, public input plays a big role in the direction a project will take. The Department is always interested in what citizens have to say, and we give them several opportunities to air those views from this point on.

For example, if a project is classified as a major action requiring a new location, a pre-location study meeting will be held. This meeting allows the public to comment and make suggestions after the preliminary engineering study has been completed.

If the project involves a relocation, Department engineers next conduct alternative location studies. Such studies reveal the best of several relocations that enable the road to meet present and anticipated traffic needs. Cost estimates are made for every alternative considered. The best alternative is then

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presented to the Highway and Transportation Commission for their tentative approval.

Once that approval is obtained, the issue goes back to the public in the form of a location public hearing. The District Engineer explains the project's proposed location and the Department's reasons for its selection to interested citizens. The people, in turn, tell us what they think about it. In a nutshell, this hearing informs the public of our plans and lets the public inform us of ways those plans could work better.

Deliberations from this hearing are recorded and sent to the Chief Engineer along with the District Engineer's recommendations. The Chief Engineer adds suggestions and submits the proposed location to the Commission for their final approval. Commission approval then authorizes the next phases a project goes through—survey, design and right-of-way acquisition.

The survey is used to get both the highs and lows of a project area, you might say. Aerial photography taken from the Department airplane combines with ground party techniques to provide information showing alignment and topography of the improvements to be made. The survey establishes grade lines, culvert locations, construction limits and right-of-way boundaries in their final form.

Once these design details are set, it's time once more to ask what the public thinks of them through a design public hearing. Again conducted at the District level, results are recorded and reviewed by the Commission. Public comments here could lead the Department to modify the plans.

On this basis, the Department arrives at a consensus recommendation for design details and again presents it before the Commission for their approval. With the Department acting as a middleman between the public and the Commission, the best decision for all concerned is made.

Design approval gives the Department the green light to proceed with right-of-way acquisition. First, right-of-way limits for the project are established. This allows property appraisals to begin. These appraisals are made either by Department appraisers or independent qualified appraisers in the area.

The property owner accompanies the appraiser as he makes a land and improvement inspection. This allows the owner to point out valuable land features he feels may be overlooked. The appraiser then establishes figures that justly compensate the property owner, as well as assure a proper expenditure of public funds.

Next the Department reviews the figures to assure compliance with approved appraisal formats and establishes a just compensation figure.

A Department negotiator takes over at this point. He contacts the property owner and explains the Department's plans and what effects the right-of-way taking will have on his property. He advises the owner being relocated and offers financial help to offset moving expenses. No one is required to leave until proper housing is obtained.

Then the negotiator offers the owner what the Department considers a fair price for the property. The offer is made in writing, and shows separately the amount for real estate and damages, if any, to the remaining property. If the owner accepts the offer, right-of-way acquisition is over. If the owner and Department cannot agree on a fair price, the Department must resort to condemnation proceedings.

These proceedings begin when the Circuit Judge who has jurisdiction over the matter appoints three Condemnation Commissioners who live in the same county as the property is located. They examine the property, establish a value for it and use that value to award the property owner. As before, the value must be satisfactory to both owner and Department. If it is not, the matter is tried in Circuit Court with a jury making the final award.

It is important to note that if the matter must be resolved in Circuit Court, the Department will receive possession of the land within a reasonable time period after the Department pays the fee established by the Commissioners to the Circuit Clerk.

Since the Department does try to compensate the owner as justly as possible, condemnation fortunately is more the exception than the rule where property acquisition is involved.

With right-of-way acquisition accomplished, all that remains is advertising the project across the state to receive bids from interested contractors. This is contingent upon sufficient available funds before the improvement can begin.

After awarding the project to the contractor with the lowest satisfactory bid, Department Materials and Construction personnel then supervise the work. And the project is truly on its way to completion.

Even though the study and research may have taken some time, the wait will be worth it because in the end, the public and the Department are both satisfied.

Caring for Bridges

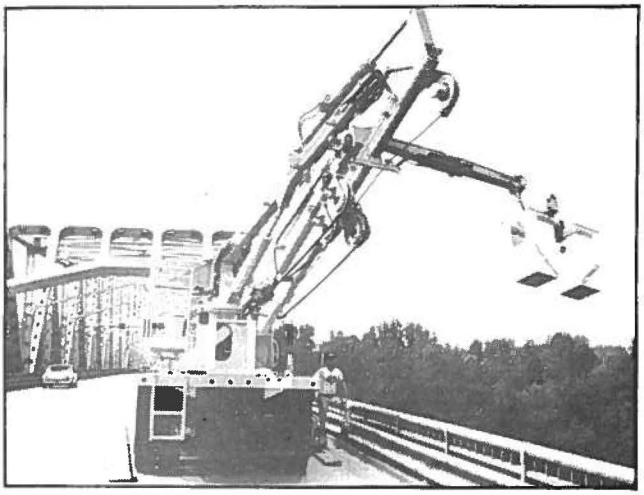
Of the thousands of motorists who cross Missouri highway bridges each day, few give any serious consideration to the possibility of their automobiles falling through the structures.

And actually, there's no need for them to worry; it's not likely to happen.

In Missouri, the annual inspection of bridges is one of the fundamental activities long used by the Highway and Transportation Department to insure safety and to protect the service life of structures. Additionally, checks on traffic and axle loadings help to pinpoint impending trouble if vehicles crossing the bridge are carrying heavier loads than what the bridge is designed for.

The Department is responsible for approximately 9,200 bridges on the designated state highway system. These bridge lengths vary from 20 feet to about one mile in length.

Structure inspections are made of each bridge annually under the supervision of licensed professional highway engineers who are familiar with both the design and construction of the spans. Seriously weakened structures such as those damaged in traffic accidents are promptly repaired.



The Department's Snooper truck allows Department field bridge inspectors to get an "up-close and personal" view of the major river bridges. The Snooper's telescoping arm when fully extended can reach about 70 feet.

Other repairs involving general bridge deterioration are regularly scheduled work items. Structures are examined for concealed rust and corrosion and a need for painting. A general inspection is made of the individual bridge parts and the various joints. Rust is removed before repainting; loose rivets are replaced; damaged parts are repaired; and other observed defects are corrected.

Although the possibility exists, the collapse of critical truss members from damage by collision does not usually lead to collapse of the total truss span on a bridge. In such cases repairs can frequently be made even while traffic continues on the structure. The damaged parts are replaced or straightened and retained in place.

Prolonged stress, however, is a different matter. The failure of a steel bridge member from repeated overloadings could be compared to the bending of a length of wire in order to break it. The first time the wire is bent, it doesn't bend easily, but after repeated bending, it gets weaker and weaker and finally breaks.

To combat this problem, sufficiency reports are compiled and maintained on all bridges in the state by the Department's Bridge Division. Bridges found to be weakened by age and heavy use are posted for maximum safe loads by the Department.

Any trouble, if it comes, is generally the result of drivers ignoring the posted load limits on weaker bridges. Department officials in the past have reported instances of truck drivers, for example, crossing a span with a 10,000-pound posted limit in a tractor-trailer unit weighing more than 72,000 pounds.

Sufficiency ratings are updated constantly. The condition of the structures and the amount of use by the traveling public generally determine which bridges should be given the highest priority for improvements. But available funding determines when these improvements can actually be made.

With capital outlays in the hundreds of thousands and even millions of dollars for each new bridge built, the Department is forced to repair many bridges that it cannot afford to replace and to fall back on the system of posting load limits.

Obviously, the replacement of outdated bridges will be slow because of the availability of funding. But in the meantime, the Department will continue to take precautionary measures to protect all structures on the state highway system in Missouri and will continue to periodically evaluate the bridge maintenance and inspection programs.

The Silent Partner

Your mission should you choose to accept it—to safely travel throughout Missouri. Your method—a motor vehicle. Your companion—a silent partner to help protect you from mishap.

But what a silent partner!

In this case the silent partner is the highway itself. The Missouri Highway and Transportation Department uses highway design standards and proper maintenance procedures to make the highways safer for your missions.

The Department has adopted guidelines developed by the American Association of State Highway and Transportation Officials (AASHTO) to design the highway system. The design standards include such criteria as the width of the pavement, the steepness of the highway slopes, the curvatures of the roadway and the sight distance required for safe passing.

Ongoing committees on the national level constantly review these standards. Their recommendations are implemented throughout the state as traffic demands and funding allows.

The volume of traffic and the terrain on a particular highway system determine the design standards that are followed when constructing and later maintaining the highway. There are three main highway systems in Missouri—Interstate, primary and supplementary.

The Interstate system is a national highway system designed to promote interstate commerce and provide for defense access needs. This system, which has about 1,150 miles in Missouri, contains less than 4 percent of the total state road mileage. But the Interstate carries about 35 percent of all the vehicle miles of travel on the state system.

One of the safety features of Interstate highways is that there is no opposing traffic. There are at least two traffic lanes, and sometimes as many as four, going in the same direction. This makes passing during your mission easier and safer.

Each traffic lane is 12 feet wide. Shoulders adjacent to the outside lanes are 10 feet wide, while shoulders adjacent to the inside passing lanes are 6 feet wide. These shoulders are hard surfaced.

Another safety feature is the Interstate's controlled access. This means you may exit or enter the Interstate only through interchanges. These are generally located at towns and cities along the route, as well as at major road intersections. This controlled access protects motorists from constant driving interruptions.

Highways that provide both interstate and intrastate travel and extend into each county of the state make up the primary system. In Missouri there are about 6,800 miles of primary roads. The primary system also accounts for about 34 percent of all the vehicle miles of travel on the state system.

On this system, you will find more curves and steeper grades than on the Interstate. There are many areas of dual-lane primary highway across the state; on a primary road that is not dual lane, at least 40 percent of the highway must provide passing opportunities.

Like Interstate highways, the lanes on primary highways are generally 12 feet wide. Shoulders can be 8 to 10 feet wide. Newer shoulders are usually hard surfaced, however gravel or sod is also used. Primary highways are also required to be centerline and edge-line striped.

The primary system works as a collector for the supplementary system. The supplementary system is made of "farm-to-market" roads that funnel traffic to the primary system, as well as provide a high level of service to adjoining properties.

It takes two to motor safely on Missouri's highways--you and the highway.

There are about 24,300 miles of supplementary highway throughout Missouri. This system carries about 31 percent of all the vehicle miles of travel on the state system. Traffic lanes on supplementary highways are 10 to 12 feet wide with shoulders that are 4 to 8 feet wide.

Once these highways have been built to the proper design standards, the Department works to keep them in the safest possible condition. This involves annually checking the highway markings and the highway surface.

Inspectors look for ruts in the pavement that could collect water and cause hydroplaning. The slickness of the road surface is also checked. A highway must have the proper surface, not too smooth or too rough.

Corrective measures such as shaving off part of the highway surface or resurfacing the highway can correct these problems. Resurfacing can also correct high-accident locations by improving the drainage or revising an intersection.

The Department may also resurface a multilane roadway or intersection to cover longitudinal joints. Motorists tend to confuse these pavement joints with lane-marking stripes. After resurfacing, new lane-marking stripes are put down to safely guide drivers.

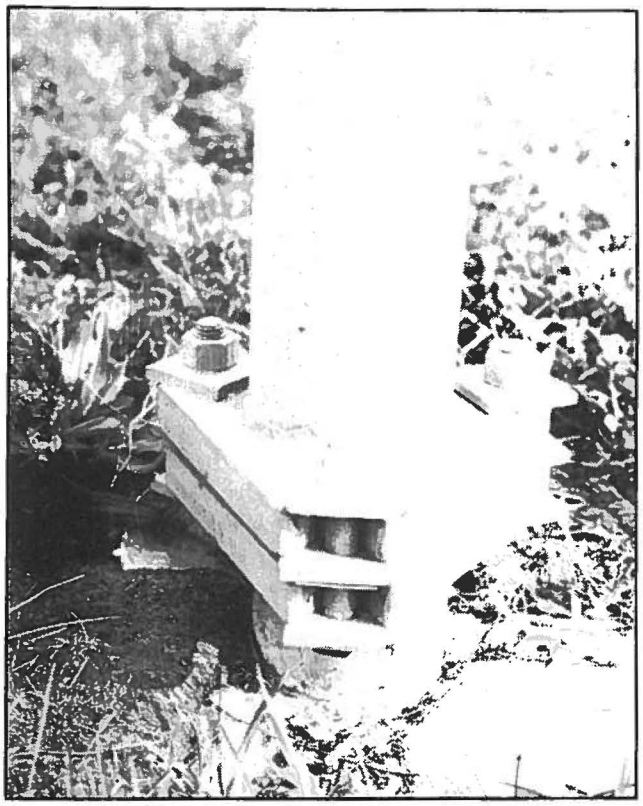
From design to maintenance, the Department works to make the highway system safer for motorists. So take heart! Your mission is not impossible! Let the safe, silent partnership between you and the highway make traveling on Missouri's highway system a pleasure.

Traveling In the Safety Zone

Mary Motorist starts her car. She pulls out of her garage and begins to turn onto the highway. Mary is about to enter . . . "The Safety Zone". . . a dimension where highway features work together to protect motorists.

Although the safety zone may sound like something from TV land, it is in fact an important part of highway safety. The Missouri Highway and Transportation Department keeps this zone clear of unnecessary obstacles to make traveling safer. If motorists veer off the road, they have a better chance of recovering.

The safety zone is the 30-foot strip adjoining the highway on both sides. This includes the 10-foot shoulder and the 20-foot strip of land beyond the shoulders. This zone is part of highways built since the late 1960s that carry 750 or more vehicles each day.



A breakaway signpost "breaks" when it's hit by a vehicle. A thin metal sheet between the two sections holds the bolts in place. When the vehicle hits the pole, the metal sheet tears. This releases the bolts and allows the pole to separate from the base. The vehicle then goes over the base and under the pole.

Statistics from the Fatal Accident Reporting System offer support for highway designs that include the safety zone. The report shows that approximately 60 percent of all fatal accidents in the nation involve only one vehicle. In 50 percent of these collisions, the vehicle strikes a fixed object.

Within the safety zone, motorists will encounter signs that have special breakaway designs. The metal signs have a slip-hinge base. If the sign is hit, the hinge releases, and the sign will go over the car. A wooden signpost has a slotted hole near the bottom that allows it to break when a vehicle hits it.

Light posts installed within the zone are also specially made. They're "frangible" which means the base of the post will break like an eggshell, allowing the car to pass under the pole when it's hit.

These "give" features can help prevent serious injuries. When a vehicle strikes a sign or light, it doesn't come to an abrupt stop, which could cause serious injuries or death.

But the safety zone is designed to do more than lessen the severity of an accident. Another feature could possibly prevent accidents. The safety zone has a flattened slope that gives motorists more time to recover control of their vehicle if it leaves the roadway. The slope ratio is 6:1. This means the slope drops 1 foot vertically for every 6 feet horizontally.

Whether it's a flattened slope or a breakaway sign, all these features are based on the Department's forgiving road principle. When motorists, like Mary, make mistakes, the safety zone gives them an opportunity to recover without serious injury or death.

Safety Barriers Help Save Lives

As far as the eye can see, a concrete wall stretches between opposing lanes of traffic. Cars whizz by, their drivers unaware of the wall's importance.

But the Missouri Highway and Transportation Department knows the importance of this wall. It helps save motorists' lives. The wall is just one of several safety barriers the Department uses to make traveling on Missouri's highways safer.

The concrete wall barrier is commonly referred to as the New Jersey barrier after the state where it was

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first used. The barrier, placed in the median, is 32 inches tall. It is 6 inches wide at the top and widens gradually to form a slanted ledge about 10 inches from the bottom. The wall's base is 2 feet wide.

When a car hits the barrier, this design keeps the auto from crossing the median into oncoming lanes or turning back into the other lanes. Tire marks have shown that the ledge safely redirects the car without serious injury.

Exact statistics are not available on how many lives the barrier has saved. Accidents when a vehicle hits the barrier and is safely redirected usually go unreported unless a major accident occurs.

Another barrier the Department uses primarily in the highway median is the cable barrier. This barrier is made of three cables attached to light steel posts. The cables are anchored every 1,000 feet in concrete pads that are level with the ground's surface. When a car hits the barrier, the cables release from the posts and restrain the vehicle.

But keeping vehicles from crossing the median isn't the Department's only safety concern. Another safety barrier is crash cushions. These are commonly placed in the V-area where two roadways separate, such as at an exit from a freeway.

Gigantic barrels form a crash cushion that could help protect motorists from serious injury. This safety device is usually placed at the V-area where two roadways separate. The barrels can be filled with a sand, crushable concrete or water mixture.

Crash cushions can be one large pre-formed unit or a group of barrels, which look like oversized trash containers. But instead of garbage, these barrels are filled with a sand, crushable concrete or water mixture. The barrels help absorb the energy of a crash so the stop at the end of the accident will not be so abrupt.

The proper water/chemical mixture must be maintained to prevent winter freezing, which would make the barrier too solid. The concrete used in the cushions is a special low-density type that crushes on impact.

Probably the most familiar safety barrier is the metal guardrail. These silver-colored curved beams help redirect a vehicle back to the roadway. Guardrails are also placed around such things as signs and overpass supports to keep the motorist from hitting them. The approach ends of the guardrails are flared away from the road, anchored to the ground or otherwise blended into the approach environment to protect motorists, too.

The Department carefully chooses the proper barrier for each location and situation to best protect motorists. Such things as accident statistics, the terrain and past experience are taken into consideration. For example, the concrete barrier is usually installed on narrow, paved medians with fairly flat terrain where highway speeds are fast.

However, protecting motorists with safety barriers can be an expensive proposition. Guardrails cost about $12 per foot, cable barriers cost about $6 per foot and one crash barrel costs about $200. One foot of New Jersey concrete barrier costs about $14 or $74,000 per mile.

But these safety barriers are cost effective. Helping save lives along Missouri's highways is a priceless task that the Department is more than willing to share. This task can't be accomplished alone. Careful motorists play the most important part.

Litterbugs Take Bite Out of Highway Funds

The litterbug continues to be a common pest along Missouri's highways. Litter clean-up costs have soared to more than $1,500,000 annually.

The Interstate system is the most litter-prone and costly to pick up. Cleaning Interstate rights-of-way in urban areas costs about $1,974 per mile. Rural Interstate costs amount to about $266 per mile.

More than $1,500,000 is spent annually to clean up after litterbugs who plague the state's highways.

Primary and supplementary systems also suffer. Litter control on urban primary highways totals about $480 per mile, while that figure for rural primary highways is about $52 per mile. Supplementary system expenditures amount to approximately $13 per mile in rural areas and $178 per mile in urban regions.

Much of this litter will still be around long after most motorists have driven their last mile. One aluminum can takes 80 to 100 years to decompose. Glass bottles require more than 1,000 years!

So the next time you roll down your window to throw a soda can out, the Department urges you to reconsider. The money we spend to pick up the soda can is better spent on resurfacing or construction to provide all motorists with better highways.

Uniting Mother Nature and the Highway

Blending a highway into the environment and developing other ways to protect and preserve that environment are an integral part of work on a Missouri highway project. It takes a special skill to make a highway look like one of Mother Nature's elements.

The process for the Missouri Highway and Transportation Department literally begins with ground work. Just like any farmer, soil samples are taken and analyzed to determine soil deficiencies. Based on these samples and past experience, the Department determines which type of vegetation is suited for the area. Then the land grading, fertilizing and seeding and mulching takes place.

By experimenting, Department researchers have discovered the adaptable vegetation to prevent erosion, as well as provide a pleasing roadside. The seeding of grasses and legumes is the most economical and usually the best means of controlling erosion. So on practically all roadway locations, a mixture of grass and legumes is sowed.

Legumes are used as the primary erosion control plant in a seed mixture or to furnish nitrogen for the grass. Just what type of grass and legume is used in the mixtures is determined by the soil, climate and whether the area is rural or urban.

Some legumes used by the Department include Alsike, Red and White Clovers, Hairy Vetch, Birdsfoot Trefoil, and Sericea Lespedezea. Another popular legume used by the Department is Crown Vetch. This vining, pink to lavender-flowered plant is better adapted to the northern two-thirds of the state. It chokes out weeds, making it very adaptable to steep slopes otherwise requiring mowing.

Tall fescue is the preferred grass used by the Department because of its exceptional adaptability and erosion prevention. It is the most versatile vegetation the Department plants and can be used anywhere in the state.

Other grasses sowed by the Department include Bermuda Grass, Smooth Brome Grass, Kentucky Bluegrass, Red Top, Timothy, Reed Canary Grass and Orchard Grass.

But grasses and legumes aren't the only plantings gracing our highways. Tree and shrubbery landscaping made possible through highway beautification funds rounds out the picture.

Finally, matching a highway to its environment also means killing noxious weeds such as Johnson grass and thistles. This is something the Department monitors and controls.

You can't fool Mother Nature, but the Department does its best to protect the natural environment and make a highway blend in with the rest of nature's family.

Highway Mission Is Monumental Task

The mission of the Highway and Transportation Department is to maintain and improve the highway system so people and goods can flow smoothly from one place to another at the lowest cost. This is no easy task since Missouri's state highway system, the nation's seventh largest, comprises more than 32,000 miles of highway, more than 9,000 bridges and more than 385,000 acres of right-of-way.

And there is one big problem with this mission. The work that needs to be done to maintain and improve the system is far outstripping the money available to do it. What the Department is able to improve and fix is being outdistanced by additional congested intersections, more deficient bridges and more miles of highway that need to be resurfaced or replaced.

There are several culprits in this funding crunch including rising construction costs. In 1970 it cost about $900,000 to build a mile of two-lane primary highway. Today that same mile of highway costs about $2 million to $2.5 million. A mile of eight-lane Interstate highway in an urban area cost about $14 million to $15 million to build in 1970. Today it takes $36 million to $40 million to build this mile.

The Department is not adding any new mileage to the state highway system. The construction program it has undertaken in the past few years has been to modernize sections of highways and bridges built in the 1920s and 30s. Highways do not last forever, and constant wear and tear from years of daily driving underscore the need to replace sections that are falling apart.

Material prices have helped add to the higher construction costs and also to the Department's maintenance costs. In 1970 a cubic yard of crushed stone cost about $3. Today this cubic yard costs about $13. Another example is asphalt which costs 10 cents per gallon in 1970, but now costs $1 a gallon.

Another major culprit in the funding crunch are other state agencies who siphon money from the state highway fund. Each year more than $100 million from the fund goes to various projects and programs in other agencies, instead of being spent on highway improvement projects.

A list of all the Department's road projects needing to be done would fill a multi-volume set, but the Department is doing what it can with the resources currently available to it. It's like trying to patch holes in an aging rubber life raft. As soon as one hole is fixed, three more spring up.

And with costs going up, and more work to do, the Department may not be able to fix what it needs to and what the people want. In the final analysis, the needs of Missouri's citizens are the needs of the Department.

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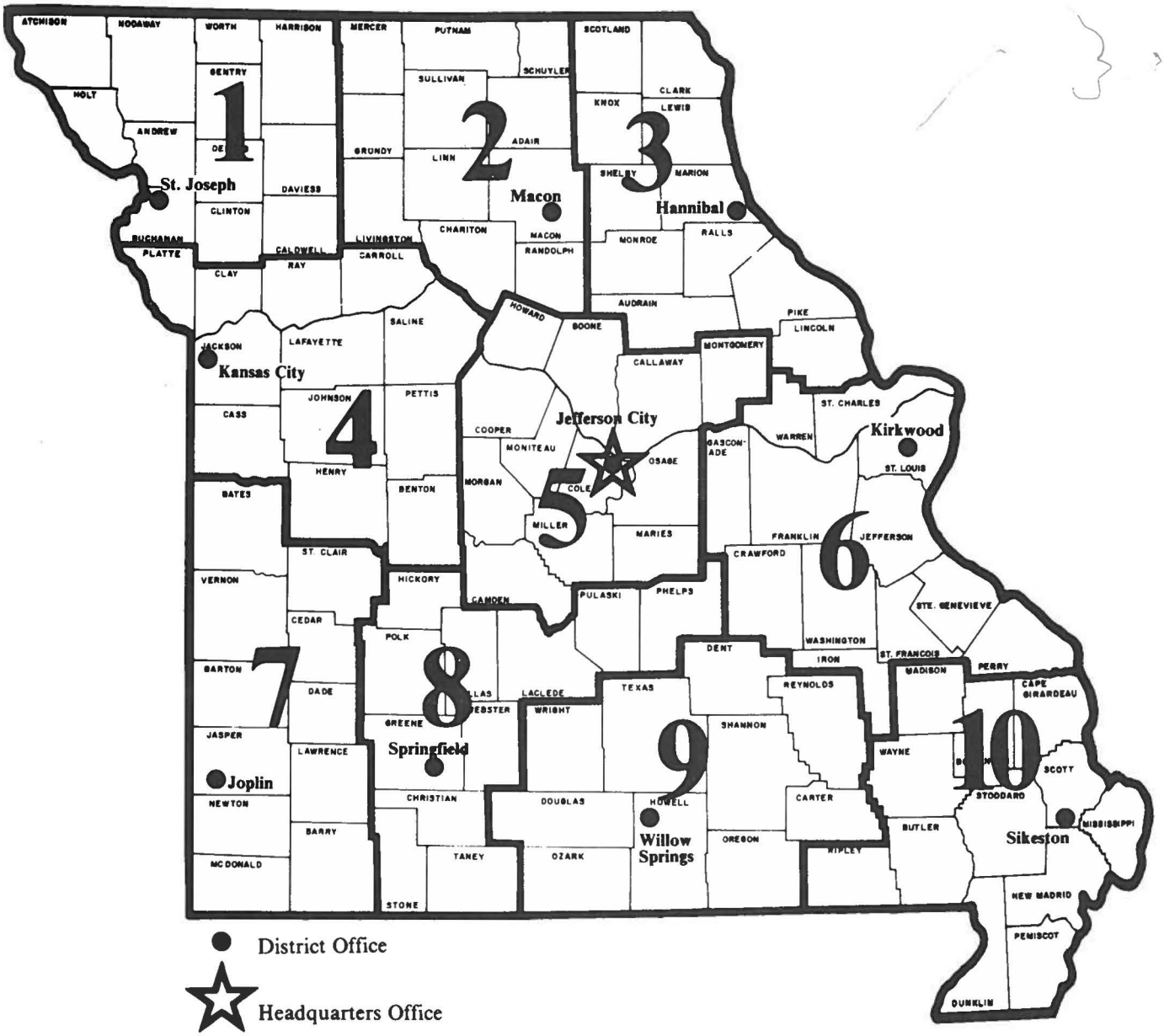
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