THE RELATIONSHIP BETWEEN THE DEVELOPMENT OF HIGHWAYS AND WATER RESOURCES MANAGEMENT

by

G. F. Hughes, Jr.
Civil Engineer Senior, Division of Planning
Kentucky Department of Highways

During every stage in the development of a highway - from the planning stage through construction - considerable thought and effort must be given to the management of water. In a State such as Kentucky, which has more miles of running water than any other State, this task can be demanding as well as expensive. The reverse of this is also true. During the development of a water resources project such as a multipurpose reservoir, highway needs within and through the project area demand proper consideration of highway adjustments.

Because of the many elements involved in a study of the relationship between highways and water, I will limit my discussion primarily to three elements. Firstly, I will discuss water pollution and the method presently employed by the Department of Highways to protect and preserve water quality. Secondly, I will discuss briefly the Department’s highway-fill-lake program under which a fill section may be designed and constructed to impound water. Thirdly, I will reverse the line of thought and discuss the impact on highways from large reservoir construction.

Water Pollution

As you know, water pollution has become a major concern of the entire nation. There is hardly a stream left in the country and, especially this State, that does not receive pollution from either improperly treated sewage that is released in the streams from cities as well as residents along its banks, or from industrial wastes, strip mining, highway construction and many other construction sources.

In order to offer some means of protection to those streams supporting or capable of supporting a good fish population, a program was implemented in 1964 to protect and enhance fish and wildlike habitat along Federal-aid highway construction projects. The Department of Highways, in compliance with a Bureau of Public Roads' Instructional Memorandum, adopted a procedure for coordination of public interest of highway improvements with those of the Kentucky Department of Fish and Wildlife Resources. The procedure insures that every effort will be made in the planning, design and construction of Federal-aid highway projects, so as to cause a minimum of disturbance to, and reasonable preservation and development of, the State's fish and wildlife and related natural resources.
The procedure requires the Department of Highways to furnish the Fish and Wildlife Department, for review and comments, a copy of official orders for survey and plans for all Federal-aid projects only. However, it was agreed that Fish and Wildlife should be given the opportunity to review and offer comments on all highway construction projects for which plans were developed, and Fish and Wildlife is, therefore, furnished copies of all official orders for survey and plans. Any interest indicated in a project by Fish and Wildlife is forwarded to the Division of Design where it is given full consideration during project design.

It is felt the procedure has established a definite line of communication between the two departments that did not exist prior to its adoption and that it is a helpful tool in the Department of Highway's fight against water pollution.

Even though the procedure offers some protection to those streams and waters of the State in which Fish and Wildlife has a special interest, it does not offer state-wide preservation of water quality. Recognizing this need, the Bureau of Public Roads in June of 1966, issued another Instructional Memorandum which required all Federal-aid projects after January of 1967, to be developed in accordance with practices designed to reduce water pollution. This prompted the Department to adopt in January of 1967, Special Provision No. 46 relative to water pollution which was subsequently applied to all Federal-aid primary projects; this past spring it was made applicable to the secondary road program as well.

In April of 1967, the special provision was submitted for review and comment to all departments in State government having an interest in the abatement of water pollution. I would like to mention that a warm response was received from all departments. Each comment and recommendation was carefully studied regarding the feasibility of its inclusion in the special provision. As a result of this review by other State departments, the special provision was revised in March of 1968 to include all justifiable suggestions, and is now referred to as Special Provision No. 46-A, Water Pollution Controls.

Even though the Department is required to apply the special provision to only Federal-aid projects, it is hopeful that we can, also, soon apply it to those State projects in which Fish and Wildlife has indicated an interest.

When applicable to a project, Special Provision 46-A enhances the protection afforded by the procedure between the Departments of Highways and Fish and Wildlife Resources, in that it requires the contractor to exercise every reasonable precaution to prevent the pollution of all streams, lakes and reservoirs regardless of whether an interest was indicated by Fish and Wildlife.
I will not attempt to discuss the Special Provision in detail, but I would like to point out some of the protection it offers against water pollution when applied to a project. In areas of highly erosive land it requires progressive seeding and/or sodding of all cut and fill slopes insofar as is necessary to prevent excessive erosion. Clearing of trees from stream banks is held to an absolute minimum and no mechanical equipment is allowed to operate in stream channels unless it is required for channel changes and structures and is so noted on approved plans, or unless the stream bed is solid rock and muddying the stream is unlikely to result. No material shall be deposited in an area along a stream that is subject to flooding or where it may be washed or carried away by high stream flows or fast runoff.

Further protection against water pollution is offered by the provision in that it requires proper handling of all harmful construction materials, it requires the removal or coverage of all acid-producing material; and finally, to prevent pollution from human wastes, it requires the contractor to provide adequate sanitary facilities for the duration of his work.

It is evident that a tremendous stride has been taken to prevent any possible pollution of water that may result directly or indirectly from the construction of highways. This will go far in lending a helping hand to preserve one of the nation's greatest but dwindling natural resources.

Highway Fill Dams

I have just discussed methods employed by the Department of Highways to prevent or abate water pollution. Next, I will discuss a method by which useful water may be impounded by designing and constructing a highway fill to serve as a dam.

Under certain conditions the Department can, and will, design and construct a highway fill to impound water. Those conditions or pre-requisites and their priority are as follows: (1) a road must be programmed for construction before a dam can be considered - in other words, a section of road cannot be planned, designed and constructed just to impound water; (2) a request must be received from a qualified sponsoring agency - qualified meaning it must be a legal governmental group that is willing and able to perform certain requirements; and (3) a feasible site must be available that will supply the needs of the sponsor.

To give you some insight on the development of a typical project, I will relate the events as they happen from the day a request is received until the project is either abandoned or constructed.
On receipt of a request from a qualified sponsor, a preliminary feasibility study is made of all possible locations along the proposed route. If a site is found in which the estimated cost of the dam is less than or equal to the estimated cost of the normal highway section, the site is considered feasible, as the Department can contribute toward the cost of a dam only to the estimated cost of normal highway construction. If the feasibility study shows the dam to cost more than the normal highway, then the sponsor or some other agency, which in some cases has been the Department of Natural Resources, must agree to bear the additional costs.

The sponsor is informed of any feasible or near feasible sites and, at the same time, is also informed of his requirements if the Department is to proceed with the project. The major requirements of the sponsor are: (1) to acquire, at no cost to the Department, the necessary rights of way for the reservoir area, (2) to clear the lake area, (3) to provide access to the lake shore for public use, and (4) to agree to reimburse the Department for all costs above and beyond the estimated cost of the normal roadway section, to include all construction change orders.

If a feasible site is found and it is determined the sponsor is willing and capable to perform his requirements, then a contract between the Department of Highways and the sponsoring agency is executed. If another agency is participating in additional construction and design costs, it shall be made a third party to the contract.

Upon execution of the agreement, an engineering firm is usually retained to prepare a detailed feasibility study to include the collection of sufficient foundation and field data to insure a reliable project feasibility report. If his report shows the project still feasible, then he is requested to proceed with a thorough geologic investigation, on completion of which further detailed cost estimates are prepared, based on actual foundation conditions and the availability of suitable material for the dam. If the foundation is found to be unsuitable to support a dam, or if it is determined the cost to prepare the foundation to support a dam is in excess of that which could be borne by the sponsor, then the project is abandoned and the sponsor held liable only for engineering costs incurred to this point.

If the project is still feasible on completion of foundation studies, then the consultant is directed to proceed with final design of the project and preparation of a new cost estimate based on final design. Again, the sponsor is once more informed of the expected additional construction and design costs and if it is more than he anticipated, the project would be abandoned and the sponsor would be obligated to reimburse the Department only for engineering fees incurred to this point.

If Federal funds are involved, the Bureau of Public Roads will normally submit the plans to the Corps of Engineers for review and comments as the Bureau has stated they are not qualified dam designers. The plans are also submitted to the Division of Water, Department of Natural Resources, for review to determine if they qualify under State requirements.
If we still have a feasible project based on the final design cost estimate, then the project is let to contract. Again, since we are unable to anticipate actual unit bid prices that will be received from the low bidder, a new cost estimate is prepared using his actual unit bid prices and, if the additional costs are still within the realm of that previously anticipated by the sponsor, then the contract is awarded and the project built. On completion of the project the sponsor will be billed for the actual additional cost incurred by the Department in building the dam.

Ten lakes, ranging in size from 3 to 200 acres and totaling approximately 700 acres, have been completed utilizing a highway fill as a dam. Presently, there are three under construction, two as part of I-75 in Laurel and Rockcastle Counties. Renfro Creek, a 370-acre lake in Rockcastle County which is sponsored by the City of Mt. Vernon, is essentially complete and should be impounded by the spring of 1969. A 700-acre lake with an expected completion date of late fall 1969 is under construction as part of I-75 where it crosses Woods Creek in Laurel County. This lake, sponsored by the Woods Creek Water District, will have approximately 140 feet of depth at the dam with the lake at normal pool and, when completed, will be the deepest and largest of the highway fill lakes. In Washington County, the City of Willisburg is sponsoring a 146-acre lake which will be impounded by KY 53, the Springfield-Bluegrass Parkway connector. This project is nearing completion and should be impounded in the near future.

We in the Highway Department feel that utilization of a highway fill to impound water for an area that is in dire need of an adequate supply performs a maximum service for the citizens of Kentucky and guarantees the utmost use of the taxpayers dollar. Possibly, at some future date it is hopeful the joint development concept may be expanded to include the construction of highway fill lakes.

Corps of Engineer Projects

Up to this point my discussion has been concerned with the effects of highway construction on water resources. I would now like to reverse the line of thought and discuss the effects that construction of large reservoirs have on highways; I refer here to those reservoirs primarily constructed by the U. S. Corps of Engineers.

There is presently a closer working relationship than ever before between the Department and the Corps of Engineers regarding road adjustments around Corps projects; however, past experience has revealed several problem areas involving public laws and regulations concerning road adjustments which the Corps must adhere to and which the Department must accept. Before I discuss these problems I would like to relate briefly the methods and regulations presently employed to determine a replacement road network.
In the early stages of a reservoir project, the Corps will normally offer the Department an opportunity to express its interest in utilizing the proposed dam as a future highway. If the Department's answer is yes, we agree to reimburse the Corps for the additional costs necessary to design and construct the dam to carry a highway. This cost is usually nominal.

Occasionally, in the early planning stages, the Corps will also submit to the Department for review and comments a proposed plan of relocation around a particular project. This is very desirable because it gives the Department an opportunity to review its priority of future road needs through the area with regard to relocations necessitated by the reservoir and with respect to traffic conditions generated by the reservoir. Another advantage of an early review could be a savings to the Corps of not having to relocate a section of newly constructed road.

After its review of the proposed relocations plan, the Department informs the Corps by letter of its comments and any requested changes to the plan. This letter is the basis of further negotiations with the Corps resulting in the ultimate execution of a relocations contract.

Now I will point out some of the trouble areas the Department has encountered during negotiations for relocation contracts and some of the problems inherited by the Department, which are the result of completed, inadequate road adjustments.

As stated earlier, the Department's concern is not the cooperation which it receives from Corps representatives, but lies mainly with existing public laws and regulations under which the Corps program is administered. Under existing regulations the Corps is authorized to provide, at Federal expense, the relocation of public roads to design standards in existence at the time of contract execution and to a design class dictated by existing traffic at the time of contract execution. They are authorized to provide access roads to reservoir project developments, such as public recreational sites, but this authority normally ends at the Corps project acquisition line. Application of each category is dependent on a determination by the Corps that the specific road or roads are necessary and justified.

Corps regulations do not permit relocations to a standard capable of carrying not only existing traffic, but traffic that can be expected to be generated by the reservoir as well. This puts the Department in the unfortunate position of having to search for funds on a moment's notice to finance a betterment or, if funds are not available, which is usually the case because the road is probably low on the Department's priority list for improvement, of being forced to accept responsibility for a new facility that will be overloaded immediately after completion of the reservoir.

Neither do regulations permit the Corps to authorize a change in design class or engineering criteria if they were adopted subsequent to the date of contract execution. To the Department it is not logical, especially
during this age when so much stress is being placed on highway safety, for
the Corps of Engineers, an agency of the Federal government which is the
prime enforcer of increased safety standards, not to participate in the
additional construction cost due to safer design criteria that are adopted
subsequent to a date of a relocation contract. To us this is similar to
refusal by the Bureau of Public Roads, after design authorization, to
participate in additional cost due to revised criteria. The Bureau not only
insists that up-to-date criteria be applied after a project is authorized for
design, but in recent instances have required new criteria to be applied
after a project had been let to contract. In our opinion we are clearly
dealing with two Federal agencies that are administering Federal monies
under entirely different philosophies.

Recreational planning by the Corps is normally a slow process and
expected development is usually unknown until the latter stages of reservoir
construction. This, in effect, forces the Department to sign a contract for
road adjustments without benefit of vital knowledge concerning recreational
development. The location of each recreational area, the expected usage of
each area, the expected development date of each area and the extent of
access to be provided to each site by the Corps, all play a major role in
determining future road needs to and through the project area.

The Corps has been known to develop recreational sites around
some reservoirs that were far removed from the nearest State facility
able of providing access. In such cases, access roads were constructed
within Corps property lines and the Department of Highways, through public
demand, was forced to extend or provide access from that point to a State
road capable of handling the traffic.

Occasionally, private properties that are served by a public road
are severed from access by a reservoir. The Corps' policy regarding such
situations is to provide access to the property unless the cost of providing
access exceeds the value of the property, in which case the entire property
is acquired; however, on occasions the property owner will request that he
be allowed to retain an isolated segment which the Corps will agree to subject
to two conditions: (1) that the owner release the United States from damages
for lack of access and (2) the obtainment of such release in lieu of acquisition
is concurred in writing by the State and/or county road authority concerned.

Until early 1967, the Department of Highways was not involved in
waiver of access agreements to isolated properties primarily because almost
all properties were served by a county road prior to reservoir construction,
and the release was, therefore, obtained from the county rather than from the
Department. Neither was the release, prior to 1967, made a permanent
part of or permanently attached to a deed. This created problems for
the Department. Since we were unaware of the number and location of
properties that were being isolated and since the waiving of access rights
was not a permanent part of a deed, the property owners could approach
the Department at some future date after reservoir construction and request that we provide them with access.

In order to become better informed and to save the Department from future requests for access to isolated properties, the Corps was asked, in 1967, to revise their procedure in a manner that would involve the Department on each and every case. The Corps agreed and the Waiver of Access and Release of Damage Claim Agreement must now be signed by the property owner, the County Judge, the Commissioner of Highways and the Corps of Engineers. A provision regarding future access rights is also included in the Deed of Conveyance. Since the revised procedure has been in effect for only a little more than a year, we have been unable to gage its effectiveness, but it should be a definite improvement over the old method.

One of the most critical problems the Department is facing today concerns county roads that were constructed by the Corps to provide access to residents in Pike County that would otherwise have been isolated by Fishtrap Reservoir. The Fishtrap Reservoir project greatly exemplifies some of the problems inherited by the Department as a direct result of roads built to inadequate standards by the Corps.

At Fishtrap, approximately 16 miles of county roads were built to provide access to 118 families that would have been isolated. The roads were built to a low, heavy mountainous design standard and traverse some of the most rugged terrain to be found anywhere in the State. Slides and fill slips have been very common because practically all mileage of the roads was constructed using side hill cuts and fills on very steep mountain sides. As a result, the roads have been extremely difficult and costly to maintain and keep open to traffic on a yearly basis, especially during winter months. The Corps is well aware of the problems for they have spent some $60,000 on the roads to keep them passable since their completion in 1964. It was learned recently that additional remedial work is planned by the Corps for the next construction season.

Department engineers have estimated that it would cost approximately $210,000 to restore the roads to an acceptable state of maintenance, and because of the age and location of the roads, this cost or a portion thereof, could be required annually until the roads stabilize. It is readily seen that the Department, through its County Road Aid Program, is definitely unable to finance such costly repairs. For this reason, a report was submitted to the Corps of Engineers requesting corrective measures to be undertaken at Federal expense. I am happy to say that as a result of the report, a joint study is now underway between several State and Federal agencies to determine the best course of action to alleviate the road conditions at Fishtrap.

Since the Department does not have responsibility for county roads, it was unaware of the exact nature of county road adjustments provided by a
contract executed between the Corps and Pike County. In an effort to become more knowledgeable concerning county road adjustments, at least to a point that situations such as that created at Fishtrap could be avoided, two actions have been initiated. First, the Department is now reviewing all county roads affected by Corps projects and is including recommendations regarding county roads in its initial reply letter to the Corps. Secondly, the Corps has been or will be requested on each individual project to offer the Department an opportunity to attend all meetings between the Corps and county fiscal courts regarding county road adjustments. In this way, the Department can offer guidance and engineering assistance to the counties during negotiations and thereby, hopefully, insure a better county road replacement system.

I have touched briefly only a few of the elements involved in the relationship between water resources management and the development of highways. I hope I have shown you that the Department of Highways is definitely not interested in constructing roads in the cheapest and most economical manner, regardless of the destructive impact on water resources of an area, but that we in the Department are sincerely interested in designing and constructing roads in such a way that they will lend themselves toward the improvement, rather than destruction, of water quality and water resources.