

Indiana State Highway Commission Programs— Past and Future

GENE K. HALLOCK
Chief Highway Engineer
ISHC, Indianapolis, Indiana

INTRODUCTION

The Indiana State Highway Commission is entering a period of transition unlike any other in its entire history of more than 56 years. We are near the close of two major building programs—the interstate system and the replacement of killer highways. The future, both immediate and long range, is full of uncertainty—in funding, in priorities to be established, in the federal-state relationship—in almost all phases of the overall highway program.

INTERSTATE UNDER CONSTRUCTION IN '74

To look for a moment at the accomplishments of the last year, it certainly represents a milestone in two great construction programs that have had top priority in Indiana for several years. Within the last year every uncompleted mile of Indiana's original interstate system was put under construction in either the grading or paving phase. This insures that all of the original interstate system in Indiana should be open to traffic before or by 1977.

The national interstate system represents the largest public works project ever undertaken in the United States. After several years of study, planning, and discussion, federal legislation in 1956 authorized and funded a National System of Interstate and Defense Highways. The national system of 41,000 miles was established and 1,120 miles of this total was Indiana's share. Indiana received more interstate mileage on the basis of population, area, and highway mileage than most other states. The 1968 Federal-Aid Highway Act provided for additional interstate mileage and a 14-mile segment designated as I-164 was approved for Indiana.

The 1957 session of the Indiana Assembly increased the state gasoline tax to provide matching funds for the interstate program. Construction began in Indiana in 1958. When Congress established

the interstate program in 1956 the target date for completion was set for 1972. Due to the effect of inflation and limitation on annual expenditure for interstate construction, the year 1972 has come and gone with the interstate far from completion nationwide. The anticipated completion nationwide is now not before 1990 and possibly after the year 2000.

Not satisfied with the slow progress being made toward completion in Indiana, the state highway commission developed a program to insure completion of the original system in Indiana by 1977, at least six to eight years before projected funding would allow. Governor Bowen approved the program and the 1974 General Assembly provided the \$15 million loan necessary to complete a \$47 million advanced construction program. Thus a way was found to get around the formula derived by Washington bureaucrats whereby all states would finish the interstate system at the same time—if ever.

In March of 1974, soon after approval of the advanced interstate construction program by the legislature, the final contracts of the \$47 million ACI program were awarded. In June 1974, the awarding of a grading contract for I-275 meant that all of the original interstate system was at least in the grading stage. In September 1974, the final contracts for major structures on the original interstate system were awarded, leaving only the contracts for paving on several segments to complete the original system in Indiana. These remaining paving contracts will be in contract lettings in the remainder of this year and in January 1976, the final paving contracts should be awarded.

There is a lot of work yet to be done. Work on contracts now underway in Marion County alone amount to close to \$90 million. However, with the cooperation of the weatherman, all of I-65 and I-70 in Marion County, all of I-265 in New Albany, and all of I-64 in southern Indiana will be open to traffic by the end of 1976. Connecting the Ohio and Kentucky portion of the Cincinnati Bypass, I-275 will be open in 1977. There will be much discussion and many ribbon-cuttings in these final stages of interstate completion. However, every planner, designer, construction personnel, and contractor who has been involved in the interstate program since 1956 can well be proud of having been a part of the greatest public works program in history.

OPENING OF FINAL LINKS OF REPLACEMENT OF KILLER HIGHWAYS IN '74

Another landmark reached during 1974 was the opening of the final links of replacement of killer highways. The Highway Needs

Study Committee created by the 1965 Indiana General Assembly designated 157 miles of single-lane stretches of US 30, US 31, US 41, US 24, and State Roads (SR) 37 and 63 as killer highways because they consistently ranked among the highest in traffic volume accidents and deaths. The 1969 General Assembly provided the gasoline tax increase necessary to start the killer road replacement program.

The US 30 segment has been completed. In September of 1974 the last sections of SR 37 between Indianapolis and Bloomington were opened to four-lane traffic. This seemed to be of particular interest to several motorists wanting to reach that southern city. Then in November of 1974, the Bedford Bypass on SR 37 was opened to traffic completing the four-laning of this killer highway from Indianapolis to Bedford.

November of 1974 saw the opening of the last link in Marion County and Miami County on US 31 to provide a continuous four-lane highway between Indianapolis and South Bend. Thus SR 37 and US 31 were added as completed segments of the killer highway replacement program. A 15-mile section of SR 63 in Vermillion County was opened to four-lane traffic in December 1974. More contracts were started during the year on the US 41—SR 63 corridor. Work was also begun on the replacement of US 24 between US 31 and the Wabash Bypass. Within the next year all segments of the replacement for the original 157-mile killer highway system should be under way.

PRELIMINARIES ON CLINE AVENUE PROJECT STARTED IN '74

During the past year, preliminary steps were initiated to begin the most expensive, most complex project ever undertaken by the Indiana State Highway Commission. For several years there had been considerable discussion about the need for extension of the existing Cline Avenue artery into the industrial complex of East Chicago and Hammond. The estimated cost of over \$10 million per mile for the five and one-half mile length prohibited initiation of the project with state funds. However, with inclusion of the Urban High Density Program in the 1973 Federal Highway Act providing 90% federal funding for approved projects, the avenue for completion of the Cline Avenue extension was opened.

The SR 912 location connecting to Cline Avenue at US 12 or Industrial Boulevard on the east end and extending to the Indiana Toll Road near the Illinois state line on the west end was one of three projects approved nationwide as an Urban High Density

project. In 1974 the draft environmental impact statement was completed and three design contracts were executed. Design is now well underway and preliminary right-of-way and utility planning is beginning. The complexity of the 5.5-mile project is unparalleled in Indiana history. The project has been divided into three phases with the initial phase beginning at US 12 skirting the urban renewal area and paralleling three railroad lines to be relocated out of the way. The first phase ends with an interchange at Michigan Avenue and the entrance to Inland Steel. The second phase begins with a viaduct over a parallel street and railroad line and then turns west to the high level structure over the Indiana Harbor ship canal. It was decided that a lift bridge with the inherent traffic delays was not compatible with the concept of a major artery for moving people and goods. Therefore, a high level structure with 120-foot clearance over the ship canal is being designed. The second phase ends with an interchange at Riley Road just west of the high level structure. Due to the high level and limits on available area the interchange will be one of the most complex in the nation—very similar to the result of dropping three strings of limp spaghetti on the kitchen floor.

The third phase continues the westward line through a highly industrialized area including a strip through one of the oldest oil refineries in the nation. The third phase ends at an interchange with US 41 at Calumet Avenue and possibly a connection with the Indiana Toll Road. Environmental problems will be the most difficult ever faced in Indiana. The EPA is raising questions such as possible pollution of the Indiana Harbor Canal and Lake Michigan from oil and grease deposited on the roadway from trucks and by salt used for removal of ice and snow. Noise and air pollution problems are yet to be resolved. The cost of right-way in industrial property, the relocation of several railroad lines and several utilities including oil lines and storage tanks as well as the effect of inflation over the last two years has caused the initial estimate for cost to complete the 5.5-mile project to soar from \$50 million to a figure well over \$110 million. However, due to restrictions on the federal funds, a tight schedule is well underway and the first phase should be under contract early in 1977.

FUTURE NEEDS, CONSTRUCTION, MAINTENANCE, AND FUNDING?

During 1974, Chairman Boehning and representatives of the state highway commission participated in five state-wide hearings of the Legislative Study Committee on Highway Needs. Local city and county officials as well as private citizens participated in these hearings

to discuss the future needs for construction and maintenance of an adequate highway system as well as the present problems with funding those needs. The panel tomorrow will address the topic of Financing the Needs of the Indiana Highway System. Until the solution is found to that problem, no far reaching conclusions can be drawn as to future programs of the Indiana State Highway Commission. Runaway inflation during the last year has spread even wider the gap between needs for construction and maintenance and the revenue necessary to meet those needs. In 1974 a record setting \$175 million of construction contracts were awarded. Present revenue outlook indicates that the prospects for coming even close to that record in future years is not at all bright.

In assessing the possibilities for future highway programs some items are certain. It is a certainty that the interstate program will go ahead in Indiana to early completion. It is a certainty that replacement of killer highways will proceed toward early completion of the originally designated 157 miles. Past this point the picture begins to get hazy. It is a certainty that there are several more miles of killer highways and bridges that need replacement. However, it is also a certainty that Indiana can no longer afford to neglect adequate maintenance of the existing system. Top priority in future programs must be given to protection of the \$8 billion investment in the state highway system. We are now resurfacing state highways at less than half the necessary annual mileage. We are reconstructing half as many bridges as should be. We are not performing adequate preventive maintenance to conserve highways and bridges until more lasting repairs can be made. It is a certainty that increased funds and increased attention must be given to these vital areas.

ESTABLISHMENT OF MAINTENANCE MANAGEMENT SYSTEM

Rather than try to predict just what the future highway program will be, I would like to discuss some of the concepts that will be considered and used in the years to come. The Indiana State Highway Commission has recognized the increased importance of adequate maintenance by establishment of the maintenance management system. In 1973 Chairman Boehning expressed his concern for improvement of maintenance performance, and requested suggestions to bring about this improvement. Several state highway departments were implementing a system designed for this purpose called the maintenance management system. It was determined that a state highway department which was already using the system should be visited to observe firsthand the advantages and disadvantages and applicability to Indiana. Since the

state of Washington is recognized as a leader in the field of highway maintenance, the visit was made to the Washington Department of Highways. It was determined that a maintenance management system would benefit Indiana and was applicable in our organization. Since the maintenance staff was already inadequate in number to handle the daily work load, it was decided that a management consultant should be used to design the system. To insure early implementation based on proven procedures, a consultant was chosen who had many times the experience in development of a maintenance management system as any other consultant. It was necessary to appoint a commission engineer well versed in maintenance practice, with a patient temperament and considerable vigor to direct the development of the system. Kenny Mellinger was chosen for this position. Kenny and the consultant have done an excellent job in getting implementation underway and Kenny will be discussing the system later today.

AN INDIANA DEPARTMENT OF TRANSPORTATION— EVENTUALLY

Other changes in the commission organization will no doubt come about through the years as programs and priorities change. One item that occasionally crops up for discussion is the question of a department of transportation in Indiana. This discussion has gone on for several years and as each year passes, transportation problems in Indiana continue to grow. It is inevitable that there will eventually be an Indiana Department of Transportation. The question remaining is when will the final step occur. Each year more states join the growing number who have decided that coordinated transportation planning is a necessity and not a luxury. The states of Texas and Washington are the latest to join this group. The increasing concern with mass transportation or public transit as well as changes in federal planning regulations and federal transportation funding is beginning to mandate a single state agency capable of overseeing the coordinated effort necessary in the federal-state relationship and at least desirable, if not necessary, in the state-local community relationship.

This is not at all to say that the state highway commission should take on the additional responsibility of a state DOT. A staff that is not adequate in number for the normal workload is certainly not adequate for the crash program or an additional workload. However, the state highway commission would be a vital part of a complete DOT, which could take many forms. The duplication of planning effort that is now beginning to appear on the horizon in Indiana can only be prevented by a more efficient single agency concept. Many of the old argu-

ments against a state DOT such as diversion of funds are already a fact of life on the national level and are now in the realm of possibility on the state level. The highway interests may well be in a better position to preserve their financial share in a single agency rather than watching it flow to another agency in which they have no input. All of the states which now have a state DOT are funding a portion of the highway program from general fund revenue. The DOT question will not be resolved in the near future but it is an item looming ever larger on the horizon.

THE DEGENERATE FEDERAL-STATE RELATIONSHIP

Another organizational question of growing concern is the federal-state relationship in the highway program. The current Congress will have under consideration re-revisions in highway legislation having the greatest impact on future highway programs since the Federal-Aid Highway Act of 1956 which established the interstate program. However, this time the interest is in less federal involvement rather than more. Questions such as abolition of the Highway Trust Fund and rescission of federal gasoline taxes to be picked up by the states will be addressed. There could not be a more opportune time for less federal involvement. The fine federal-state partnership that once existed in the highway field has degenerated to a relationship much closer to a dictatorship or a lord and concubine relationship. The relationship has degraded to the point that now the carpetbaggers from Washington in addition to telling the individual states what their problems are, are also dictating the priorities to be observed. In many instances more emphasis is placed on slowing down the improvement of highways than in solving the problems to everyone's advantage. Hearings, meetings, and paperwork consume time that could be better spent in productive effort. Hopefully the new federal highway legislation will help restore the federal-state relationship as it once existed.

NEW DESIGN AND CONSTRUCTION CONCEPTS ON HORIZON

Many new concepts are on the horizon in the design and construction of Indiana highways. These are coming about due to questions about future availability of material in some instances, but in all cases also due to the need to continuously look for a better way of getting the job done. Engineers, who are professional in deed as well as in name, will not be satisfied with the status quo, but will be creative, always searching for a more efficient method, a longer-lasting material, or an improved final result at a lower cost.

There is no guarantee that all of the materials being used today will be available tomorrow in sufficient quantity at reasonable cost. Therefore, we will be trying different alternatives to gain experience if the need should later arise. Indiana is blessed with an abundant supply of stone in some areas of the state. Stone subbase has been shown to provide good drainage qualities so very necessary for some if not all pavement types. Stone subbase has been incorporated in a few recent contracts. Concrete shoulders have been incorporated in two recently awarded contracts to be constructed this summer. The dryer drum mixer offers a possibility of fuel saving and production economy. One construction contract and two resurface contracts to be let this year will allow the dryer drum mixer as an option. Other fuel and oil saving materials requiring less heat and less asphalt will be investigated. Corten-type steel will be incorporated in several bridge projects.

Several new concepts will involve a better method of getting the job done for an improved product. To improve subgrade stability in recent years, we have required moisture-controlled compaction in the top two feet of the embankment. Investigation and consideration will be given to specify moisture-controlled density in the entire embankment from bottom to top.

END RESULT SPECIFICATIONS

There has been considerable interest in recent years in the concept known as end result specifications. In Indiana, as well as most other states, it has been the standard practice to specify how the contractor is to do the work, specify the result that he is expected to obtain, and then penalize the contractor if everything doesn't work out right. End result specifications give room for innovation by the contractor, insure a more uniform product, place responsibility for control of production on the contractor where it belongs, and relieve the state inspector from supervising the contractor's production. Several states are now trying end result specifications and no state, which has turned to end result specs, has gone back to the former method.

Indiana began discussion of end result specifications two years ago and a committee was formed to develop trial specifications. The specifications were developed for construction of bituminous pavements and it was determined that the end result specifications should be used in simulation testing on active contracts. In other words, the standard specifications would be used for contract acceptance and payment. Separate testing, using the end result specifications, would be used to compare the results and determine the price adjustment that would have resulted. By agreement with the individual contractors, two projects

have been chosen for simulation testing of end result specifications in 1975.

The contractor will be responsible for maintaining control of the mixtures under end result specifications. The contractor will obtain random samples and run tests to check for compliance with allowable tolerances as set out in the specifications. The contractor will make adjustments as necessary to stay within the tolerances. The contractor's test results will be available for review by the state.

Acceptance of the mixture will be determined by tests performed by the state. Adjustments in price will be based on variation from specification for gradation of the mix, bitumen content and density of the compacted mix for subbase, base and binder courses. Adjustment of price for surface mixture will depend on gradation, bitumen content and surface smoothness. The lower percent of the adjusted contract price will determine an adjusted lot price. The weighted average of all the adjusted lot prices will then determine the final adjusted contract price for each pay item. This simulation testing should help indicate the advantages or disadvantages of end result specifications.

NOW TO PLAIN CONCRETE PAVEMENT AND SKEWED JOINTS

Concrete pavement design has undergone a complete cycle in Indiana from 1920 to the present. Starting with plain pavement in the early '20's and evolving to reinforced pavement in the late 30's and early 40's, the trend was back to plain pavement in the middle 40's. With the discovery of the importance of adequate drainage and the advent of granular subbase, reinforced pavement was the standard design from the late 40's to the middle 1960's. The problems associated with transverse joints brought on the advent of continuously reinforced concrete pavement. The automobile industry had its Edsel, the aircraft industry had its F-111, and the highway industry had its CRC pavement. The present trend in concrete pavement in Indiana is the use of plain pavement with 20-foot joint spacing. If the concept now being tried on a few Indiana projects proves out, the future trend in Indiana will be to skewed randomly-spaced joints in plain pavement.

IMPROVING SKID RESISTANCE ON CONCRETE

Another change in concrete pavement design will be increased emphasis on construction of longer-lasting skid resistant surfaces. A recent directive from the Federal Highway Administration prohibits approval of concrete surface texture construction which was commonplace in Indiana just last year. Indiana's own skid tests confirm that concrete

surfaces are not maintaining proper skid resistance in just a few years after construction. As long as studded tires are permitted in Indiana, the broom finish is not going to be good enough. Therefore the new concrete pavement specifications will require surface texturing with a comb, a rake, or a roller device incorporating heavier, longer-lasting grooves in the pavement surface.

IMPROVING SKID RESISTANCE ON ASPHALT

Some problem with skid resistance also exists with bituminous pavements. Aggregates that tend to polish and dense mixtures contribute to the problem. The Federal Highway Administration claims that the open-graded surface is the answer to skid resistance problems on bituminous pavements. Indiana's experience in prior years with open-graded surfaces has not been particularly good. However, we will be trying open-graded surfaces on some projects as a comparison with standard Indiana mixtures. We will be making increased use of sand mix surfaces which have proven to be the best skid resistant of any of the Indiana surface treatments. With the concurrence of FHWA we are now specifying sand surface on several new construction projects.

NEW SEGMENTAL BRIDGES IN INDIANA

One of the more exciting new concepts now taking place in Indiana is the use of segmental, post-tensioned, concrete-box-girder bridges. The first segmental bridge in Indiana which is the second of this type in the United States has been fabricated at a plant in Lafayette and will be erected over the Muscatatuck River at North Vernon on U.S. 50 this summer. A segmental bridge is under design for the new crossing on U.S. 136 over the Wabash River at Covington. A county bridge using the segmental concept will be placed under contract in Parke County this year. A segmental structure is being considered for use in the realignment and ramp addition for the I-465/I-70 interchange on the east side of Indianapolis. Normally at this stage of a new concept we would sit back and see how things turn out. However, in the preliminary planning for the high level structure over the ship canal on the SR 912, Cline Avenue project, it was indicated that segmental post-tensioned construction could offer a substantial economic saving. With a structure cost of more than \$20 million, the savings could amount to a few million dollars. Due to the possibility of this great economic advantage on one hand and on the other hand the fact that the first structure was not yet erected in Indiana combined with other questions, it was decided that a group should journey to a location where

several completed and under-construction structures could be observed first-hand.

SEGMENTAL BRIDGES IN EUROPE

The French and the Belgians were the original developers of pre-stressed-concrete. The French were the front-runners in development of segmental, post-tensioned, concrete box girders and this quickly spread to the Netherlands. Four members of the Indiana State Highway Commission staff as well as designers from three Indiana consultant firms spent a week in January observing segmental manufacture and construction in Holland and France. All of the group were impressed with the fact that these European countries are far ahead of the U.S. in the use of pre-stressed concrete.

Several completed structures were observed near Rotterdam in the Netherlands. One structure known as the Kleinpolderplein Fly-over is very similar to the one being considered for the I-465/I-70 interchange. It also was constructed over very heavy traffic movements with no interruption of traffic. This was the first segmental structure constructed in Holland. Segmental structures over Dutch rivers and canals proved to be the most economical in solving problems associated with that type of construction. A segmental bridge under construction near Hilversum by a German contractor was the type chosen due to the fact that the dual-lane highway underneath had to remain open to traffic at all times. Other modern concepts such as cable-stayed bridges and tower lighting were observed in Holland. Perhaps the most impressive item to the entire trip was the high priority and great attention given to maintenance of preservation of all capital improvements, highways as well as buildings.

South of Lyon, France, a visit was made to a fabrication plant used for a toll road project consisting of 80 miles of dual-lane highways with over 240 bridges. A standard design was used for the local road over-type of structure. Then in the foot-hills of the French Alps a segmental bridge was observed under construction. The use of launching girders are commonplace at European segmental bridge construction sites. This makes construction much simpler at 200-foot heights as observed at Lyon.

Outside of Anger, France, segmental construction over the Loire River was observed. At this site the complete process was observed starting with fabrication and including erection and post-tensioning of the segments. A full day was spent observing the various steps required.

In Paris several completed segmental structures were observed. The structure known as B-3 is an interchange which is for the most part made up of segmental construction. Since there was great importance placed on early completion of the interchange, 2,200 segments were fabricated and erected in one year.

The Pont de Saint-Cloud bridge over the River Seine is very similar to the geometrics involved in the Cline Avenue project. The structure passes over the river and then continues over a parallel street.

The last bridge visited was also over the River Seine at Choisy-Le-Roi. This structure was the first segmental bridge incorporating epoxy joints and is now over 12 years old. The bridge was in excellent condition. All of the French segmental structures make use of a waterproof membrane and an asphalt overlay. The trip confirmed that segmental post-tensioned box girder structures are a feasible alternative when conditions warrant. Based on well-founded estimates provided by the consultant for the high level bridge on Cline Avenue over the ship canal indicating a probable saving of \$3 million, it has been decided that segmental construction will be used for this bridge. The decision has not yet been made on the adjacent structures, but segmental design will continue to be used when site conditions and economics are in its favor.

OTHER PLANS OF ISHC

These are several of the new concepts that will be taking place in the future, as a part of the overall state highway commission program. Several other changes in emphasis are certain to come about such as more effort in informing the public and more attention to satisfying the environment. The discussion tomorrow on financing the needs of the Indiana highway system will provide more insight into the future programs of the highway commission. With the winding down of interstate and killer highway construction, interest will swing to programs to improve highway safety, the flow of traffic through urban areas, and mostly importantly—adequate maintenance of the investment we already have. The challenge to highway planners and engineers will not diminish but promises to grow in many areas to new dimensions.