A PEEP AT THE TURNPIKE

J. J. Pollitte
President, Smith, Politte and Associates, Lexington

Time was of the essence. The problem was simple and direct. 145 miles of highways were to be designed and constructed in order to carry out a part of the Department of Highways construction program.

The proposed road designated as a Major Route for Eastern Kentucky (1) was to include as one of its component parts the Eastern Kentucky Turnpike, which we will discuss today.

43.2 miles in length, the Eastern Kentucky Turnpike begins at a point on Interstate Route 64 approximately 2,000 feet East of the Midland Trail overhead bridge, and terminates at a point on existing Route 15 a few hundred feet East of the Eastern city limits of Campton.

Multiplex base maps, to a scale of 1 inch equals 833 feet, were used to develop corridors of location and preliminary profiles. The preliminary projections proved to be the essential approach to establishing the final general location of the route, in accordance with the established design criteria. The general route location from the point of beginning to Slade necessitated the many detailed investigations and analytical procedures normally utilized in route location studies. The route location from Slade to Pine Ridge was a “horse of another color”.

The solution to location problems in mountain locations involving high design characteristics can generally be solved in one of three ways, namely:

(1) To bench where necessary and fill where permissible up the side of the mountain slope.

(2) To tunnel when economically feasible and where topographic conditions along the location prove suitable for such construction.

(3) The third and, in the case of the Eastern Kentucky Turnpike, the most feasible method would be to construct embankments to the side of the drainage pattern as dictated by engineering judgment, revise the drainage pattern by channel change where necessary to do so, completely fill the drainage pattern on the approach to the gap by the embankment, provide a new drainage pattern on the outside of the embankments by means of cut-surface ditches, and make the necessary cut at the crest of the gap as required by the grade involved.

After we had ascended the escarpment of Slade Mountain the major problem involved was the positioning of the turnpike location on the narrow ridges and still provide service on Route 15 as it exists or as it might be reconstructed.

Subject to review and approval of the general route location by the Kentucky Department of Highways, engineering consultants were employed to prepare
detailed studies of traffic and earnings, to refine the location and design within the chosen corridor, and to prepare construction drawings.

Design criteria was established from the above mentioned studies to include the following features:

**Control of Access**—The Eastern Kentucky Turnpike has been designed as a fully controlled access highway, with access permitted only at designated interchange points, which were outlined in the traffic and earnings report. All grade crossings at cross roads and railroads are eliminated by structures. Existing Route 15 and its relocation where required will provide a free trafficway for vehicular traffic not using the toll road.

**Design Speed**—The minimum design speed for all through lanes on the toll road will be 60 miles per hour.

**Sight Distance**—The minimum non-passing sight distance for the proposed route is 550 feet.

**Horizontal Curvature**—The maximum curve used on the project is of 6 degrees having a radius of approximately 955 feet. Horizontal curves are spiralling in accordance with existing practices of the Kentucky Department of Highways.

**Superelevation**—Horizontal curves sharper than 0 degrees 30 minutes have been super-elevated. The maximum rate of superelevation is 0.10 foot per foot.

**Grades**—The maximum grade for the Eastern Kentucky Turnpike is 7% which occurs at Slade Mountain. Generally grades range between 0.5% and 3% throughout the remainder of the project.

**Number of Lanes**—Four lanes are provided for the project from the beginning to the Hazard Interchange. These lanes are arranged to provide for the separation of traffic flowing in opposite directions by a depressed median. Two lanes with truck climbing lanes and passing lanes are provided from the Hazard Interchange Eastward towards Salyersville and Southeasterly towards Jackson on the extensions of the route beyond the turnpike.

**Lane Widths**—The minimum lane width is 12 feet. Where barrier curbs are used, as on structures, the curbs are offset at least three feet from the edge of the through traffic lane.

**Median Width**—A depressed 36 foot median is used to separate the two roadways. The 36 foot median consists of two 10 foot shoulders on the inside edge of the pavements and a common 16 foot ditch which is constructed on a 3 to 1 slope.

**Shoulders**—The shoulders on the right or outside edge of the roadway are 12 feet wide. Shoulders on the left or median side of the roadway, as described above, are 10 feet in width. All shoulders are to be constructed as an extension of the base course, full width, to grade.

**Slopes**—In earth construction side slopes are 4 to 1 for cuts and fills to 4 feet in height. Earth cuts and fills over 4 feet in height are designed to have side slopes of 2 to 1. Shale cuts slope generally are designed from $\frac{3}{4}$ to 1 to 1 to 1. Slopes in solid rock cuts are $\frac{1}{4}$ to 1. For embankment sections in excess of 20 feet in height where construction has been made of rock material the embankment slope may be reduced to $\frac{1}{12}$ to 1.

**Pavement**—Portland Cement Concrete pavement 9 inches thick will be used for the through lanes throughout the project. The pavement shall be placed on a 4 inch thickness of dense graded aggregate base course which has been placed on a compacted subgrade. Shoulders shall be constructed of 12 inches of dense graded aggregate base or 10 inches of local aggregate base and 2 inches of dense graded aggregate base for the full shoulder width. A double seal is to be placed for a width of 10 feet on the outside shoulder and 8 feet on the inside shoulder.

**Frontage Roads**—Frontage roads are limited in number and are constructed
only where necessary to provide access to and from property adjacent to the toll road facility.

**Right-of-Way**—A minimum right-of-way of 200 feet has been obtained for the route. In heavy cuts and embankment sections where additional right-of-way is necessary, the right-of-way has been acquired for a sufficient distance beyond the top of slopes and toe of fills to provide for adequate maintenance and fencing.

**Fencing**—The entire route will be adequately fenced to keep pedestrians and animals from the right-of-way.

**Erosion Control and Landscape Development**—Landscape development and erosion control will be in keeping with the character of the highway and is a part of the initial highway construction.

**Lighting and Signing**—Adequate lighting through the staggered spacing of luminaires has been developed at toll stations. For maximum operational efficiency and safety the turnpike is to be signed in general accordance with the signing standards adopted for the Interstate Highway System.

**Structure Width and Clearances**—Curb to curb width of bridges less than 50 feet in length are 44 feet, with 22 feet on each side of the pavement center line. Bridges more than 150 feet in length are 30 feet wide between curbs and have an 18 inch minimum safety walk located back of the curb on each side of the structure. Minimum vertical clearance under bridges has been established at 15 feet. Minimum horizontal distance from the edge of the pavement to obstructions on each side of the pavement is 10 feet.

**Points of Interchange**—Kentucky 82 and 11 at Waltersville; Kentucky 1057 at Clay City; Kentucky 213 at Santon; Kentucky 72 at Slade; Kentucky 11 at Pine Ridge and the Hazard Interchange near Campton.

**Toll Stations**—Two toll stations are planned for the turnpike. The stations will be of barrier types and will be located one approximately ½ miles West of the Waltersville Interchange and at the Slade Interchange.

**Toll Equipment**—Automatic equipment from attended and unattended lanes will be used throughout the turnpike.

Due to the scheduled deadline for the design of the project, which was November 1, 1960, we proposed to utilize the use of aerial photography and digital computers when possible.

Field location activities began by establishing in the field, as accurately as possible, the tangent projections of the preliminary engineering report (1). It was assumed, and later confirmed, that approximately 80% of these tangent lines, if accurately established in the field, would prove to be acceptable for the final location. After the tangent projections were established in the field by conventional field methods the line was monumented by targets for aerial control purposes. Each subsection of the project was tied into the State Plane Coordinating System through traverse ties with U. S. Coast and Geodetic Survey monuments and bench marks where the latter were available. Where U. S. Coast and Geodetic Survey monuments were not available, throughout the area to be traversed, a Geodimeter was used to bridge the area between government control points and to provide a means of closing the traverse. Levels were developed over the tangent traverse and at controlled panel points.

It was deemed advisable to offer the photogrammetrist a control point for every 50 foot section when using the read out devise to establish cross section data. After this phase of the operation was completed and the line was reviewed in the field all we could do was to wait on the weather. All we needed was about 20 days of sunshine, clear skies and no ground coverage. I need not tell you about the late winter and spring of 1960. We had clouds, snow and more snow. The ground was covered for about 6 weeks. As time flew by our fears turned from snow to possible foliage coverage. The question occurred, would we be able
to get photographic coverage of the entire area before ground coverage became a problem. We made it by the skin of our teeth, by utilizing conventional field location procedures for certain critical areas of the route location.

Our next concern was the development of and delivery of 43 miles of topographic maps to a scale of 1 inch equals 100 feet, to a width of 2,000 feet; 43 miles of cross section data which was to be developed through a read out device from a digital computer which obtains its data from the Kelsh Plotter; 38 site plans to a scale of 1 inch equals 20 feet including 2 foot contours, each site being from 2 to 40 acres in size; which would enable us to refine the location and geometries prior to the beginning of the design of the project. It certainly was a long spring. As the field location work and the aerial topography and cross sections became available, the development of the final location proceeded generally as planned. We now had accumulated sufficient data and surface maps to carry out our line and grade work. The next step was to develop subsurface exploration, soil profiles and cores and borings at structure sites. For those of you here who are not familiar with this area let me assure you that it represents a geologist’s dream and an engineer’s nightmare. Not only do you encounter almost every soil and sedimentary parent rock formation known to man, but also their by-products brought about by the heat, pressure and cooling procedures after faulting. We have gathered samples of rock formations from crystalline limestones to fool’s gold.

From the rolling limestone soil of the Blue Grass region, through the limestone ledges and Eden Shales of the outer Blue Grass area, through the light shales and black shales encountered along the slopes to the Red River Valley to the sandstone formations near the top of Slade Mountain we encountered soil having a range in California bearing ratio from 3 to 30; crawfish lands akin to fire clays to highly desirable sandy loam.

On the brighter side structure foundations were generally stable with rock and hard shale near the stream bed levels, and the areas of the poor soils which required wasting generally adjoined shales and better soil that might be used in embankments. An example of utilizing better soil for embankments occurs near Station 740 which is a few hundred feet West of West Bend. At this location we found an apparent need for a considerable amount of embankment material. The soil profile information indicated that the point located near the above mentioned Station included some fairly good sandy shale which far exceeded any other embankment material in this area, in quality.

By utilizing the original cross section data we located the centerline to cut through this point sufficiently to provide enough material to construct the embankments within this area of the project.

The completion of the soil profile cleared the way for construction plan production. It was not long forthcoming. The first right-of-way plans were completed on June 23, 1960, and all right-of-way plans and deeds were completed by March 15, 1961. The Kentucky Department of Highways wisely set up a separate right-of-way unit for the procurement of the turnpike right-of-way. This unit was located at Stanton, Kentucky, and they did a splendid job. The total acquisition involved was approximately 1,773 acres.

With reasonable weather and a favorable construction schedule we hope to have the project open to traffic in November, 1962.

Since a considerable amount of time has been devoted to the design phase of this project we wish to present for your review slides showing the development of the project at certain locations month by month and a short movie depicting the construction completed as of February 7, 1962.

The movie was taken under very adverse conditions as considerable turbulence occurred during the shooting of the project. We offer it to you in its original form in order that we might not delete any of the construction throughout its length.
The final construction plans were completed between September 15, 1960 and May 15, 1961.

Approximately 2.01 miles of linen plan sheets were developed for the turnpike construction and approximately 3.7 tons of blue prints were used in the development of the design plans, the advertising of the contracts and for construction purposes.

The first work order was issued on February 25, 1961 for a grade and drain project and the last grade and drain project on the 4 lane section began on July 3, 1961. The Eastern Kentucky Turnpike was broken down into 9 separate grade and drain projects averaging approximately $2,300,000 in cost. In order to meet time schedules 3 of the contracts included paving as well as grade and drain. Six separate surfacing contracts have been awarded for construction between December 22, 1961 and January 28, 1962. The 15 contracts let to date have been awarded to 8 contractors. To offer some recognition to the magnitude of the construction the following tabulation of the major construction items is offered:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing and Grubbing</td>
<td>1,773 Acres</td>
</tr>
<tr>
<td>Excavation</td>
<td>13,300,000 Cubic Yards</td>
</tr>
<tr>
<td>Class A Concrete</td>
<td>58,813 Cubic Yards</td>
</tr>
<tr>
<td>Reinforcement Steel</td>
<td>10,415,000 Pounds</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>1,032,000 Pounds</td>
</tr>
<tr>
<td>High Type Pavement</td>
<td>1,245,000 Square Yards</td>
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</tbody>
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Considering the weather the contractors have made excellent progress. Based on estimated construction costs for grade and drain items only, we estimate the grade and drain project to be approximately 75% complete.

Materials are being stock piled for surfacing and the necessary contracts for signing, lighting and toll plaza equipment will be advertised in the immediate future.

Mr. C. W. Hatter, Chief Locating Engineer for the Kentucky Department of Highways loves to relate an experience which he encountered many years ago that exemplifies our feelings with regard to the route location between Slade and Pine Ridge. As the story goes, Mr. Hatter was acting as instrument man for a former chief of party with the Kentucky Department of Highways who has, since his death, become somewhat of a legend with those individuals with whom he was associated. It seems that they were making a route location within a rather large valley unencumbered by improvement, industrial development, etc., and that while the party was making the location in this area the chief of party was most specific as to where the preliminary hub line was to be located. Who, upon arriving at the foot of a mountain, showing no visible means of easy ascent, turned to Mr. Hatter and stated that “He had to go into the central office this date and would have to turn the party over to Mr. Hatter.” He suggested that the location be made within the area described by the motion of his arms, which covered an area from one mountain top to the other.

Standing at Slade and looking up Clear Branch, I felt the urge to go visit the central office that day.