Toll Agency Concepts of Project Acceleration

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This paper highlights the approach taken by the New Jersey Turnpike Authority with regard to construction trade-offs and project acceleration. A recently completed $500 million widening of the New Jersey Turnpike is used as a basis to illustrate several examples. Traffic-handling procedures used are generally discussed, and comparisons are made between the approach of a toll agency and that of a government highway agency.

When a toll authority undertakes a major reconstruction project, it is faced with many considerations not immediately apparent to the public works engineer. Very often these considerations conflict with normal practice and are contradictory within themselves.

Financing, a prime consideration for any construction project, takes an added impetus. In the private sector, an Edsel or a C5A is allowed once in a while without total and complete disaster. In the public sector with tax money as financing, we can underestimate tax revenues and still complete the project. The Interstate System in New Jersey, for example, is a monument to missed schedules, lack of financing, and political manipulation; yet the end result will probably be a system substantially completed as originally planned. The fact that millions have been lost through cost escalations and inflation and the fact that the economy of the state has been seriously negatively affected by the nonexistence of an adequate highway system become lost or clouded through political campaign rationalizations and rhetoric.

The toll authority has to "put its money where its mouth is." Large sums of money have to be borrowed, and the only funds available to repay the indebtedness are the revenues the facility receives. The repayment, over a relatively long time period, must be correctly estimated initially. Everything, therefore, becomes dependent on time. The project must be completed on time because revenues must be received according to a fixed time schedule.

Additionally, the toll authority's ability to borrow money in the future is directly keyed to its performance on previous projects. Obviously, the agency that completes projects on time, without cost overruns, and that has completely met or bettered its obligations with respect to repayment will have an attractive position in the financial marketplace when funding is required for new projects. This is important, of course, with respect not only to the availability of money but also to the cost of borrowing the money.

In January 1970, the New Jersey Turnpike Authority (NJTA) completed a $500 million widening project. Construction took 3 years. This project can serve to illustrate

several of the concepts of trade-offs that are available.

The widening project added six new lanes to an existing six-lane facility. The project was approximately 30 miles long. The end result is a dual/dual facility with four separated three-lane roadways. There are two three-lane roadways in each direction, each with its own separate exit and entry ramps to interchanges and service areas. Trucks and buses, incidentally, are limited to the outer roadways whereas passenger cars may use all roadways. In effect, therefore, it is a combined parkway and turnpike.

PROJECT ACCELERATION

Because all money is available at once, or at least available as required according to schedules developed by the engineer, it is possible and often advantageous to accelerate a construction project. In the case of the widening, design times were accelerated by dividing the project into 10 sections and simultaneously engaging the services of 10 engineering firms. Theoretically, design time was reduced by a factor of 10 and construction contracts could be scheduled so that work could begin simultaneously in all sections. Such a design approach is, of course, available to state highway departments as well. It is extremely doubtful, however, whether the approach would have been taken in this case if the project were financed through tax revenues. It does not seem feasible to spend more than $10 million to completely design a project when the financing of the project depends on future legislative actions based on fiscal considerations not even known when the project is begun. The design might be out of date when appropriations finally become available. A state highway department would have designed and constructed a section of the work, tailored to funds available at the time. The realities of politics dictate that a tangible result be shown as soon as possible. Several states have taken such an approach to the Interstate System; construction progresses on a haphazard basis with respect to the overall network, but relatively short stretches are opened, which alleviates local problems.

Another way to expedite a construction project is to acquire property in all areas at once. Real estate costs are spiraling everywhere and especially in the part of New Jersey immediately adjacent to New York City where this project was undertaken. The ability to immediately purchase all property at once, rather than to purchase on a section-by-section basis, is a great advantage.

Once the total project design is completed according to one integrated schedule, it is possible to begin construction in all sections simultaneously. This project took 3 years to construct. Had it been done in the sequence of completing a usable section, opening it to traffic, and then beginning construction of the next section, it would have taken about 12 years. Even this estimate assumes that design of the succeeding section would be completed during the construction of each section. The project would have to have been divided into six sections because of interchange locations, and the better part of two construction seasons would have been required for each section.

There were two not so obvious balancing factors at work in the project under discussion, however, that tended to cancel each other. By working on a crash basis on all sections simultaneously, we were, in effect, competing with ourselves for construction labor and equipment. This, of course, tended to increase construction costs. At the same time, we were in an inflationary period in which prices were escalating at about 12 percent per year. Conditions in the construction marketplace during the particular period in question must, of course, be analyzed for each project because these factors can fluctuate considerably.

Substantial savings can be made through better construction scheduling when the entire project is under way at one time and when the construction time is minimized. On the widening project, for example, it was possible to gain real savings in the area of hydraulic fill placement. Mobilization and demobilization for hydraulic fill contracts are substantial parts of the cost. Two dredging contractors were able to schedule their work under several contracts in more than one section so that mobilization

and demobilization were minimized. Further, it was possible to more effectively balance upland cut and fill between all sections. Although this advantage was minimal on this particular project, on a road-building project in the Jersey meadowlands this concept was extremely important. Four of the sections required overload or surcharge in depths varying from 3 to 40 feet and for time periods of 9 months to 2 years. The 10 million yards of hydraulic fill used in the four sections was so scheduled that all overload was subsequently used as embankment. At the completion of the project there was no excess hydraulic material to be trucked away or stockpiled. This would not have been the case if contracts had not been scheduled in all sections simultaneously.

Another example of a cost-saving procedure through projectwide management is the ability to purchase scarce materials on a large scale. On this project we purchased all bearing piles required for the more than 100 bridges through a single purchase order. Piles were made available directly to the contractors, as required, on a cost basis agreed to by the authority and the vendor at the inception of the contract. This pile order, incidentally, was reported to be the second largest pile order in the history of the steel company.

SERVICE AND SAFETY

A toll authority must be very much aware of its patrons. If, through a maintenance or construction procedure, we diminish the road's ability to serve all the needs of patrons, we are obviously doing the NJTA a disservice. Contrary to the usual highway department approach, a toll authority cannot trade dollars for inconvenience. We cannot take the attitude that the motorist can decide for himself whether he wants to live with inconvenience or find an alternate route. Further, the contractor cannot be made responsible for convenience to the public or, more importantly, for safety. A toll agency, fully responsible under law and subject to legal action, cannot decide who can sue and under what conditions suit may be brought. NJTA is very proud of its safety record and is willing to assume the costs for the procedures and concepts outlined below.

Project acceleration provides the immediate advantage of minimizing construction time and, therefore, traffic exposure to construction conditions. Many of our decisions with respect to traffic handling, on this project and on all other Authority projects, are based on this concept.

The particular project under discussion did require three construction seasons, and, as is frequently the case, the construction season is unfortunately the season of highest traffic volumes. This project required changes in roadway direction, traffic detours from one roadway to another, bridge construction over live roadways, widening and reconstruction of bridges carrying traffic, and almost any other traffic-handling nightmare imaginable.

We determined at the outset that the following ground rules would apply universally in all sections.

1. Construction areas were always physically separated from traffic. This was accomplished by installing permanent steel guardrail, or, where that was impossible, temporary interlocked 12 by 12 timber barriers were installed adjacent to all construction areas.
2. Detours were designed for 60-mph speeds and had full 12-ft right shoulders and 5-ft left shoulders as did the existing turnpike. Except for some detour signing, the motorist did not necessarily know he was negotiating a detour from one roadway to another.
3. No lane closings were allowed between Memorial Day and Labor Day. Necessary asphalt overlays, ramp merges, and so on were scheduled for other time periods.
4. Traffic was stopped for a maximum of 5 minutes to allow for steel erection over live roadways. This requirement subsequently became unnecessary when we initiated

a traffic slowdown procedure. State police cars, traveling abreast, entered the roadway upstream from the work site and proceeded toward the area at approximately 30 mph. The gap between them and the 60-mph traffic in front of them could be regulated so that the contractor had the necessary time to erect steel. Obviously, a great deal of preplanning by the contractor and coordination by the engineer and the police was necessary. These procedures are now our standards and are used whenever necessary for construction or maintenance.

5. All standard turnpike authority lane-closing procedures and presigning for such lane closings were used. These procedures are too complex to describe here; however, an index of the importance we place on these procedures may be gained from the fact that 10 percent of our construction costs associated with work on live roadways are spent on traffic handling.

Besides traffic handling, there are several other areas worthy of mention in a discussion of acceleration and attendant pros and cons. We must, from time to time, make decisions where we knowingly accept less than optimum construction, time schedules, and patron convenience. Safety and revenue considerations combine to force us to make decisions where "first cost" or construction cost must take a back seat. This is acceptable as long as all facets of the problem have been evaluated and given their proper weight when the decision is made. We in the toll industry are exposed to these decisions as a consequence of the overriding necessity to meet completion dates.

During the course of this project, for example, we were faced with several serious soils problems in an area where the widening took the form of a new alignment through the Hackensack meadowlands. This is an area of virgin swampland where approximately 25 ft of peat or muck overlays clay that runs to a depth of over 100 ft. Although we used muck removal, sand drains, and overload, there were areas where acceptable consolidation simply could not be reached within our construction timetable. We accepted substantial settlements and the concept of asphalt overlays within 2 years of completion. This was done knowingly, and the cost of settlement correction and inconvenience were weighed against opening the facility to traffic and relieving congestion on the existing facility.

In the same vein we accepted a construction schedule that dictated finishing bridge and culvert construction at the same time paving operations were concluding. This led to relatively short paving areas and an almost checkerboard approach to paving. Obviously, such an approach is not conducive to the smoothest possible ride. We accepted the concept, however, as a trade-off against time and tolls. Although there are smoother roads, there are also similar or even rougher roads where neither tolls nor time was a factor.

Our standard, because of our need to attract patrons rather than to reluctantly accept traffic, is higher; therefore, our concerns with regard to smooth riding qualities are not shared by the public.

In the area of contract administration, too, we had to consider trade-offs. There were many instances in which differences in specification interpretation could not be fully adjudicated during the lifetime of the contract in question. When that occurred, the contractor proceeded as directed by the engineer and we accepted the exposure for claims inherent in such unilateral decisions. There were many claims, almost all of which have been satisfactorily settled. Again, inasmuch as the exposure was weighed against the overall benefit to the Authority and all other administrative procedures provided for in the contract had been exhausted, this procedure was correct.

In line with the concept just mentioned, several times we were faced with the necessity to accelerate construction. The contractor, through no fault of his own, was delayed. This could happen for a variety of reasons such as bad weather, unavailability of materials, or delay caused by an adjoining contractor. Under normal conditions, the contractor would have been granted an extension of time. Because time was the one commodity we could not expend, we were forced to conclude separate

acceleration agreements wherein we accepted the costs associated with overtime, additional shifts, and the like.

These examples of contract administration procedures are important for another reason as well. We are a large construction user in New Jersey and our reputation with the contracting industry is very important. We attempt to present an image to the contracting industry of an agency with a no-nonsense approach to getting the job done on time, but at the same time an agency that will be entirely fair.

In summary, the differences in the approach to a construction project by a toll agency whose financing is based solely on revenue bonds and a government agency whose direction is set primarily by governmental and political considerations have been highlighted. The project discussed included a great deal of traffic involvement, but the comments would be pertinent to any construction project where the end result is a service facility.