A Status Report on Indiana State Highway Reciprocity and Highway Cost-Allocation Studies

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INTRODUCTION

This paper provides a brief status report of two studies mandated by the House Enrolled Act (HEA) 1006 of the 103rd Indiana General Assembly. HEA 1006 authorized the Indiana Department of Highways (IDOH) to undertake a state highway reciprocity study pursuant to HEA 1567. The HEA 1006 also required the IDOH to conduct a highway cost-allocation study "to: (a) document the full cost of building and maintaining the state's highway system, including that portion of the federal Interstate system within Indiana; and (b) develop an equitable methodology for allocating such costs to all the users of the system."

Both studies were initiated by the Advisory Board of the Joint Highway Research Project of Purdue University in cooperation with the IDOH on May, 1983. The state highway reciprocity study was completed in October, 1983 and the results were presented to the Joint Legislative Study Committee on Highway Finance [5]. The highway cost-allocation study is still in progress and it is expected to be completed by October, 1984.

STATE HIGHWAY RECIPROCITY STUDY

Purpose

The purpose of the study was to examine the consequences of Indiana's joining the International Registration Plan (IRP).

Over the years reciprocity among the states with respect to the use of highways by out-of-state trucks has become a complicated set of arrangements. There has been a proliferation of agreements and requirements on motor carriers for registering their fleet of vehicles. Truckers and shippers point out that the system has become complex and cumbersome. This leads to time delays, increased paperwork and regulation

costs and an imbalance between jurisdiction of road use and jurisdiction of fee payment.

IRP is an attempt to simplify and unify interstate truck registration. Under IRP carriers pay registration fees through their base jurisdiction to jurisdictions in which they travel according to the percent fleet miles traveled and the fee schedule operative in each jurisdiction.

Study Methodology

In order to assess the fiscal impact of Indiana's joining IRP, the net effect of two revenue streams was considered. First, an estimate was made of how much of the current registration revenue collected by Indiana from its resident interstate carriers with vehicles of 26,000 lb or more will be lost due to IRP. Then the expected registration revenue from carriers based in the current IRP member jurisdictions who operate in Indiana was estimated.

The estimation of fees related to the resident carriers was done on the basis of the information gathered through a random sample survey of the carriers. A statistically sampled mail survey was sent to 3,170 of Indiana's home-based carriers, stratified by fleet size. A 29.3% response rate provided statistically reliable information on truck type and mileage of Indiana operators.

In order to estimate incoming revenue from out-of-state carriers under the IPR, data from several state records were used. These primarily included the motor fuel use tax records and indefinite situs tax records. In addition, the IRP recap data for nine states from the American Association of Motor Vehicle Administrators and data from several other jurisdictions were used.

Fiscal Impact

If the present registration fee level is considered, under IRP with base-mile option 1 (Indiana miles plus non-IRP miles in base-mile ratio) for 1982, Indiana would have retained, on average, about $16.24 million while losing about $9.06 million from Indiana based carriers. Additional revenue collected from out-of-state carriers was estimated to be $11.51 million. These figures, based on vehicles of 26,000 lb and above, would have resulted in net average revenue gain of about $2.45 million. The maximum and minimum revenue gains would have been $2.7 and $2.2 million, respectively.

If base-mile option 2 (only Indiana miles in base-mile ratio) is exercised, Indiana would have retained, on average, about $12.25 million while losing $13.04 million from its home-based carriers. Additional revenue collected from out-of-state carriers would be the same as above. This option would thus mean a net average revenue loss of about $1.5

million. The maximum and minimum values of the loss could be expected to be $1.7 within and $1.3 million, respectively.

A 25% increase in Indiana registration fee for all power units of 26,000 lb and above would provide additional revenue of between $8.469 and $9.092 million. In case Indiana joins IRP and the registration fee are raised by 25%, the expected additional revenue on the basis of base-mile option 1 would be between $11.234 and $12.460 million, and this range for base-mile option 2 would be $6.315 and $7.427 million. Any additional increase in registration fees would result in a proportional increase in additional revenues.

Indiana's participation in IRP under any level of registration fee would add to the cost of registration for Indiana based truckers. However, if registration fee is increased by 25% or more, it is beneficial for the Indiana carriers for Indiana to participate in the IRP, provided the mileage ratios include only Indiana miles.

Study Implications

- A decision to enter IRP should not be considered in isolation from a restructuring of the truck taxes.
- There would be little benefit if Indiana joined IRP without a truck tax restructuring, and possibly a loss if only Indiana base-miles are counted in the calculation of base-mile ratios (base-mile option 2).
- A 25% increase in registration fees would not affect Indiana's truck tax burden ranking relative to other midwestern states. However, it should be recognized that a change in truck registration fee may trigger realignments in the resident trucking industry and some shift and relocation of individual firms can be expected.
- If non-IRP miles are included in Indiana's base-mile calculation (base-mile option 1), Indiana would probably remain at a comparative disadvantage to Illinois as a place to register trucks and possibly expand business.
- In addition to revenue impact, IRP participation has several other effects. First, with IRP the productivity of trucking industry may increase, because the trucking firms would no longer have to register separately in member states for either interstate or intrastate operations. Indiana trucking firms would also benefit through increased flexibility of routing and scheduling. Furthermore, the IRP will make the enforcement of trucking laws much easier.
- If Indiana registration fees were raised by about 25% for power

units of 26,000 lb and above the resulting increase in revenue to Indiana together with the other factors noted above would appear to make the joining of IRP a desirable option. Under this condition, consideration should be given to include only Indiana miles in base-mile ratio computation (base-mile option 2). This may provide financial relief to Indiana truckers and retain Indiana's competitiveness with nearby states.

HIGHWAY COST-ALLOCATION STUDY

Purpose

The main purpose of the study is to fulfill the requirement of the legislative directive mentioned earlier by determining the responsibility of individual vehicle classes in occasioning highway costs.

Indiana highway system consists of 11,294 miles of State Roads, 66,564 miles of County Roads and 13,818 miles of City Streets. The Federal-Aid portion of the Indiana highway system is comprised of 1144 miles of Interstates, 5064 miles of Primary, 8980 miles of Secondary and 4828 miles of Federal-Aid Urban highways. For all governmental units combined, annual expenditures for highway purposes in Indiana are well over 3/4 billion dollars.

It is essential that a fair and equitable cost-allocation procedure is used to determine the appropriate cost responsibilities for comparison with respective revenue contributions so that revenue obtained from each user class matches its cost responsibility. Appropriate measures can then be taken to correct any discrepancy, if it exists.

Study Elements

Highway Classification

In order to consider the entire public road system in Indiana, the following highway classification was adopted: Interstate Urban, Interstate Rural, State Routes Primary, State Routes Secondary, County Roads, and City Streets.

Vehicle Classification

The basic idea of vehicle classification is to group vehicles having similar characteristics with respect to highway use and highway damage. Ideally, each group must be small enough so that the cost responsibility calculated would represent accurately the cost responsibility of the individual user within the group. On the other hand, the number of groups cannot be so large as to make date sets too formidable to handle. The classificatioin used must reflect the range of highway users in Indiana. It also must be such that the existing data at the IDOH can be

used and any new data collected can in turn be employed by the IDOH for other purposes.

Most classification systems used in cost-allocation study follow a two-step procedure: (i) major classes according to function type of vehicles, e.g., passenger cars, buses and trucks; (ii) subdivision of these major classes into smaller grouping based on vehicle weights and/or axle configuration.

In the present study vehicles are being classified both in terms of functional group as well as by gross operating weight. There are 14 functional groups ranging from standard automobile to double bottom trucks. For each of the functional groups, the gross operating weight is being considered in an increment of 2500 lb.

Costs to be Allocated

The HEA 1006 requires that the study consider the full cost of building and maintaining the state's highway system. Full costs are really what we have been spending and an estimate of these estimates can be made by examining actual expenditures for a period of time. The present study follows the general categories used in the State cost data. The exact categories are as follows: highway construction, highway rehabilitation, structure construction, structure replacement and rehabilitation, maintenance and operation, and other costs.

Each expenditure category is further subdivided into a number of expenditure items. These subdivisions enable more accurate cost-allocation to be carried out. This is mainly because each expenditure item is likely to have different responsible attributes (or cost-allocators). The detailed division of each expenditure category into smaller items depends largely upon the degree of breakdown available in the cost data.

Time Frame of Study

The base period cost analysis is being carried out for four years, 1980 to 1983. Traffic and cost data are being analyzed for the base period to determine the appropriate allocation factors, while the study period analysis is for the comparison of cost responsibility with revenue responsibility. The allocation factors from base period will be applied to the future highway programs of the study years of 1985-86 and 1989-90 to arrive at the cost responsibility of each vehicle class for the future years.

Overview of the Study Approach

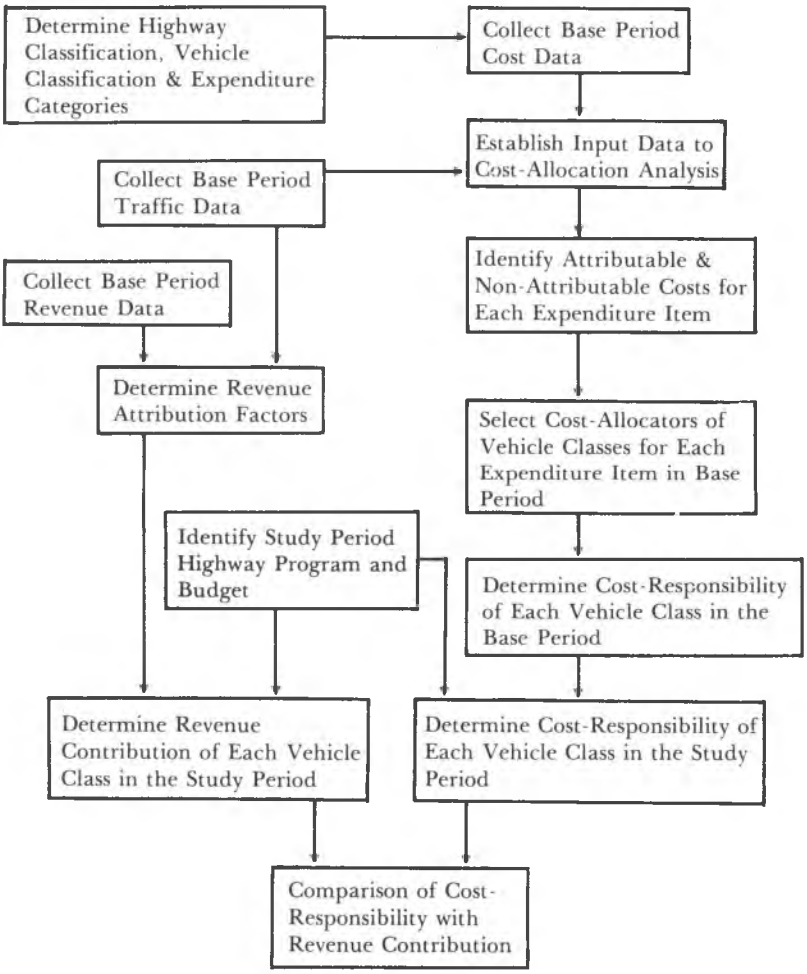
The major steps in the present cost-allocation study are identified in Figure 1, and these are:

a. Collection of Data and Establishing Input: Data collection is

conducted in three sets. The first set involves highway traffic data, the second set consists of highway cost data and the third set deals with highway revenue data.

b. Identifying Attributable and Non-Attributable Costs: One of the major issues in cost-allocation study is to determine the proportions of attributable and non-attributable costs in each expenditure item. Attributable costs are costs which can be attributed to specific vehicle classes, whereas non-attributable costs are those which are not related to vehicular characteristics and vehicle use. Non-attributable costs can therefore be considered as common costs to all highway users.

Figure 1. Cost-Allocation Study Flow Chart



c. Selection of Cost-Allocators for Expenditure Items: After identifying attributable and non-attributable costs, the next step is to select suitable cost-allocators to distribute these costs among vehicle classes. Due to the differing nature and causes of various expenditure items, it is not possible to use a single cost-allocator that is satisfactory for all expenditure items. In order to distribute equitably highway costs among vehicle classes in proportion to their responsibility for occasioning these costs, an appropriate cost-allocator must be selected for each expenditure item so as to reflect as closely as possible the relationships between particular expenditure items and the specific vehicle classes. A separate set of allocators also needs to be selected for distributing the non-attributable or common costs among user groups.

d. Determination of Cost-Responsibility Factors: The direct consequence of using different expenditure items is obvious—the proportion of cost responsibility (i.e. the cost responsibility factor) of a specific vehicle class for different expenditure items would be different. As mentioned earlier, cost-responsibility factors are determined using the base period data. These factors are then applied to the study period budgeted expenditure to arrive at the cost-responsibility for each vehicle class in the study period.

e. Determinatin of Revenue Attribution: Once the cost-responsibilities are determined, it is necessary to compare them with the revenues contributed by each vehicle class. This will be accomplished by examining the separate sources of revenues paid by Indiana highway users and then apportioning the revenue amounts by vehicle class.

Highway Construction Cost Allocation

Highway construction costs are divided into the following items for cost-allocation purposes: right-of-way costs, grading and drainage costs, pavement costs, shoulder costs, and miscellaneous costs. Appropriate procedures, based on an incremented approach, are being used to allocate these costs among different vehicle groups.

The procedure of rigid and flexible pavement design adopted by IDOH [7] forms the basis of engineering analysis for pavement cost in this study. This procedure follows essentially the method outlined in *1980 AASHTO Interim Guide for Design of Pavement Structures* [1].

A revised incremental procedure has been developed in the present study aiming to: (i) overcome the problem of economies of scale in pavement cost-allocation, and (ii) be in consistence with the design procedure used in Indiana.

The proposed procedure, known as the Thickness Incremental

Method, begins by defining pavement thickness increments, in contrast to the common practice of starting with traffic increments or decrements.

Highway Rehabilitation Cost Allocation

Rehabilitation costs in this study are defined as being the expenditures spent to restore the level-of-service of highways in Indiana. Rehabilitation consists of major reconstruction or resurfacing activities that are not classified and coded as routine maintenance activities in IDOH.

Only a few previous cost-allocation studies treated rehabilitation as a separate expenditure category. A majority of these studies grouped rehabilitation costs with construction costs and allocated them based on the same methods used for allocating construction costs [3, 4, 6].

Rehabilitation and routine maintenance, though involve different forms of activities and end results, are interdependent and closely related. It is important that a consistent unified approach be used for allocating rehabilitation and routine maintenance costs so that rehabilitation responsibilities could be separated from routine maintenance responsibilities, and that no double counting would occur. The present study follows a procedure that attempts to satisfy the above requirements.

Structure Construction and Replacement Cost Allocation

Structural costs would include the costs for the new or replacement bridges, box culverts, and sign structures. In addition, structure rehabilitation cost would include the cost of such items as bridge deck replacement. The classical incremental method which involves repetitive designing of a given bridge structure for different vehicle loadings is still the commonly used method for allocating bridge structure costs. Consequently, the basic procedure in this study follows an incremental approach used in other studies with modifications to satisfy the unique features of Indiana practice.

Maintenance and Operational Cost Allocation

Maintenance and operation activities are classified into the following major groups: 1. roadway and shoulder maintenance, 2. roadside, 3. drainage, 4. bridge, 5. traffic control, 6. winter and emergency, 7. public service, and 8. others.

Roadway maintenance consists of activities such as patching, leveling, and sealing of cracks and joints. The associated pavement damages are considered to be caused either by weather conditions or by the interaction of weather and the weight of vehicles. The impact of weather can be expected to vary from region to region within the state. For the pur-

pose of allocating roadway maintenance costs due to traffic and its interaction with weather, an appropriate procedure has been developed in the present study. This procedure pursues the same concept adopted for allocating pavement rehabilitation costs.

Traffic Data Collection

One of the most critical data items necessary for a cost-allocation study is information on number of vehicle-miles traveled for each type of vehicles on each of the highway class. In addition, traffic data must also include the estimation of vehicle weight distribution. In the present study, a detailed vehicle count survey was undertaken to estimate vehicle miles of travel. Combining these estimates with the data from the IDOH Truck Weight Study, information on vehicle weight is being compiled.

The study team conducted a vehicle classification field survey at about 60 randomly selected sites throughout Indiana during the summer of 1983. The resulting data were converted to represent an average day of the year with factors developed from the FHWA report "Vehicle Classification Case Study" performed for the HPMS [2].

Revenue Attribution

After cost responsibilities are identified it is necessary to examine revenue payment by vehicle class to provide a base for comparison. The apportionment is being done of appropriate revenues paid by Indiana highway users to state, federal and local governments. In particular, the user revenues to be considered are those which support highway construction, operation and maintenance activities in Indiana.

The Indiana system of highway user taxation consists primarily of the motor fuel taxes, registration fees, motor carrier fees, and vehicle operator's fees. In addition, miscellaneous revenues in the nature of fines and charges are collected and deposited in the Motor Vehicle Highway Account (MVHA). The majority of highway revenues in Indiana is gathered in MVHA. Fuel taxes and registration fees are the main sourses of revenues for the MVHA. The other highway related fund is the Highway Road and Street Fund (Primary Fund). A part of the motor fuel tax is gathered in the Primary Fund for use in two separate accounts, the Primary Highway System Special Account and the Local Road and Street Account.

The federal funds available to Indiana are generated through Federal Trust Fund consisting of revenues from motor fuel tax, sales tax, use tax, parts and accessories tax, tires and tubes tax and tax on lubricating oil. It should be noted that only that part of the federal revenues that was allocated to Indiana are being considered.

In addition to state and federal charges, a small amount of user fees and taxes is collected by some local governments in the form of local option taxes.

Other Considerations

A significant part of the commercial vehicles on Indiana highways are from other states. The fees and taxes paid by these vehicles are different and much lower than the Indiana based commercial vehicles. For the purpose of cost allocation as well as for revenue attribution, appropriate adjustments are therefore being made to account for the out-of-state commercial vehicles using Indiana highways.

CONCLUSIONS

Highway cost allocation and subsequent analysis of revenue attribution should not be considered as a one-time exercise. Instead, it should be recognized as a part of a continuing process of pricing and financing highway services in Indiana. A periodic updating of the cost responsibility and revenue attribution factors is essential in order to keep abreast with the changing traffic distributions, changing expenditure patterns, changing program emphasis, and changing technology. In addition, the procedure and methodology of the highway cost allocation process itself change with time, as new information on such key elements as relationships between traffic load, weather, and pavement and structure damage is generated.

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