

User Services and the Demand for Land at Interchange Points

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MOTORISTS using the thousands of miles of American highways regularly generate demands for large quantities of certain items such as fuel, food, lodging, restroom facilities, etc. The provision of these user services is normally undertaken by a limited variety of firms: the service stations, motels, restaurants, etc., that have become, over the years, a familiar scene along highways. In the past, access to the highway was normally uncontrolled and these firms tended to array themselves in "strips" or "ribbons" along the margins of the road. This was a convenient arrangement from the standpoint of the motorist because he was seldom forced to travel any significant distance from his desired route to obtain needed services.

The margins of the highway proved to be good locations for certain other types of firms as well. These businesses (such as building supply firms) do not serve the direct needs generated by use of the highway, but the nature of their operations is such that they need frequent and direct access to the highway. The aggregate ribbon development patterns produced by both types of businesses were frequently unsightly and the incidence of turning movements, etc., produced high congestion levels that frequently proved to be prime accident generators.

With the advent of highway facilities where access was fully controlled, all of these land uses were prohibited in their former configurations and were forced to seek new sites. The first limited-access highways of any significant length were the toll roads of the northeastern United States, where the problem of the provision of user services was frequently aggravated by the construction of interchange facilities at relatively widely separated points. This problem was solved, at least in part, by the establishment of service areas which provided fuel, food, and minor repair services at intervals along the road (Table 1). These service areas were cut off from the surrounding countryside and depended entirely on the passing vehicles for their economic existence.¹

When Congress established the 41,000-mile Interstate System, a provision was included which prohibited the establishment of user services on rights-of-way of the system.² This provision not only eliminated the ribbon developments so characteristic of the uncontrolled-access highway, it also effectively prohibited any extension of the old road system of service areas to the Interstate System. As a result, user services and other land uses desiring to locate in close proximity to access points find themselves forced to cluster in the vicinity of interchange points. The major concern of this investigation lies with the firms providing user services, the users, and their reaction to this new situation.

THE DEMAND STRUCTURE OF HIGHWAY USERS

Economists, market researchers, and others have devoted a great deal of time and energy to deriving estimates of the demand for various goods and services, and in

The marketing and royalty arrangements under which these service areas are operated are reviewed in a recent study "Customer Services to Users of Limited-Access Highways" which was undertaken by the Committee on Public Affairs of the American Petroleum Institute.

The prohibition was quite explicit in regard to user services: "...the State will permit automotive service stations or other commercial establishments for serving motor-vehicle users to be constructed or located on the rights-of-way of the Interstate System..."

seeking information on the basic factors which influence demand levels. It is indeed unfortunate, from the standpoint of the present investigation, that such a small portion of this effort has been directed toward an examination of the demand structure of the highway user. The limited information that is currently available makes it extremely difficult to understand the behavior patterns of motorists under changed conditions because it is far from clear how they acted previously and what factors influenced them at that time. The present discussion therefore represents, at best, an attempt to review the existing fragmentary evidence with the hope that directions for future investigation will be clearly pointed out.

TABLE 1
FREQUENCY OF INTERCHANGES AND SERVICE STATION OUTLETS
ON SELECTED TOLL ROADS

Toll Road	Length of Toll Road	Average Distance Between Points of Ingress & Egress (mi)	Average Distance Between Service Station Outlets
Connecticut Turnpike	129	1.4	18.0
Illinois Turnpike	187	3.7	37.4 ¹
Indiana Toll Road	156	14.2	19.5
Kansas Turnpike	236	16.9	39.3
Maine Turnpike	110	8.5	36.7
Massachusetts Turnpike	123	8.8	24.6
New Jersey (Garden State Parkway)	173	2.1	19.2
New Jersey Turnpike	132	6.3	18.9
New York Thruway	539	7.9	32.0
Ohio Turnpike	241	15.1	30.1
Pennsylvania Turnpike	469	12.7	31.3

Source: Adapted from American Petroleum Institutes study, "Customer Services to Users of Limited-Access Highways."

¹Average distance between 3 service station outlets on Tri-State Tollway is 17.5 mi., and for the 2 outlets on the Northwest Tollway—50 mi.

Classes of Users

Available evidence indicates that there are at least two distinct classes of uses: commercial and non-commercial. This breakdown is based entirely on the type of user services required, but it does bear a fairly close relationship to normal use of the terms. The commercial users require certain special services over and above those demanded by the non-commercial users; these include such items as time-clock machines for stamping trucker's trip records, tire banks, special fuels, and expanded service facilities. Although the breakdown into two classes appears quite reasonable on the basis of existing information, there are no studies which explicitly examine differences in the demand structures of the two classes.

User Behavior Under Conditions of Unlimited Access

Despite the numerous origin-destination and motor-vehicle use studies that have only a small amount of information is available on factors influencing user behavior under conditions of unlimited access. Some studies have been undertaken to examine the relationships existing between trip length, socio-economic status of the operator, type of vehicle, etc., but only passing references have been made to possible ties between these factors and the demand for the various user services.³

User Behavior Under Conditions of Limited Access

Perhaps the most comprehensive study available which relates user behavior to the demand for user services under conditions of limited access is one which was conducted by the Ohio Turnpike Commission in December-January of 1956-57. The study analyzed the use of service facilities by non-commercial users who entered and left the turnpike within the State of Ohio.⁴ The data are based on 8,126 trips and trip length was defined as the distance between the entering and exiting interchanges. The study indicated that the percentage of cars stopping at service plazas increased in a nearly linear fashion with length of trip (Fig. 1). Of the vehicles that stopped, food and restroom facilities were most important on the shorter trips and fuel on the longer ones (Figs. 2 and 3). The latter result is not too surprising in the light of the fact that on trips of up to 100 miles or so users appeared to plan their fuel purchases in order to have sufficient fuel in their tanks to avoid having to stop enroute (Fig. 4). (Figures 1 through 4 adapted from material in the Ohio Turnpike Commission's "Use of Facilities on Limited-Access Highways.")

The Ohio study provides some tantalizing glimpses, but fails to supply enough data to serve the needs of any realistic investigation of the topic in hand. Do users really structure their demands differently on limited-access facilities? The Ohio study would seem to provide a limited amount of verification for this conclusion which represents the point of view of many highway engineers and marketing consultants. Many planners, the supplying firms, while agreeing in general with the conclusion, would tend to reject the Ohio study as proof, even in a limited form, because the possible differences in user behavior on toll facilities and freeways have never been examined. A limited number of studies of behavior on short stretches of freeway are available, but they are quite inadequate to serve as a comparison with the Ohio data.

The information available relating to user behavior under conditions of unlimited and limited access lacks the depth and validity that are needed; in addition, almost no attempt has been made to relate user behavior to the demand for user services. With little information available, it would seem to be impossible even to venture an opinion on questions such as: "Was it wise (in terms of user convenience) to ban commercial establishments from the Interstate?"⁵ Even the purely engineering questions of traffic congestion in relation to type of land use have been inadequately studied.

RESPONSES OF THE SUPPLYING FIRMS

The reaction of the highway user to new situations has been far from clear. This uncertainty is reflected in the behavior patterns of the supplying firms who have reacted in almost every possible fashion—from advocating the banning of all land uses from

These studies are reviewed in detail in sections III and IV of William L. Garrison, Ian J.L. Berry, Duane F. Marble, John D. Nystuen, and Richard L. Morrill's "Studies in Highway Development and Geographic Change." There would be little to be gained in examining them again at this time.

It would seem that the latter restriction would result in a certain bias (of unknown degree) toward shorter trip lengths.

This question, along with others, is currently being debated by various supplying firms and user associations. It would appear that less debate and more information are needed to answer questions of this nature.

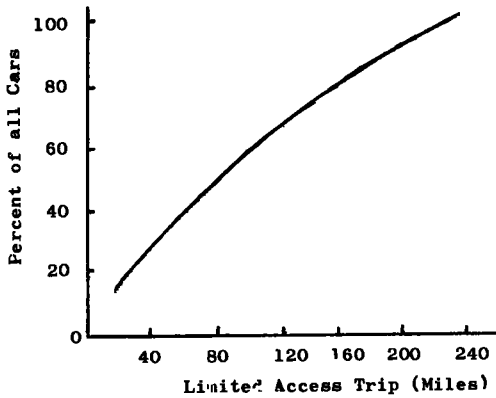


Figure 1. Cars stopping at plazas.

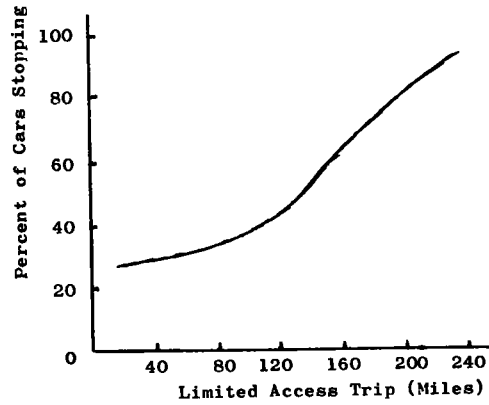


Figure 2. Cars stopping for fuel.

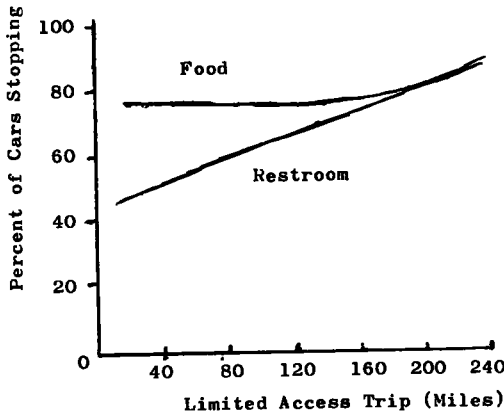


Figure 3. Cars stopping for food and restroom.

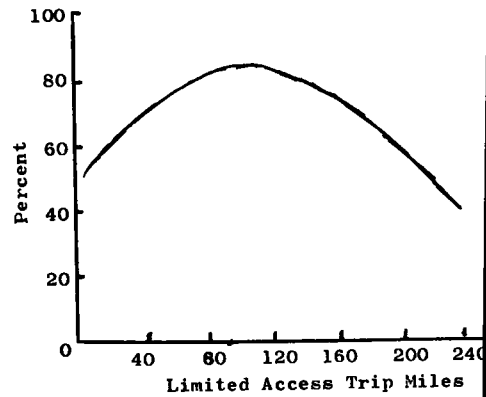


Figure 4. Cars with full tanks at entry percent of all cars.

interchange areas, to "experimenting" with one or two installations, to actively seeking interchange locations. Part of this reaction is due to different interpretations of the very limited information or user demand structures, some to differences in policy (that is, location of service stations to maximize net returns vs location of stations to maximize total station gallonage), and some to a lack of internal operating information.

The first cause of this reaction can best be illustrated by the varying estimates of user response to interchange locations. According to the evaluation of some supplying firms, users will not leave the limited-access facility unless forced to do so; others feel that they will leave if proper signing is present which identifies the services available.⁶ The second cause, policy differences between firms, is probably a reflection of a lack of information on a larger scale, as well as individual differences in goals.

It has been realized for some time that land uses compete for locations and that

6/ The question of signing for user services is a complex one in itself (Figs. 5 and 6). Most of the supplying firms believe in "adequate" signing, but little information is available as to just what constitutes adequate signing and how users respond to various types of signs. Hence there is little internal agreement among the supplying firms on this topic.

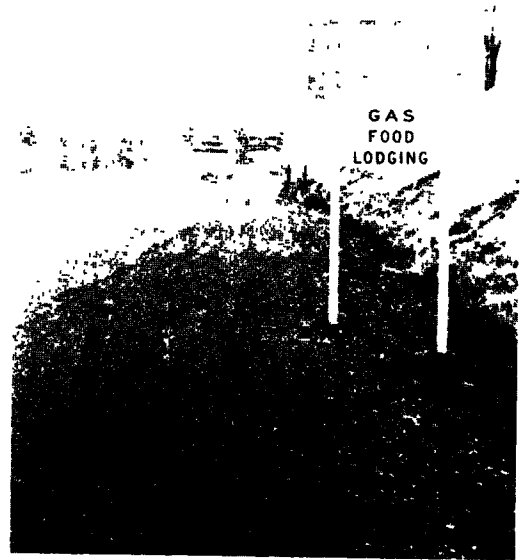
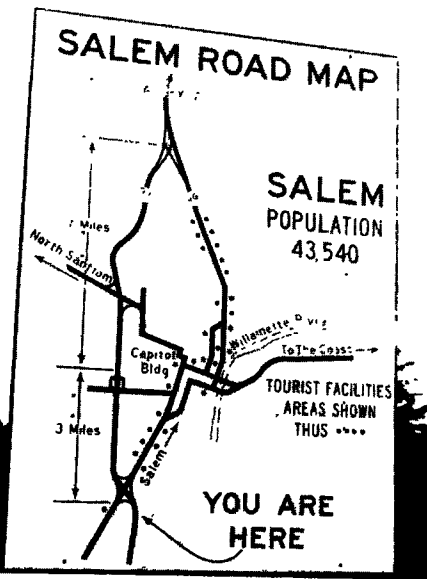


Figure 5. A tourist facilities map on US 99 near Salem, Oregon. It seems doubtful much of the information could be read at normal freeway speeds. For all its detail it fails to identify any of the tourist facilities.

Figure 6. Another type of user service signing on US 99 south of Olympia, Washington.

their ability to capture specific locations is directly related to the income that the firm can generate while occupying the locations in question. Although supplying firms have been operating, in many cases, for several decades there appears to be a remarkable lack of information in most firms on such items as operating thresholds, amount of income derived from various activities (for example, in service stations gas sales and TBA items), etc., that would enable them to estimate amounts that could realistically be paid for sites and the amount of land needed to support different levels of operation. In addition, no firms were encountered that would admit to any knowledge of their competitive position in relation to other land uses.⁷ It would appear then that both the supply and demand sides of the problem represent very nearly unknown situations—even to the firms most interested in this area.

A NEW PROBLEM

Recently several of the toll roads in the northeastern United States have authorized operation of special commercial vehicles known as tandem-trailers or "double-toms" (Fig. 7). These units comprise two regular semi-trailers hauled by a single heavy-duty truck tractor. In addition to the normal needs of the commercial users, these vehicles pose a new and special problem—it is illegal to operate them on regular highway facilities and they must be provided with special areas where the units can be broken up prior to entering the toll road and broken up after leaving the facility (Fig. 8). At the present time there is some discussion (on the part of the trucking industry) relating to possible operation of these or similar units on the Interstate System. This would provide another distinct class of user and would place new demands on the land available in the interchange areas because the "truck transfer areas" require at least one acre of land for their operation. At the present time this remains only a possibility, but it could serve to complicate even further an already confused situation.

⁷In all justice to the supplying firms, it should be noted that this appears to be a situation that is not limited to firms supplying user services.



Figure 7. A typical tandem-trailer combination. (Photo courtesy New York State Thruway Authority)

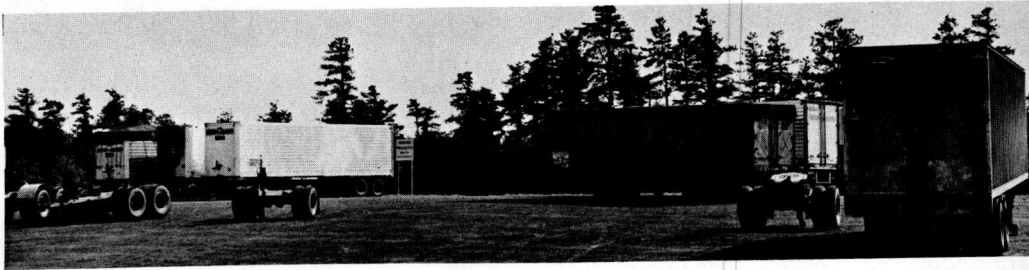


Figure 8. A typical tandem makeup-breakup area at Albany interchange 24, New York Thruway. (Photo courtesy New York State Thruway Authority)

CONCLUSIONS

This paper has briefly reviewed most of the available evidence pertaining to user services and the demand for land at interchange points. It should be abundantly clear at this point that very little is known about the situation—indeed, it has proved difficult to identify the forces at work, let alone produce meaningful estimates of their degree and direction of action.

The topic is one of importance and clearly a high priority should be given to empirical investigations of such topics as:

1. With regard to the users:
 - (a) What are the specific differences in the demand structures of the various classes of highway users? What are the significant differences, if any, between the demands of local and through traffic?
 - (b) What factors influence this demand structure? How do they cause it to vary over space? Over time?
 - (c) What differences, if any, exist in user behavior between limited- and unlimited-access facilities? Between toll and non-toll facilities?
2. With regard to the supplying firms:
 - (a) What differences exist in the operating thresholds of the various kinds of supplying firms? What portion of this is a result of demands generated by through traffic? How much by local traffic?
 - (b) For each of the various user services, what relation exists between scale of operations and amount of land needed to support the operations? How

are they able to compete with each other for locations? With other types of firms?

When an adequate amount of information of this nature is on hand, it will be possible to undertake specific and meaningful inquiries into questions of the users, the firms supplying user services, and their joint response to changing conditions.