INTERMODAL TRANSFER FACILITIES RESEARCH NEEDS

Committee on Intermodal Transfer Facilities,
Transportation Research Board

The Committee on Intermodal Transfer Facilities was recently formed as part of Group 1, Transportation Systems Planning and Administration. As one of its initial activities, the committee developed this general outline and classification of the elements in the typical intermodal passenger transfer system and a brief description of each element and its perceived research needs. The statement will require periodic revision as these needs are filled or new problems emerge. Comments on the statement are welcomed by the committee.

•INTERMODAL transfer facilities are interchanges between transportation subsystems. They range from relatively simple bus or rail platforms to multimodal regional transportation centers or large airport terminals. Because intermodal transfer facilities are expensive to construct and operate, it is important to optimize their function.

INTERMODAL TRANSFER SYSTEM

Figure 1 shows a schematic of the intermodal transfer facility system. The intermodal transfer system is complex; it involves many planning factors to determine not only location, size, and configuration but also effects on the transportation network, the region, and the community.

The classification of elements shown in Figure 1 is useful because it forms the basis for a systematic approach to passenger-transportation system interface problems, and illustrates factors that are common to other modal interfaces. For example, improvements in building technology, maintenance, or information systems could apply to rail, bus, or air terminals. Although the research needs discussed in this paper follow this outline, enough interrelationships between system elements exist that several could be combined into 1 research project.

SYSTEM ELEMENTS AND RESEARCH NEEDS

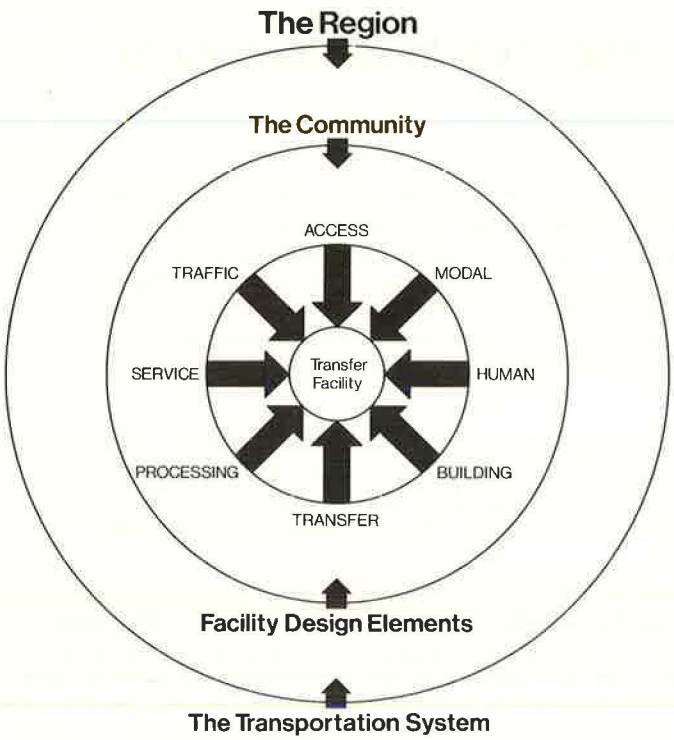
Regional

Intermodal transfer facilities are important because they connect the small feeder service systems with the large line-haul system; they promote passenger accessibility and enhance the utility of the total system. The efficiency of passenger interchange between transportation subsystems determines patron usage. Their regional influences involve land use, socioeconomic, and environmental effects. For example, airport terminals occupy large amounts of land space and central business district transportation centers occupy strategic, expensive core space. Transportation systems have significant socioeconomic effects as employers, generators of commercial development, and enhancers of regional mobility. Therefore, factors that determine optimal sizing and location of intermodal transfer facilities, including quantitative data requirements and analytical procedures, should be established.

Community

The intermodal transfer facility promotes community accessibility to the regional transportation network. The transfer facility can provide a nucleus for community development; it can be the focal point of the local supporting transportation network and the center for governmental, cultural, commercial, or other development. Commercial

Figure 1. Intermodal transfer facility system.



development within the facility can provide useful user services and help to defray facility costs. The relationship of the facility to community development should be determined. This includes considerations of land use strategy and control near terminals, facility expansion and change, zoning techniques, joint development programs, institutional and financial arrangements, jurisdictions, and commercial development within and surrounding the facility.

Transportation System

The intermodal transfer facility determines total transportation network effectiveness. As a connecting node, the facility integrates the various transportation modes to maximize the number of users. A poor connector would discourage potential users or cause them to be diverted to other modes. Poor transportation system operating practices sometimes introduce crowding and delay, which can be attributed wrongly to inadequacy of the transfer facility. There is a need to establish factors that optimize total transportation network effectiveness. More information is required on the effect of system operating practices on modal transfer efficiency and space use, and procedures should be developed to improve efficiency and reduce space requirements, passenger inconvenience, and delay.

Access

Access adequacy determines the operating capacity of a modal transfer facility. Inadequate access can result in underuse of the facility and wasted investment. To maximize productivity and minimize passenger crowding and delay, equipment supply must match passenger demand. The relationship of the access system to facility productivity must be determined. This includes not only equipment arriving off the line, but also equipment held in reserve for increased demand. Passenger and equipment arrival

characteristics, including expected variances in arrival times and demand, must be studied. Planning, design, and development criteria for feeder systems such as para-transit, pedestrian ways, bikeways, and kiss-and-ride must be determined along with regulatory or design strategies for proper use of station parking facilities.

Modes

The physical dimensions, configuration, and operating characteristics of the modes serving the transfer facility determine its form. For example, conventional rail transit configurations dictate linear platform designs, which result in long pedestrian walking distances. The number, size, and location of transit vehicle doors determine the size and positioning of many design features such as stairs, escalators, columns, and signs. The positions of trains at platforms can affect platform clearance times, which are a measure of convenience and efficiency. After the relationships of vehicle configurations and operating characteristics have been established, it can be determined whether changes in equipment design or operation will improve the efficiency and convenience of passenger movements from one mode to another.

Passengers

Passenger perceptions of service efficiency, convenience, comfort, and security greatly influence their choices of transportation modes. There are no existing analytical techniques to quantify the values that passengers place on waiting time or walking distances or other activities at transfer facilities. The relationship of human behavioral factors to facility design should be established to evaluate alternative designs and their relationship to increased facility investment and improvements in service. One aspect of this would be to determine the factors affecting human delay tolerance and its relationship to situations such as transit platform clearance times and delays in long headway versus short headway systems.

Building

The building houses the intermodal transfer function and includes the electrical and mechanical systems. The basic configuration of the building is determined by human and modal requirements, but construction methods, materials, architecture, and finishes can affect its cost and useful life. Maintenance costs over the life of a terminal facility can far outweigh the first construction cost. Therefore, the building types, finishes, maintenance procedures, and systems that will best minimize total facility-life costs should be determined, and the relative building costs per processed passenger for different facilities should be established. The variability of transportation demand and evolutionary changes in transportation systems emphasizes the need for flexible building design that is capable of alteration as use characteristics change.

Transfer

Transfer elements are mechanical subsystems requiring substantial investment and continuing maintenance for movement and storage of people and goods. When these systems are not adequate, or are out of service because of mechanical failure, the passenger may be subjected to delay and inconvenience. Typical problems faced by designers are the height at which escalators should be used to supplement stairs and the proportion of the user population that should be accommodated by the mechanical system. The human factors, traffic capacity, and costs that govern the use of mechanical vertical movement systems (elevators, escalators, and walks) also need to be determined. In addition, the need for balance in standby systems; the need for higher speed escalators and moving walks, such as those in operation in Europe; actual traffic flow capacities of mechanical movement systems, rather than manufacturers' claims; and preventive maintenance procedures or redesign of mechanical service systems must be determined.

Processing

Processing elements are turnstiles, ticket dispensing devices, and other passenger control systems. Processing system efficiency can affect passenger demand. An example of processing system effect may be seen in the long-distance bus industry. There is no ticket reservation system in this industry, so passenger arrivals are uncontrolled; this causes serious passenger congestion and delay during seasonal peak periods. The functions, capacities, and costs of passenger processing systems should be established; criteria should be developed to optimize efficiency.

Service

Service elements are auxiliary subsystems such as rest rooms, waiting rooms, and concessions. Concessions can be an important determinant of the economic feasibility of some facilities. But, concession revenues are extremely variable; they are related to factors such as terminal location, the type of passenger and his or her needs, and the type of concession and its marketing. There is a need to determine planning criteria for concessions to provide guidelines on the amount of revenue for different types of concessions so that revenue can be optimized.

Traffic

Traffic is related to hourly, daily, seasonal, and other factors that determine the size, efficiency, and service of the facility. There are few industry criteria to aid in designing facilities to accommodate traffic. Regulated passenger traffic, controlled by ticket reservation systems such as those in the air industry, limit terminal demands and provide more balanced facility use. Unregulated passenger arrival traffic, such as that in the long-distance bus industry, causes unbalanced passenger demands, severe crowding, and lengthy service delays. Staggered work-hour programs reduce facility traffic and improve passenger service levels. Traffic characteristics that change over time affect passenger service levels. Design guidelines should be established for various types of facilities based on traffic characteristics and operational techniques. Procedures should be developed to modify traffic patterns and provide optimal use of facilities.

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