Abridgment

A TRANSIT STATION DESIGN PROCESS

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The state-of-the-art of transit station planning is characterized by a lack of consistency among principles, standards, and techniques (1,2). Design standards and design guidelines as developed by transit operating agencies do not address trade-offs among the different station features or design components. In order to provide for consistency among the procedures used by different agencies to design transit stations and to ensure comprehensive treatment in the station design process, a methodology which uses analytical techniques for designing and evaluating alternative transit stations has been developed (3,4,5).

The performance of the station must be judged relative to a set of predefined objectives which derive from anticipated interests. Typical station design objectives reflect the points of view of the general user, the special user (the elderly and handicapped), and the operator concerning passenger processing, the station environment, and cost (6). The design objectives are then translated into a set of performance criteria which serve to define explicit performance measures that are the basis for comparisons among alternative station designs.

This paper shows a method for analyzing transit interface facilities. The discussion focuses on the procedures which can be used to establish policy for station features, to provide performance measures for subsystems, and to give cost estimates.

Station Design Process

A complete transit station design process requires the following levels of input data:

1. Exogenous Design Data
   a. Local site data
   b. Demand data (passenger flows, vehicle arrivals)
   c. Supply data (access modes and modal technology)
2. Endogenous Design Data
   a. Policy objectives (local and system-wide)
   b. User attitudes and preferences
   c. Performance standards
   d. Cost constraints

The exogenous (or external) data show the loads (in terms of passengers and transit vehicles plus local land use) which the facility must sustain. The endogenous information are requirements that are established by the planning agency prior to the investigation of the physical station configuration

Design Variable Classification

In this transit station design framework, design variables are classified according to the manner by which they enter the analysis process; i.e., as a result of an initial policy decision or as measures of performance or economic efficiency. Table 1 illustrates an example of typical station components classified under this scheme.

Policy Requirements

The process is structured so that before transit station designs are investigated in terms of performance and cost, local policy must be established regarding the construction and operation of the facility. Table 1 indicates the most common areas where public officials must make policy regarding transit stations. Furthermore, some station features may be restricted by their impact on the environment. Other station aspects may be influenced by local Transportation Systems Management (TSM) plans which are directed at providing for short-range transportation needs of urbanized areas at low costs.

Table 1. Transit station component classification for analysis.

Policy Elements	Cost Elements	Performance Elements
Concessions	Fixed Capital Cost	Passenger Processing
Advertising	Operating Cost	Passenger Orientation
Personal Care Facilities	Maintenance Cost	Physical Environment
Telephones	Policy Related Cost	Safety
Aesthetics	User Cost	Security
Construction Materials		
Design Flexibility		
Parking Facilities		
Provisions for Handicapped		

Table 2. Typical station features associated with performance.

Passenger Processing
Level change facilities
Entrance-exit facilities
Area provided per person on flow paths
Travel distances
Travel paths
Fare collection devices
Vehicle boarding and exiting areas
Passenger Orientation
Directional signs and maps
Visibility of major destination points
Information booths
Physical Environment
Air flow control devices
Heating and air conditioning
Lights
Weather protection
Security
Police patrols
Isolated spaces
Surveillance cameras
Alarms
Entry control
Safety
Number of levels
Walking distances
Curbs
Stairs
Escalators
Platform edges
Lighting

Selecting and Sizing Station Components

The transit station design process involves component selection and evaluation based on pre-established criteria. Station components that may be included are listed in Table 2.

The designer proposes a set of variables and station configuration plans to be tested against the performance criteria. The performance of a design relative to some standard or expected level is then estimated through use of manual and/or computer models. Manual techniques for estimating lighting adequacy, safety, security, and passenger processing characteristics are reported in Reference (4). The main computer techniques available include the Urban Mass Transportation Administration Station Simulation (USS) Package (7) and the Subway Environmental Simulation (SES) Model (8). The final criteria for selecting elements in a transit station design are associated with cost since the effectiveness of any improvement of a design over minimal performance levels must reflect economic considerations.

Development of Alternative Designs

Constraints on the transit station design process are design standards, established policy and budgetary limits. Accordingly, the standards, policy, and budget for each specific station plan should be available to the design team, a body that includes architects, planners and engineers. At this point alternative design concepts which meet the stated requirements and objectives are developed.

Design concepts are those basic issues which account for major differences in terminal configurations. Examples of these are multi-level vs. single level, underground vs. aboveground, exclusive shopping mall zones, automated pedestrian movement aids, etc. This stage generally includes estimates of environmental impacts, the incorporation of local transportation systems management plans, and a public hearing process to determine community acceptance of alternative proposals.

After an acceptable design has been established that is compatible with policy statements and the transportation requirements, detailed designs reflecting alternative facility components and layouts are tested. At this point the analyst can consider variation in the design relative to the physical environment, passenger orientation aids, safety and security.

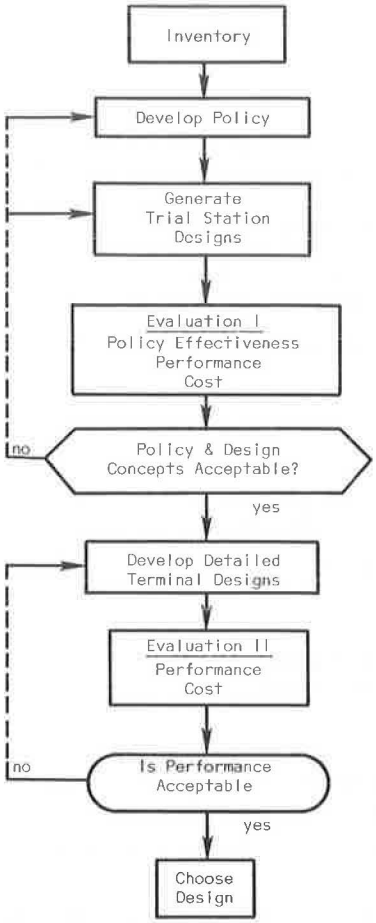
Detailed station designs are evaluated in terms of performance and cost. The performance and cost measures obtained are interpreted with an effectiveness model to select the "best" alternative (6). This iterative process is repeated until a specific design is selected.

The analytical stages in the transit interface facility design methodology are summarized in Figure 1. This strategy integrates design objectives, criteria, and measures within an evaluation framework with the judgmental, analytical and computerized methods available for developing and analyzing various station designs (3).

The procedural method that has been given for the design of transit terminals can also be adopted for station renovation. The primary difference between these two applications of the methodology is that the station renovation study begins with the

execution of Evaluation I and Evaluation II phases, given inventory data, policy, and design detail. Once the existing facility is evaluated, the findings are employed to develop new policy and to redesign the facility. From this point on, the standard procedure is followed.

Figure 1. Stages in transit station design methodology.



Conclusions

This paper has described a formalized, yet flexible, methodology to assist the planning and design professions in the development of efficient and acceptable transit station designs. The framework provides the analyst with various options for arriving at a recommended design relative to the manner through which the various station subsystems are developed. Problems which relate to the interrelationships among the various subsystems can only be checked through applications of an iterative comprehensive design process which assesses the performance of the entire facility relative to specified measures of performance.

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