

plan, four important points should always be remembered:

1. Each campus is unique, which means that what is best for one campus will probably not work well on another campus, although their demographic characteristics are comparable.

2. The town-gown relationship is critical to the planning process. Local government agencies should be involved in the planning process or at least kept informed.

3. Campus policymaking groups should be involved as much as possible in the planning process. Planning or transportation committees should be allowed

to have input in the decision-making process because they represent the users of the campus parking and transit system.

4. Common sense should prevail at all times. This may seem evident but it often appears to be forgotten or neglected during the preparation of a transportation plan.

If these suggestions are followed, the development, acceptance, and implementation of a plan should be successful.

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Campus Traffic and Parking Problems and Some Solutions

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Traffic congestion and parking needs continue to present pressing problems for many college and university campuses in the United States. Questions must often be resolved in a traffic and parking analysis even though the solutions studied involve issues embodied in an overall master plan, which may be out of date. There are also concerns about the changing role of higher education and the possible demise of some institutions over the next several years. Each campus has its unique policies, problems, and planning parameters. In the analysis of traffic and parking questions, attention must often be given to such matters as financing limitations, planning the campus as part of the larger community, recognizing that campus travel demand is different from that of other areas, and protecting the campus core from vehicle-pedestrian conflicts. Procedures for setting overall parking demand should respond to the needs of the different population categories (faculty and staff, commuters, resident students, and visitors) as well as policies on how to meet transportation service demand.

Traffic congestion and parking needs continue to present pressing problems for many university campuses. Although questions are often presented solely from a transportation viewpoint, traffic and parking solutions involve more comprehensive questions that are properly addressed in overall campus master planning. Consideration of traffic and parking problems includes many aspects of overall campus planning, which can best be accommodated during the preparation of a master plan.

Obviously solutions to transportation problems must often be sought without the benefit of concurrent overall master planning. At such times it is necessary to make maximum use of previous planning efforts and current activities in relation to matters such as day-to-day campus operations, classroom scheduling, special events, basic philosophies and policies of university administration, and so forth. A number of campuses are currently facing major questions regarding their future role in education. There are concerns about changing roles within the system of higher education, including the demise of many campuses. These have led to an increased need to review immediate traffic and parking problems in the context of a difficult and changing future.

Each campus is unique and has its own set of policies, problems, and planning parameters. Among the recurring problems affecting traffic and parking on campus are the following.

URBAN CONTEXT

University campuses are a significant part of an

urban area, and their impact on the economy as well as needed services can be considerable, particularly in the case of larger institutions. A university will sometimes generate more daily trips to and from the campus area than the central business district of the city in which the campus is located.

Campus traffic and parking problems should be studied in the context of overall urban-area activities. Some major considerations are the following:

1. Just a few years ago less than half of the educational institutions in urban areas surveyed were active participants in the urban area transportation planning process. The institution should be an active participant in any continuing, cooperative, and comprehensive transportation planning process in the urban area. Urban areas with a total population of 50,000 or more are required by federal law to have such a process under way to maintain an areawide transportation plan.

2. Street and highway planning should take into consideration the special needs of institutions of higher education. These special needs include (a) heavy pedestrian flows in certain corridors; (b) bikeway needs; (c) periodic ebb and flow of traffic with class changes; (d) traffic peaking characteristics different from those of the urban area as a whole (often the university peak hour is at noon); (e) recurring special events, such as athletic events, conventions, and concerts; (f) extent of control through policy decisions by the institution; and (g) transit service needs.

3. Major streets should serve the campus as well as urban-area travel. At the same time, major streets should not divide the campus or penetrate unnecessarily into the heart of the campus. Too often, as an institution grows, street planning does not properly accommodate these changes or protect the integrity of the central campus.

4. When an inadequate number of parking spaces is provided by the university, a conflict often develops between local residents and persons traveling to the campus. Parking on local residential streets by persons destined for the campus can become a major problem. A recent study of an institution that has an enrollment of about 20,000 students and provides 7,017 parking spaces indicated that 1,091 vehicles (or 15.5 percent) were not parked in

spaces administered by the university. More than half of these 1,091 vehicles were parked in spaces on streets serving local-area residents.

5. The university serves the urban area, and the urban area serves the university.

PARKING DEMAND

The demand for parking at a university is largely determined by the numbers of persons served, the need for vehicles to commute to class or office, and policies on vehicle use. These and other factors are often interrelated. An important indicator of existing demand is peak parking on campus by user category (such as faculty and staff, resident students, and commuter students). This provides better information about parking demand than can be obtained by using statistics on the supply of parking or simply using averages from several campuses.

Table 1 presents two examples of parking-space ratios from recent studies. The ratio is the number of parking spaces per 100 persons in each user category. The supply ratio presents the available parking spaces per 100 persons according to parking area designations at the campus, the peak use ratio depicts the observed peak number of parked vehicles per 100 persons in each category, and the planning ratio presents the value selected for long-range planning purposes after consideration was given to desired changes in supply as well as required increases in supply due to peak-hour congestion.

More and more persons at institutions of higher education prefer to have an automobile on campus. Twenty years ago, there tended to be approximately one vehicle per faculty member but significantly lower numbers for other groups. Some recent studies have indicated the following levels of parking demand:

User Category	Parking Demand (no. of spaces/100 persons)
Faculty and staff	70
Resident students	50
Commuter students	35

The foregoing ratios are somewhat typical of current conditions at many universities, although factors unique to each campus influence the actual demand levels. In addition, the mix of commuter and resident students and the number of students, faculty, and staff dictate the overall number of parking spaces needed. Other influences include the availability of transit service, the density of development, the location of various activities within reasonable walking distance, and the need for automobile transportation outside of class hours.

Parking congestion is further illustrated by the percentage of parking occupied at peak hours. Table 2 gives some recent examples from four campus studies. In each instance, faculty and staff parking areas were quite full whereas overall occupancy

Table 1. Parking ratios for universities with approximately 20,000 and 25,000 students.

Student Population	User Category	Parking-Space Ratio (no. of spaces/100 persons)		
		Supply	Peak Use	Planning
20,000	Faculty and staff	41	41	60
	Resident students	41	45	50
	Commuter students	41	18	40
25,000	Faculty and staff	56	54	70
	Resident students	37	36	50
	Commuter students	23	22	35

Table 2. Peak-hour occupancy of parking spaces at four campuses.

User Category	Parking Occupancy by Campus (%)			
	A	C	G	O
Faculty and staff	92	98	96	91
Resident students	90	69	99	99
Commuter students	71	71	98	41
Overall	82	68	97	63

Note: Campus A has 7,814 total spaces, campus C 9,506 spaces, campus G 11,149 spaces, and campus O 10,079 spaces.

varied from 63 percent at campus O to 97 percent at campus G. Campus G has an extensive, well-used campus transit system.

A sampling of parking duration and turnover data for four campuses is given below:

Campus	No. of Spaces		Average Duration (hr)
	Surveyed	Turnover	
C	1,547	0.78	5.7
G	377	1.98	4.9
M	320	2.96	2.7
O	1,088	1.25	3.2

If a parking system has high peak occupancy (more than 85 to 90 percent) and low turnover, there is likely to be a greater problem than simply having too few parking spaces.

PARKING ADMINISTRATION AND ENFORCEMENT

Most campuses are currently using some type of zone system to designate who can park in certain parking lots and areas. Frequently, the zones are restricted to faculty, faculty and staff, resident students, or commuting students and special provisions are made for visitors and for others (handicapped, service vehicles, and so on).

Another approach to limiting who parks where involves the use of gate controls and key cards. These cards can be programmed to permit the user entry to only one lot or to any number of lots or structures. The user can be charged for the key card on the basis of the number of facilities to which entry is permitted as well as the location of the facilities or their convenience.

An overcrowded parking system encourages illegal parking, which proliferates once it is permitted to become a common practice. Some students become frustrated looking for a parking place and park illegally, little concerned that their parents must pay their fines. Faculty are dismayed at not being able to park next door to their classroom when they have to travel from building to building for classes and meetings. There is so much illegal and informal parking at some campuses that matters are rapidly getting out of control.

These are all symptoms of an overburdened parking system, but the basic question of whether driving from destination to destination is the best answer may be overlooked. Such questions should be addressed in a traffic and parking analysis. To get tough on parking infractions, many campuses are turning more and more to towing operations. Computerized registration systems are a good aid for improved enforcement practices.

TRAFFIC CIRCULATION

Many campuses have traffic problems on internal campus streets. In some instances, on-street park-

ing is extensive and often hazardous. Sight-distance restrictions at intersections, illegal parking, informal parking with poor entrance and exit controls, and confusing signing or inadequate intersection controls can add to the difficulties. Such problems can be corrected by applying straightforward traffic engineering techniques and good enforcement.

Perhaps one of the most-studied aspects of traffic circulation is the closing of streets. Some campus streets provide necessary daily and emergency service, but others can (and should) be closed to eliminate vehicle-pedestrian conflicts. Street closures during the day are often sufficient if adequate controls can be implemented. Signing and minimal enforcement may be all that is necessary to implement such a street closure. The following table illustrates the change in traffic volume as well as its composition at one location in a campus core. At this campus (which has approximately 7,500 students), student vehicles were prohibited in the before study.

Category	No. of Vehicles in Core		
	Before	After	Ratio
Student	200	357	1.78
Faculty and Staff	247	138	0.56
Others	75	195	2.60
Total	522	690	1.32

COMPETITION FOR SPACE

There are many examples of serious competition for campus space among the many land uses needed to serve the campus. For example, parking and street needs compete with land-area needs for buildings. Many campuses in the past have found it convenient to locate new academic and support buildings on existing parking lots and in the process have failed to provide replacement parking. Protection of open spaces and landscaped areas is of continuing and increasing importance and should not be overlooked, but the cost of replacing parking should be included in the building cost when parking is displaced.

Severe competition for land area can lead to the justification of the high cost of a parking garage (as compared with the typical cost of surface parking). A number of major educational institutions have begun to rely on parking structures. A specific traffic engineering analysis of their location and traffic service requirements is needed to ensure that such a permanent facility is properly located and is designed to best serve the many campus goals involved. Parking structures must be located where they will be used, where there is good ingress and egress and the proper relationship to generators of traffic, and where they can be blended into the overall campus development in a proper and pleasing manner.

PROTECTION OF PEDESTRIAN AREAS

One of the greatest problems facing many campuses is how to provide proper transition between areas with direct automobile access and pedestrian-protected areas. The ultimate goal of the campus is to serve people and their needs. Parking spaces and traffic ways are not the most important ingredient. However, many people do want to drive and to park their automobiles. It is becoming increasingly necessary to plan and design pedestrian areas that are protected from vehicle intrusions and conflicts. This requires the proper balancing of peripheral parking, transit service, traffic circulation routes, and pedestrian-protected areas; but the transition from

Table 3. Average annual parking fees at 34 universities surveyed in 1979.

Type of Fee	Average Annual Parking Fee (\$)		
	Faculty and Staff	Resident Student	Commuter Student
Uniform	20	11	13
Variable (minimum-maximum)	50-95	20-36	33-34
Range in minimum-maximum	10-293	1-162	1-162

existing to desirable can be difficult, time-consuming, and expensive.

FINANCING

Obtaining the funds to finance needed campus transportation improvements is becoming increasingly difficult. Even though people are demanding transportation service, many are unwilling to make the commitment to the direct financing of such services. This poses a particularly difficult problem for administrators, and yet the services cannot be provided without adequate funding. Most funding that does not come from a general annual revenue source is derived from transportation fees, registration fees, sale of parking permits, fines, and bond financing.

A 1979 survey of 34 educational institutions produced interesting statistics on parking (or transportation) fees charged. There are many variations in specific rates as well as in the categories used, but a summary of these data indicates the annualized rates given in Table 3.

CONCLUSIONS

Some of the transportation problems facing campuses today and a few of the traffic and parking considerations encountered in a comprehensive study have been presented in this paper. A number of the key issues and recurring problems at many institutions are embodied in the issues presented. Approaching these problems in a comprehensive manner--whether through the development of a master plan or the separate analysis of traffic and parking requirements--can lead to appropriate immediate and long-range solutions by competent professionals working with university administrators.

There are about 3,100 institutions of higher education in the United States. About 10 percent serve student populations of 10,000 or more. These institutions can effectively use data bases on parking policies, administration, and financing of facilities.

There is a significant amount of planning information available to institutions of higher education. However, data on a number of subjects need to be collected and tabulated in a consistent manner to be most useful to campus planners. Possible topics for investigation are current registration fees, current data and trends in the use of parking spaces (by category of campus affiliation), costs of various enforcement practices, transit use (including effects of the availability of transit on parking demand), cost-effectiveness of parking structures, desirable walking distances, and demand for special-event parking. Many of these topics have been addressed to one degree or another over the years, but a comprehensive analysis could provide educational institutions with fresh and significant information.

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