Operation of Off-Street and On-Street Parking Facilities

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OFF-STREET PARKING FACILITIES

The satisfactory operation of an off-street parking facility may be dependent on the operation of on-street parking. If on-street parking is not properly controlled, the resulting traffic problems could cause the off-street operation to fail.

Location

When planning the operation of an off-street facility, the first item of consideration must be the location of the facility itself. The owner of a successful facility must make certain that its location will be convenient to the user. What the engineer must guarantee, is that its location will not create undue hardship on the general public. He must make sure that no unsafe or inconvenient condition is created for either pedestrians or motorists.

Access Drives

The next point that must be considered is access to the facility including the internal and external storage of vehicles. When these matters are considered, it is inevitable that on-street parking be given attention. These will be the points covered in this paper.

When studying the operation of the access to the facility, there are three important points that must be considered: (1) location of the access points, (2) width of access, and (3) the number of access points.

The location of the access drives are important because it is this feature that has the greatest influence on the other motorist. If at all possible, a drive should not be located on a major street or near the intersection of major streets. This requirement is necessary because it affects traffic in both directions.

If the drive is located just beyond an intersection for left turning traffic, the vehicle waiting to make the turn will cause other traffic to back up into the intersection. In addition to causing a delay to traffic

moving in the same direction as the turning vehicle, there will be congestion on the cross street due to the vehicles left stranded in the intersection. Figure 1 is an example of a drive located too near the intersec-

Fig. 1. Drive located too near intersection where left turns are being made. Turning vehicles block bus across crosswalk.

tion with left turns being made into the driveway. One can readily see from this photograph the results of such an operation. The problem becomes even more acute when the left turn is made from the only lane available for moving traffic.

A similar problem occurs where a drive is located just beyond the intersection with right turns being made into the drive. However, this problem is generally not as acute as that caused by left turns. Since only the traffic in the same direction as the turning vehicle is affected.

A serious problem can arise when turns into a drive are made from a one-way street. The traffic from the cross street may block the complete intersection, while trying to get in line to enter the off-street facility. The results of such a maneuver is depicted in Figure 2. This photo shows that all traffic through the intersection has come to a stand still.

Fig. 2. Vehicles from cross street entering line to off-street facility blocking intersection.

When a drive is located too near the intersection on the approach side, a problem can develop on the street if there is a backlog of vehicles waiting to enter the drive. The driver of a passing vehicle may be required to weave in and out of the parking and traffic lanes to continue through the intersection. This weaving is not only hazardous, but also will cause loss of time. If the passing driver is intending to make a right turn, he may have to make it from the wrong lane.

Width of Drives

The width of the drive is important to the successful operation of the facility. The width of the drive must be so designed that a vehicle can turn easily into it. The width also will be dependent upon how efficient the facility operating organization is. In general, with an efficient organization, it will take about six to ten seconds to move a vehicle through the entrance. The elapsed time will depend on whether the driver must merely pick up a ticket at a self-park facility or whether the driver will have to leave his vehicle and an attendant take it over. Depending on which operation is used one can expect the facility to handle approximately six to ten vehicles per minute per driveway lane. With this information, all that is necessary to determine the desired width of the drive is to know the expected rate of arrival of the vehicles.

In some cases, the rate of arrival will be so great that an extremely wide drive will be required. However, an extremely wide drive is unsafe for pedestrians. The pedestrian should not be made to walk across a wide drive without some sort of refuge where he can stand and wait for a vehicle to go past. Indianapolis uses a maximum width of 30 feet. This width is more than sufficient for two lines of vehicles. This width also permits a pedestrian safe passage. If more than two lines are required to handle the peak volume, it may be advisable to add a second drive. This second drive can then be used as an exit drive during other than peak hours.

Number of Drives

In addition to the width of drives, it is also well to consider the number of drives along the property front. It is well known that the more access points there are along a given section of roadway the more chances there are for accidents. It is desirable to keep the number of driveways to a minimum. It should also be remembered that a motorist desiring to enter the facility may be confused if presented with a view of a large number of drives, and a confused motorist is a dangerous one. A large number of drives can also be aesthetically undesirable.

Reservoir Space

If a wide enough drive or a sufficient number of drives can not be designed into the facility so it will operate properly, it may require that the internal reservoir space for storage be increased. This storage should be such that there will be no back up of traffic on the public street during most of the open hours. Figure 3 shows the results of a location that does not have sufficient internal storage and also the results of multiple drives.

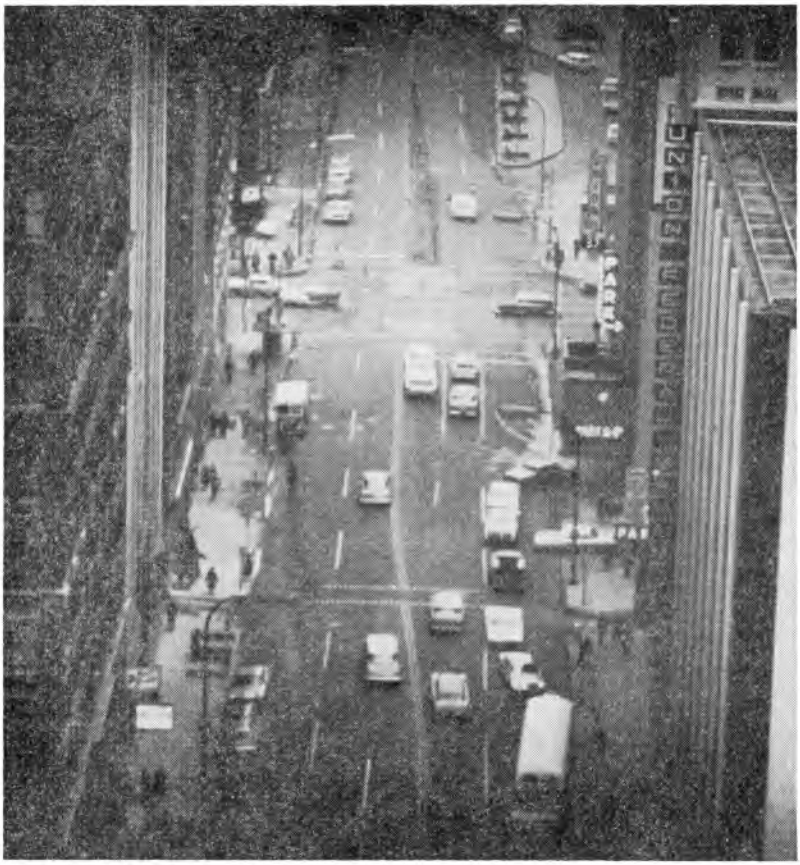

Fig. 3. Insufficient reservoir storage. The bus must maneuver around waiting vehicles then back to the curb lane for a stop on the other side of the intersection.

It has been found through general observations that during peak rush hour periods, there will be a time when there will be an additional surge of traffic. This extra surge will occur shortly before persons in a traffic generator, such as a nearby large office building, are scheduled to

begin work. It may not be economically feasible to design the internal reservoir space for storage to meet peak parking surges. As a result of this shortage of storage, the overflow will be required to wait upon the public street. It is, at this point, that on-street parking plays a vital role in the operation of an off-street facility.

Auxiliary Lanes

Where curb-side parking is permitted, turning vehicles may block the remaining traffic lane. If this occurs, it may be desirable and necessary for the off-street facility to provide storage on the public street in the form of auxiliary turning lanes. This would insure the efficient operation of both the through traffic and the traffic desiring to enter a parking lot or garage.

Figure 4 is an excellent example of what can and will happen if auxiliary lanes are not provided. In this particular case, Indianapolis is fortunate that this location is on a low volume street, since this condition occurs frequently.

Fig. 4. Lack of auxiliary lane for left turning vehicle results in half the street being blocked.

ON-STREET PARKING FACILITIES

In addition to its effect on off-street parking, the operation of on-street parking is vitally important to the movement of all traffic. How-

ever, on-street parking is not always harmful. Under some conditions, parking can be used to help the flow of traffic and at some locations, parking is neither helpful or harmful to the flow of traffic.

Beneficial On-street Parking

It makes little difference, to the over all traffic operation of a street, if parking is permitted or prohibited in areas where a street has been widened by a lane on one or both sides, for a short distance, and then returns to the original width beyond the widened section.

Parking can be used to help the flow of traffic by occupying such extra lanes to avoid trapping moving vehicles in them. One example of such a location may be at the end of a one-way street where two-way operation begins. If there are four lanes through the intersection, the one-way approach has a need for only three lanes. Two of the lanes nearest the right hand curb can be used for through lanes and the third for a left turn lane. It is then very desirable to use the fourth lane at the left curb, as a parking lane; or, if an off-street facility is nearby on the left side of the one-way approach, this lane could be used as external reservoir space for storage of vehicles.

A second example of where parking can be used to an advantage, is where the pavement narrows such as at an underpass. Parking can be used to block the unneeded approach lane or lanes.

In most cases, however, parking is harmful to the efficient movement of traffic.

Harmful On-street Parking

One place where on street parking is harmful is where it stops the curb lane from being used for external storage for the off-street facility. It is possible for a single parked vehicle to force a line of vehicles, desiring to enter a facility to use the second lane from the curb. This reduces the number of lanes available for through movement. Figure 5 shows such a problem.

Another location where parking creates a serious problem is at an intersection when parking is prohibited on the approach side and permitted on the exit side. The problem is even more acute when you add the condition where the cross-street is a one-way street and a right turn is prohibited. Figure 6 shows such a location. The cross-street is one-way and right turns are prohibited from the direction the photograph was taken. It can be readily seen from the photograph that such a condition will create unnecessary merging. Merging under these conditions is always hazardous. Consider also the effect this condition would also have on an off-street parking facility just beyond the intersection. A con-

Fig. 5. Parked truck keeps the curb lane from being used as storage lane for right turns into facility.

Fig. 6. Parking is prohibited on approach side and permitted on exit side. The cross street is one-way to the left, therefore, the curb lane has no place to go.

siderable amount of merging and weaving would have to occur to enter such a facility.

Traffic can be greatly hampered when parking is permitted in a lane on a street where the volume exceeds the capacity of the remaining moving lanes. This condition causes unnecessary confusion, lane changing, collisions and loss of time and money to the motoring public.

Extra Wide Parking Lanes

A serious traffic hazard is created when there are two lanes with the curb lane extra wide and parking permitted, although, the remaining width of the curb lane is not quite fully adequate for moving traffic. Motorists will attempt to use such remaining width as an additional traffic lane. A condition such as this will tend to increase straddling of lane lines, accidents with parked vehicles, head-on collisions and sideswipes.

Figure 7 shows an example of such a condition as was just described. Figure 8 shows the resulting congestion that will occur as a result of the narrow partial lane.

Fig. 7. Shows extra wide curb lane with parking with remaining width not adequate for moving traffic.

Fig. 8. Shows resulting congestion due to condition in figure 7— bus must weave around parked car.

In Indianapolis, studies found that about eleven percent of accidents were accidents with parked vehicles, and about nine percent were side-swipes and head-on collisions.

A study was made of the accidents on E. Washington Street, Indianapolis for the years 1962, 1963 and 1964. E. Washington Street is a two-way street that has one full lane in each direction with a second extra wide lane for parking. The results of the accident study show that over the three-year period, more than 22 percent of all accidents on this street involve parked vehicles as compared to 10 percent overall for the city. In addition, more than 18 percent of all accidents on Washington Street were side-swipes and head-on collisions. This compares to 9 percent overall for the city. For the three-year period studied, there have been an average of over 400 accidents in the study area.

This type of parking condition causes an extreme hardship on the operation of any off-street facility located in the area. It is difficult to get vehicles to and from an off-street parking facility when there will be lane changing, weaving and merging of traffic due to vehicles parking on the adjacent street.

Sight Restrictions

Another hazardous condition that will increase parked vehicle accidents is the prohibition of parking along a stretch of road and then permitting it beyond a curve where the parked vehicle can not be seen by the approaching driver. This condition is doubly dangerous since the approaching driver must generally make a sudden lane change rather than a smooth merging movement, when he comes blindly upon the parked vehicle.

A problem of sight restriction can also arise when vehicles parking along a curb are permitted to park too near the exit drive of an off-street facility. The results of this condition is that the exiting vehicle will not have adequate sight distance before entering the flow of traffic.

Narrow Streets

The final condition to be reviewed, and probably the most common of all, is the permitting of vehicles to park along a narrow street. This condition is not only dangerous to the motoring public, but at times the street can become completely blocked to all traffic. Figure 9 is an excellent example of such a condition. The accidents that result from this parking will be side-swipes, rear-end and head-on collisions.

SUMMARY

In review, off-street parking and on-street parking facilities affect and are affected by each other.

Fig. 9. Parking permitted on both sides of a narrow street, resulting in street being blocked during maneuvering of vehicles.

Successful traffic operation of an off-street parking facility (measuring success by ease of ingress and egress at the off-street facility, and the consequential effect upon the movement of street traffic) is greatly influenced by (1) the location of the facility itself, (2) the location and number of access driveways at the facility, (3) the width of access drives along with associated internal or external reservoir space, (4) on-street auxiliary turn lanes, (5) arrival rates of vehicles, and whether these vehicles are parked by the motorist or by an attendant.

Yet, even when these matters have been dealt with properly, their potential benefits can be lost or seriously reduced because of an unfavorable on-street traffic environment. This on-street environment is powerfully conditioned by the operation of on-street parking facilities.

Successful operation of on-street parking facilities (as measured by consequential congestion produced and collisions generated) is greatly influenced by: (1) street capacity and traffic volumes, (2) the location and number of driveways into off-street facilities, (3) reservoir space and auxiliary lanes serving off-street facilities, (4) the turn-over rate and parking maneuvers occurring at curb-side, (5) transitions in street use such as from one-way to two-way operation, (6) changes in street width, especially at intersections, or at underpasses, narrow bridges, and other points of constricted width, (7) sight restrictions such as blind curves or intersecting steep grades, (8) one-way cross streets onto which right turns cannot be made, and, (9) extra wide parking lanes which mistakenly are accepted as being wide enough to accommodate moving vehicles in addition to the parked vehicles.

For these, and similar reasons, the writer considers the operation of off-street and on-street parking facilities as being practically inseparable as they relate to the operation of public streets for the safe and expeditious movements of motorists and pedestrians when they are lumped together under the general term "TRAFFIC."