

# SIGHT DISTANCE OBSTRUCTIONS ON PRIVATE PROPERTY AT URBAN INTERSECTIONS

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This paper discusses a study of current procedures used to correct sight distance obstruction on private property at urban intersections. The purpose of the paper is to identify the problems encountered in the removal of the obstruction; to determine the current laws, ordinances, and practices used by government agencies in removing obstructions; and to make recommendations for improving the laws, ordinances, and current methods of removal. A questionnaire mailed to state, county, and municipal traffic engineers throughout the United States was used to gather data for the study. Based on responses, recommendations are made for improving the level of voluntary compliance by the property owner. A model ordinance and a drawing showing how one city deals with this problem are included.

●PAST RESEARCH has shown that a high percentage of all traffic accidents occur at roadway intersections. The National Safety Council (1) recently reported that 41 percent of all accidents in urban areas and 27 percent of all accidents in rural areas occurred at intersections. Accident research in Tennessee shows that 54 percent of all accidents reported to the Department of Safety in 1973 occurred at intersections.

This study was to investigate the problem of obstructions such as shrubbery, trees, and signs that limit motorists' sight distance at roadway intersections and thus increase the accident potential at this point on the road. Sight obstructions are a major factor in the safe operation of an intersection. This is particularly true in urban areas where there is a great deal of land development adjacent to the roadway.

Disque (2) described the problem as follows:

Sight distance at street intersections in urban areas is another phase of traffic safety on which much that is critical and very little that is commendable can be said. It can be stated, probably without contradiction, that in every community in the land there are street crossings where trees and shrubs have been planted within the street right-of-way and permitted to grow there until they approach, and perhaps overhang, the curb. At such a crossing, the cautious driver must creep his vehicle slowly forward to a position beyond the verdant obstruction where he can glance to the right and left down the intersecting street and judge when he can cross or turn. Statistics reveal that a very great number of accidents occur at street and highway intersections, where highway and vehicle conditions and circumstances, together with driver behavior, result in experiences that are costly, painful and often tragic.

Unfortunately, the problem of sight obstructions at intersections does not limit itself to the public right-of-way. In many cases, the obstruction is located on private property behind the right-of-way line. Because of the limited public street right-of-way, especially in cities, the government agency must cope with the problem of eliminating obstructions on private property in the interest of public safety. The accident rate at most intersections will generally decrease if and when problem sight obstructions are removed. A recent before and after study in Concord, California, illustrates this point. In this study (3), Mitchell stated:

An intersection sight distance study and a stop sign visibility check led to the trimming or removal of vegetation in the public right-of-way. Intersections where trimming would be required periodically were noted and reported to the Park Department. Where trimming on private property was needed, the owners were contacted by letters citing the requirements of the municipal code. With few exceptions, the response was excellent.

The sight distance at five intersections was improved during the study in Concord. After these obstructions were eliminated, total accidents at these intersections dropped from 39 in the year before to 13 in the year after obstruction removal, a 67 percent reduction. In the same study, many other intersections at other locations in Concord were improved by use of signal installation or modification, delineation striping, improved pavement markings, and increased police enforcement. However, although all these intersection improvements resulted in a reduction in accidents, the greatest percentage of reduction was experienced at the intersections where the sight distance was improved (3).

Although the sample size in Concord was small, the study reveals the potential reduction in accidents that could be obtained if this type of obstruction removal program were implemented nationwide.

To determine the significance of this problem nationwide and to obtain the necessary data to evaluate this problem area, a questionnaire was prepared and submitted to 202 government officials. The questionnaire was sent to state government officials in 48 states, city government officials in 138 cities from all 50 states, and 16 county government officials from 13 states. The questionnaire was basically designed to identify the problems associated with sight obstructions at intersections and to determine the methods used by the different levels of government in attempting to solve this problem. It was assumed that all government agencies had the authority to remove sight obstructions located on public rights-of-way; however, the officials were urged to send copies of state laws and city or county ordinances that were directly related to the removal of sight obstructions located on private property.

A total of 77 percent of the questionnaires was returned. State governments had 81 percent returned; city governments, 76 percent; and county governments, 69 percent. In addition, over 57 agencies returned copies of actual laws or ordinances that were evaluated in this study. All of the questionnaire data and the selected literature were used to answer the following questions:

1. What is considered to be adequate sight distance at an intersection?
2. What are the major problems experienced by government officials in obtaining adequate sight distance at intersections?
3. What changes should be made in the present method used to obtain removal, and can a model law or ordinance be developed that if adopted would help solve this problem without requiring expensive legal battles and a lot of engineering time?

An analysis of these questions follows.

## SIGHT DISTANCE AT INTERSECTIONS

To recommend a size for a sight distance triangle at intersections required that the minimum value be determined. This was accomplished by evaluating two types of intersection control. Case 1 included intersections at which no traffic control existed and the basic right-of-way rule controlled the entering traffic. Case 2 included intersections where stop control had been placed on the minor street approaches and the major street was assigned the right-of-way. The AASHO procedure (4) was used to evaluate two specific intersection conditions that were relevant to our minimum sight triangle investigation.

Case 1 involved an intersection with no traffic control devices on any of the approaches. This condition is sometimes desirable in urban or suburban areas for

intersections of local streets where the total entering average daily traffic is 1,500 vehicles or fewer [accident history indicates fewer than three right-angle accidents per year and adequate safe stopping sight distance exists (5)]. In the evaluation of case 1, a design speed of 30 mph (48.3 km/h) for both local streets and a roadway right-of-way width of 60 ft (18.3 m) were assumed (6). This condition is shown in Figure 1. Based on these given roadway conditions, the safe stopping distance was calculated. A perception reaction and brake lag time of 1.0 sec was assumed (7). It was also assumed that the pavement was wet and that the coefficient of friction for a 30-mph (48.3-km/h) approach speed was 0.36 (4). A safe stopping distance of 127 ft (38.7 m) was calculated for case 1, and this distance was used to evaluate several different sight distance triangles. From these trials, it was concluded that a sight distance triangle with legs equal to 50 ft (15.2 m) extended along the property lines was the minimum triangle that would basically satisfy the stopping sight distance requirement. When this triangle is used, approximately 110 ft (33.5 m) of sight distance is provided for driver perception and reaction to a vehicle approaching on the cross street.

Although 60 ft (18.3 m) is a frequently recommended minimum right-of-way width for a local street (6), many existing roadways do not meet this criterion. When this condition occurs and an adequate sight distance triangle cannot be obtained, installing some form of traffic control device such as a yield or stop sign is often necessary. Installation of a traffic control device is also usually required at (a) the intersection of a county road, city street, or township road with a state road or (b) any street that enters a through highway (5).

In case 2, one of the two intersecting streets is controlled by a traffic control device (Figure 2). Since most state highways have ample right-of-way width, especially in rural areas, an urban intersection of a local street was evaluated with another through street having a limited right-of-way width of 40 ft (12.2 m). The through street could be classified as another local street, a collector street, or even possibly a minor, old state highway. It was necessary to determine the minimum sight distance required for the stopped vehicle to safely cross the through roadway. Based on the conditions shown in Figure 2 and a through roadway speed of 30 mph (48.3 km/h), 285 ft (86.7 m) of clear sight distance along the through highway was required for the driver of a passenger car design vehicle to safely cross the through highway (4). After several trials, it was determined that a 30-ft (9.1-m) sight distance triangle along the property lines at this intersection provided a sight distance of 285 to 350 ft (86.7 to 106.7 m) depending on the position of the stopped vehicle. The front of the vehicle could be 10 ft (3 m) behind the near edge of pavement and still have adequate crossing sight distance. Therefore, the 30-ft (9.1-m) sight triangle measured along the property line provided adequate sight distance for a safe crossing at this intersection if the controlled vehicle stopped within 10 ft (3 m) of the intersecting street. In this evaluation, only passenger cars were used; additional sight distance is required for larger vehicles. The required sight distance for a WB-50 design vehicle (the maximum case), for example, is approximately 650 ft (198.1 m). However, drivers of WB-50s are often compensated for their

Figure 1. Case 1.

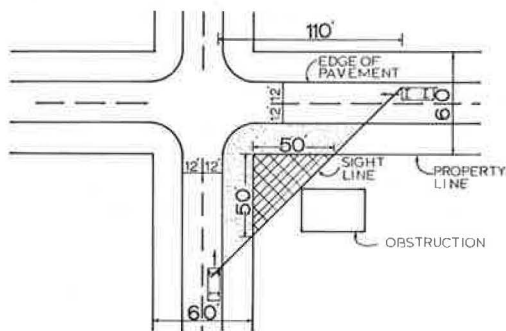
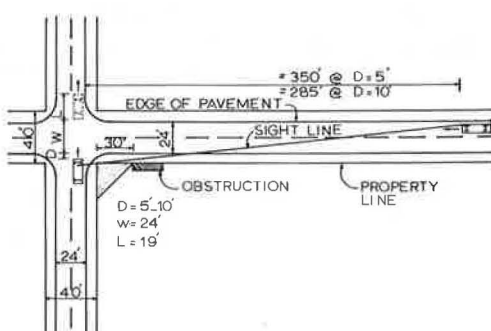


Figure 2. Case 2.





larger vehicles by higher sight levels [6.0 ft (1.8 m) compared to 3.75 ft (1.1 m) for passenger vehicles] and by the 285-ft (86.7-m) sight distance that is provided under these conditions. This sight distance is over two times greater than the safe stopping sight distance required for the vehicle on the through roadway to come to a complete stop before reaching the intersection. In addition, the 40-ft (12.2-m) right-of-way width used in this example is the absolute minimum for this type of intersection and is rarely designed today.

Thus, based on cases 1 and 2, a sight distance triangle with 30-ft (9.1-m) legs, measured along the property line, was necessary to provide the minimum sight distance required for most urban or suburban intersections. A 30-ft (9.1-m) triangle would accommodate vehicles in case 1 up to 25 mph (40.2 km/h); this would include most urban intersections.

To determine the existing use nationally of this recommended 30-ft (9.1-m) sight triangle required that the existing laws or ordinances that were obtained from the questionnaire be evaluated. Only 57 percent or 86 of the agencies returning the questionnaire had an existing law or ordinance that covered the problem of sight obstructions at intersections. Of these 86 agencies, only 57 returned a copy of their actual laws and ordinances. Only 40 of the laws and ordinances listed a specific sight distance triangle, and these were divided into two groups: (a) laws and ordinances prohibiting sight obstruction in a sight triangle by using the property line as reference and (b) laws and ordinances prohibiting sight obstructions in a sight triangle by using the curb line as reference. Only 8 percent of the agencies returning the questionnaire had a law or ordinance that equaled or exceeded the recommended 30-ft (9.1-m) sight triangle.

Since it is not realistic to expect that all objects can be removed from the sight distance triangle, two other factors must be considered when its effectiveness is evaluated: (a) the maximum height of an object, such as a hedge, a shrub, or a fence, and (b) the minimum clearance of an object, such as tree limbs, or the bottom of a sign, that are allowed in the sight distance triangle. The average for all 40 laws and ordinances was 2.74 ft (0.8 m) for the height of an object in the sight distance triangle. The average of the 24 laws or ordinances was 8.95 ft (2.7 m) for minimum clearance heights for objects such as tree limbs and signs in the sight distance triangle.

The many possible combinations of roadway grades made it impossible to satisfactorily evaluate the maximum allowed height of low obstructions and the minimum allowed height of high obstructions. However, several roadway grade combinations were tested, and within the recommended sight triangle at intersections [that triangular area between the property line and a diagonal line joining points on the property line 30 ft (9.1 m) from the point of their intersection] no object that impairs sight distance should be allowed to remain between 2.5 and 8 ft (0.8 and 2.4 m) above the level of the adjacent roadway. This recommended sight triangle should provide adequate sight distance for the safe operation of most intersections throughout the country.

## PROBLEMS IN OBTAINING ADEQUATE SIGHT DISTANCE AT INTERSECTIONS

After minimum sight distance values at intersections were determined, attention shifted to the problem of obtaining this value in the field. Eight questions were designed to obtain information on this problem.

Of those who returned the questionnaire, 97 percent of the city, 100 percent of the county, and 89 percent of the state officials replied that sight obstructions at intersections presented problems for their agencies. So that the major problem in removing these obstructions could be ascertained, the officials were asked to indicate their problems. A lack of voluntary removal of the obstruction by the property owner was a more major problem in obtaining good sight distance than the problem of having no existing law or ordinance in effect.

Having no ordinance or law in effect received its highest rating with state officials, who indicated this condition on 50 percent of the returns. This was expected, however,

since the returns also revealed that 71 percent of the states have no applicable law that covers this problem area. A number of states indicated that the problem of removing sight obstructions was basically urban because the right-of-way was usually adequate to provide sufficient sight distance in rural areas. In only 19 percent of the returns, city officials reported that having no applicable ordinance presented problems; however, 27 percent of the cities have no ordinance. The number of replies from the county officials was so small that the results were of questionable reliability; thus, they were not considered in the evaluation of problem areas.

The other two possible problems on the questionnaire were (a) lack of engineering personnel to investigate problem areas and (b) no administrative backing for enforcement of existing laws or ordinances. Lack of engineering personnel was a problem for 29 percent of the cities and 21 percent of the states. Surprisingly, only 14 percent of the city officials and 4 percent of the state officials gave no administrative backing as a problem area. From these replies, it was obvious that an effective method should be developed whereby affected property owners would voluntarily remove, or allow the government agency to remove, existing obstructions in the sight distance triangle.

Before any method can be successful, local backing is needed in the form of a law or ordinance; however, the total solution to this problem cannot rely on this. Of the cities replying, 73 percent had existing ordinances, but 97 percent were having problems removing obstructions. Thus, in an effort to identify other problem areas, an analysis of the method of obstruction removal, the degree of agency enforcement, and the number of locations investigated each year was conducted. Since only 18 percent of the 39 states returning questionnaires have existing laws allowing obstruction removal from private property, this analysis was limited to the returns from city agencies.

In this analysis, the method of obstruction removal was explored. Of the cities with an ordinance, 96 percent indicated that the property owner was required to remove the obstruction at his own expense. However, in 26 percent of the cities, the obstruction could be removed by city forces and the cost billed to the property owner. In 56 percent of the cities, the city would remove the obstruction only when the property owner refused to do so. In most of these cases, the cost of the removal was charged to the property owner. Some degree of flexibility should be provided regarding the method of obstruction removal; however, in the interest of public safety, the city should have authority to enter private property and remove obstructions if the property owner refuses to do so.

The replies showed that existing ordinances were never enforced by 4 percent of the cities, seldom enforced by 30 percent, usually enforced by 38 percent, and very frequently enforced by 28 percent. The disturbing fact is that 34 percent of the cities seldom or never enforced existing ordinances. Since only 14 percent of the cities cited no administrative backing as a major problem area, it can only be concluded that enforcement officials feel that this law is not important enough to enforce. There appears to be no clear solution to this problem, although it is hoped that, through reports such as this, the importance of obtaining a good sight triangle at intersections will be conveyed to the affected enforcement officials.

A place on the questionnaire was provided for all cities, whether or not they had obstruction ordinances, to indicate the yearly number of cases investigated that concerned problems of sight obstructions at intersections. The replies indicated that, each year, 10 percent investigated 0 to 5 cases, 7 percent investigated 6 to 10 cases, 17 percent investigated 11 to 25 cases, 23 percent investigated 26 to 50 cases, and 30 percent investigated over 50 cases. One official reported investigating over 600 cases a year.

## RECOMMENDATIONS FOR CHANGE

There are 3 important questions regarding sight distance obstructions:

1. What is the adequate size of a sight triangle at intersections?
2. What is an adequate law or ordinance controlling sight obstructions at



intersections, and how are elected officials to establish it?

3. How can the ordinance be effectively enforced with a minimum amount of engineering time and legal expense?

### Sight Triangle

A 50-ft (15.2-m) sight triangle is desirable for intersections with no traffic control. At intersections where one street is regulated by a traffic control device, a 30-ft (9.1-m) sight triangle is required. In application, the 50-ft (15.2-m) triangle, although certainly desirable, is probably unrealistic because of its size. This triangle requires 1,250 ft<sup>2</sup> (116 m<sup>2</sup>) of land if the lot property lines intersect at right angles. In comparison, the 30-ft (9.1-m) sight triangle requires only 450 ft<sup>2</sup> (42 m<sup>2</sup>), 64 percent less land at the intersection. In addition, few of the existing zoning setback regulations in cities meet or exceed requirements for a 50-ft (15.2-m) triangle, even in low-density residential areas. Therefore, a 30-ft (9.1-m) sight triangle is recommended.

### Model Ordinance

After a sight distance triangle has been established, the next step is to include it in a model ordinance. Zoning setback regulations play an important role in an obstruction ordinance. The zoning setback requirements should be written so that the sight triangle can be obtained in all residential and local business areas. Obviously, however, this same value cannot be obtained in the central business district and possibly other areas of high commercial development. Because of this limited CBD factor, it is recommended that the area within the 30-ft (9.1-m) triangle that encroaches within the interior of the setback lines established by the local zoning laws be exempted from compliance with this requirement. The validity of such an exception relies to a great extent on the zoning laws of the city, and a complete review of these laws is recommended before such a regulation is adopted. However, if reasonable zoning laws exist, this exception will in most cases provide drivers with some usable sight distance at all intersections. In addition to the exemptions made of areas encroaching within the interior of zoning setback lines the following exemptions are also recommended:

1. Small trees that are not more than 12 in. (30.5 cm) wide and that are planted so as to leave a clear and unobstructed cross-view;
2. Existing permanent buildings;
3. Existing grades that, by reason of natural topography, are more than 30 in. (76.2 cm) above the center of the adjacent intersection; and
4. Fire hydrants, public utility poles, street markers, and traffic control devices.

Buildings and existing grades are exempted because the removal of these obstructions would place an unreasonable financial burden on the property owner. It is recommended that during roadway design consideration be given to purchasing adequate right-of-way to provide the required sight distance. All of the objects installed to serve the general public do not usually cause a sight distance problem. Small trees, properly trimmed and planted, will not create significant sight distance problems for motorists.

It is also recommended that failure to remove obstructions in this specified area within 10 days of notification be classified as a misdemeanor committed by the property owner. The recommended fine for conviction of this offense is not less than \$50 nor more than \$100, and each day that the violation continues constitutes a separate offense.

Since the ultimate goal of this ordinance is to remove obstructions and not to engage in lengthy and costly legal battles, the city should be given authority to enter private property as required, to remove any obstructions in the specified sight distance triangle, and to charge the cost of such action by the city to the property owner in the

form of a lien against the property from which such obstruction is removed. This clause will permit quick and correct removal of the sight obstruction.

Based on the information given above, the following model city ordinance is proposed.

#### SECTION 01-001. Obstructions to Visibility at Intersections—Visibility Area Defined.

It shall be a misdemeanor for any person or persons or corporations owning real property at intersecting streets to install, set out, or maintain or to allow the installation, setting out, or maintenance of any sign, hedge, fence, shrubbery, natural growth, or other obstruction to the view, whether movable or stationary, higher than 30 in. (76.2 cm) above the level of the adjacent intersection.

1. The obstruction shall not be placed in that triangular area between the property line and a diagonal line joining points on the property line, 30 ft (9.1 m) from the point of their intersection.

2. In the case of rounded property corners, that triangular area shall be between the property lines extended and a diagonal line joining points on the property lines, 30 ft (9.1 m) from the point of their intersection.

3. In both 1 and 2 above, such area within the said triangle that encroaches within the interior of the setback lines applicable to any lot or parcel of real property by and through the zoning laws of this city as fully set forth in this code shall be exempted from the application of this section and shall not be deemed a part of the visibility area.

4. Sections 1, 2, and 3 above shall also apply to the intersection of a public street right-of-way and a railroad right-of-way.

#### SECTION 01-002. Obstructions to Visibility at Driveways—Visibility Area Defined.

It shall be a misdemeanor for any person or persons or corporations owning real property to install, set out, or maintain or to allow the installation, setting out, or maintenance of any sign, hedge, fence, shrubbery, natural growth, or other obstruction to the view, whether movable or stationary, higher than 30 in. (76.2 cm) above the level of the adjacent roadway on any lot where a private drive enters a street within the triangular area formed by the street property line, the private drive-edge line, and a line connecting them at 10 ft (3 m) from their intersection.

#### SECTION 01-003. Obstructions to Visibility at Intersections and Driveways—Exceptions.

Sections 01-001 and 01-002 shall not apply to small trees that are not more than 12 in. (30.5 cm) in diameter (trimmed to the trunk), that are at least 8 ft (2.4 m) above the level of the intersection, and that are planted so as to leave a clear and unobstructed cross-view. Sections 01-001 and 01-002 also shall not apply to fire hydrants; public utility poles; street markers; traffic control devices; existing permanent buildings; existing grades, which by reason of natural topography exceed 30 in. (76.2 cm) above the center of the adjacent intersection; and signs mounted 8 ft (2.4 m) or more above the ground and whose supports do not constitute an obstruction as defined in section 01-002.

#### SECTION 01-004. Obstructions to Visibility at Intersections and Driveways—Existing Obstructions.

No obstruction to cross-visibility shall be excepted from the application of this article because of its being in existence at the time of the adoption hereof.

#### SECTION 01-005. Obstructions to Visibility at Intersections and Driveways—Penalty.

Any person or persons or corporations violating sections 01-001 through 01-004 of this code shall be guilty of a misdemeanor and on conviction shall be fined any sum not less than \$50 nor more than \$100, and each day that the violation shall continue shall constitute a separate offense.

#### SECTION 01-006. Obstructions to Visibility at Intersections and Driveways—Removal of Obstructions by City.

In the event of any violation of sections 01-001 through 01-004, in addition to the fine mentioned in section 01-005, the city, at the direction of the director of traffic engineering, is authorized to go on said real property and to take any usual and necessary action to effect full compliance with the provisions of these sections. The cost thereof shall be a charge against the person or persons or corporation responsible and shall be a lien against the property from which such obstruction is removed.



Although this ordinance is written for cities, it can also be used by states by deleting section 01-001(3) and by inserting the word "state" instead of "city." The results of before and after accident studies, such as the one conducted in Concord, California, can be used to stress the importance of this legislation to the elected officials. Studies in the particular city or state should be used to provide a more local application, e.g., locations where voluntary compliance was obtained even though no law or ordinance was in effect. In regard to the legality of this ordinance, only 4 of the 202 agencies stated that their laws or ordinances had been tested in the courts; however, all 4 stated that the laws or ordinances had been upheld. The model ordinance is similar to those that were upheld.

### Ordinance Enforcement

The easiest and least expensive method of obstruction removal is for the property owner to voluntarily comply. This eliminates the need for expensive and unpopular legal battles. However, voluntary compliance by the property owner was determined from questionnaire replies as the major problem in removing obstructions at intersections. Therefore, improvements in this area are definitely needed. Many officials indicated that a great deal of voluntary compliance was usually obtained when the affected property owner was personally contacted at the site of the obstruction. However, this procedure is quite expensive because of limited engineering time and personnel. Therefore, a cheaper method that obtains the same compliance is desired.

One such method, currently used by several cities, involves sending the property owner a letter identifying the problem. In this letter, the problem condition is explained and the appropriate section of the city code that is violated is quoted. It should be supplemented with a typical intersection drawing showing the limits of the obstruction law or ordinance. Figure 3 shows such a drawing used by Louisville, Kentucky. The letter sent to the property owner should also include a method of appeal, for example, the telephone number of an official with whom the problem can be discussed. It is also recommended that the city or state volunteer to remove the obstruction from the property with city or state forces at a fair price to the property owner, if the owner so desires.

If the first letter to the property owner obtains no results, then a second letter should be sent. This letter should point out more strongly that the obstruction is in violation of a local ordinance and that a potential liability on the property owner is present if a traffic accident were to occur in which the obstruction was a contributing factor. One city responded that this remark usually brought about quick action by the property owner.

If this approach also fails, the property owner should be personally contacted at the site of the obstruction and the dangers of the obstruction pointed out. Although this explanation could probably be presented best by a qualified traffic engineer, one city reported good results when the dangers were explained by an off-duty police officer.

If the personal contact fails to obtain action within a reasonable specified period, the city should enter the private property and remove the obstruction, and, at the same time, file legal action against the property owner.

If action is taken voluntarily by the property owner, a letter of appreciation is certainly in order. Such a response by local governments will go a

Figure 3. Intersection sketch sent to property owner.





long way in maintaining good public relations.

This section has focused on the problem of obstruction removal. A better solution to this problem would be to eliminate the obstruction before it appears. This can be accomplished to a certain extent by an effective public relations program and also by contact with the local garden clubs. A few minutes of obstruction explanation before planting could save several hours of obtaining obstruction removal after planting.

## CONCLUSION

This paper has dealt with the problem of obstructions on private property that block motorists' sight distance at intersections. The responses to the questionnaire demonstrated that this problem exists in almost all U.S. cities and states. The recommended model ordinance, if established, and the other recommended enforcement changes, if implemented, could significantly help the city or state obtain the removal of the offending sight obstructions. The procedures recommended are aimed at obtaining the desired voluntary compliance by the property owner. If these procedures are used, a high degree of voluntary compliance should be expected. However, if voluntary compliance in removal is not obtained, the city or state should not hesitate to use whatever means available to remove the obstruction because the safety of the motorists is at stake.

## ACKNOWLEDGMENTS

We wish to thank the Louisville Department of Traffic Engineering for the use of its intersection drawing shown in Figure 3.

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