

# Roadway Design Standards for Rural and Suburban Subdivisions



**Final Report**  
**June 2007**

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# **ROADWAY DESIGN STANDARDS FOR RURAL AND SUBURBAN SUBDIVISIONS**

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**Principal Investigator**

Paul D. Wiegand, P.E.  
Research Engineer

Center for Transportation Research and Education, Iowa State University

**Co-Principal Investigator**

Larry Stevens, P.E.  
SUDAS Director

Center for Transportation Research and Education, Iowa State University

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**Center for Transportation Research and Education**

**Iowa State University**  
2711 South Loop Drive, Suite 4700  
Ames, IA 50010-8664  
Phone: 515-294-8103  
Fax: 515-294-0467  
[www.ctre.iastate.edu](http://www.ctre.iastate.edu)

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The authors also thank Snyder & Associates for their work in preparation of the typical cross-sections and background information on older subdivisions in central Iowa.

## **EXECUTIVE SUMMARY**

### **Introduction**

In Iowa, there are currently no uniform design standards for rural and suburban subdivision development roadways; thus, many counties are unable to provide adequate guidance for public facilities to be constructed as part of a rural subdivision development. It is well-recognized that not having uniform design standards for rural and suburban subdivision development improvements creates situations where there is potential for inconsistency and confusion. Differences in the way development standards are applied also create incentives or disincentives for developers to initiate subdivision platting in a particular county or away from a city.

### **State of the Practice**

The responses from a questionnaire completed by 36 county officials can be summarized by indicating that the “typical” county does require paving of the roads within a subdivision, but does not require paving of the connecting road. Only one county responded that they have established warrants for the paving of the connecting road. For most of the responding counties, the internal subdivision roads are generally privately owned, with homeowners associations responsible for maintenance. The internal subdivision roads are typically built on 66-foot right-of-way easements or outlots. When the local road within the subdivision is paved, it will more than likely be a rural cross section 22 to 24 feet wide with 4-foot rock shoulders and ditches for drainage.

### **Roadway Geometrics**

Roadway geometrics are the parameters that create a well-designed facility, and are established as a function of design speed. The design speed is determined by evaluating the use of the road, the use of the adjacent land, and the expected traffic volume on the road. Once the design speed is established, the roadway vertical and horizontal alignments are set to meet those characteristics necessary to travel safely at that speed. The use of a particular cross-section, either rural or urban, should be decided with consideration of the desires of the developer and the location of the road with respect to the designated growth area of the nearest urban area.

The most important decision to be made as agencies review subdivision development plans is not whether to use a rural or an urban cross-section, but whether to require paving or allow the construction of granular roads. The answer to that question will determine the long-term impact on the generation of fugitive dust and escalating maintenance costs that the homeowners and the agency must deal with. This decision is particularly important when the development is within the designated growth area of a city. Requiring an appropriate level of paving for the expected traffic volume and adjacent land use will initially cost the developer and the homeowners within the subdivision more, but will minimize long-term concerns of both the homeowners and the regulating agency.



## **Recommendations**

It is critical for the county and the adjacent city to cooperate and establish joint development requirements in the designated growth area of the city. The first step in that cooperation process is for the city to look closely at its land use policy plan and evaluate where and to what extent growth over a 20-year period is expected. From that review, a designated growth area should be established. The designated growth area then becomes the most critical area for jointly determining the type of developments that will be allowed and the public improvement regulations that govern the development.

Developments within the designated growth area of a city should use the roadway standards that include an urban cross-section with storm sewers. Using the urban cross-sections within the designated growth area provides for smoother transitions as rural areas are annexed into the adjacent city. Once the roadways within the subdivision are properly constructed to the appropriate local or collector standards, they should be dedicated as public right-of-way, and the county should accept them for maintenance. Although acceptance into the county road system brings increased costs, the properly-constructed road with a design life of at least 40 years will not create unusual problems in the future and will serve the adjacent homeowners. Also, the regulation of speeds and other regulatory elements, such as on-street parking, can be established and enforced if the county has jurisdiction. Enforcement of these regulations is difficult when the right-of-way and road are not dedicated to the county.

An unpaved existing county road connecting a proposed development to a paved road is of particular concern. The connecting road is a part of the county road network, and is likely to become an important street as the area develops and the road is used by more traffic in the designated growth area of a city. Because of that importance and the long life of any pavement, the connecting road should also be paved to an urban cross-section within the designated growth area of a city. It is very likely that this road will need to be widened to multiple lanes as the area grows in the future and is annexed into the nearby city. The urban cross-section will make any expansion of the road reasonably cost-effective, since the existing paving would only need to be widened. Conversely, converting a two-lane rural road to a multi-lane urban facility would involve total removal of the pavement and reconstruction to meet the urban requirements.

For roads within developments outside of the designated growth area of a city, the selection of rural versus urban cross-section is not as critical. The option could be left to the developer to select the type they would like to propose, as long as good regulations are in place for both types. The amount of land required for right-of-way, the characteristics of the land (soils, slope, wooded area, etc.), and the type of drainage facilities to be used are elements to consider in the decision. It is recommended that the rural cross-sections be used as a default and the developers be allowed to propose other cross-sections if they so desire.

## **PROBLEM STATEMENT**

In Iowa, there are currently no uniform design standards for rural and suburban subdivision development roadways. Without uniform design standards, many counties are unable to provide adequate guidance for public facilities, particularly roadways, to be constructed as part of a rural subdivision development. If a developer is not required to install appropriate public improvements or does not do so properly, significant liability and maintenance expenses can be expected, along with the potential for major project costs to correct the situation.

It has been documented that Iowans are increasingly looking to rural areas for larger lots and larger homes. Development in these rural areas is a double-edged sword. The tax growth contributes some money to the county funds, but if developers are not held to the appropriate public improvement standards, maintenance and improvement costs will easily exceed the increased tax revenues. The largest problem in rural/suburban subdivisions relates to the lack of appropriate paving of internal roadways and external connecting roadways.

It is well recognized that not having uniform design standards for rural and suburban subdivision development improvements in Iowa creates situations where there is potential for inconsistency and confusion. Differences in the way development standards are applied also create incentives or disincentives for developers to initiate subdivision platting in a particular county.

If the rural development lies within the two-mile jurisdictional area adjacent to a city, further problems are possible due to the differing public improvement standards between the county and the city. Cities generally require significant public improvements, such as curbed streets, storm sewers, other underground utilities, and sidewalks, which encourage smaller lots. Counties generally allow larger lot developments without usual urban public improvements. Generally, rural subdivisions have roads with shoulders, ditches for drainage control, and no curbs.

A search of county websites indicated that only 28% of Iowa counties have specific subdivision public improvement requirements. A review of prior research indicated that no studies had been done to address statewide geometric standards for rural and suburban roadways in subdivision areas. The Statewide Urban Design and Specification (SUDAS) and Iowa DOT manuals currently do not have geometric standards for rural cross-sections on low-volume, low-speed facilities.

## TECHNICAL ADVISORY COMMITTEE

Because of the nature of the research, the involvement of county officials was needed to provide input to the study. Some also served on the Technical Advisory Committee, along with city officials and consultants. Committee members included

Ron Gaines, City of Cedar Falls	Murray McConnell, Dallas County
Greg Parker, Johnson County	John Peterson, City of Ankeny
Joel Romey, Bishop Engineering	Larry Ryan, Jasper County
Roger Schletzbaum, Marion County	Aric Schroeder, City of Waterloo/Black Hawk County
Chris Whitaker, Carroll County Region 12	Duane Wittstock, City of West Des Moines
Council of Governments	

## LEGAL ELEMENTS

Chapter 354 of the 2007 *Code of Iowa* sets standards for the division of land in Iowa that consider the rights of the landowner and the governmental entity involved with the subdivision. The state regulations establish uniform procedures and minimum standards related to the subdivision of land and also allow cities and counties to establish additional requirements through local subdivision ordinances. Overall, these regulations are established to provide for orderly development in accordance with comprehensive plans of the local agency.

The 2007 *Code of Iowa* requires “a subdivision plat must be made when a tract of land is divided by repeated divisions or simultaneous division into three or more parcels, any of which are described by metes and bounds description for which no plat of survey is recorded.” After submittal of a subdivision plat, the governing body “shall determine if the development is in accordance with its comprehensive plan, and shall give consideration to the possible burden on public improvements and to a balance of interests between the proprietor, future purchasers, and the public interest in the subdivision when reviewing the proposed subdivision, and when requiring the installation of public improvements in conjunction with approval of the subdivision.”

Cities have the ability to establish ordinances that provide for the regulation of subdivisions outside the boundaries of the city, but within a specified area. That extra-territorial area can be specifically described in the city’s comprehensive plan, or it can be all land within a certain distance of the city’s boundaries. The specific distance outside the city can not exceed two miles. When a subdivision is proposed in the designated extra-territorial area, the subdivision plat is submitted to both the county and the city involved. The standards applied by the city or county for review and approval of the subdivision shall be the same standards and conditions used for the review and approval of subdivisions within the city limits, or shall be the standards and conditions for review and approval established by agreement of the city and county. Either the city or the county may waive its right to review a subdivision within the extra-territorial zone or waive the requirements of its standards or conditions, including public improvements.

In addition to subdivision regulations, Chapter 414 in the 2007 *Code of Iowa* allows the zoning of land. It allows cities and counties to establish zoning regulations within their jurisdictions to promote the health, safety, and welfare of a community. It generally involves regulations relating to the density of a development, size of lots, location of structures within lots (i.e., yard requirements), and type of development that is permitted within a given area. It also involves regulations to facilitate the provision of transportation, utilities, schools, parks, and other public requirements.

Cities may also provide for zoning regulations within their designated extra-territorial jurisdiction, provided the affected county does not have zoning regulations. If a city extends its zoning regulations outside of its boundaries, the membership of the city's Planning and Zoning Commission and its Board of Adjustment must provide for representation from the impacted area.

## **STATE OF THE PRACTICE**

### **Literature Search**

The results of the literature search are presented in Appendix A. It appears that no state has established statewide geometric standards for roadways in rural and suburban subdivisions. Some state DOTs have provided guidelines for rural roadways, but no standards were adopted.

Marion County, Oregon, has established minimum rural design standards that are targeted to both new roads and paving of existing rural granular roads. The standards are established by design speed and volume of traffic. This represents the closest program to this study.

### **Questionnaire**

A questionnaire was developed to determine how roadway improvements in rural and suburban subdivisions were currently being addressed in Iowa. The questionnaire and complete results can be found in Appendix B. The initial questions focused on the status of roadway ownership and the methods by which internal subdivision roads could become paved. The next focal area dealt with the roadway standards themselves, including geometrics, pavement thickness, whether sidewalks/trails are required, and if the regulations provided a particular location within the right-of-way for underground utilities. The final question dealt with the paving of the connecting roadway between the subdivision development and the nearest paved road.

The questionnaire was posted on the Iowa County Engineers Association Service Bureau website and also distributed to the County Zoning Administrators through their website. A total of 36 responses were received. The responses can be summarized by indicating that the "typical" county does not require paving of the connecting road, but does require paving of the roads within a subdivision. Only one county responded that they have

established warrants for the paving of the connecting road. For most of the responding counties, the internal subdivision roads are generally private, with homeowners associations responsible for maintenance. The internal subdivision roads are typically built on 66-foot right-of-way easements or outlots. When the local road within the subdivision is paved, it will more than likely be a 22- to 24-foot-wide rural cross-section with 4-foot rock shoulders and ditches for drainage.

The question dealing with ownership and maintenance responsibility indicated a very diverse range of situations in the counties that responded. Several responses were mixed because the county generally will designate the road as private, but if the developer agrees to certain construction standards, the county will take the road as an easement and be responsible for the maintenance. The general reason that the roads are designated as private is that the width of the right-of-way and the construction of the roadway elements do not meet the county's geometric and pavement thickness requirements.

Many of the comments from the Technical Advisory Committee and the questionnaire responses indicate that problems have resulted from "private" roads that are substandard when constructed and later need major upgrades or maintenance. The needed rehabilitation is often much more costly than the homeowners association has resources for, and/or the maintenance bond (if any) is insufficient; therefore, they request help from the county Board of Supervisors. The Supervisors must then address the issue and balance it with other needs within their county.

With the wide range of standards or lack of standards for local roads in development areas, it is critical that some level of uniformity is created to address equity in development across jurisdictional lines. The standards must be effective in addressing the problem, but they must not be so excessive as to curtail development activities within a local jurisdiction. Politically, it may be difficult to develop roadway paving standards due to concerns over initial cost. However, the long-term cost must be included as the regulations are developed. Initial costs for unpaved roadways, or those constructed below typical local jurisdiction paving standards, may be attractive to the developer; however, the homeowners and the county will face long-term problems. One way to address the higher initial cost, and make that investment more attractive to developers and homeowners, is for the county to accept the completed roadway into their system for maintenance if it is built to the required standards. To provide long-term service and to avoid undue hardship on the county secondary roads budget, the design life of the new pavement should be a minimum of 40 years.

Established standards provide information to developers in the early stages of their planning and allow them to incorporate the requirements into their project layout and economics. Regulators can then consistently apply the standards as developments are being proposed.

Developments along an existing unpaved granular road are particularly troublesome in relation to providing good levels of service while not being too onerous in development requirements to the extent that potential developers do not proceed with subdivisions, or

that they develop in another county where standards are less restrictive. Jurisdictions find it difficult to mandate paving of the connecting road when the adjacent development is small. However, a series of small developments along an existing county granular road will create maintenance problems for the county as traffic volumes grow to more than 200 vehicles per day. The problems caused by the area development, similar to the dust shown in Figure 1, often pit pre-existing rural homeowners against the new homeowners because the existing rural homesteads are experiencing the problems caused by others, yet are faced with having to pay for the improvement that will solve the problem because of the land they own adjacent to the granular road. Paving the connecting road after development has occurred and problems become evident is difficult and typically involves the use of limited resources that could be used elsewhere on the county road network. If the county finances the improvements, the costs may be spread across the entire county population and not assigned to the subdivision developments that have occurred over the years and created the problems.

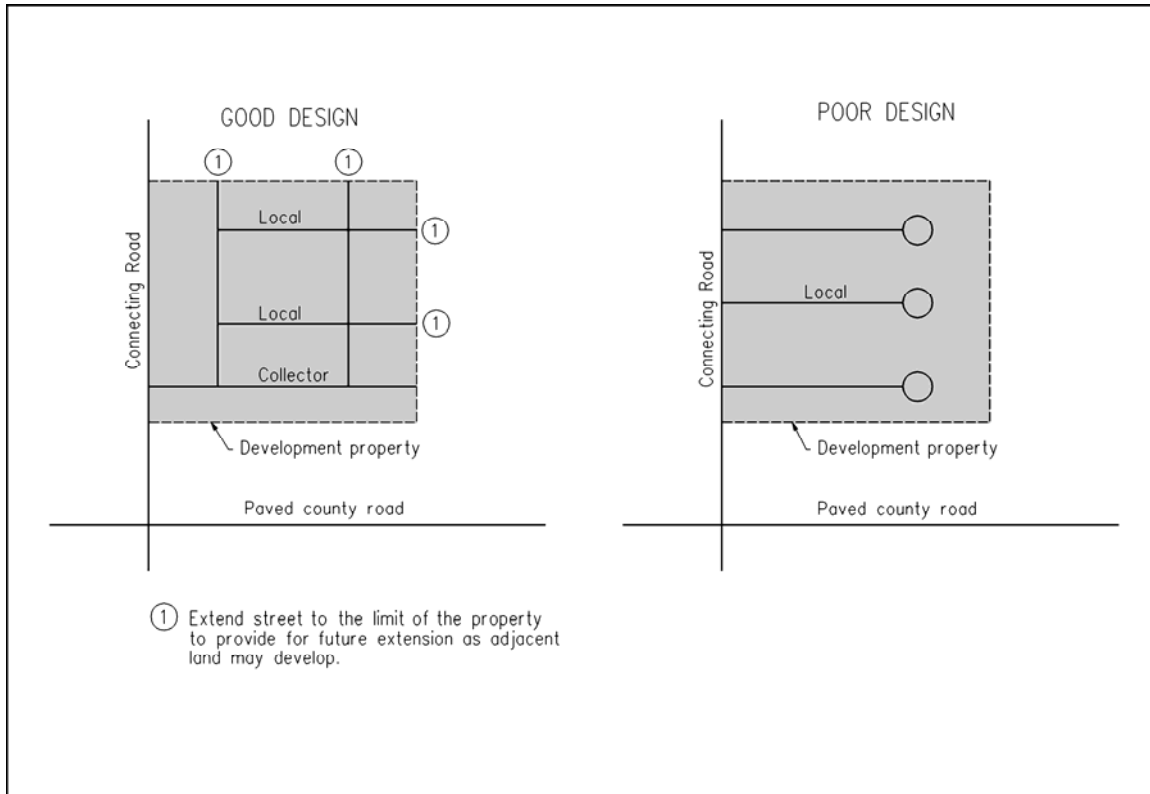


**Figure 1. Unpaved connector road**

## **ROADWAY STANDARDS**

Various elements should be included in the documents for review as a development is brought forth. The initial review needs to address the size of the development and the traffic generation created by the subdivision. For rural developments, a typical single family lot will generate about eight trips per day according to research completed at the Center for Transportation Research and Education (CTRE) at Iowa State University. The volume of traffic generated from the proposed lots needs to then be assigned to the proposed road system to determine the projected traffic volumes on each road. It is also important to include any unpaved roads that would connect the new development area to the existing paved farm-to-market system. The proposed development should be laid out

to provide good traffic circulation within the subdivision, without unnecessary circulation on the main external roadway. Note the design example in Figure 2. If the proposed development is small, provisions should be made for roadway connections to adjacent property to assist circulation from within the area to the neighboring property, should it be developed. Individual developments that do not provide for circulation to adjacent properties compound the access points to the major adjacent roadway with multiple road intersections. The projected traffic volumes on each road then drive the standards that would be applied to that road. Pavements are generally designed to handle the expected traffic volume for a minimum of 20 years, up to the desired 40 years.



**Figure 2. Traffic circulation**

Design and construction standards can vary, especially as traffic volumes increase, but the overall goal should be to provide a safe, economical, and low-maintenance road system that is designed and constructed to meet the needs of the users. The American Association of State Highway and Transportation Officials (AASHTO) provides guidelines for very low-volume roads. They have defined low-volume roads as those with daily traffic volumes fewer than 400 vehicles per day (vpd). AASHTO indicates that low-volume roads can be constructed with granular surface with a total width of 18 feet, including shoulders (see Appendix C). The AASHTO low-volume guide reasons that since traffic volumes are low, encounters with oncoming vehicles will be rare, and that all drivers will be familiar with the road since it serves local residents.

Counties across Iowa generally do not allow roadways to be constructed to these standards due to concerns for safety. Drivers who may be unfamiliar with the road or operators inexperienced in granular road driving could experience crashes as a result of these standards.

As agencies look to establish appropriate standards based on traffic volumes, it is important to understand roadway standards and their objectives. Paved roads are provided as a means to serve users with an established travel path that is free of mud and dust, designed for the traffic volume involved, and safe at the operating speeds of the users. Unpaved roads do not meet those needs on a long-term basis, especially as traffic volumes increase.

Roadway geometrics are the controls that create a well-designed facility and are established as a function of design speed. The design speed is determined by evaluating the use of the road, the use of the adjacent land, and the expected traffic volume on the road. Once the design speed is established, the roadway vertical and horizontal alignment are set to meet those characteristics necessary to travel safely at that speed.

County roads are functionally classified in three groups: local, minor collector, and major collector. Local roads primarily provide access to private property and have the lowest daily volumes, usually fewer than 400 vehicles per day (vpd). Operating speeds on local roads are generally expected to be 25 miles per hour (mph); and the design speed would be 30 mph for urban cross-sections and 45 mph for rural cross-sections. Minor collector roads also provide access to private property, but have higher traffic volumes (generally more than 400 vpd, but fewer than 1500 vpd) because local road traffic accumulates as the drivers move through the area. The design speed for minor collector roads is slightly higher than for local roads, and is usually set at 35 mph for urban cross-sections and 50 to 55 mph for rural roads. Major collector roads are those that are used primarily for the movement of traffic and have a higher design speed of 60 mph; access to private property is less of a function due to safety considerations.

## **TYPICAL CROSS-SECTIONS**

Roads are constructed to either a rural or urban cross-section. Each type of cross-section has specific characteristics that define what is included in the roadway.

Rural cross-sections consist of a roadway surface of a defined width that includes the driving area and shoulders. The driving area and the shoulders can be granular or paved, or a combination of the two. Rural cross-sections include drainage ditches, which are adjacent to an elevated roadway and are designed to accommodate drainage from the roadway and adjacent properties. With 11-foot driving lanes, 4-foot shoulders, and adequate slopes and ditch width that can be appropriately maintained by adjacent property owners, the required land for the right-of-way of a local road with a rural cross-section will exceed 80 feet. The ditch foreslopes and backslopes (see Figure C.1) and ditch bottom can be made steeper and narrower as a means to construct the road in the



typical 66-foot right-of-way; however, the ability to properly maintain the slopes by the adjacent owner is compromised, as shown in Figure 3.



**Figure 3. Steep slopes**

Private property accesses most often involve use of culverts under the driveways to carry stormwater flow. Rural cross-sections do not typically provide a specific facility to address the needs of pedestrians and bicyclists due to low demand. Sidewalks and trails can be constructed with rural cross-sections; however, they most often will need to be located beyond the ditch slope area. The preferred location for the pedestrian facilities is within the right-of-way. Depending on the ditch slopes and width, the requirement for sidewalks in rural cross-section areas could make the right-of-way at least 10 feet wider. An alternative to the wider right-of-way is to place the sidewalks in an easement. The use of an easement provides less control than having the sidewalk in the right-of-way, but it does reduce the front yard requirements for the homeowner. Some rural paved roads have a wider (5-foot minimum) paved shoulder that can be designated as a bicycle facility. See Figure 4.



**Figure 4. Paved shoulder with maintainable slopes**

Urban cross-sections are characterized by the presence of curb and gutter that define the edge of the road and channel stormwater runoff. Urban roads are usually constructed below the surrounding ground in order to collect the stormwater runoff onto the road. Typically, drainage is handled by a system of storm sewers that ultimately discharge the runoff into established waterways. Newer concepts related to stormwater runoff, which use swales instead of storm sewer piping, can be incorporated into urban cross-sections, as shown in Figure 5. These swales are typically 2-3 feet deep with relatively flat slopes. Care must be taken so as not to create areas in the swales where water will pond and make maintenance difficult. Pedestrian and bicyclist needs are addressed with the inclusion of sidewalks and/or trails. The traditional location of the sidewalks and/or trails is near the private property line; but on lower-speed roads, the sidewalk can be located at the back of the curb or in an easement on private property at the top of the swale slope. These alternative locations allow for the use of swales to handle stormwater runoff, rather than using a traditional storm sewer. The required right-of-way needed for a traditional urban cross-section for a local road is 60 feet.

Typical cross-sections for each type of road are shown in Appendix C. The cross-sections are grouped into local, collector, and connector roads. As the traffic volume increases above that for local roads, the pavement width and other safety features become more of a factor in the cross-section that is constructed. In each situation, either a rural or an urban cross-section can meet the needs of the development.



**Figure 5. Urban cross-section without storm sewer**

## **PAVED VERSUS UNPAVED ROADS**

The most important decision to be made as agencies review subdivision development plans is not whether to use a rural or an urban cross-section, but whether to require paving or allow the construction of granular roads, as shown in Figure 6. The answer to that question will determine the long-term impact on generation of fugitive dust and escalating maintenance costs that the homeowners and the agency must deal with. This decision is particularly important when the development is within the designated growth area of a city. Allowing granular roads at a low initial developer cost will generate long-term problems due to the concerns that are raised by the homeowners for upgrades and/or maintenance. A portion of the costs will likely be placed on the public agency and thus the other citizens of the jurisdiction beyond the homeowners of the subdivision. Requiring an appropriate level of paving for the expected traffic volume and adjacent land use will initially cost the developer and the homeowners within the subdivision more, but will minimize long-term concerns for both the homeowners and the regulating agency. If roads are not paved, as traffic volumes increase, the generation of fugitive dust and the low level of service will become critical issues to the surrounding property owners. Concerns for environmental and health issues are then brought to the County Supervisors. An exception to this paving standard might be a short local road within a subdivision that cannot be extended because of a physical constraint, such as a river or steep bluff.





**Figure 6. Unpaved local rural subdivision road**

Technical Advisory Committee members felt that any currently unpaved road that connected the proposed development area to the paved county system should be paved if the proposed development created a projected traffic volume of 200 vehicles per day. At that level of traffic, it is very difficult to keep the crown of the road intact for drainage, and the driving surface becomes textured like a washboard in just a few days. Based on the traffic generation of eight trips per day for single family rural lots, the paving would be required if 25 lots were included in the development. The number of lots to trigger paving would be reduced by the pre-existing traffic volume on the granular road. The committee also felt that any road within the boundaries of the subdivision should be paved as a part of the development process. Groupings of developments that individually do not exceed 25 lots could present a problem because the paving threshold is not met as each of the developments is being reviewed; however, in aggregate, and over time, the area developments generate over 200 vehicles per day, causing roadway maintenance problems.

## **URBAN VERSUS RURAL ROADS**

The use of a particular cross-section, either rural or urban, should be decided with consideration for the desires of the developer and the location of the road with respect to the designated growth area of the nearest urban area. Converting or reconstructing a rural roadway to an urban roadway as areas are annexed into the adjacent city is very difficult because of the characteristics related to the elevation of the road with respect to the surrounding properties and the drainage methods used. This is especially critical on

higher-volume roads that may be two-lane facilities in the rural area; however, as the land is annexed and urban growth occurs in the area, a multiple-lane road is needed to meet the traffic demands.

Developers may prefer the use of an urban cross-section to minimize the amount of land that is needed for right-of-way, thus maximizing the land available for sale. Urban sections also provide property owners with lawn areas that are easier to maintain than steeper rural ditch slopes. Initial costs for urban pavements can be minimized through the use of swales to handle stormwater runoff, versus using complete storm sewer pipe systems. The swales also address the growing need to provide for stormwater quality issues in development areas.

## **RECOMMENDATIONS**

Presently, there are many differences in the regulations for subdivisions and the required public improvements between most cities and counties in Iowa. The differences can be categorized by the size of lots and the public improvements required by the jurisdictions.

Establishing a good set of zoning and subdivision regulations, and uniformly applying those regulations, is critical in addressing rural and suburban roadway standards. The zoning regulations establish the appropriate land use in a particular area and dictate the locations and size of developments; the subdivision regulations establish the public improvement requirements that must be part of the development. It is also critical for the county and adjacent city to cooperate and establish joint development requirements in the designated growth area of the city. The first step in that cooperation process is for the city to look closely at its land use policy plan and evaluate where and to what extent growth over a 20-year period is expected. From that review, a designated growth area should be established. The designated growth area then becomes the most critical area for jointly determining the type of developments that will be allowed and the public improvement regulations that govern the development.

Although both jurisdictions are involved, by law, the city can impose its regulations directly on any developments within a two-mile radius of the city. If those requirements are perceived to be too onerous by area developers, they will move beyond the two-mile area and build their subdivisions based on county regulations only. Thus, to create the most efficient rural and suburban developments near city areas, it is critical to have reasonable development standards that are cost-efficient in the long run for the developers, the end users (homeowners), and the adjoining jurisdictions.

It is recommended that developments within the designated growth area of a city use the roadway standards that include an urban cross-section with storm sewers. Once the roadways within the subdivision are properly-constructed to the appropriate local or collector standards, they should be dedicated as public right-of-way, and the county should accept them for maintenance. Although acceptance into the county road system brings increased costs, the properly constructed road with a design life of at least 40 years

will not create unusual problems in the future and will serve the adjacent homeowners. In addition, property values will be higher on a well-constructed road as opposed to a granular or substandard road. Also, the regulation of speeds and other regulatory elements, such as on-street parking, can be established and dealt with when the right-of-way and road, as noted in the cross-sections in Appendix C, are dedicated to the county. When public improvement requirements related to subdivision developments are implemented, the street improvements are likely to remain in place for more than 20 years. Thus, using the urban cross-sections within the designated growth area provides for smoother transitions as rural areas are annexed into the adjacent city.

One potentially unfortunate result of accepting new, properly constructed roadways into the county system for maintenance is the likelihood that homeowners groups faced with maintaining older, substandard roadways may request that their roads be maintained by the county. The county Board of Supervisors will have to be strict about only accepting properly designed and constructed roads.

An unpaved existing county road connecting a proposed development to a paved road is of particular concern. Since these roads are typically on one-mile spacing and are continuous throughout the county, they are considered the backbone of the area transportation system. As granular roads, they serve the needs of rural homesteads and agricultural traffic but may not be adequate once development takes place. In accordance with Chapter 311 of the 2007 *Code of Iowa*, counties are unable to initiate a special assessment project for the impacted property owners to pay for paving of an unpaved connecting road. Without a voluntary petition from at least 50% of the owners of the land in the assessment district that indicates that they will pay for at least 50% of the project costs, counties would have to pay for the paving project as a part of their secondary road program.

A connecting road is a part of the county road network and is likely to become an important street as the area develops and the road is used by more traffic in the designated growth area of a city. Because of that importance and the long life of any pavement, the connecting road should be paved to an urban cross-section within the designated growth area of a city. It is very likely that this road will need to be widened to multiple lanes as the area grows in the future and is annexed into the nearby city. The urban cross-section will make any expansion of the road reasonably cost-effective, since the additional paving would consist only of widening. Conversely, converting a two-lane rural cross-section to a multi-lane urban facility would involve total removal of the paving and reconstruction to meet the urban requirements.

For roads within developments outside of the designated growth area of a city, the selection of rural versus urban cross-section is not as critical. The option could be left to the developer to select the type they would like to propose, as long as good regulations were in place for both types. The amount of land required for right-of-way, the characteristics of the land (soils, slope, wooded area, etc.), and the type of drainage facilities to be used would be elements to consider in the decision. It is recommended that

the rural cross-sections be used as a default and the developers be allowed to propose other cross-sections, if they so desire.

Each cross-section alternative in Appendix C has two possible layouts. The desirable cross-section should be used whenever possible. If a physical restriction prevents the implementation of the desirable cross-section, the county can use the minimum. Use of the minimum cross-section should only take place after adequate justification has been presented and approved. The geometrics for the different road cross-sections are summarized in the tables below.

**Table 1. Rural subdivision cross-section geometrics**

<b>Design Elements</b>	<b>Connector</b>		<b>Collector</b>		<b>Local</b>	
	<i>Desirable</i>	<i>Minimum</i>	<i>Desirable</i>	<i>Minimum</i>	<i>Desirable</i>	<i>Minimum</i>
Design speed (mph)	60	60	55	50	45	45
Avg. daily traffic	> 1500	>1500	400-1500	400-1500	<400	<400
Pavement width	24'	24'-striped at 22'	24'	22'	22'	22'
Shoulder width	8'	8'	6'	5'	4'	4'
Shoulder type	4' paved/4' rock	rock	rock	rock	rock	earth
Right-of-way width	100'	80'	80'	66'	66'	66'
Slopes	6:1	4:1	4:1	3:1	4:1	3:1
Parking allowed	none	none	none	none	none	none
Stopping sight distance	570'	570'	495'	425'	360'	360'
Horiz. curve (min)*	1340'	1205'	965'	760'	500'	500'
Maximum grade	5%	8%	6%	8%	8%	10%

\*Horizontal curve minimum values are based on 6% superelevation for desirable sections and 8% for minimum sections for connector and collector roads. The 8% superelevation will require special design elements. For grades greater than 3%, the stopping site distance is increased.

**Table 2. Urban and suburban cross-section geometrics**

<b>Design Elements</b>	<b>Connector</b>		<b>Collector</b>		<b>Local</b>	
	<i>Desirable</i>	<i>Minimum</i>	<i>Desirable</i>	<i>Minimum</i>	<i>Desirable</i>	<i>Minimum</i>
Design speed (mph)	60	60	35	35	30	30
Avg. daily traffic	> 1500	>1500	400-1500	400-1500	<400	<400
Pavement width	31'	31'	31'	26'	26'	26'
Right-of-way width	100'	80'	80'	66'	66'	60'
Parking allowed	none	none	one side	none	one side	one side
Stopping sight distance	570'	570'	250'	250'	200'	200'
Horiz. curve (min)*	1505'	1505'	420'	420'	300'	300'
Maximum Grade	5%	8%	6%	10%	6%	10%

\*Horizontal curve minimums are based on 4% superelevation on connector and collector roads with no superelevation on local roads.

It is recommended that these geometric tables and cross-sections be processed through the Statewide Urban Design and Specifications (SUDAS) review program of district meetings and action by the Board of Directors to include these geometric tables and typical cross-sections in the SUDAS Design Standards.



## **APPENDIX A: LITERATURE REVIEW**

This literature search was conducted with the following resources:

- TRIS
- Google
- State and county websites

Keywords used:

- County
- Design
- Geometrics
- Highway
- Road
- Roadway
- Rural
- Standards
- Streets
- Subdivision

## Vermont State Design Standards: Chapter 6 Local Roads and Streets

### Vermont Agency of Transportation

<http://www.aot.state.vt.us/progdev/standards/06local.htm>

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#### Design Speed

- Normally 25 to 50 mph
- Normally equal to anticipated posted speed
- Lower design speed may be considered to:
  - Avoid and/or minimize impacts to historical, architectural, scenic, natural, or other resources
  - Avoid excessive construction costs
  - Better comply with a town or regional plan
- Design speeds may be as much as 10 mph lower than legal speeds, provided appropriate warnings are posted

#### **Minimum Stopping Sight Distance for Local Roads/Street (Wet Pavement)**

Design Speed (mph)	Rehabilitation, Reconstruction, or New Construction		
	Stopping Sight Distance (ft)	K Value for Crest Vertical Curve	K Value for Sag Vertical Curve
25	150	20	30
30	200	30	40
35	225	40	50
40	275	60	60
45	325	80	70
50	400	110	90

#### **Minimum Corner Sight Distances\* For Local Roads & Streets**

Design Speed on Main Road (mph)	Corner Sight Distance (ft)
25	275
30	330
35	385
40	440
45	495
50	550
55	605

\* Corner sight distance is measured from a point on the intersecting road, at least 15 ft from the edge of traveled way on the main road

## Vermont Agency of Transportation

### Minimum Width of Lanes & Shoulders for Rural Local Roads

Design Speed (mph)	Design Traffic Volume						
	ADT* 0-25	ADT 25-50	ADT 50-100	ADT 100-400	ADT 400-1500	ADT 1500-2000	ADT 2000+
	Width of Lane / Shoulder (ft)						
25	7/0	8/0	9/0	9/2	9/2	10/3	11/3
30	7/0	8/0	9/0	9/2	9/2	10/3	11/3
35	7/0	8/0	9/0	9/2	9/2	10/3	11/3
40	7/0	8/0	9/2	9/2	9/2	10/3	11/3
45	---	---	9/2	9/2	9/2	10/3	11/3
50	---	---	9/2	9/2	10/2	10/3	11/3

\*Minimum width of 8 / 0 wherever there is a guardrail

### Minimum Clear Zone Distances For Rural Principal Arterials (in ft from edge of traveled way)

Design Speed (mph)	Design ADT (VPD)	Fill Slopes		Cut Slopes	
		1:4 or flatter	1:3	1:3	1:4 or flatter
45 or less	<750	7	*	7	7
	750-1500	12	*	10	10
	1500-6000	14	*	12	12
	>6000	16	*	14	14
50	<750	12	*	8	8
	750-1500	16	*	10	12
	1500-6000	20	*	12	14
	>6000	24	*	14	18

\*Determination of recovery area width should take into consideration ROW availability, environmental concerns, cost, and safety

### Clear Zones

- Clear zones as narrow as 5 feet may be used to avoid and/or minimize disturbances
- On high speed roads (50+ mph), clear zones may be limited to 10 ft
- On low speed roads (< 45 mph), clear zones may be limited to 7 ft
- On uncurbed local roads where speeds are 35+ mph, the clear zone may be limited to 5 ft
- On curbed local roads, a 1.5 ft horizontal offset from face of curb should be provided

### Alignment

- Alignment is normally designed in accordance to AASHTO values for design speed
- Curves with design speed 20 mph below posted speed may be used to avoid and/or minimize disturbances
- Curves within 750 ft of a stop sign may have design speed up to 15 mph below posted speed

## Vermont Agency of Transportation

### Maximum Grades for Rural Local Roads

Type of Terrain	Design Speed (mph)					
	25	30	35	40	45	50
	Maximum Grade (%)					
Level	7	7	7	7	7	6
Rolling	11	10	10	9	8	8
Mountainous	15	14	13	12	11	10

### Bicycle & Pedestrian Considerations

Where bicycles and pedestrian are allowed by law the roadway should be designed assuming these users will use the roadway. Bicycles require a paved surface and pedestrians can be accommodated by unpaved shoulders.

### Minimum Width of Paved Shoulder to Accommodate Shared Use of Paved Local Roadways by Bicycles

Projected Design Traffic Volume	ADT 0-100	ADT 100-1500	ADT 1500-2000	ADT >2000
Design Speed (mph)	Width of Paved Shoulder (ft)			
25-30	NA	1	1	2
35-40	NA	1	2	3
45	NA	2	3	3
50	NA	2	3	4

### Minimum Width of Paved Shoulders and Shared-Use Curb Lanes to Accommodate Shared Use of Urban or Village Local Streets With Curbing by Bicycles

Projected Design Traffic Volume	ADT 0-1500	ADT 1500-2000	ADT >2000
Design Speed (mph)	Width of Paved Shoulder (ft)* / Width of Shared-Use Curb Lane (ft)		
25	2/12	2/12	2/13
30	2/12	2/12	3/13
35	2/12	3/13	3/14
40	2/13	3/13	4/14
45	3/13	4/14	4/14
50	4/14	4/14	4/14

\*Width may be reduced by 1 ft in uncurbed areas; these recommendations are for roads with no adjacent on-street parking

### Pedestrian Facilities

Adequate accommodation of pedestrians must be designed for all roadway projects. Sidewalks must be design in compliance with the current Americans with Disabilities Act Accessibility Guidelines (ADAAG). Pedestrian accommodation on roadway shoulders need not comply with ADAAG.

**Geometric Design Tables / Design Appendices****Minnesota Department of Transportation**<http://www.dot.state.mn.us/tecsup/xyz/plu/desstand/highway/>

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**Minimum Geometric Design Standards; Rural and Suburban Undivided;  
New or Reconstruction Projects**

Projected ADT	Land Width, ft	Shoulder Width, ft	In-Slope, rise:run	Recovery Area, feet	Design Speed, mph	Surfacing	Structural Design Strength, tons	Roadway Width C-C, ft
0-49	11	1	1:3	7	30-60	Agg.		22
50-149	11	3	1:4	9	40-60	Agg.		22
150-749	12	4	1:4	15	40-60	Paved	9	28
750-1499	12	4	1:4	25	40-60	Paved	9	28
1500+	12	6	1:4	30	40-60	Paved	10	30

Source: <http://www.revisor.leg.state.mn.us/arule/8820/9920.html>**Minimum Geometric Design Standards; Rural and Suburban Undivided; Reconditioning Projects**

Existing ADT	Statutory or Regulatory Posted Speed (mph)	Lane Width (Paved)	Combined Lane (Paved) and Shoulder Width
1-749	< 50	10	11
1-749	50+	10	12
750+	< 50	10	12
750+	50+	11	14

Source: <http://www.revisor.leg.state.mn.us/arule/8820/9926.html>

## Best Practices for Rural Entrance Policy

Montebello, D.; Domres, T.

SRF Consulting Group, Inc.

Sponsored by the Minnesota Local Road Research Board

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The main reasons for managing rural access are safety and operational/maintenance issues:

- Protect the functional area of the intersections
- Provide adequate sight distance
- Avoid offset access points

### Rural Private Entrance Spacing Guidelines

State		Speed (mph)			
		<35	35	45	> 45
New York		One access per parcel; 100' from an intersecting roadway			
Iowa		100-200'			
Wisconsin		One access per parcel			
South Dakota		150-350'			350'
Florida		125'	440'	660'	1,320'
Oregon		160'	330'	660'	660'
Maine		125'	150'	230'	275'
Ohio	Collector Roads	150-250'	250'	495'	550-715'
	Local Roads	One access per parcel; stopping sight distance			
Minnesota	Private/Farm Access	One access per parcel			
	Low-Volume Entrance/Road	One access per parcel; stopping sight distance			
	High-Volume Entrance/Road	One access per parcel by exception; stopping sight distance			

## Minnesota Local Research Board

### Access Spacing Criteria for Unsignalized Roads (ft)

Spacing Criteria	Scenario	Posted Speed (mph)					
		30	35	40	45	50	55
Right-Turn Conflict Overlap	Local roads & divided highways in rural areas	100	150	200	300		
AASHTO Stopping Sight Distance <sup>(1)</sup>	Local roads & collector roads in rural areas	200	250	305	360	425	495
Intersection Sight Distance	Local roads, collector & arterials in rural & transition areas	325	400	475	550	650	725
Stopping Sight Distance <sup>(2)</sup>	Local roads, collectors & arterials in rural area types	275	350	435	530	640	750
Functional Intersection Area <sup>(3)</sup>	Local roads, collectors & arterials in rural area types	480	480	480	590	700	820
Maximum Egress Capacity	Collectors & arterials in rural area types	320	450	620	860	1125	1500

<sup>(1)</sup> 9 ft/s<sup>2</sup> deceleration

<sup>(2)</sup> 6 ft/s<sup>2</sup> deceleration

<sup>(3)</sup> Length of turn lane (480 ft min.) – turning traffic to leave through lane with a speed differential less than or equal to 10 mph

### Entrance Design Guidelines for Rural Two-Lane Collectors & Local Roads

Design Criteria	Residential			Commercial, Industrial, Farm			Local Roads & Collectors		
	Min	Max	Desired	Min	Max	Desired	Min	Max	Desired
Entrance Angle/Skew (degrees)	70	110	90	70	110	90	70	110	90
Width (ft)	18	24	24	24	32	32	24	32	24
Corner Clearance (ft)	60	500+	500+	60	500+	500+	60	500+	500+
Radius (ft)	5	25	25	25	40	25	25	60	35
Entrance Grade (percent)	0	±7	0	0	±7	0	0	±7	0
Landing (ft)	15	150	50	25	150	50	25	150	50
Side Slope (ft:ft)	1:4	1:6	1:6	1:4	1:6	1:6	1:4	1:6	1:6
Turn Lane* Width (ft)	12	14	12	12	14	12	12	14	12

\* 480 feet in length

## **Growing Traffic in Rural America: Safety, Mobility and Economic Challenges in America's Heartland**

The Road Information Program

March 2005

<http://www.tripnet.org/RuralRoads2005Report.pdf>

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- Rural populations and rural road use has been increasing
- The reliance of truck traffic on rural roads to move agricultural goods is expected to increase
- Traffic fatalities occur on the nation's rural roads at a rate 2.5 times greater than all other roads
- Inadequate roadway safety design and higher speeds on rural roadways are factors in the higher fatality rate on non-interstate rural roads
- Fatal crashes due to a vehicle leaving its lane is far more likely on rural roads than on urban roads

Safety improvements to consider:

- Rumble strips
- Centerline rumble strips
- Improved signage & pavement markings
- Install lighting
- Removing or shielding roadside obstacles
- Upgrade or add guardrails
- Chevrons and post-mounted delineators along curves
- Install median barriers
- Adding turn lanes at intersections
- Resurfacing pavements
- Add or pave shoulders
- Improved highway alignment
- Construct intermittent passing lanes or two-way left turn lanes
- Widen lanes
- Add lanes



**Suggested Minimum Design Standards for Rural Subdivision Streets**  
**New Hampshire Department of Transportation**  
December 2003

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Intersection Angle	$\geq 60$ degrees (try for 90 degrees)
Cul-de-Sacs	
Length	$\leq 1,000$ ft
Diameter	$\geq 100$ ft
ROW Width	$\geq 50$ ft
Horizontal Curvature	$\geq 100$ ft radius
Grades	$\geq 0.5$ % and $\leq 10$ %
Gravel Base	$\geq 12$ inches
Asphalt Surface	
Traveled Way Width	$\geq 20$ ft (51-750 vpd) $\geq 22$ ft (751-1500 vpd) $\geq 24$ ft (1501+ vpd)
Pavement Width	44 ft (parking on both sides)
Gravel Shoulder Width	2 ft (51-200 vpd) 4 ft (201-1500 vpd) 8-10 ft (1500+ vpd)
Gravel Surface	$\leq 50$ vpd, roadway width $\geq 22$ ft
Parking	No angle parking
Sidewalks (when deemed necessary)	
Thickness	2 inches (asphalt) 4 inches (gravel base)
Width	$\geq 5$ ft
Distance from Centerline	$\geq 22$ ft
Utility Poles	Keep close to the ROW line; no closer than the ditch line

## New Hampshire Department of Transportation

### Minimum Geometric & Structural Guides For Local Roads And Streets

ADT (vpd)		0-50	51-200	201-750	751-1500	1500+
Pavement Width		18' min.	20'	20'	22'	24'
Shoulder Width		2'	2'	4'	4'	8-10'
Center of Road to Ditch Line		15'	16'	18'	19-21'	Varies
Pavement Type		Gravel	Asphalt Surface Treated	Hot Bituminous	Hot Bituminous	Hot Bituminous
Slope of Roadway		4%	3%	2%	2%	2%
Base Course Depth	Gravel	12"	12"	12"	12"	18"
	Cr. Gravel	-	-	4"	6"	6"

#### Notes:

1. Gravel surface should be paved where steep grades occur
2. For ADT greater than 1000 vpd, paved shoulders should be considered
3. Base course depths may need to be increased in areas of poor soils

## Local Low-Volume Roads and Streets

ASCE Highway Division

Federal Highway Administration

November 1992

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1990 AASHTO Green Book design guidelines generally used as standards:

Maximum Superelevation	4% (for icy areas)
Curb Radius	$\geq 15$ ft
Cul-de-Sac Radii	$\geq 30$ ft
Tapers	
Straight Bay Taper	Vary from 4:1 to 15:1
Straight or Reverse Curve Taper	Ranges from 80-120 ft
Curved Bay Taper	Typically 100-120 ft
Minimum Grade	0.5% for curbed roadways, (0.3% may be acceptable where a high type pavement with stable subgrade is utilized)
Lane Width	12 ft (9 ft minimum)
Cross Slope	1.5% to 2.0% for good surface quality 2.0% to 6.0% for poor surface quality
Shoulder Width	$\geq 2$ ft and $\leq 8$ ft
Shoulder Cross Slope	4% (6% maximum)
Pavement Width	26 ft, 12 ft lane with two 7 ft parking lanes 34 ft, two 10 ft lanes with two 7 ft parking lanes
Gutter Grade	$\geq 0.30\%$ ( $\geq 0.2\%$ in very flat areas)
Curb Height	4-9 inches (6 inches is average)
Sidewalks	Preferably near ROW lines
Sidewalk Width	$\geq 4$ ft

**Roadway Design Manual**  
**Nebraska Department of Roads**

July 2005

<http://www.nebraskatransportation.org/roadway-design/pdfs/rwydesignman.pdf>

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The NDOR design criteria generally conform to the AASHTO guidelines.

Urban Typical Cross Section for 2-Lane Undivided (pg 1-4)

Cross Slope	2%
Lane Width	12 ft
Shoulder	5 ft (4 ft minimum)
Foreslope	≤ 3:1

**Needs Study Criteria**

Future ADT (20 yrs)	Surfaced Lane Width (ft)	Shoulder Width (ft)	Paved Shoulder (ft)	Roadway Width (ft)
> 3000	12	10	8	44, 39**
1700-3000	12	8, 10*	8*	40, 44*
400-1699	12	6, 10*	8*	36, 44*
<400	12	4	---	32, 44*

\*If on Priority Commercial System

\*\* If on 4-lane divided highway

Superelevation	6%, 8% maximum for rural highways 4%, 2% minimum for low-speed urban roadways
Minimum Grade	0.50%, for rural curbed roadways and bridges 0.20% -0.35%, for urban curbed roadways 0.35%, for non-curbed roadways
Parking	≥ 20 ft from the radius return of an unsignalized intersection
Rural Driveway	Normal diameter of 24 inches; depending on ditch hydrology
Culvert Pipes	Larger pipes may be needed; minimum of 1 ft cover required at the shoulder break point
Typical Shoulder Cross Slope	4% for paved shoulders 6% for earth shoulders

## Rural Geometric Design Standards

### Marion County, Oregon

<http://publicworks.co.marion.or.us/engineering/engineeringstandards/Tables/TABLE%202.pdf>  
Cited August 2006

Road Classification	ADT (vpd)	Minimum ROW	Minimum Pavement Width	Gravel Shoulders <sup>4</sup>	Parking	Terrain Cross Slope	Design Speed (mph)	Minimum Horizontal Radius <sup>1</sup>	Maximum Superelevation (ft/ft)	Maximum Grade (%) <sup>5</sup>
Arterial	1000-10000	66'	28'	2'	None	S < 5 5=S=15 S = 15	55 45 35	1035' 660' 380'	.06	6 8 10
Collector	500-1500	60'	22'	5'	None	S < 5 5=S=15 S = 15	55 45 35	1035' 660' 380'	.06	6 8 10
Local (Through Road)	0-500	60'	22 <sup>5</sup>	5'	On Shoulder	S < 5 5=S=15 S = 15	50 40 30	925' 560' 300'	.04	7 9 12
Local (Subdivision of Cul-de-sac = 1320')	0-500	60'	22 <sup>5</sup>	5'	On Shoulder	S < 5 5=S=15 S = 15	30 25 20	460' 320' 205'	Normal Crown	8 10 12
Cul-de-sac = 1320'	0-500	60' (50' if = 500' long)	22 <sup>5</sup> (20' if = 500' long)	5'	On Shoulder	S < 5 5=S=15 S = 15	25 20 20	320' 205' 205'	Normal Crown	8 <sup>3</sup> 10 <sup>3</sup> 12 <sup>2,3</sup>

1. For minimum (centerline) radius shown, maximum superelevation must be used.
2. Grades of up to 15% may be approved. They shall be located a distance of 200 feet or more from and intersection with a major street or an intersection requiring a stop.
3. Maximum slope from center of cul-de-sac to back of cul-de-sac shall not exceed 8%.
4. Roads that are designed as bike routes shall have paved shoulders.
5. For paving of existing gravel roads, the minimum pavement width should be 20'.

Note: At intersections, the maximum longitudinal slope of all non-through streets shall be 8% for at least 50' from the edge of the intersecting pavement.

**Recommended Range of Design Speeds by Location & Functional Classification, mph**

Terrain	Rural Collector & Local Roads
Flat	35-60
Rolling	30-50

**Recommended Design Levels of Service by Location & Functional Classification**

Terrain	Rural Collector & Local Roads
Flat	C
Rolling	C-D

**Maximum Grades for Design of Highways and Streets**

Type of Terrain	Rural Collector Design Speed (mph)								
	20	25	30	35	45	50	55	60	70
	Grade (%)								
Level	7	7	7	7	7	6	6	5	4
Rolling	10	10	9	8	8	7	7	6	5
Type of Terrain	Rural Local Road Design Speed (mph)								
	20	25	30	35	45	50	55	60	
	Grade (%)								
Level	8	7	7	7	7	6	6	5	
Rolling	11	11	10	10	8	7	7	6	

Width of traveled way (Local roads)	18 ft min. (ADT <400, design speed 30 mph) 24 ft max. (ADT >2000, design speed 50 mph)
Width of graded shoulder (Local roads)	2 ft min. (ADT <400) 8 ft max. (ADT >2000)
Corner radii	Should be determined using an appropriate design vehicle
Sidewalk width	4-6 ft are common
Sidewalk setback from traveled way	≥5 ft, and desirably up to 10 ft
Sidewalk grades	<5 %

## Sources

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<http://www.revisor.leg.state.mn.us/arule/8820/9920.html>

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*Growing Traffic in Rural America: Safety, Mobility and Economic Challenges in America's Heartland*. The Road Information Program. March 2005.  
<http://www.tripnet.org/RuralRoads2005Report.pdf>

*Local Low Volume Roads And Streets*. 1992. American Society of Civil Engineers Highway Division. Federal Highway Administration.

*Marion County, Oregon Rural Geometric Design Standards*. Cited August 2006.  
<http://publicworks.co.marion.or.us/engineering/engineeringstandards/Tables/TABLE%202.pdf>

*Roadway Design Manual*. Nebraska Department of Roads. July 2005.  
<http://www.nebraskatransportation.org/roadway-design/pdfs/rwydesignman.pdf>

*Suggested Minimum Design Standards for Rural Subdivision Streets*. 2003. New Hampshire Department of Transportation.

*Traffic Engineering Handbook 5th Edition*. 1999. Institute of Transportation Engineers.

*Vermont State Design Standards: Chapter 6 Local Roads and Streets*. Vermont Agency of Transportation. October 1997.  
<http://www.aot.state.vt.us/progdev/standards/06local.htm>

## **APPENDIX B: QUESTIONNAIRE RESULTS**

### **Questionnaire**

To: (Name of County Engineer/Zoning Administrator)  
From: Paul Wiegand, SUDAS Transportation Research Engineer  
Subject: Roadway Design Standards for Rural and Suburban Subdivisions

To address concerns raised by County Engineers and other staff members involved with development review, and through funding of the Iowa Highway Research Board, SUDAS staff is undertaking a research project to develop roadway design standards for rural and suburban residential subdivisions. As a part of that project, we would like to determine what existing standards are being used, as well as concerns you might have about the current standards, or lack thereof, in your jurisdiction. Your input will be very valuable as we pursue this project. Please complete the questionnaire at your earliest convenience. You may return it in the envelope we have provided or FAX it to my attention at the number below.

If another department has authority for development regulations within your County, please forward this survey to them. If you have any questions about the project, please feel free to contact me at the address shown below.

Paul Wiegand  
Center for Transportation Research and Education  
2901 South Loop Drive, Ste 3100  
Ames, IA 50010  
pwiegand@iastate.edu  
515-294-7082  
FAX 515-294-0467



QUESTIONNAIRE  
RELATED TO  
ROADWAY DESIGN STANDARDS FOR RURAL AND SUBURBAN SUBDIVISIONS

Name of County: \_\_\_\_\_

Person completing the survey (optional): \_\_\_\_\_

1. Within new subdivisions, how are the maintenance and ownership of the roadway area dealt with?

- \_\_\_\_\_ Required to be dedicated to the County in fee; County accepts maintenance  
\_\_\_\_\_ Dedicated as an easement for public use, but no County maintenance  
\_\_\_\_\_ Dedicated as an easement for public use, and County accepts maintenance  
\_\_\_\_\_ Designated as an outlot with Homeowners Association responsible for maintenance  
\_\_\_\_\_ Designated as a private road with Homeowners Association responsible for maintenance  
\_\_\_\_\_ Other (please explain) \_\_\_\_\_  
\_\_\_\_\_

2. Does your county have warrants for paving internal subdivision roads?

Yes: \_\_\_\_\_

No: \_\_\_\_\_

If No, go to question 3.

If Yes, please provide the following information:

Roadway paving is a basic requirement of the platting and development of the subdivision? \_\_\_\_\_

If warrant is based on estimated average daily traffic (ADT), what is the threshold for paving? \_\_\_\_\_

If warrant is based on lot density (i.e. lots per acre; lots per mile),  
What is the density? \_\_\_\_\_

List other paving warrants: \_\_\_\_\_

3. Does your County have design standards for new subdivision roads?

Yes: \_\_\_\_\_

No: \_\_\_\_\_

If No, go to question 4.

If Yes, please complete the questions below or forward a copy of your standards to me by email, letter, or FAX according to the applicable contact information shown on the cover letter.

Roadway Design Standards:

Design speed: \_\_\_\_\_

Right-of-way width: \_\_\_\_\_

Pavement width: \_\_\_\_\_

Cul-de-sac radius: \_\_\_\_\_

Maximum grade: \_\_\_\_\_

Maximum length of cul-de-sac or dead end street: \_\_\_\_\_

List if different length based on different land uses

Low density residential \_\_\_\_\_

High density residential \_\_\_\_\_

Commercial \_\_\_\_\_

Industrial: \_\_\_\_\_

Pavement thickness:

HMA: \_\_\_\_\_

PCC: \_\_\_\_\_

Shoulder width (if applicable): \_\_\_\_\_

Curb required: \_\_\_\_\_

If yes, intakes and storm sewer required: \_\_\_\_\_

On-street/shoulder parking allowed: \_\_\_\_\_

Ditch geometrics (if applicable):

Fore slope: \_\_\_\_\_

Minimum width: \_\_\_\_\_

Minimum depth: \_\_\_\_\_

Back slope: \_\_\_\_\_

Storm sewer design frequency (if applicable): \_\_\_\_\_

Sidewalks required:

No: \_\_\_\_\_

Yes: \_\_\_\_\_

One side: \_\_\_\_\_

Both sides: \_\_\_\_\_

Within the right-of-way: \_\_\_\_\_

Within easements on private property: \_\_\_\_\_

Driveways:

Restrictions on access

Number per mile \_\_\_\_\_

Width: Minimum: \_\_\_\_\_

Maximum: \_\_\_\_\_

Minimum culvert size (if applicable): \_\_\_\_\_

Spacing requirement:

To nearest intersection: \_\_\_\_\_

Between driveways: \_\_\_\_\_

Material requirement: \_\_\_\_\_

Do your standards provide a specific location within the right-of-way for underground utilities, such as rural water and natural gas?

Yes: \_\_\_\_\_

No: \_\_\_\_\_

4. Does your County have paving warrants for unpaved roads connecting the subdivision with a paved road?

Yes: \_\_\_\_\_

No: \_\_\_\_\_

If No, go to question 5.

If yes, please provide the following information:

If warrant is based on average daily travel volume, what is the volume?

\_\_\_\_\_

If warrant is based on density (i.e. lots per acre; lots per mile), what is the density? \_\_\_\_\_

Other paving warrants: \_\_\_\_\_

5. Comments and concerns about your regulations:

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## Questionnaire Responses

Questions 1-3 (frequency indicated in parentheses)

Question 1*	Question 2	Question 3	Question 4	ROW Width, ft	Pavement Width, ft	Cul-de-sac Radius, ft
A (8)	N (21)	Y (25)	N (33)	32 (1)	18-41 (1)	30 (1)
B (6)	Y1 (13)	N (13)	Y1, Y3 (1)	42-80 (1)	20 (1)	35.5, 39.5 ROW (1)
C (6)	Y3 (1)		Y (1)	50 (3)	20-31 (1)	40 (1)
D (2)	Y4 (1)			60 (3)	<b>22 (6)</b>	40-45 (1)
E (22)				60-80 (1)	22-31 (1)	42.5 (1)
Other (12)				<b>66 (7)</b>	<b>24 (5)</b>	45 (2)
				66 min (1)	26 (1)	50 (1)
				70 (1)	26-49 (1)	50 min (1)
				80 (1)	30 incl. shoulders (1)	50, 60 ROW (1)
				depends (1)	depends (2)	50, 80 ROW (1)
					N/A (1)	55 (1)
						75 (1)
						80 (1)
						80, 120 ROW (1)
						100 (1)
						100 ROW, 80 turnaround (1)
						100, 120 ROW (1)
						120 (1)
						132 (1)

\* Some Multiple Responses

Max. Grade, %	Max. Length of Cul-de-sac or Dead End Street, ft	Pavement Thickness HMA, in	Pavement Thickness PCC, in
6 (1)	500 (2)	4 on 12 in. stone (1)	<b>6 (9)</b>
<b>7 (6)</b>	<b>600 (7)</b>	4 base, 1.5 wearing course (1)	6 min (1)
7-8 (1)	600, up to 1000 w/ approval (1)	6.5 w/ 4 in. rolled stone base (1)	<b>7 (6)</b>
8 rec (1)	750 (1)	6.5+ (1)	7 on 8 in. stone
9 (2)	800 (1)	<b>7 (5)</b>	N/A (2)
<b>10 (6)</b>	1000 (2)	7 min (1)	
11 (2)	1300 (1)	3-4 on 4 in. choke stone, 8 McCadem Stone (1)	
12 (2)	4500 (1)	6 in. base, 4 in. subbase, 2 in. cover (1)	
	variable (1)	8 (1)	
	N/A (1)	8 w/ 5 in. rock base (1)	
		8.5 (2)	
		N/A (2)	

Shoulder Width, ft	Curb Required	Intakes & Storm Sewer Req'd	On Street / Shoulder Parking Allowed?
2 min (1)	Yes (5)	<b>Yes (8)</b>	<b>Yes (8)</b>
2 (1)	<b>No (10)</b>	Yes, if city design (1)	Yes , on wider street (1)
3 (1)	can use (1)	No (1)	No(4)
<b>4 (8)</b>	urban sections (1)	as engineered (1)	31' B-B (1-side), 39' B-B (both sides)
4 min (1)	on island (1)	where proper drainage facilities do not exist (1)	N/A (2)
4-6 (1)	optional (2)	when curb is 31' B-B and storm sewer (1)	
5 (1)			
6 (1)			
7 (1)			
N/A (1)			

Ditch Foreslope	Ditch Minimum Width, ft	Ditch Minimum Depth, ft	Ditch Backslope	Storm Sewer Design Frequency	Sidewalks Required
2:1 (4)	3 (1)	1 (1)	1.5:1 (1)	5 yr (1)	Yes (3)
< 2:1 (1)	4 (3)	<b>2 (8)</b>	2:1 (4)	10 yr (1)	<b>No (18)</b>
<b>3:1 (10)</b>	5 (1)	2.5 (2)	< 2:1 (1)	25 yr (2)	Depends (3)
< 3:1 (1)	6 (2)	3 (5)	2.5:1 (1)	50 yr (1)	
4:1 (1)	9 (1)		<b>3:1 (9)</b>	100 yr (1)	
6:1 w/ drainage structure, 10:1 w/ out	10 (2)		< 3:1 (1)	varies (1)	
	13 (1)			N/A (4)	
	15 (1)				
	variable (1)				

Driveways per Mile	Driveways Min. Width, ft	Driveways Max. Width, ft	Driveway Min. Culvert Size, in	Driveway Spacing to Nearest Intersection, ft	Spacing Between Driveways, ft
12 (2)	16 (2)	24 (1)	12 (1)	150 (2)	100 (1)
30 (1)	18 (1)	36 (1)	<b>15 (10)</b>	75 (1)	250 (1)
1 per lot (2)	<b>20 (4)</b>	40 (2)	<b>18 (6)</b>	100 (1)	75 (1)
4 for ag. Zoned (1)	<b>24 (5)</b>	45 (1)	24 (1)	125 (1)	N/A (4)
N/A (4)	40 (1)	50 (1)		N/A (4)	varies (1)
no restriction (1)	N/A (1)	N/A (1)			1 per lot (1)

Driveway Material Requirement	Specific ROW location for Utilities?
2 in. of 3/4 in. crushed rock (1)	Yes (6)
4 in. rolled stone (1)	<b>No (17)</b>
Class B gravel or Class A crushed stone (1)	
CMP (2)	
CMP or RCP (2)	
concrete (1)	
granular material (1)	
N/A (1)	
rock surface min. (1)	
Steel or Concrete (2)	

#### Question 4

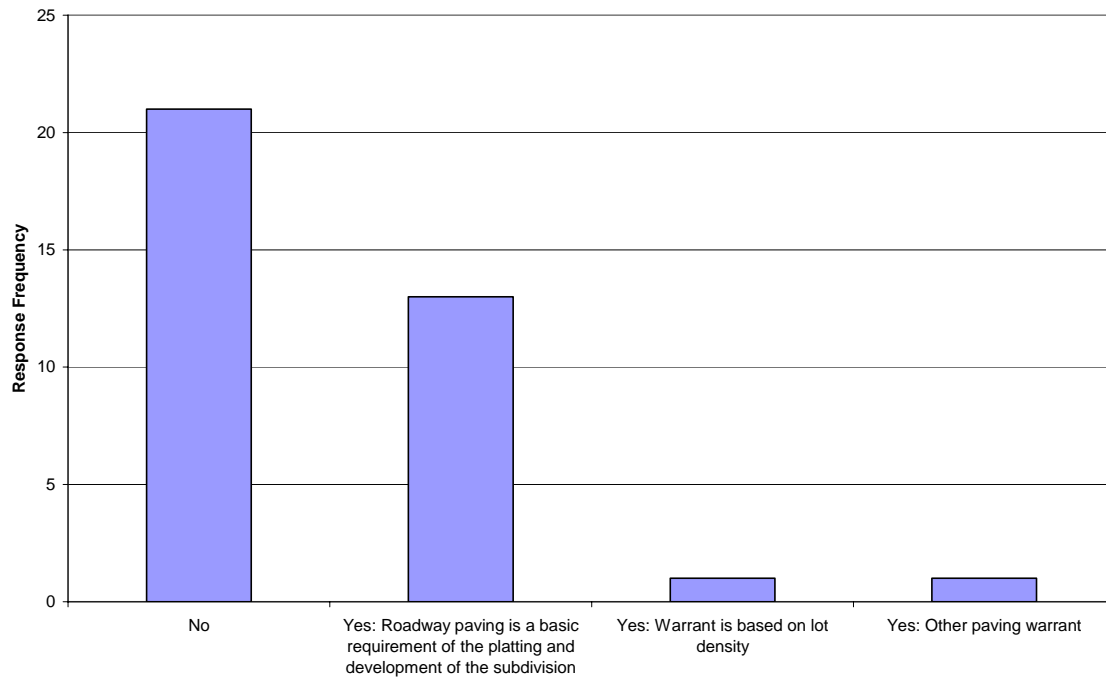
Question 4: Does your County have paving warrants for new subdivision roads?	Frequency	ROW Width	Frequency	Pavement Width	Frequency	Cul-de-sac Radius	Frequency
No	33	32 ft	1	18-41 ft	1	30 ft	1
Yes	1	42-80 ft	1	20 ft	1	35.5 ft	1
Yes: warrant is based on ADT and another paving warrant	1	50 ft	3	20-31 ft	1	40 ft	1
		60 ft	3	22 ft	6	40-45 ft	1
		60-80 ft	1	22-31 ft	1	42.5 ft	1
		66 ft	8	24 ft	5	45 ft	2
		70 ft	1	26 ft	1	50 ft	4
		80 ft	1	26-49 ft	1	55 ft	1
		depends	1	30 ft incl. shoulders	1	75 ft	1
				depends	2	80 ft	3
				N/A	1	100 ft	2
						120 ft	1
						132 ft	1

Max. Grade	Frequency	Max. Length of Cul-de-sac or Dead End Street	Frequency	Shoulder Width	Frequency
6%	1	500 ft	2	2 ft min.	1
7%	6	600 ft	7	2 ft	1
7-8 %	1	600 ft, up to 1000 ft w/ approval	1	3 ft	1
8 % recommended	1	750 ft	1	4 ft	9
9%	2	800 ft	1	4-6 ft	1
10%	6	1000 ft	2	5 ft	1
11%	2	1300 ft	1	6 ft	1
12%	2	4500 ft	1	7 ft	1
		variable	1	N/A	1
		N/A	1		

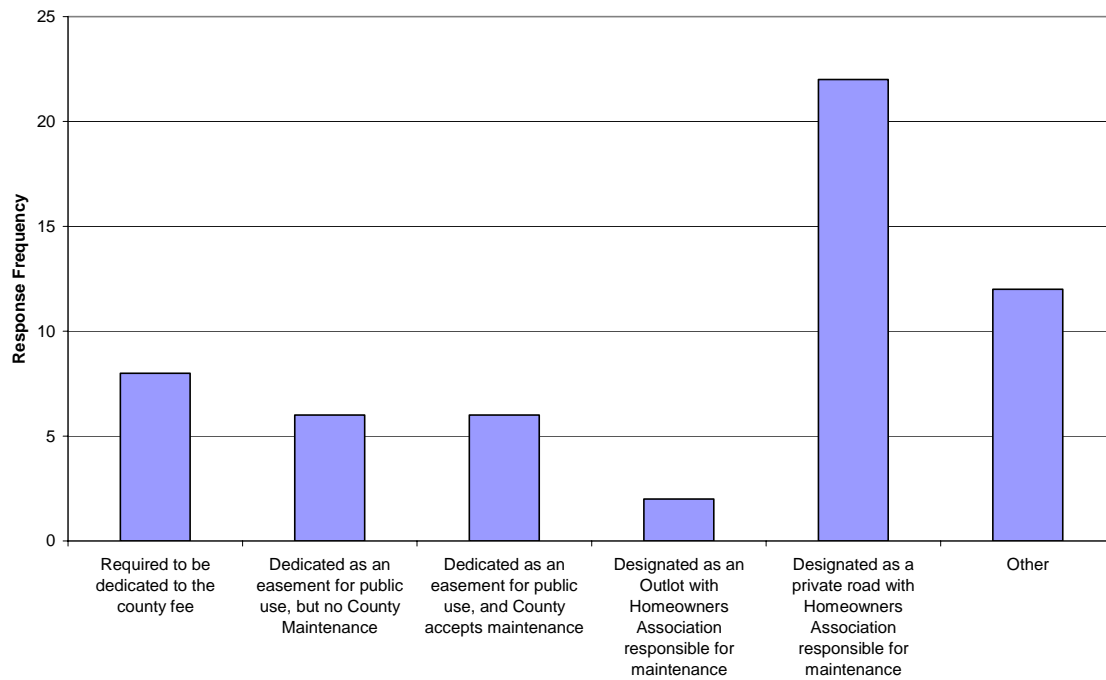
Driveway Min. Culvert Size	Frequency	Specific ROW location For Utilities?	Frequency
12 in	1	Yes	6
15 in	10	No	17
18 in	6		
24 in	1		



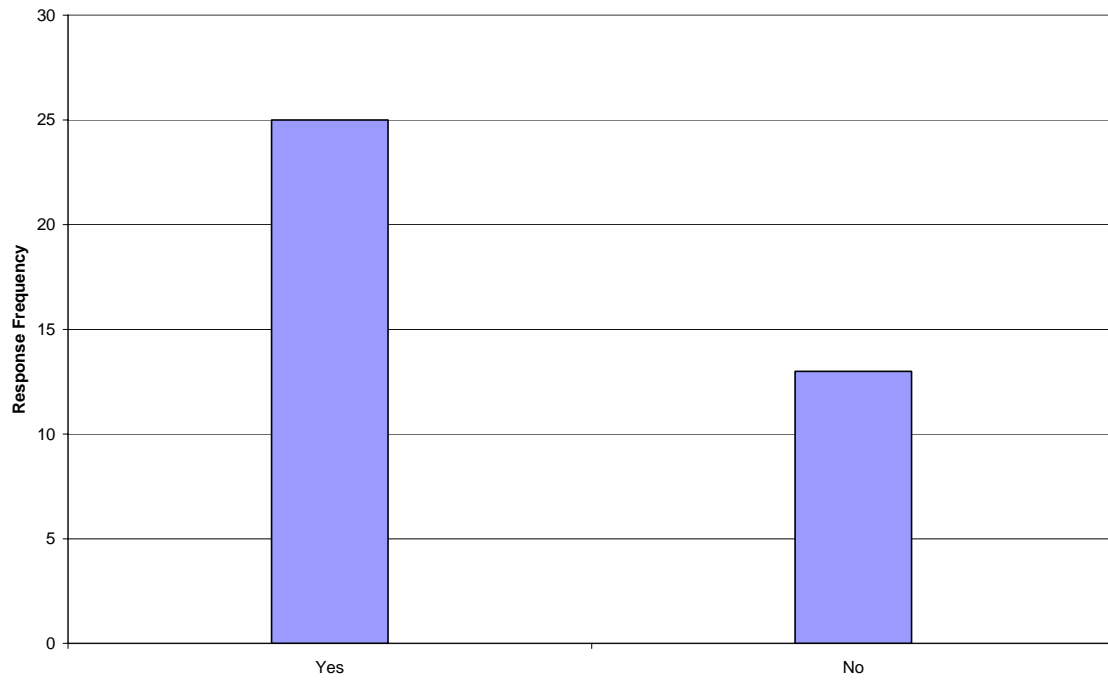
Does your county have warrants for paving internal subdivision roads?



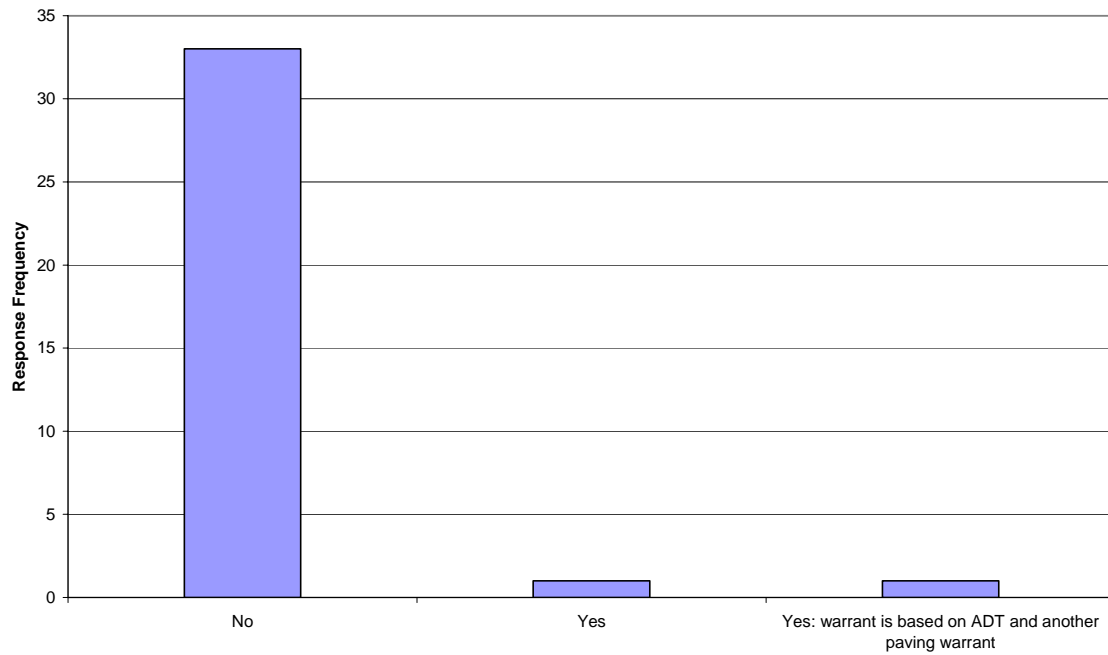
Within new subdivisions, how is the roadway area dealt with?



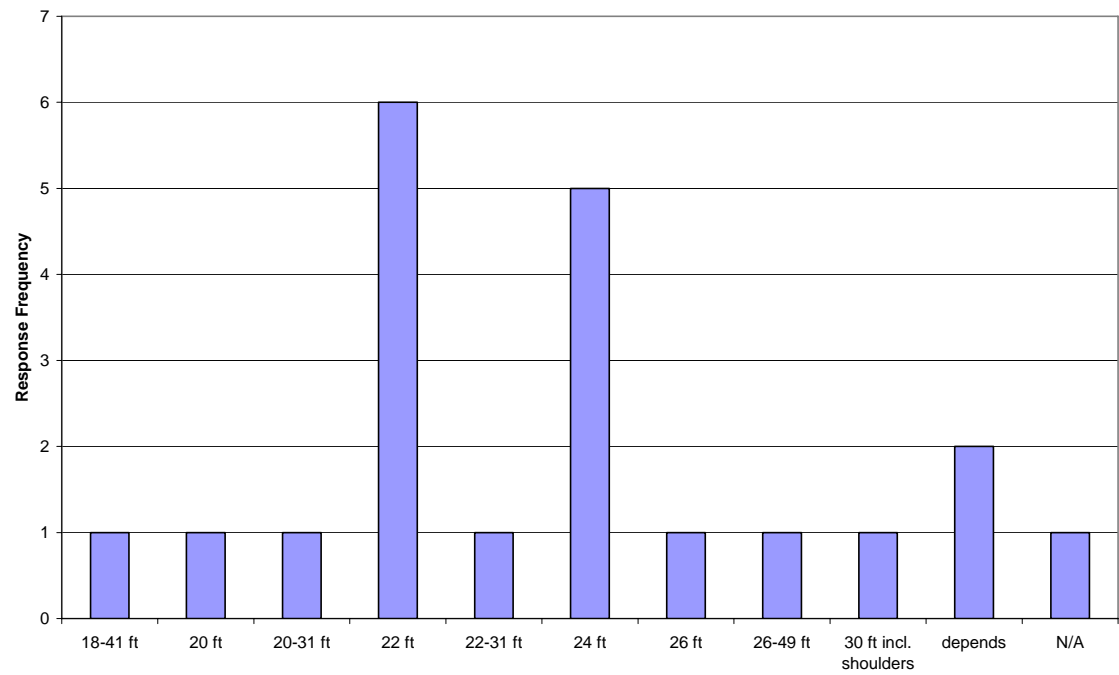
**Does your County have paving standards for new subdivision roads?**



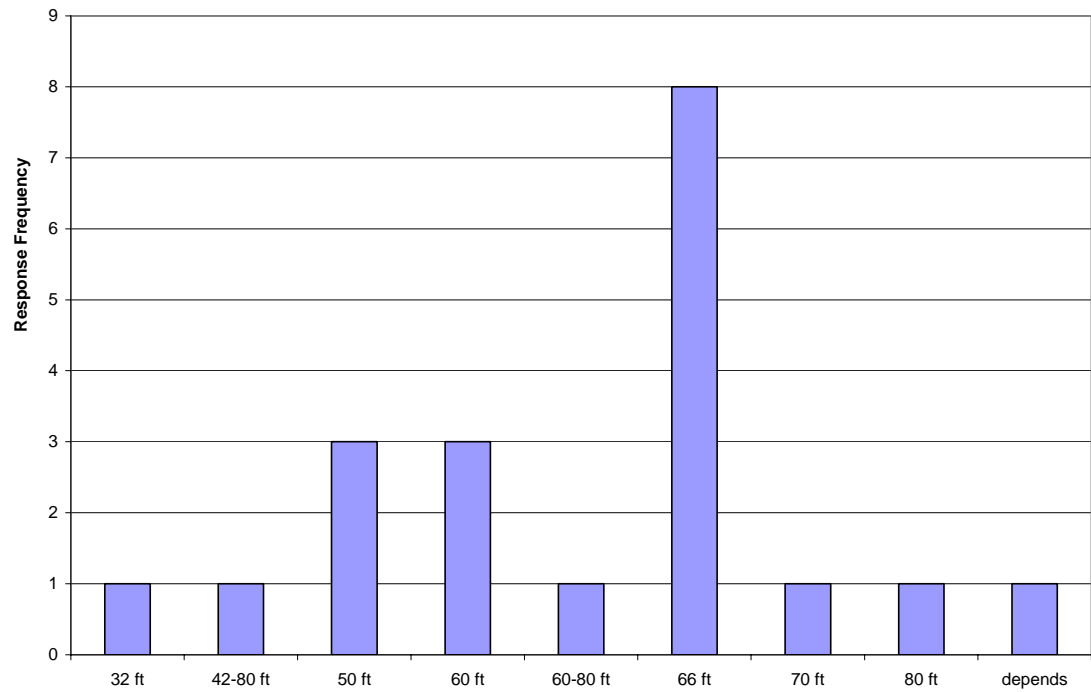
**Does your County have paving warrants for unpaved roads connecting the subdivision with a paved road?**



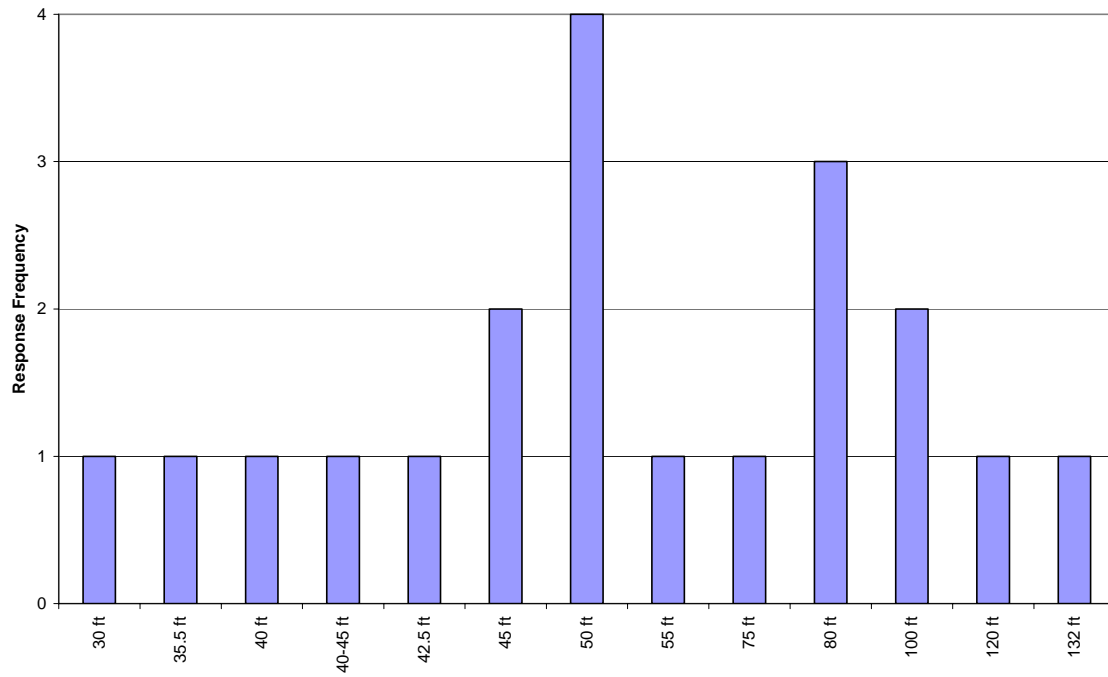
Pavement Width



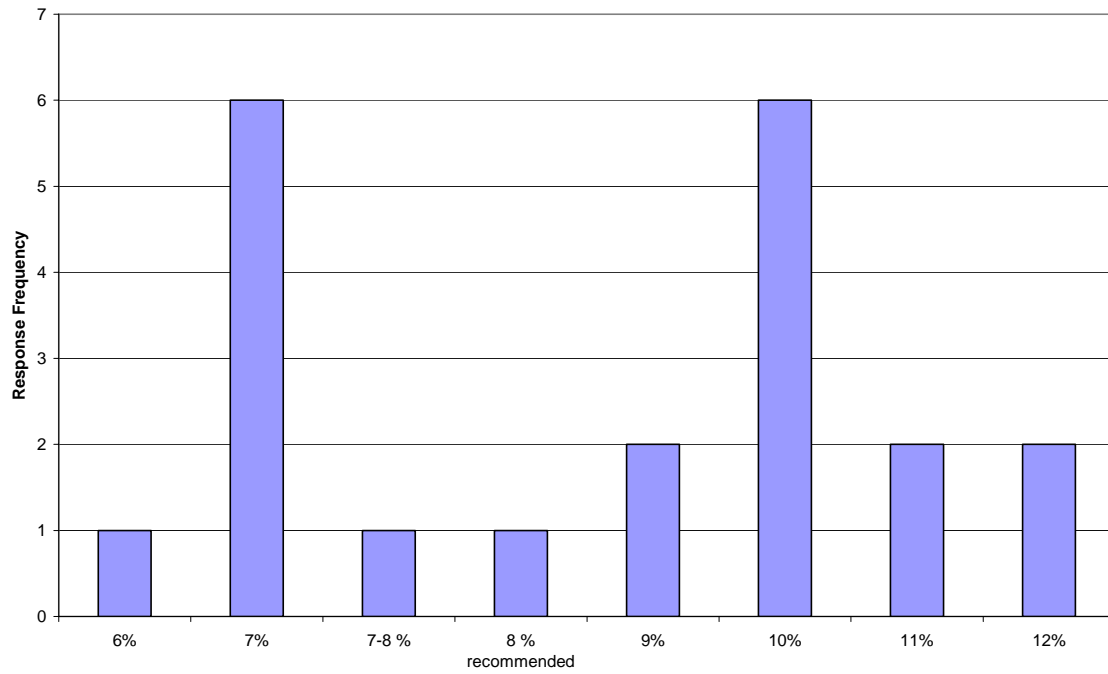
ROW Width



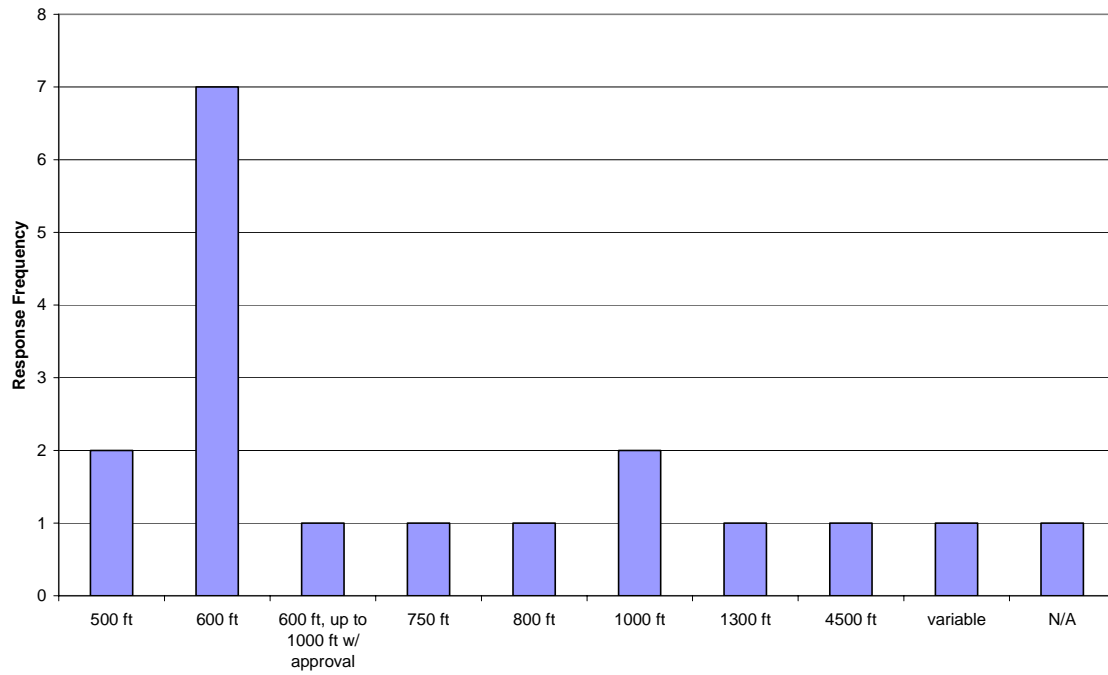
Cul-de-sac Radius



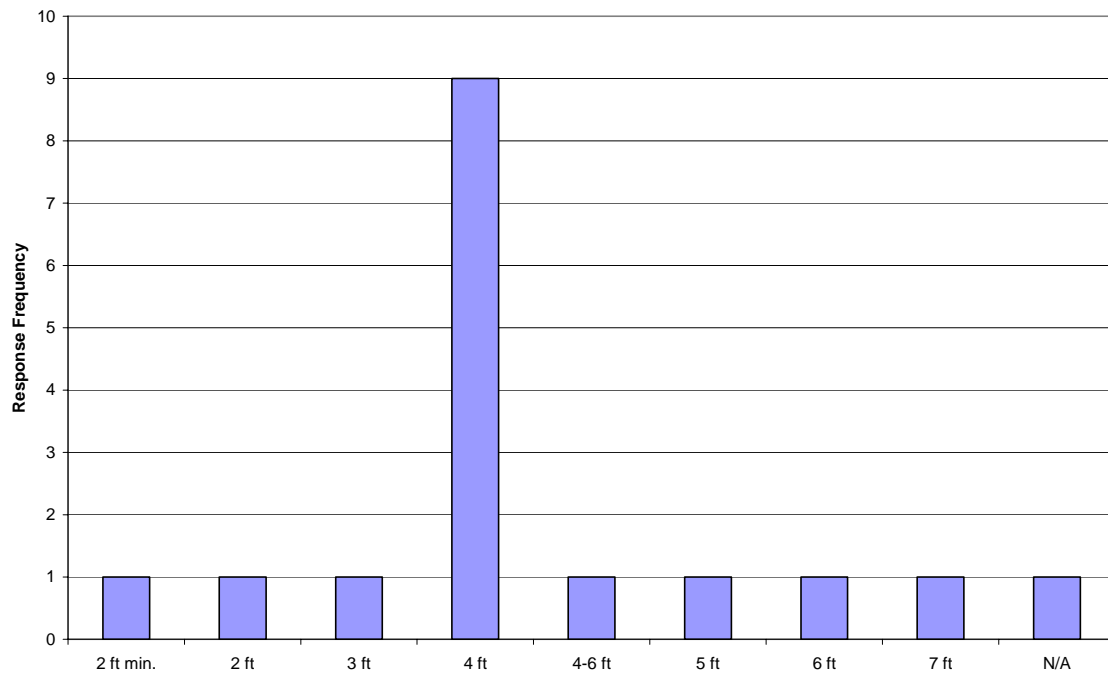
Maximum Grade



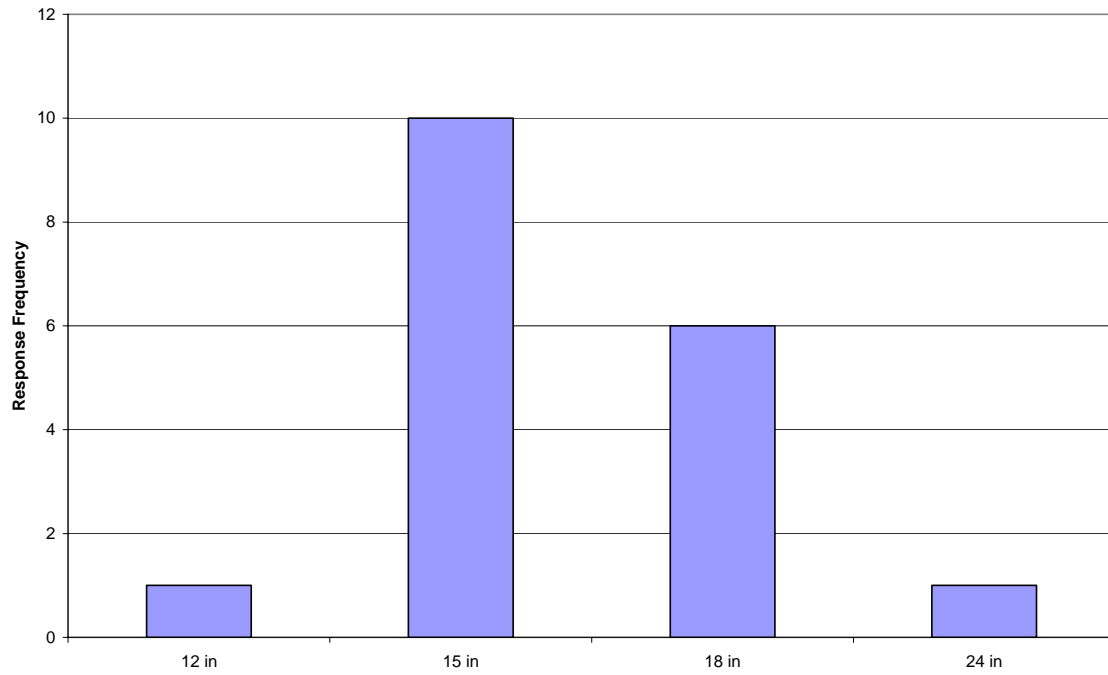
Maximum Length of Cul-de-sac or Dead End Street



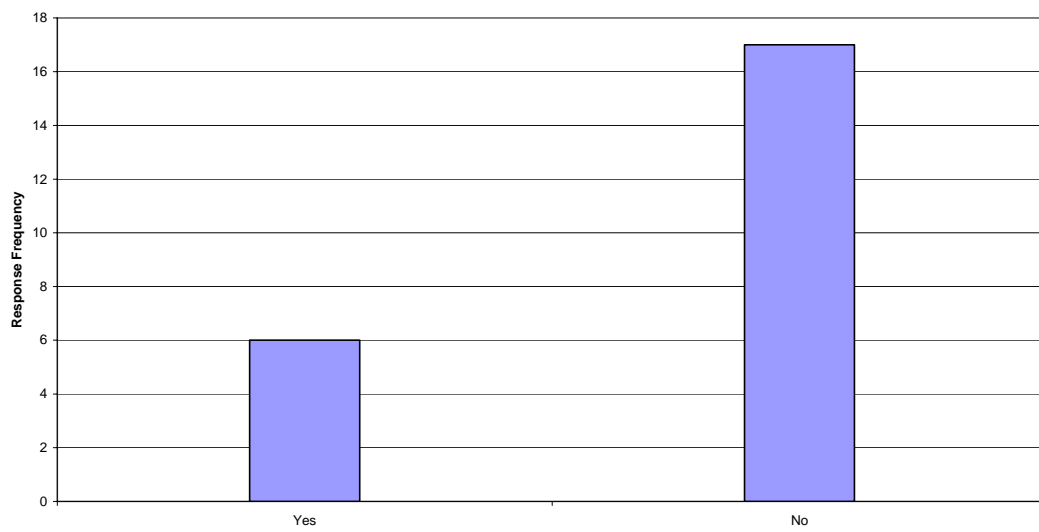
Shoulder Width



Minimum Driveway Culvert Size



Specific ROW location For Utilities?



## APPENDIX C: TYPICAL CROSS-SECTIONS

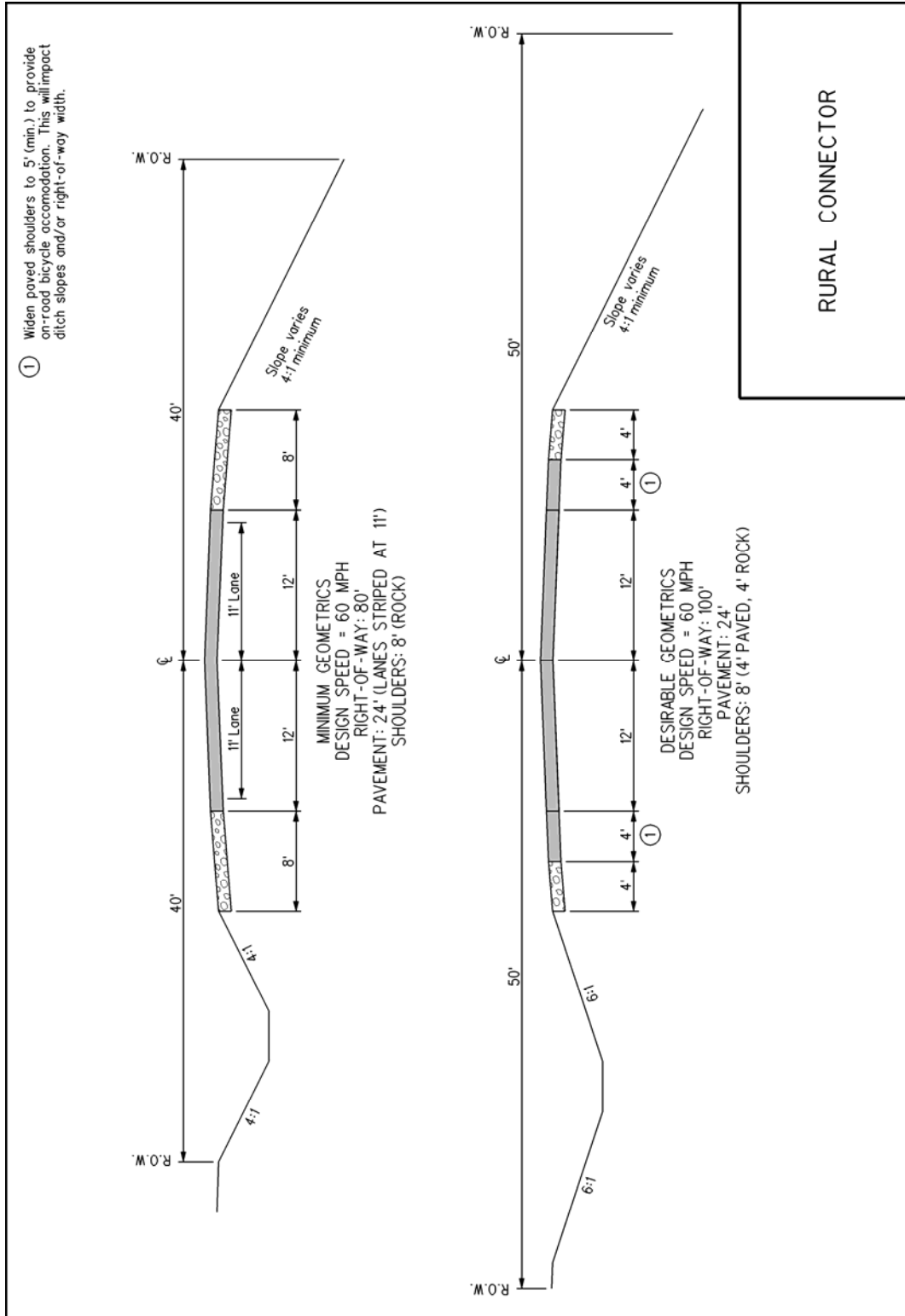


Figure C.1 Rural connector

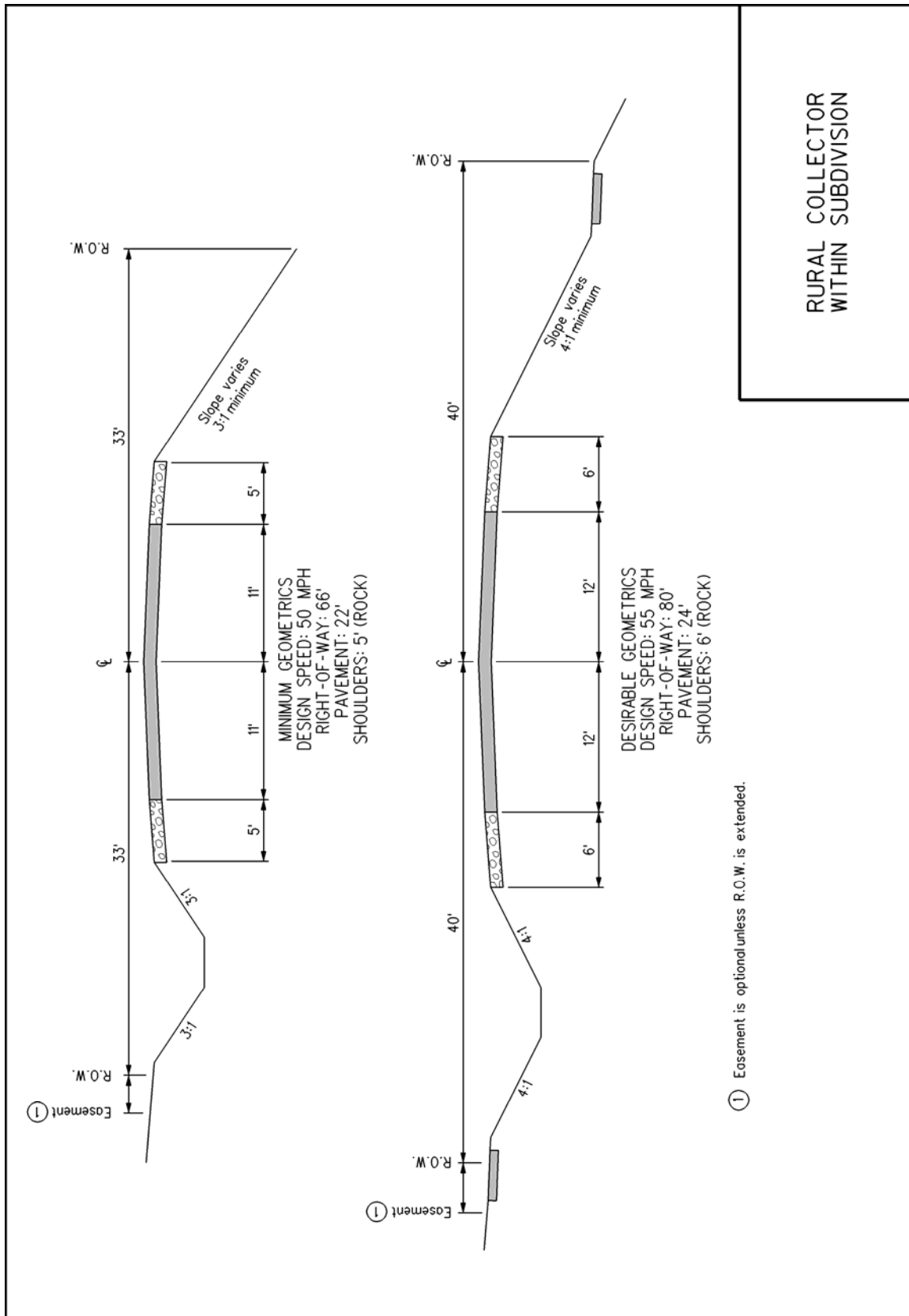


Figure C.2 Rural collector within subdivision



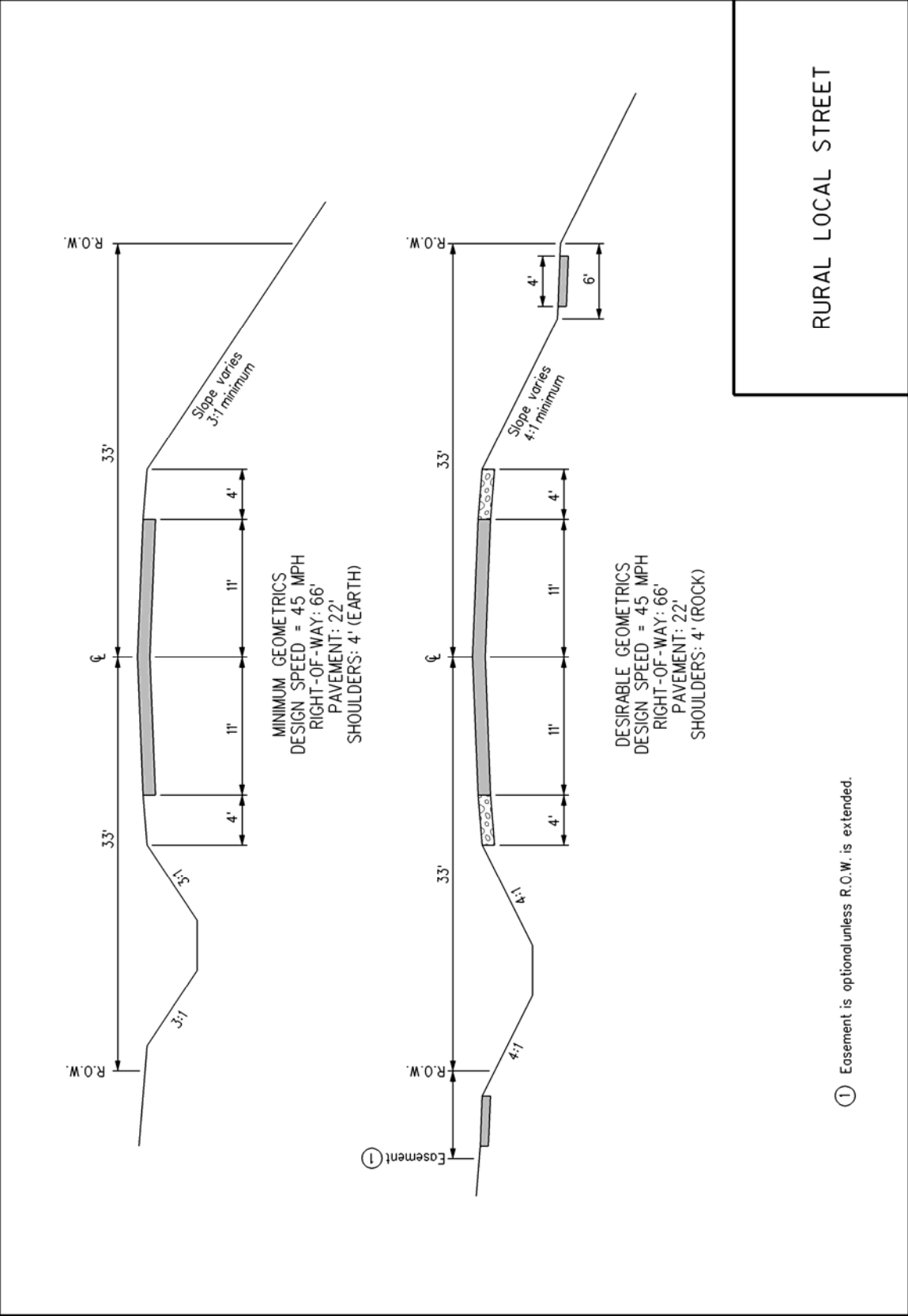


Figure C.3 Rural local street

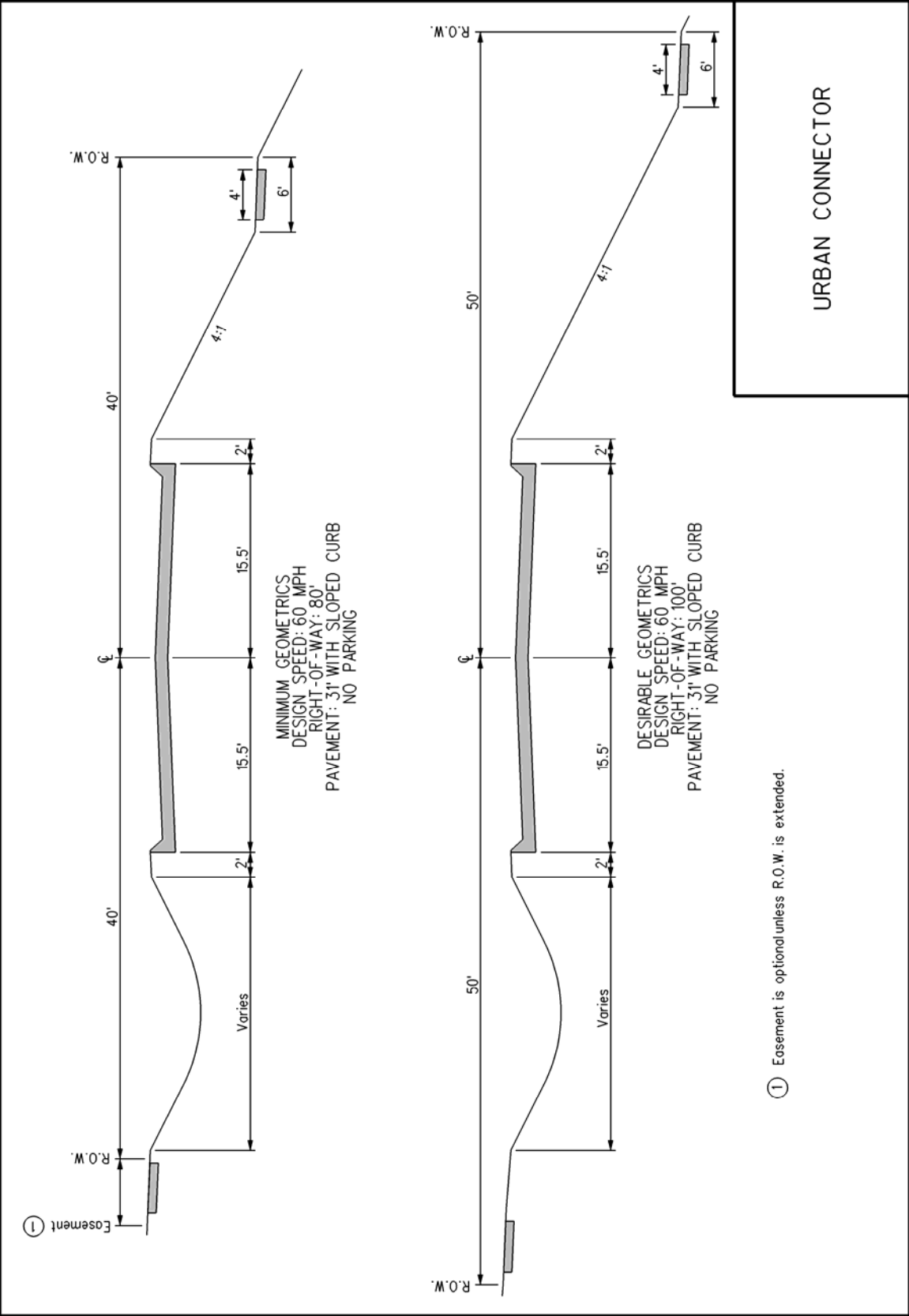


Figure C.4 Urban connector

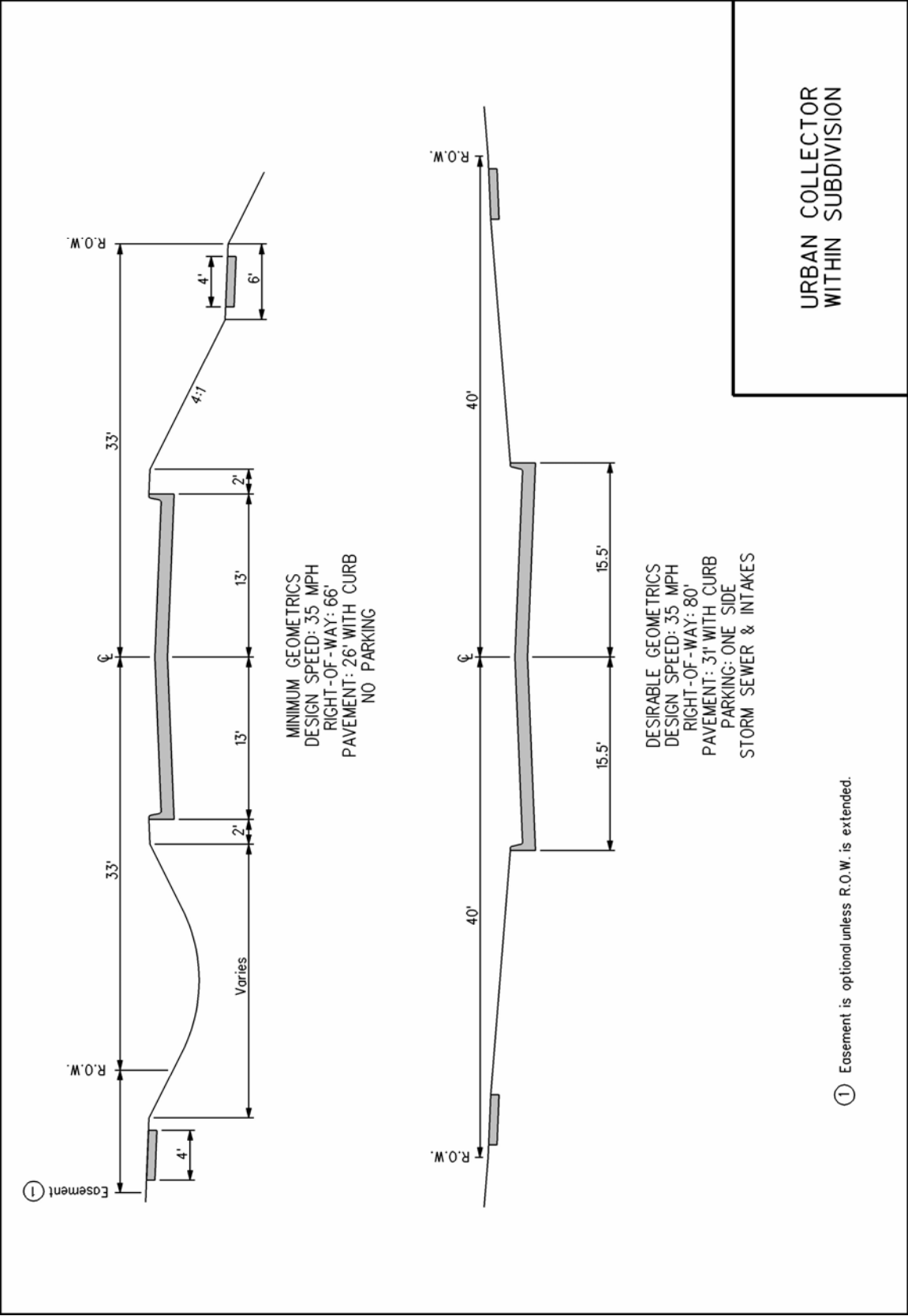


Figure C.5 Urban collector within subdivision

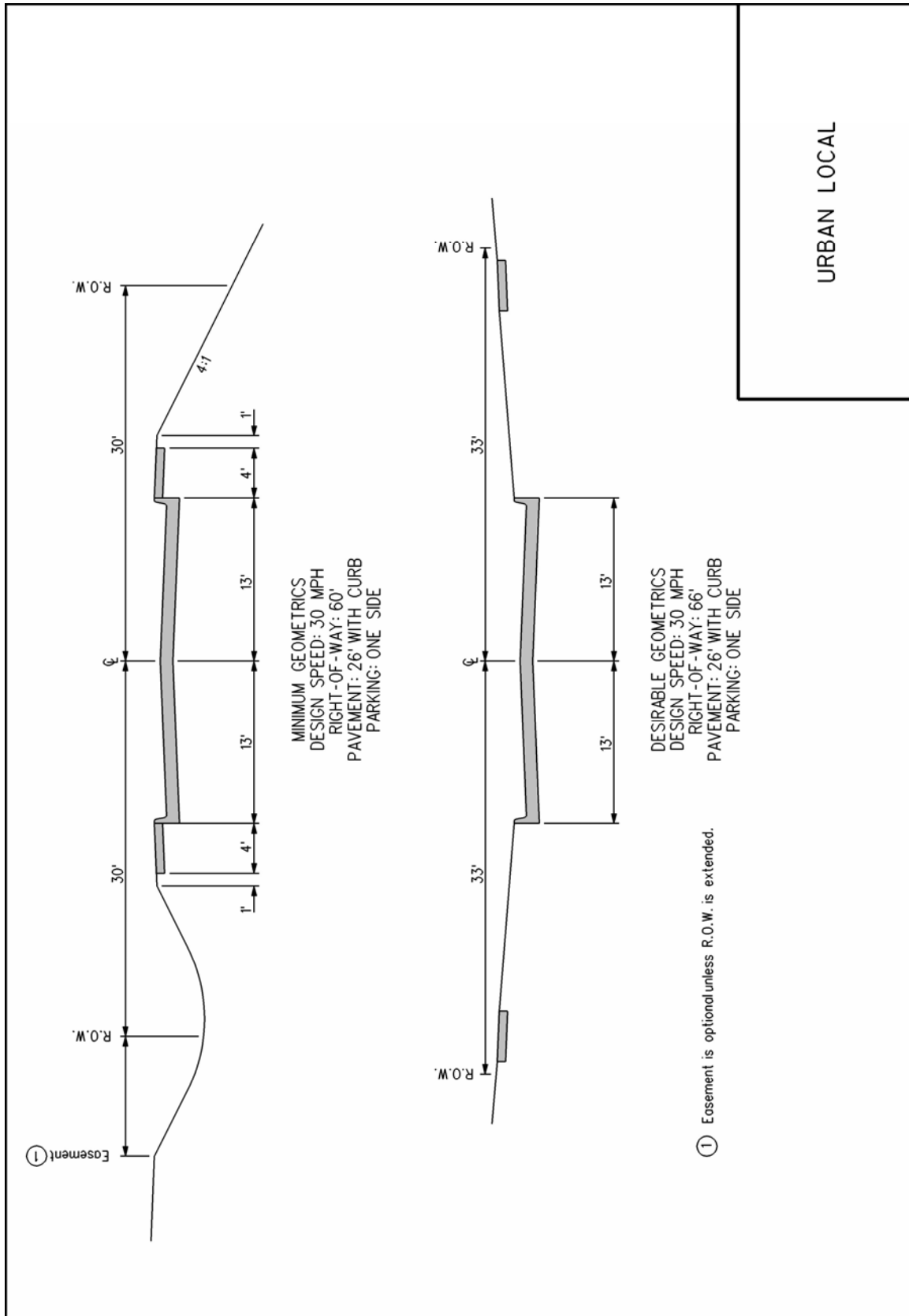


Figure C.6 Urban local

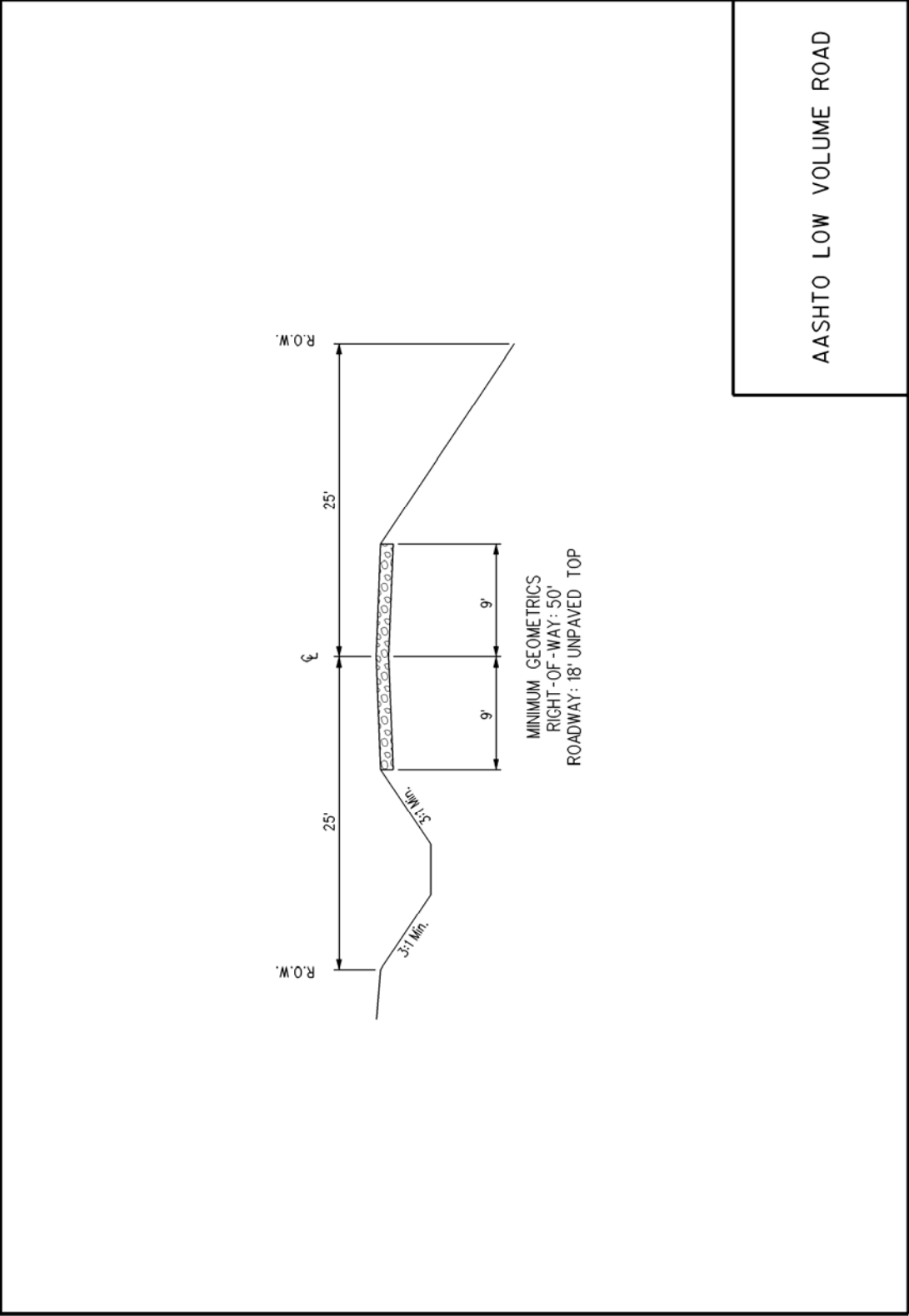


Figure C.7 AASHTO low-volume road

## TYPICAL RURAL UTILITY LOCATIONS



- A. R.O.W. width varies: see Chapter 5, Section 5C-1, Tables 1 to 5 for dimensions.
- B. When utilities are in the R.O.W, the following should be adhered to unless otherwise provided/approved:
  1. All utilities should be buried. When overhead utilities are allowed to cross the roadway, the minimum vertical clearances are 20 feet for the main cable, and 18 feet for services.
  2. Telephone, cable TV, and water: install on the east and south side of the road.
  3. Gas and electric: install on the west and north side of the road.
  4. Sanitary sewer: install on the west and north side of the road.
- C. Water mains, valves, and hydrants: Rural water mains are normally located in water main easements. If the size and pressure of the rural water main allows the placement of hydrants, the hydrant will be placed between the water main and the roadway at a location directed by the jurisdiction. If the water main must be
- D. Utility Easements - Telephone, fiber optic, cable TV, electric and gas lines should be located in front or rear yard easements on all local and minor collector routes. For major collectors and arterials, these utilities may be placed in the R.O.W. upon approval of the Jurisdiction. Normally, telephone and cable TV lines are placed in rear yards: fiber optic, electric and gas lines in front yards. Placement of electric lines in rear yards will depend on transformer locations and will also require approval of the electric company and Jurisdiction.
- E. Electric: the recommended depth of bury for electric cable is 4 feet. The minimum depth of bury for electric lines as per the National Electric Safety Code is:
  - 8kV to 50kV cable - 30 inches minimum
  - Up to 600-volt cable - 24 inches minimum
  - Street Light cable - 18 inches minimum
- F. Alternatives (ALT.) locations used when utility easements do not exist.

D-1

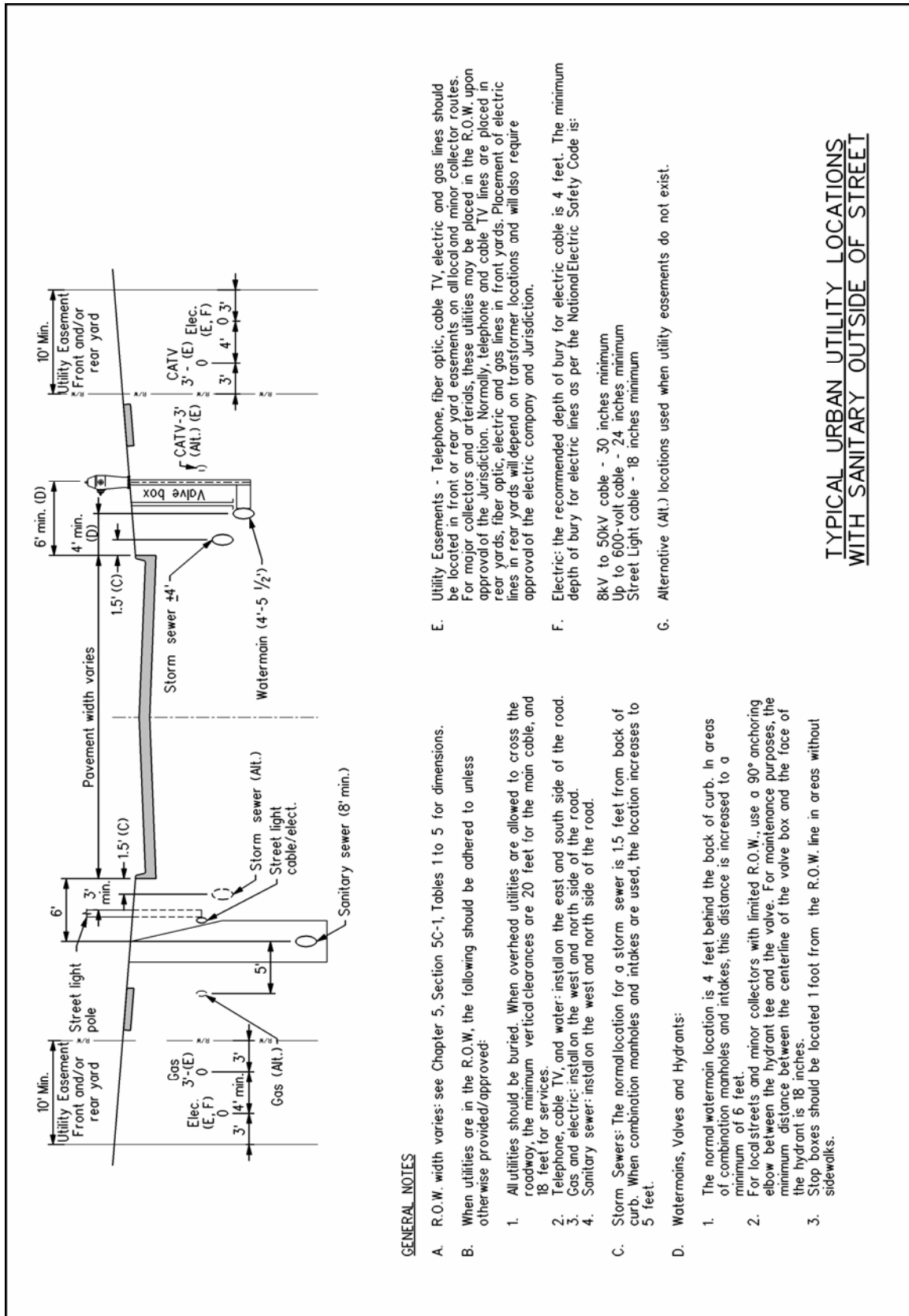


Figure D.2 Typical urban utility locations with sanitary outside of street

**Figure D.3 Typical urban utility locations with sanitary under the street**