DIVISION V
DESIGN CRITERIA

SECTION 5200 STREETS

Approved and Adopted this 17th day of April, 1996

Kansas City Metropolitan Chapter
of the American Public Works Association

Table of Contents

DIVISION V
DESIGN CRITERIA

SECTION 5200 STREETS

SECTION 5201 GENERAL

5201.1 **Introduction:** The purpose of this criteria is to provide uniform procedures for designing and checking the design of streets in the Kansas City Metropolitan area. Specific criteria have been developed and are applicable to the types of conditions ordinarily encountered in local urban and suburban areas. Other special situations may be encountered that require added criteria or more complex design than included herein.

In addition to this criteria, street improvements shall be designed to conform to applicable codes, regulations, and ordinances as established by the local governing agency. Streets shall be designed in accordance with the classifications determined by the local governing agencies and shall conform to APWA Standard Drawing Typical Sections, unless otherwise approved. Plans for said improvements shall be submitted to the local governing agency for approval and shall include all information as may be required or described hereinafter.

5201.2 **Definitions:**

A. **City Engineer:** The term City Engineer, as used in this criteria, shall represent the state, county, city, or other governmental body's representative responsible for technical decisions concerning the project. Such person may be the Director of Public Works, City or County Engineer, Administrator or any other person empowered by the governing agency to make such decisions.

B. **Engineer:** The term Engineer, as used in this criteria, shall represent the Engineer or Designer who performs the actual design work. The design shall be accomplished under the direction of a Registered Professional Engineer. Nothing in this criteria is intended to alter or circumvent local, state, or federal laws or regulations regarding liability and/or responsibility for such designs.

5201.3 **Abbreviations:**

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
FHWA	U.S. Department of Transportation/Federal Highway Administration
MUTCD	Manual of Uniform Traffic Control Devices
NGVD	National Geodetic Vertical Datum
ITE	Institute of Transportation Engineers
R/W	Right-of-Way

5201.4 **Governing Specifications:** Design shall be in accordance with the latest edition of the following specifications and the current interim supplements thereto except as modified herein or modified for the specific project:

A. A Policy on Geometric Designs of Highways and Streets, AASHTO.

B. Manual on Uniform Traffic Control Devices for Streets and Highways. FHWA.

C. Roadside Design Guide, AASHTO.

D. Design of Pavement Structures, AASHTO.

SECTION 5202 FUNCTIONAL CLASSIFICATION OF STREETS:

5202.1 **Major Arterial Streets (or Primary Arterial, or Urban Principal Arterial):** Streets that serve the highest traffic volume corridors and the longest trip. Provides travel between business districts and outlying residential areas, between major inner city communities and between major suburban centers, and connects communities to major state and interstate highways. No or limited access is allowed from residential streets. Access is usually partially controlled. Spacing of major arterial streets is generally from two kilometers to eight kilometers.

5202.2 **Minor Arterial Streets (or Secondary Arterial, or Urban Minor Arterial):** Streets that interconnect and augment the major arterial streets. No or limited access is allowed from residential lots. Accommodate trips of moderate length at a lower level of travel mobility than major arterial streets. Spacing of minor arterial streets is generally from one kilometer to five kilometers.

5202.3 **Industrial/Commercial Collector (or Collector, or Urban Collector):** Streets that collect traffic to and from commercial or industrial areas and distribute it to arterial streets.

5202.4 **Residential Collector Streets (or Collector, or Urban Collector):** Streets that collect traffic to and from residential areas and distribute it to arterial streets. Limited access is allowed from residential lots. Desirable maximum ADT = 3,000 for residential collector streets.

5202.5 **Residential Local Streets (or Local, or Urban Local):** Streets that only carry traffic having its origin or destination within the immediate neighborhood. Desirable maximum ADT = 1,000 for local streets. (ADT = ten trips per day per typical single-family residence.)

5202.6 **Residential Access Streets:** Streets that carry traffic between residential lots and residential local streets or residential collector streets. Residential access streets usually carry no through traffic and include short loop streets, cul-de-sacs, and courts. Desirable maximum ADT = 200 for cul-de-sacs and 400 for loop streets. Maximum length of cul-de-sacs = 150 meters and 300 meters for loop streets. (ADT = ten trips per day per typical single-family residence.)

SECTION 5203 GENERAL STREET DESIGN CRITERIA:

5203.1 **Design Criteria:** This section governs the general design requirements for the following street classifications (see notes on page 52-4):

	Major Arterial	Minor Arterial	Industrial/ Commercial Collector	Residential[4] Collector	Residential[4] Local	Residential[4] Access
Number of Through Traffic Lanes[2]	4-6	3-4	2-4	3	2	2
Minimum Width of Traffic Lanes (Excluding curb & gutter)	3.6m	3.6m	3.6m	3.6m	3.3m	3.2m-3.6m
No. of Parking Lanes	0-2	0-2	-0-	0-2	0-2	0-1
Width of Parking Lanes	2.5m	2.5m	-0-	2.5m	2.5m	2.5m
Width of Median	5m-12m	0-5m	-0-	-0-	-0-	-0-
Min. R/W Width[5]	30m-45m	25m	20m-25m	20m	15m	15m
Min. Design Speed km/h[8]	80	60	60	50	40	30
Minimum Stopping Sight Distance	120m-150m	80m-100m	70m-80m	60m	50m	40m
Min. K Sag Vert. Curve[3]	25-32 (17 w/lighting)	20-25 (11 w/lighting)	15 (8 w/lighting)	12 (6 w/lighting)	10 (4 w/lighting)	6 (3 w/lighting)
Min. Radii Hor. Curves[9]	333m (2% Superelevation)	213m	152m	91m	56m	30m
Min. Hor. Sight Distance	(Per AASHTO Requirements)					
Sidewalks	2	2	2	2	1-2	0-1
Maximum Grade[6]	6%	7%	6%	8%	10%	12%

METRIC

	Major Arterial	Minor Arterial	Industrial/ Commercial Collector	Residential[4] Collector	Residential[4] Local	Residential[4] Access
Minimum Grade[7]	1%	1%	1%	1%	1%	1%
Curb Return Radius	10m - 15m	10m	9m Comm. 15m	8m 10m	6m 8m	6m 8m
Min. Distance from Intersection of R/W to Driveway Curb-cut	75m	60m	45m	30m	7m	7m
Intersection Sight Distance			(See Article 5203.9)			
Maximum Grade at Intersection w/stop	---	---	---	3% (within 23m)	5% (within 15m)	5% (within 7m)
Minimum Spacing of Similar Roadways	(See Section 5202)			400m	60m	53m

NOTES:

1. *At end of cul-de-sac, minimum design speed = 4.5km/h, with corresponding minimum horizontal radius = 7m , minimum stopping sight distance = 23m ; minimum K Crest = 1 , and minimum K Sag = 1.5 (0.6 w/lighting).*

2. *All street design is subject to local governing agency approval.*

3. *K values for crest and sag vertical curves may be determined using the chart on Figure 1(M) or 2(M), or in accordance with AASHTO - A Policy on Geometric Design of Highways and Streets.*

4. *See Figure 4(M) for typical residential street layout.*

5. *Consideration should be given to providing a 5m minimum wide utility easement along each side of the right-of-way for residential access streets and 3m wide utility easements for all other streets.*

6. *Absolute maximum grade = 10% for residential collectors, 13% for residential local streets, and 15% for residential access streets.*

7. *Absolute minimum grade = 0.8% and should only be used for relatively short distances.*

8. *The 3.2m lane width for residential access streets shall only be used in a planned development where a minimum of four off-street parking spaces are provided for each dwelling unit.*

9. *50km/h design speed with corresponding horizontal and vertical curve design criteria may be used for industrial commercial collector streets under special conditions when approved by the City Engineer.*

10. *The minimum radii shown is based on the AASHTO design for low-speed urban streets with no superelevation except for major arterials. The minimum radii for major arterials is based on 2% superelevation.*

5203.2 **Maximum and Minimum Gradient:** The maximum and minimum gradient for streets as noted in Section 5203.1 may be exceeded only upon written approval of the local governing agency.

5203.3 **Shoulder Gradients:** The finished grade within the limits of the right-of-way shall slope from 2% minimum, to 4% maximum measured above the back of the curb. The grading gradients may be varied only upon written approval of the local governing agency. Back slopes beyond the R/W line shall be 1:3 maximum, 1:4 desirable.

5203.4 **Tangent Length:** No tangent length shall be required between reverse curves for residential access and local streets. The minimum tangent length between reverse curves shall be 30m for collector/industrial streets. Major and minor arterial streets shall comply with current AASHTO guidelines.

5203.5 **Off-Center Street Intersections:** Off-center street intersections shall be separated as shown on Figure 3(M).

5203.6 **Intersection Angle:** It is desirable for all intersections to meet at approximately a 90° angle. Skewed intersections should be avoided and in no case should the angle be less than 75°.

5203.7 **Intersecting Minor/Major Arterial Streets:** Where any minor or major arterial streets intersect each other, the crowns of both streets shall be uniformly transitioned into a plane at the intersection unless otherwise approved. Changes from one cross slope to another should be gradual.

5203.8 **Curb Radii:** When two streets of different classification intersect, the higher classification street shall govern the curb radii dimension listed in 5203.1. Equivalent three-center compound curves may be used in lieu of a single radius curve. Curb ends facing the flow of traffic shall have a two meter taper from full height to zero.

5203.9 **Sight Distance at Intersecting Streets:** Sight distance triangles at intersecting side streets shall be in accordance with the current edition of A Policy on Geometric Design of Highways and Streets, AASHTO. Every effort shall be made to select intersection locations so that the maximum sight distance is possible.

5203.10 **Considerations For Connection to Existing and Future Streets:** Consideration shall be given to the horizontal and vertical alignment of roadways where they connect to existing streets or where roadways may be extended in the future. Where a new street is to connect to an existing street, all deteriorated or cracked asphalt within two meters of the connection point shall be removed to a point where sound material is found. Existing pavement is to be saw cut for the entire width of the street to a minimum depth of 150 millimeters. If full-depth pavement removal is required, the subgrade shall be re-compacted to 95% of standard density.

5203.11 **Pavement Section:** Pavement shall be constructed upon compacted subgrade and of materials and the minimum thickness as shown on the standard drawings for the applicable street classification.

5203.12 **Pavement Transition:** Reduction in pavement width in the direction of traffic flow shall be accomplished by a taper. The minimum desirable length for merging taper shall be determined by the formula $L=WS^2/155$ where posted speeds are 60km/h or less. The formula $L=WxSx0.6$ should be used for roadways having a posted speed limit greater than 60km/h. Under either formula, L= taper length in meters, W = width of the lateral shift in meters, and S = design speed, in km/h.

5203.13 **Cul-De-Sacs:** At locations where streets are to be terminated and a vehicular connection between adjacent streets is not required, the termination shall be a cul-de-sac. Such cul-de-sac shall be

constructed with a minimum radius of 12 meters to the back of the curb if there are no islands located in the cul-de-sac.

5203.14 **Temporary Turn-Arounds:** At locations where streets will be temporarily terminated and which will be extended at a later date, and said street extends beyond the intersection of an adjacent street more than 45m, a temporary cul-de-sac shall be constructed with a minimum radius of 11 meters. The temporary cul-de-sac shall be constructed of asphaltic concrete with a minimum depth of 200 millimeters. Curb and gutter will not be required. The cul-de-sac shall be constructed within the limits of a temporary easement.

Temporary Turn-Arounds shall be located so that they do not interfere with permanent development. They should normally be located on property adjacent to the property to be served. For new subdivision plats, they should be located on property beyond the limits of the plat.

5203.15 **Driveway Grades:** Driveway grades shall conform to the typical section of the street within the right of way. Any deviations shall be approved by the local government official with the following limitations: Driveways shall attain a minimum elevation of 150 millimeters above the gutter elevation within the right of way with a maximum grade of 8%. The algebraic difference in grades at the right-of-way on crest drives shall be 8% maximum and on sag drives shall be 12% maximum. The maximum driveway grade outside the right-of-way shall be 15%.

5203.16 **Access for the Disabled:** Ramps shall be required at all planned sidewalk-curb intersections in accordance with standard practice and approved by the local governing agency. Non-standard driveways and alleys will also be designed to accommodate the handicapped.

5203.17 **Street Lighting:** All street lighting shall be designed in accordance with Section 5800 of the APWA design criteria unless otherwise directed or approved by the local governing agency.

5203.18 **Storm Drainage:** All storm drainage shall be designed in accordance with Section 5600 of the APWA design criteria unless otherwise directed or approved by the local governing agency.

5203.19 **Underdrains:** In areas that have known subsurface moisture problems, underdrains or drainage blankets shall be designed.

5203.20 **Erosion Control Within R/W Limits:** As a minimum, all grass areas in the R/W shall be seeded and mulched to control erosion on to the roadway. All construction projects that have exposed grading require temporary erosion control measures. Temporary erosion control must be approved by the City Engineer.

5203.21 **Survey Monument Boxes:** Monument boxes conforming to Figure 5(M) shall be installed at all quarter section corners involved in the street construction. The monument boxes shall be set by a Registered Land Surveyor licensed in the state the monumentation work is performed.

5203.22 **Traffic Impact Studies:** Required where developments have adverse impact on existing traffic conditions.

5203.23 **Obstructions:** Rigid structures such as poles and hydrants shall be placed a minimum horizontal distance of 500 millimeters from the face of curb to edge of obstruction. When required, guardrail and barricades shall be installed in accordance with the AASHTO Roadside Design Guide or local policies. Vertical clearance of a minimum 4.5 meters shall be provided. Along sidewalks, a minimum vertical clearance of 2.5 meters shall be provided.

5203.24 **Other Design Criteria:** Design criteria not covered by this document shall be in accordance with the most current edition of A Policy on Geometric Design of Highways and Streets by the American Association of State Highway and Transportation Officials (AASHTO) or other applicable AASHTO design guides.

SECTION 5204 GENERAL PLAN REQUIREMENTS:

5204.1 **Scope:** This section governs the preparation of plans for street projects.

5204.2 **General:** The plans shall include all information necessary to build and check the design of streets and related appurtenances. The plans shall be arranged as required by the City Engineer of local governing agency. Applicable standard plans of the local governing agency may be included by reference to standard plan number and title. Plans shall be sealed by a Registered Professional Engineer in the state of the city or governing agency and shall be submitted to the local governing agency for review and approval.

5204.3 **Scales:** Plans shall be drawn at the following minimum scales. Larger scales may be needed to clearly present the design. Bar scales shall be shown on each sheet for each scale.

Plan:	1:500 Suburban
	1:200 Urban
Profile:	
Vertical:	1:100 Suburban
	1:50 Urban
Horizontal:	1:500 Suburban
	1:200 Urban
Drainage Area Map:	
On site:	1:2,000
Off site:	1:10,000
Structural Plans: 1:10	
Graphic Drawings:	Varies

5204.4 **Sheet Sizes:** The suggested plan sheet size is ISO A1 (594mm x 865mm) or 610mm x 914mm with all sheets in a given set of plans being of the same size. Plan and profile shall be drawn on combined or separate plan and profile sheets to minimum scales shown above.

5204.5 Types of Sheets in Plans: The plans shall consist of:

1. Title sheet
2. General layout sheets
3. Plan and profile sheets
4. Cross-section sheets
5. Drainage area map
6. Standard and special detail sheets
7. Lighting plans (if required)
8. Traffic control plans (if required)
9. Temporary erosion control plans (if required)

Each sheet should contain a sheet number, including the individual sheet number and the total number of sheets, proper project identification and date. Where feasible, storm sewer construction details should be incorporated into the street plans. The engineer's seal shall appear on the title sheet.

5204.6 Required Information for Title Sheet:

1. Name of project.

2. Project number (where applicable).

3. Index of sheets included in plans.

4. A location map adequately showing project location in relation to major streets, with north arrow and scale.

5. Signature block for local governing agency approval.

6. The project control bench marks shall be identified as to location and elevation; NGVD datum or as required by the local governing agency. A minimum of two (2) bench marks are required for any project.

7. Name, address and telephone number of the consulting engineer and owner/developer as well as signature block for the owner/developer.

8. List containing name and telephone number of each utility company and the State One-Call System.

9. A legend of symbols shall be shown that shall apply to all sheets.

10. Design speed plus other traffic information as required by the local governing agency.

11. Engineer's seal, signed and dated.

5204.7 Required Information for General Layout Sheet:

1. General Notes: Minor construction notes shall appear on the proper plan and profile sheet.

2. North arrow and bar scale. Scale of the general layout map shall be 1:1,000.

3. Layout shall include name of subdivision, block designation if any, lot designation or proposed block and lots, all street names, street alignment with back of curb lines, and an accurate tie to at least one quarter section corner. An unplatted tract shall have an accurate tie to at least two (2) quarter section corners.

4. Boundary line of project area.

5. Schematic layout of all proposed sidewalks and utility improvements including storm drainage, sanitary sewers, water lines, street lights, traffic signals, etc., shall be shown.

6. A list of materials and quantities if not provided on a separate sheet.

7. Typical street sections and curb and gutter details.

5204.8 Required Information for Plan and Profile Sheets:

1. North arrows and bar scale.

2. Elevation and location of all applicable benchmarks; NGVD datum or as required by the local governing agency.

3. Existing and proposed streets with names and pavement widths.

4. Property lines properly identified as to existing or proposed lot, block and subdivision. Survey base line with adequate ties to land lines.

5. All existing and proposed utilities such as power, gas, oil, water, telephone, sewer, and other items shall be properly located in conformance with the best information available in the records of the owner of such facilities, or field location, and identified as to size and material.

6. All existing and known proposed improvements within 15 meters each side of right-of-way and 60 meters beyond the project limits shall be shown at their proper locations unless otherwise approved or required by the local governing agency. This shall include such existing items as paved streets, curb and gutters, driveways, culverts, fire hydrants, utility poles, trees, shrubs, fences, walls, houses, and other such items, and shall be identified as to type, size, material, etc. as may be applicable.

7. All existing and proposed easements and right-of-way information.

8. Locations and widths of existing and proposed sidewalks.

9. Horizontal curve data and vertical curve data (K value, stopping sight distance, and middle ordinate).

10. Center line stations shall be marked at 50 meter intervals and at other pertinent points.

11. Top of curb elevations shall be shown at maximum increments of 5 meters along the curb returns at street intersections.

12. Profile shall show existing grade as a dashed line, proposed finish grades or established street grades by solid lines.

13. Storm sewer criteria shall be in accordance with Section V.

14. Elevations shall be shown at a minimum interval of 20 meters for tangents and 10 meters for curves.

15. Approximate grading limits.

16. Location of test borings if taken.

5204.9 Required Information for Cross-Section Sheets:

1. Street cross section at each station showing existing grade by dashed lines and proposed grade by a solid line. Cross sections to show existing grade lines a minimum of three (3) meters beyond right-of-way lines or grading limit, whichever is further. The center line and location right-of-way shall be shown.

2. Center line elevation of top of pavement.

3. Center line cross sections shall be shown at all intersecting streets and driveways.

4. Additional cross sections shall be shown as required to clearly describe the extent of the grading operations.

5. In lieu of cross sections for residential development, three or five line profiles may be used if approved by the local governing agency. The three line profiles shall consist of a profile of the existing ground at each right-of-way line and existing and finished profile at the center line of the street. The other two profiles shall show the final grade at the building setback line. A grading plan may be required for residential development.

5204.10 Required Information for Standard and Special Detail Sheets: Detail sheets shall be included to show all details of appurtenances, materials, and construction. Details shall conform to the requirements of the local governing agency and are to be drawn clearly and neatly with proper identifications, dimensions, materials and other information necessary to insure the desired construction.

5204.11 Required Information for Lighting Plans: Street lighting plans shall be prepared in accordance with Section 5800 of the APWA design criteria and included in addition to the street improvement plans for approval. The plan shall be at 1:500 (minimum) scale with the streets and adjacent plats labeled.

5204.12 Required Information for Traffic Control Plan Sheets:

1. Limits of any road closures shall be shown along with the traffic control devices used to effect the closure. Length of time of road closure shall be indicated.

2. Detour plan shall be designed for traffic affected by road closures. Detour signing used to direct motorist over the detour route shall be included in the detour plan.

3. Typical lane closure or lane shift plans including taper lengths and spacing of all channelizer devices. Types and spacing of all construction signs shall be shown.

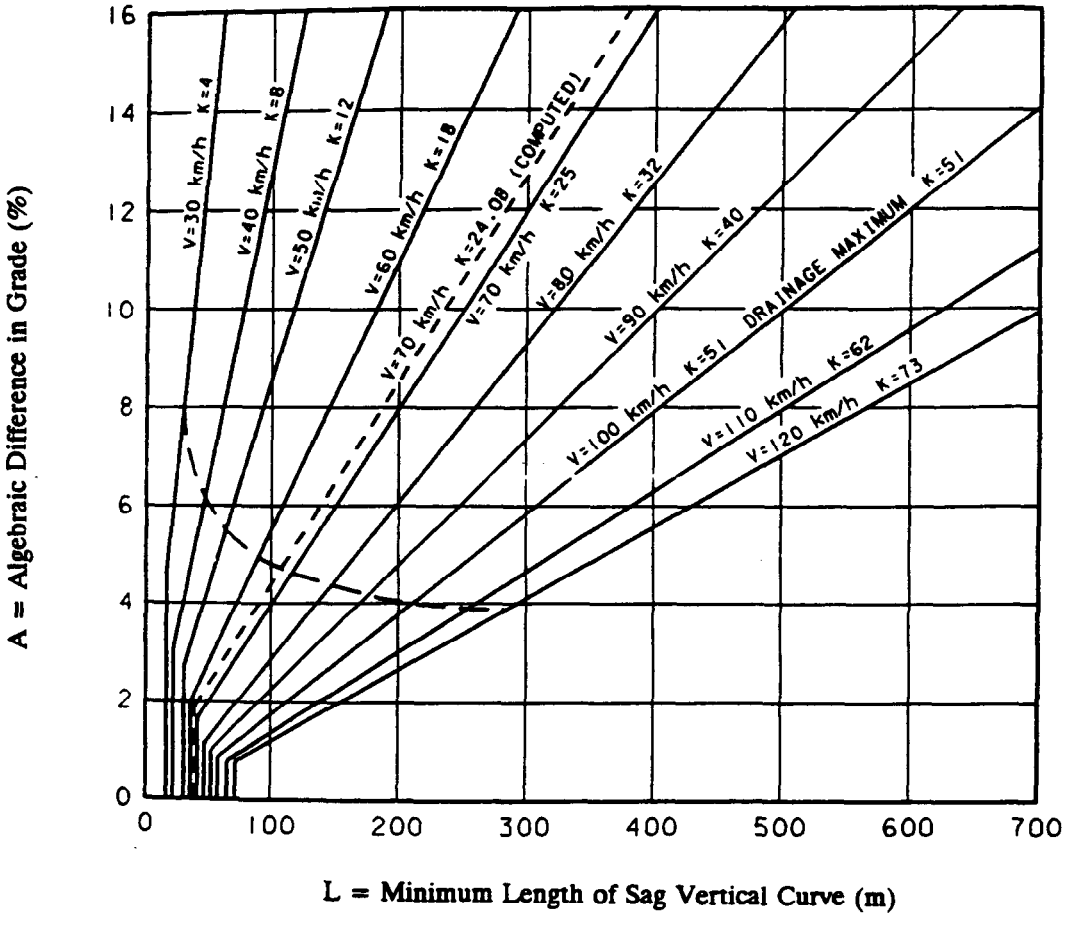
4. All traffic control shall be designed using the traffic control devices and application principles contained in the MUTCD.

5204.13 Required Information for Temporary Erosion Control Plan Sheets:

1. Each temporary erosion control feature designation shall be shown at its proper location on the plans.

2. Temporary erosion control devices details as required, such as standard temporary beams, temporary slope drains, types of ditch checks, and sediment basins.

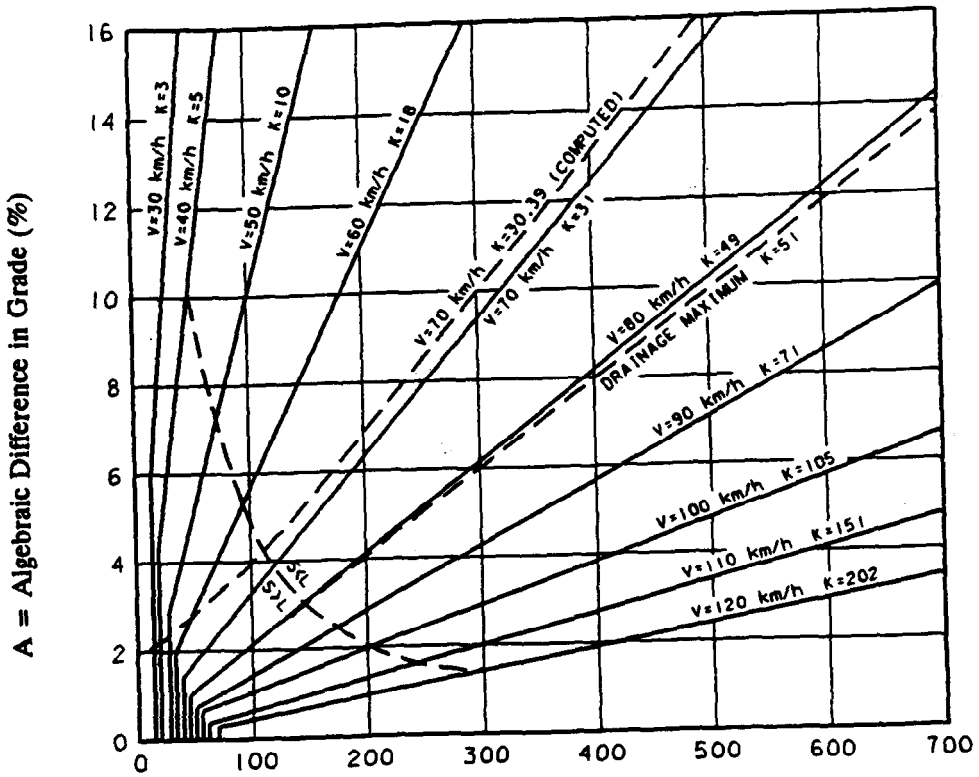
DESIGN CONTROLS FOR SAG VERTICAL CURVES - UPPER RANGE



Source: 1994 AASHTO
A Policy on Geometric Design of Highways and Streets

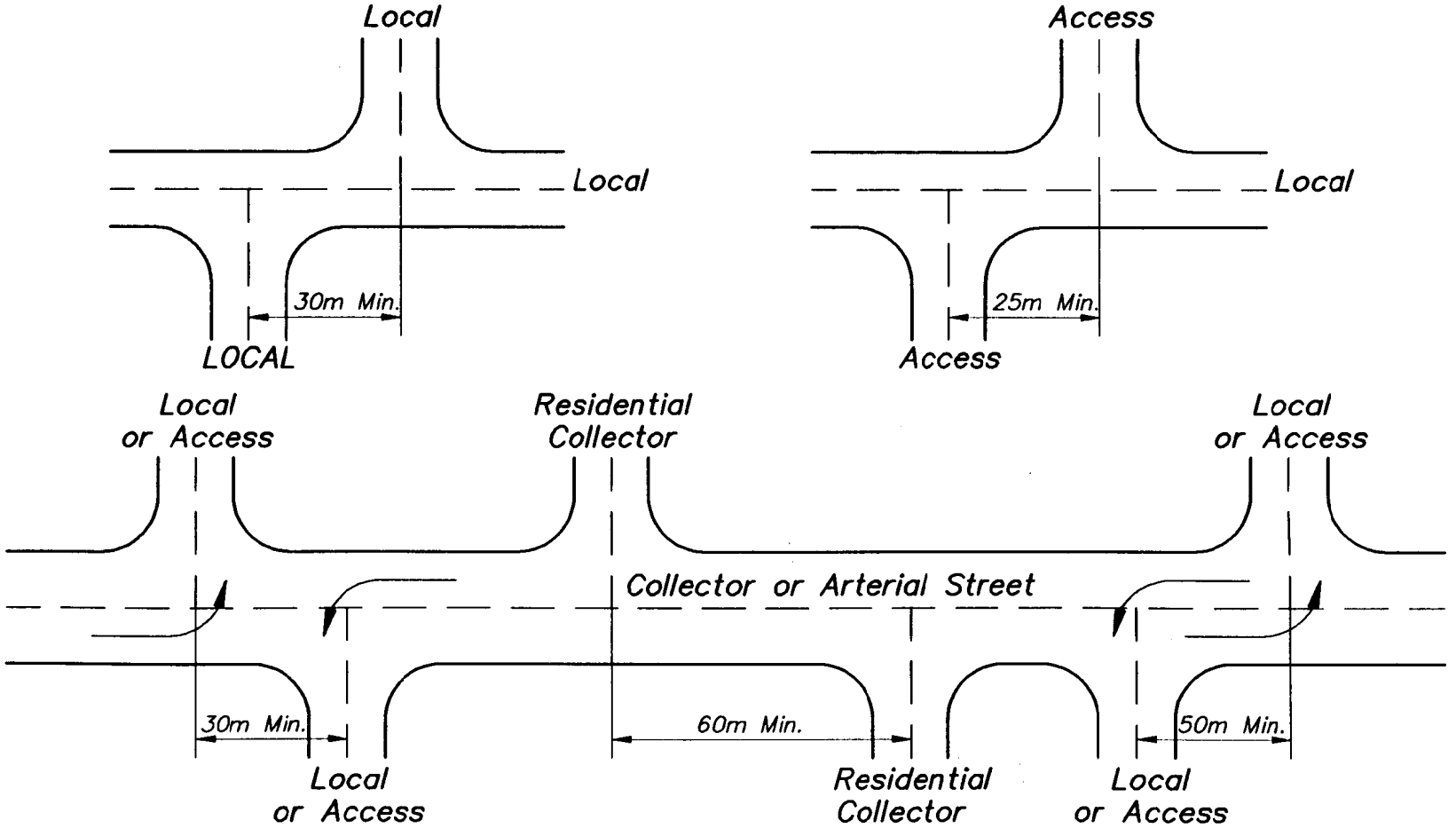
FIGURE 1 (M)

DESIGN CONTROLS FOR CREST VERTICAL CURVES - UPPER RANGE



Source: 1994 AASHTO
A Policy on Geometric Design of Highways and Streets

FIGURE 2 (M)

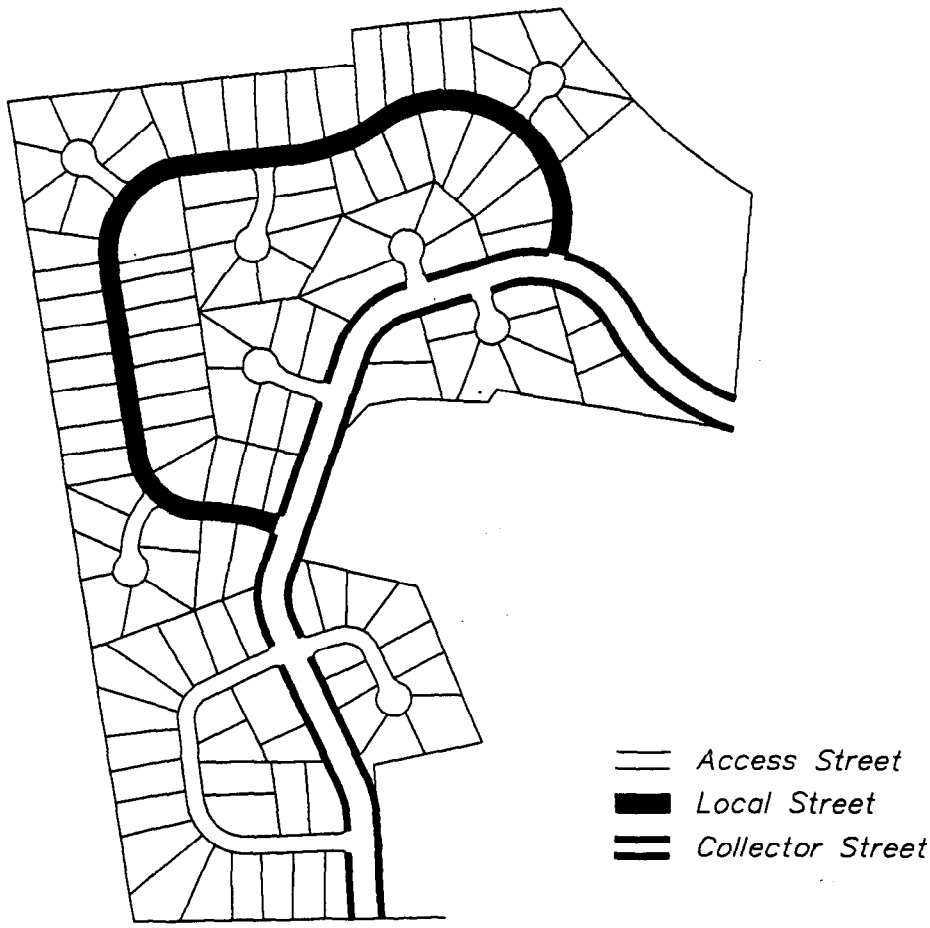


MINIMUM INTERSECTION SPACING

50m min. local street separation with no turning conflicts.

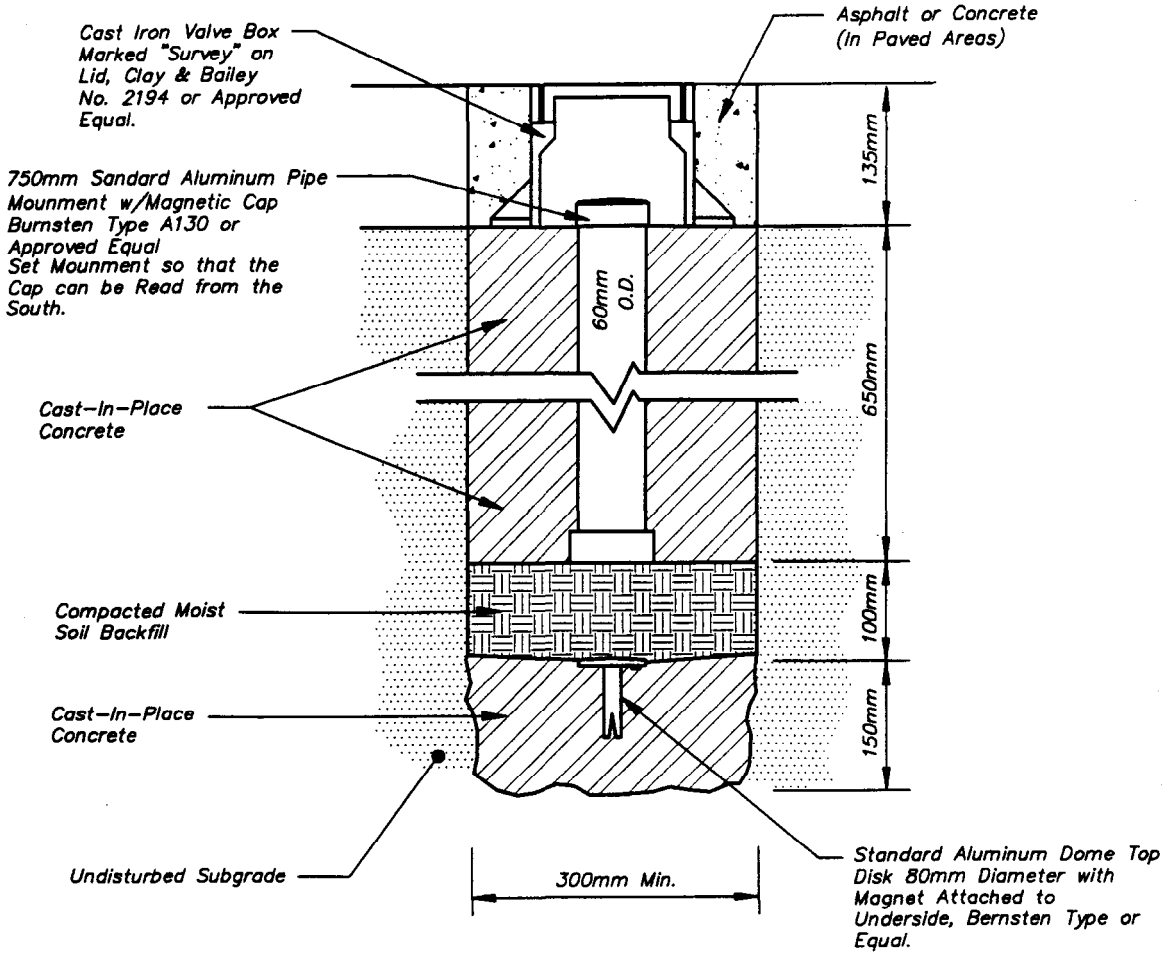
30m min. local street separation with no turning conflicts.

AMERICAN PUBLIC WORKS ASSOCIATION	
APWA	KANSAS CITY METROPOLITAN CHAPTER
OFF-CENTER STREET INTERSECTIONS (METRIC)	STANDARD DRAWING NUMBER FIGURE 3 (M)
	ADOPTED: APRIL 17, 1996



TYPICAL RESIDENTIAL STREET LAYOUT

AMERICAN PUBLIC WORKS ASSOCIATION	
APWA	KANSAS CITY METROPOLITAN CHAPTER
TYPICAL RESIDENTIAL STREET LAYOUT	STANDARD DRAWING NUMBER FIGURE 4
	ADOPTED: APRIL 17, 1996



STANDARD LAND CORNER MONUMENT

(No Scale)

Note:
Disk marking for section corners shall comply with Missouri DNR Land Survey Division Standards of Practice 10CSR30-3.060 for monument markings in Missouri and with Kansas Society of Land Surveyors Standards of Practice #1 for monuments in Kansas.

AMERICAN PUBLIC WORKS ASSOCIATION	
APWA	KANSAS CITY METROPOLITAN CHAPTER
SURVEY MONUMENT BOX (METRIC)	STANDARD DRAWING NUMBER FIGURE SMB(M)
	ADOPTED: APRIL 17, 1996

STREET CLASSIFICATION	PAVEMENT TYPES	
	OPTION 1	OPTION 2
Major Arterial	230mm min. portland cement concrete pavement 150mm min. compacted subgrade 95% of standard max. density	50mm Type 3 asphaltic concrete surface 250mm min. Type 1 asphaltic concrete base course 150mm min. compacted subgrade 95% of standard max. density
Industrial Collector and Minor Arterial	210mm min. portland cement concrete pavement 150mm min. compacted subgrade 95% of standard max. density	50mm Type 3 asphaltic concrete surface 230mm min. Type 1 asphaltic concrete base course 150mm min. compacted subgrade 95% of standard max. density
Commercial Collector	180mm min. portland cement concrete pavement 150mm min. compacted subgrade 95% of standard max. density	50mm Type 3 asphaltic concrete surface 180mm min. Type 1 asphaltic concrete base course 150mm min. compacted subgrade 95% of standard max. density
Residential Access, Residential Local, and Residential Collector	150mm min. portland cement concrete pavement 150mm min. compacted subgrade 95% of standard max. density	50mm Type 3 asphaltic concrete surface 150mm min. Type 1 asphaltic concrete base course 150mm min. compacted subgrade 95% of standard max. density

General Notes:

1. *The pavement thicknesses shown are minimums and the actual pavement design thickness should be determined by an engineering analyis of the traffic and local subgrade conditions.*
2. *Other pavement type options to be considered shall be submitted to the local goverment for approval.*
3. *Concrete pavement joint detail shall be submitted to the local goverment for approval.*

AMERICAN PUBLIC WORKS ASSOCIATION

APWA

KANSAS CITY METROPOLITAN CHAPTER

STREET PAVEMENT TYPES (METRIC)

STANDARD DRAWING NUMBER TABLE 1 (M)

ADOPTED: APRIL 17, 1996