

Matanuska-Susitna Borough Public Works Department

Subdivision Construction Manual

(Roads, Drainage and Utilities)

April 6, 2018

MATANUSKA-SUSITNA BOROUGH
SUBDIVISION CONSTRUCTION MANUAL
for
STREETS, DRAINAGE AND UTILITIES

INTRODUCTION

This manual is intended to accomplish several goals; one of which is to provide developers and their engineers and surveyors with information and guidelines which will help them to understand the requirements necessary for design of roads and utilities within the Matanuska-Susitna Borough. This manual is intended to provide information to both developers, engineers and surveyors, and to the Matanuska-Susitna Borough staff so that there is less uncertainty about requirements and so the infrastructure that is dedicated for public use meets the requirements outlined in the purpose and intent section of the current subdivision code. Ultimately, it is intended to provide Matanuska-Susitna Borough-maintained road systems which are safe throughout the year in all weather conditions. This road system must also have an inherent low maintenance cost, and meet design and construction standards. This manual should eliminate some of the commonly reoccurring problems such as inadequate right of way for future needs, substandard bridges, blockage of fish passage, poor drainage, bad intersection sight distances, hills that are too steep to traverse during winter ice conditions, and intersections that are too steep to safely stop. Other problems have been high expenses due to redesign for previous construction outside of rights of way, high expenses necessary for reconstruction due to roadbeds prepared with silty-type materials, and roads and rights-of-way that are improperly aligned and continue to provide traffic problems due to the poor locations.

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADFG	Alaska Department of Fish and Game
ADT	Average Daily Traffic
ADOT&PF	Alaska Department of Transportation and Public Facilities
ATM	Alaska Test Method
DPW	Department of Public Works of the Matanuska-Susitna Borough
LRTP	Long Range Transportation Plan
MSB	Matanuska-Susitna Borough
NTP	Notice to Proceed
OHWM	Ordinary High Water Mark
OS&HP	Official Streets and Highways Plan
PUE	Public Use Easement
ROW	Right of Way
RSA	Road Service Area

DEFINITIONS

Average Daily Traffic – the total volume during a given time period (in whole days greater than one day and less than one year) divided by the number of days in that time period. For new residential streets and driveways, the expected ADT is determined by using the Trip Generation Rates found in Section A17.

Backslope – on a roadway section in a cut, the portion of the roadside that slopes up from the roadside ditch and away from the roadway to the top of the cut.

Driveway – a private minor vehicular access way between a street and a parking area within a lot or property.

Engineer – an individual who is registered as a Professional Civil Engineer in the State of Alaska.

Foreslope – on a roadway section, the portion of the roadside that slopes down and away from the roadway.

Intersection – the general area where two or more streets join or cross.

Positive Drainage – ditches, swales, or culverts sloped to convey water away from the road prism without localized ponding.

Public Use Easement – provides the rights for ingress, egress, roadways, right of way, public utilities, and slopes for cuts and fills. The rights are to the public in general, and public utilities governed by permits required under federal, state, and local laws and regulations. May also be known as a public access easement or right of way.

Right of Way – a strip of land reserved, used, or to be used for a street, alley, walkway, airport, railroad, or other public or private purpose.

Roadway – the portion of a street, including shoulders, for vehicular use.

Shoulder – the portion of a roadway contiguous to any traveled way for lateral support of surface courses.

Street – a public thoroughfare used, or intended to be used, for passage or travel by motor vehicles. Streets are further classified according to their intended or actual function or use.

Stub Street – a street segment, usually relatively short in length, which terminates at the boundary of a subdivision or site plan, the purpose of which is to ultimately connect to abutting property when it is developed.

T-intersection – a three leg intersection in the form of a “T”.

Through Street – a street given preferential right of way; streets which intersect a through street are controlled, such as with a stop sign or yield sign.

Trafficway – the portion of a street, not including shoulders, for vehicular use.

SECTION A RESIDENTIAL STREET DESIGN

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A01 PURPOSE

A01.1 OBJECTIVE

The purpose of these provisions is to establish appropriate standards for the design of streets in residential subdivisions that will: a) promote the safety and convenience of vehicular traffic, b) protect the safety of neighborhood residents, c) minimize the long term costs for maintenance and repair of streets, d) protect the residential qualities of neighborhoods by limiting traffic volume, speed, noise and fumes, e) encourage the efficient use of land, and f) minimize the cost of street construction and thereby restrain the rise in housing costs.

A02 APPLICABILITY

These standards shall be applicable to the design and construction of all new residential streets, within the Matanuska-Susitna Borough (MSB) with the exception of those streets within cities which exercise residential road powers by ordinance.

A03 STREET CLASSIFICATIONS

A03.1 CLASSIFICATIONS

The following street classifications tailor the design of each street to its function:

Table A-1: Street Classifications

Street Classification	ROW Width (feet) ¹	Roadway Width (feet)	Trafficway Width (feet)	Minimum Foreslope ²	Minimum Backslope ³
Residential Street	60	24	20	3:1	2:1
Residential Subcollector Street	60	24	20	3:1	2:1
Residential Collector Street	60	26	22	4:1	2:1
Frontage Street	60	24	20	3:1	2:1
Mountain Access Road ⁴	60	20 ⁵	20	2:1	2:1 ⁶
Pioneer Road ⁴	60	20	20	3:1	2:1
Single Lanes	⁷	14	10	3:1	2:1
Alleys	20	12	10	--	--

1. Right of Way (ROW) required for new dedications; widths for existing ROW may vary.
2. Guardrail to be installed if required by *Alaska Highway Preconstruction Manual* (ADOT&PF).
3. 2:1 Back slopes may be reduced to 1.5:1 if cuts exceed 5 feet and appropriate slope stabilization, as determined by the developer's engineer, is used.
4. See E01.7 **Error! Reference source not found.** for maintenance of Mountain Access and Pioneer Roads.
5. See A08.2 for wider width requirements.
6. Or backslope recommended by the developer's engineer based on actual conditions.
7. ROW for single lanes shall match the street classification and include additional provisions for median width.

A03.2 GENERAL DESIGN STANDARDS

Each proposed street shall be classified and designed, for its entire length, to meet or exceed the minimum standards for one of the following street types:

- a) **Residential Street:** Residential streets are local roads intended to carry the least amount of traffic at the lowest speed. The Residential street will provide the safest and most desirable environment for a residential neighborhood. Developments should be designed so that all, or the maximum number possible, of the homes will front on this class of street.
- b) **Residential Subcollector Street:** Residential Subcollector streets are local roads which carry more traffic than the Residential street. Residential Subcollector streets should provide an acceptable if not an optimum environment for a residential neighborhood.
- c) **Residential Collector Street:** This is the highest class of street that could be considered as residential and is generally equivalent to a minor collector. Residential Collector streets will carry the largest volume of traffic at higher speeds. In large residential developments, this class of street may be necessary to carry traffic from one neighborhood to another or from the neighborhood to other areas in the community. Residential Collector streets are unsuitable for providing direct access to residences.
- d) **Special Purpose Streets:** The Platting Board may require the development to include a Frontage Street or divided street if the circumstances set forth in item 1 and 2 below exist.
 - (1) **Frontage Street:** A Frontage street is a street parallel and adjacent to a Residential collector or higher level street which provides access to abutting properties and separation from through traffic. It may be designed using Residential or Residential Subcollector standards as anticipated traffic volumes dictate.
 - (2) **Divided Streets:** For the purpose of protecting environmental features or avoiding excessive grading, the MSB may allow a street to be divided. In such a case, the design standards shall be applied to the appropriate street classification and the single lane width.

A03.3 EXISTING STREETS

Each street abutting or affecting the design of a subdivision or land development, which is not already classified, shall be classified according to its function, design and use by the MSB at the request of the applicant or during plan review. The classification of existing streets shall include those categories of Section A03.1 and A03.2 above, or higher category as determined by either the MSB's adopted street classification system, or current use.

A04 RESIDENTIAL STREETS

A04.1 SERVICE RESTRICTIONS

A Residential street provides access to abutting properties. It shall be designed to carry no more traffic than that which is generated on the street itself but in no case an average daily traffic (ADT) volume greater than 200. Each half of a loop street may be regarded as a single Residential street.

A04.2 STREET ACCESS

Residential streets may intersect or take access from any equal or higher street type. Both ends of a loop Residential street are encouraged to intersect the same collecting street and be designed to discourage through traffic.

A04.3 SHOULDERS

A two-foot wide gravel shoulder on each side will be provided on paved streets.

A04.4 ENGINEERING CRITERIA

The design criteria for Residential streets are set forth below. Any unspecified design criteria shall meet or exceed the design criteria for a roadway design speed of 25 miles per hour in the latest edition of *A Policy on Geometric Design of Highways and Streets* (AASHTO).

- a) Minimum ditch grade: 0.5%
- b) Maximum centerline grade: 10%
- c) Horizontal curvature: Minimum centerline radius 225 feet (190 ft. min. with DPW approval)
- d) Minimum tangent length between horizontal and vertical curves: 100 feet
- e) Stopping sight distances: 150 feet minimum
- f) Minimize grades within 50 feet of intersections. Maximum grade is 4% on a controlled approach and 7% on a through street.
- g) Vertical curves where the algebraic difference in grades exceeds 2.0%

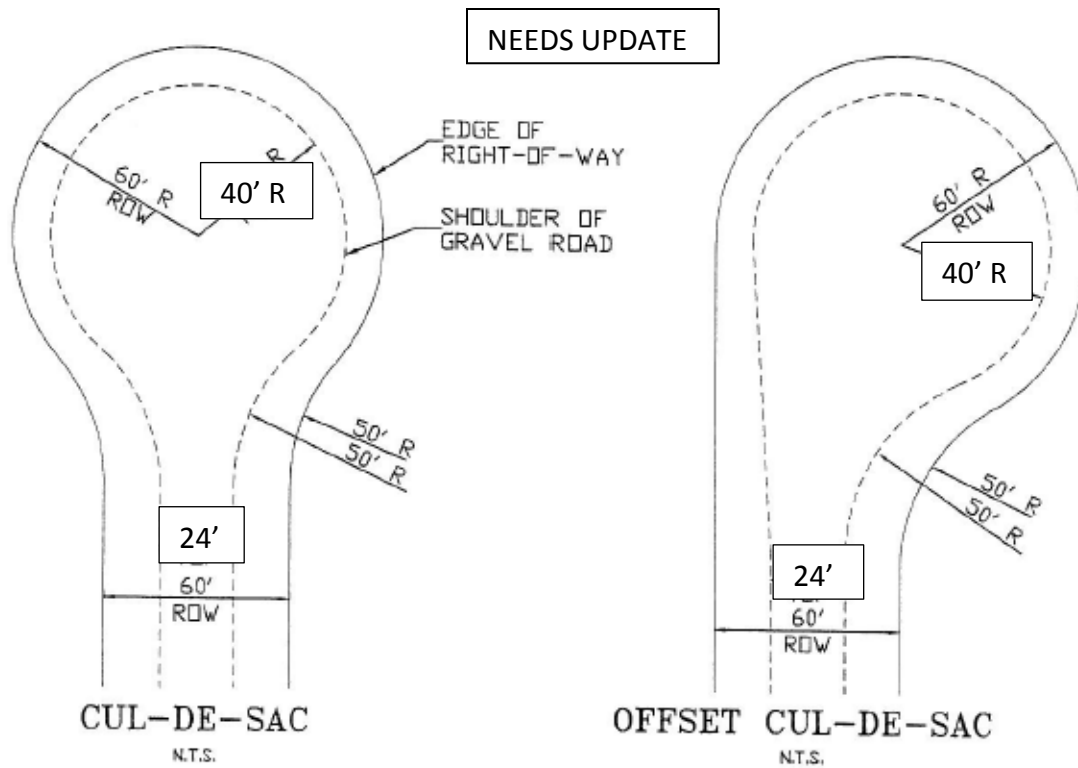


Figure A-2: Residential Cul-de-sac Turnarounds

A04.6 T-TURNAROUNDS

- a) T-turnarounds shall meet the dimensions shown in Figure A-3 **Error! Reference source not found.** T-turnarounds are only allowed on Residential Streets.
- b) Residential streets terminating in T-turnarounds are to access 20 lots or less, and not exceed 1000 feet in length measured from the intersection of the street centerline from which the street begins to the intersection point of the T-turnaround.
- c) The grade throughout the T-turnaround surface shall not exceed 4%.

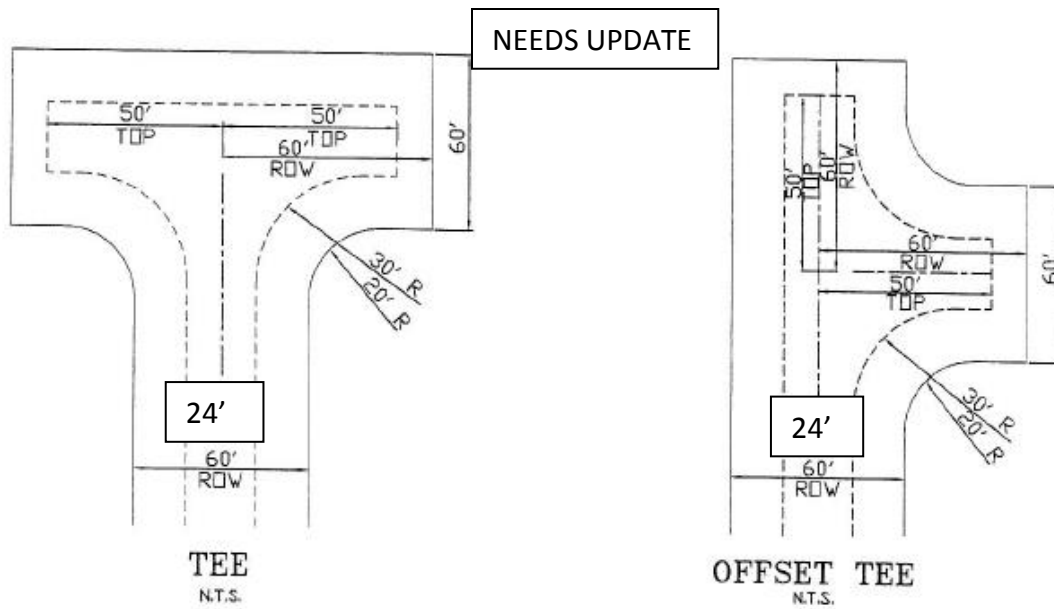


Figure A-3: Residential T-Turnarounds

A05 RESIDENTIAL SUBCOLLECTOR STREETS

A05.1 SERVICE RESTRICTIONS

- a) A Residential Subcollector street provides access to abutting properties and may also move traffic from Residential streets that intersect it.
- b) Each Residential Subcollector street shall be designed so that no section of it will move a traffic volume greater than 500 ADT. (Each half of a loop Residential Subcollector street may be regarded as a single Residential Subcollector street).
- c) Residential Subcollector streets shall be designed to exclude all external through traffic which has neither origin nor destination on the Residential Subcollector or its tributary Residential streets. Adjacent parcels may acquire access if proven to be land locked by legal or terrain features or if such Residential Subcollector access can be demonstrated to be beneficial to the public.

A05.2 STREET ACCESS

Residential Subcollectors must take access from a street of higher order in the system - either from Residential Collectors or higher classification roads. This restriction is to avoid the maze-like network of undifferentiated street types commonly found in many subdivisions. This restriction also ensures (when greater than 500 ADT) a multiplicity of access routes to the external street system. The advantages of multiple access points for Residential Subcollectors

include: 1) reducing congestion and internal travel volumes by providing alternate access routes; 2) dispersing the impact of the development on the external road system; 3) providing alternate routes for emergency vehicles; 4) providing continuity in the internal street system for service, delivery, and maintenance vehicles, (such as snow plows); and 5) providing residents with an alternate open exit or access in the event that road or utility construction closes part of the Residential Subcollector. An additional consideration is that alternate exits and entrances provide greater traffic efficiency and opportunity for residents to get where they want to go by the shortest route.

A05.3 SHOULDERS

A two-foot wide gravel shoulder on each side will be provided on paved streets.

A05.4 MOVING LANES

All Residential Subcollector streets shall be provided with two continuous moving lanes within which no parking is permitted.

A05.5 ENGINEERING CRITERIA

Design criteria for Residential Subcollector streets are set forth below. Any unspecified design criteria shall meet or exceed the design criteria for a roadway design speed of 30 miles per hour in the latest edition of *A Policy on Geometric Design of Highways and Streets* (AASHTO)..

- a) Minimum ditch grade: 0.5%
- b) Maximum centerline grade: 10%
- c) Horizontal curvature: min. centerline radius 350 ft. (275 feet with DPW approval).
- d) Minimum tangent length between horizontal and vertical curves: 100 ft.
- e) Stopping sight distance: 200 ft.
- f) Minimize grades within 50 feet of intersections. Maximum grade is 4% on a controlled approach and 7% on a through street.
- g) Vertical curves where the algebraic difference in grades exceeds 2.0%

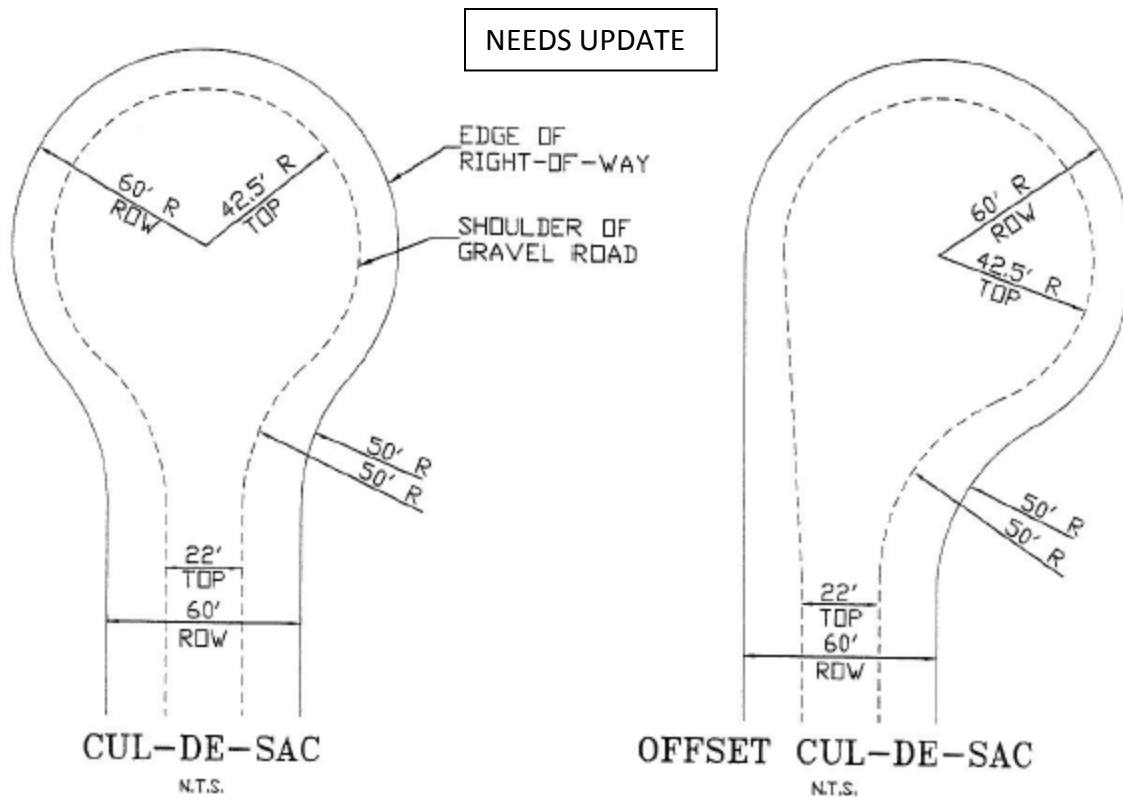


Figure A-5: Residential Subcollector Cul-de-sac Turnarounds

A06 RESIDENTIAL COLLECTOR STREETS

A06.1 SERVICE RESTRICTIONS

- a) A Residential Collector street carries residential neighborhood traffic, but restricts or limits residential frontage.

Residential Collector streets should be designed to have no residential lots directly fronting them. When topographical and physical constraints make this not possible, the amount of residential frontage shall not exceed the following limits below. Only lots having frontages of 200 feet or greater may front on collector streets and space shall be provided on these lots for turnaround so that vehicles will not have to back out onto Residential Collector streets.

Table A-2: Percent of Allowable Frontage on Residential Collector Streets

ADT Level	<1200	1200-1599	1600-1999	2000+
Percent of Allowable Frontage	20%	10%	5%	0%

(The Percent of Allowable Frontage is calculated by taking the total length of lot frontage and dividing by 2 times the centerline length.)

- b) Residential Collector streets are required when the ADT anticipated on the street will

exceed the limits for Residential Subcollectors.

- c) Residential Collector streets shall be laid out to discourage through traffic between roads of higher classification unless linkage between streets outside of the subdivision is determined by DPW to be desirable.
- d) If the anticipated ADT will exceed 3000, the street shall be classified at a higher level than Residential Collector by DPW.
- e) On-street parking shall be prohibited on Residential Collector streets.

A06.2 STREET ACCESS

Every Residential Collector must be provided with no fewer than two access intersections to streets of equal or higher classification or its termination approved by DPW.

A06.3 SHOULDERS

A two-foot wide gravel shoulder on each side will be provided on paved streets.

A06.4 MOVING LANES

All Residential Collector streets shall be provided with two continuous moving lanes within which no parking shall be permitted.

A06.5 ENGINEERING CRITERIA

The design criteria for residential collector streets are set forth below. Any unspecified design criteria for residential collectors shall meet or exceed the design criteria for a roadway design speed of 35 miles per hour in the latest edition of *A Policy on Geometric Design of Highways and Streets* (AASHTO).

- a) Minimum ditch grade: 0.5%
- b) Maximum centerline grade: 10%
- c) Horizontal curves: minimum centerline radius of 550 ft. (400 ft. minimum with DPW approval.)
- d) Minimum tangent length between horizontal and vertical curves: 100 feet
- e) Maximum superelevation: 4%
- f) Stopping sight distance: 250 feet
- g) Maximum grade within 50 feet of intersection: 4%
- h) Vertical curves where the algebraic difference in grades exceeds 1.5%

- i) When streets under this classification are located along section lines at grades exceeding 7%, the traffic-way, which includes shoulders, will be 28 feet wide.

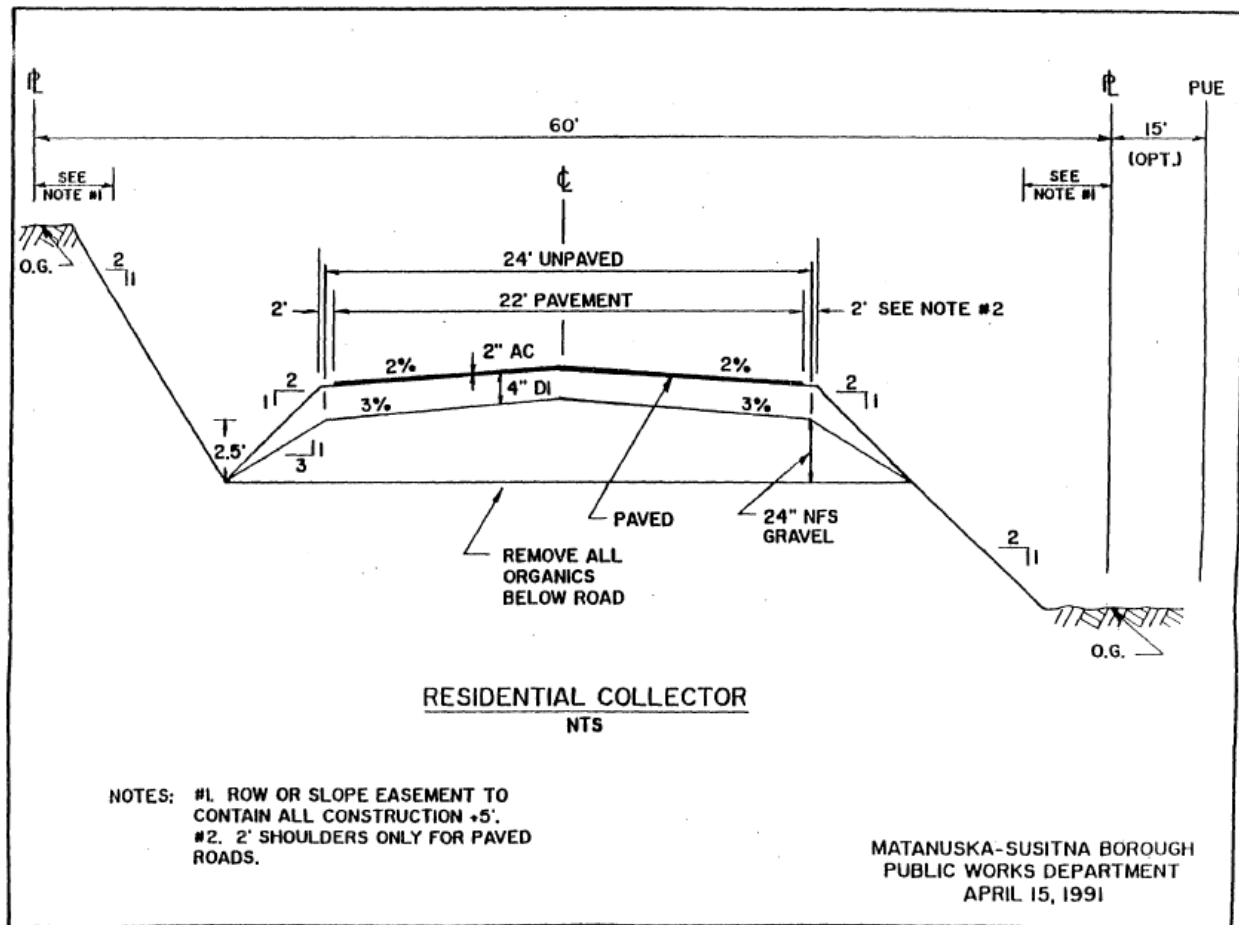


Figure A-6: Residential Collector Street Typical Section

A07 ALLEYS

A07.1 GENERAL

Alleys are permitted provided lot frontage conforming to the current subdivision code is provided on a Residential or Residential Subcollector street.

A08 MOUNTAIN ACCESS ROADS

A08.1 DESCRIPTION

In areas where terrain dictates grades in excess of 10%, grades up to 15% may be approved by the Platting Board provided it finds:

- a) Public Safety is not impaired.
- b) Increased maintenance costs are not unduly excessive.

- c) Drainage and erosion control measures are adequately provided.
- d) School bus access is considered as school bus routes require all grades less than 10%.
- e) Average terrain of access is over 25%.

A08.2 ENGINEERING CRITERIA

- a) Minimum ditch grade: 1%
- b) Maximum centerline grade: Up to 15% with no more than 200' of over 10% with 100' of 10% or less for run-out between steeper sections. Maximum grade in a horizontal curve is 10%.
- c) Maximum grade within 50 feet of an intersection is 6% on a controlled approach and 9% on a through street.
- d) Switch backs will be allowed provided Residential Subcollector cul-de-sac criteria is met or turning radius is 40 feet at centerline with a 2% grade
- e) Where grades exceed 7% the total roadway width (including shoulders) shall be 24 feet wide for safety purposes.

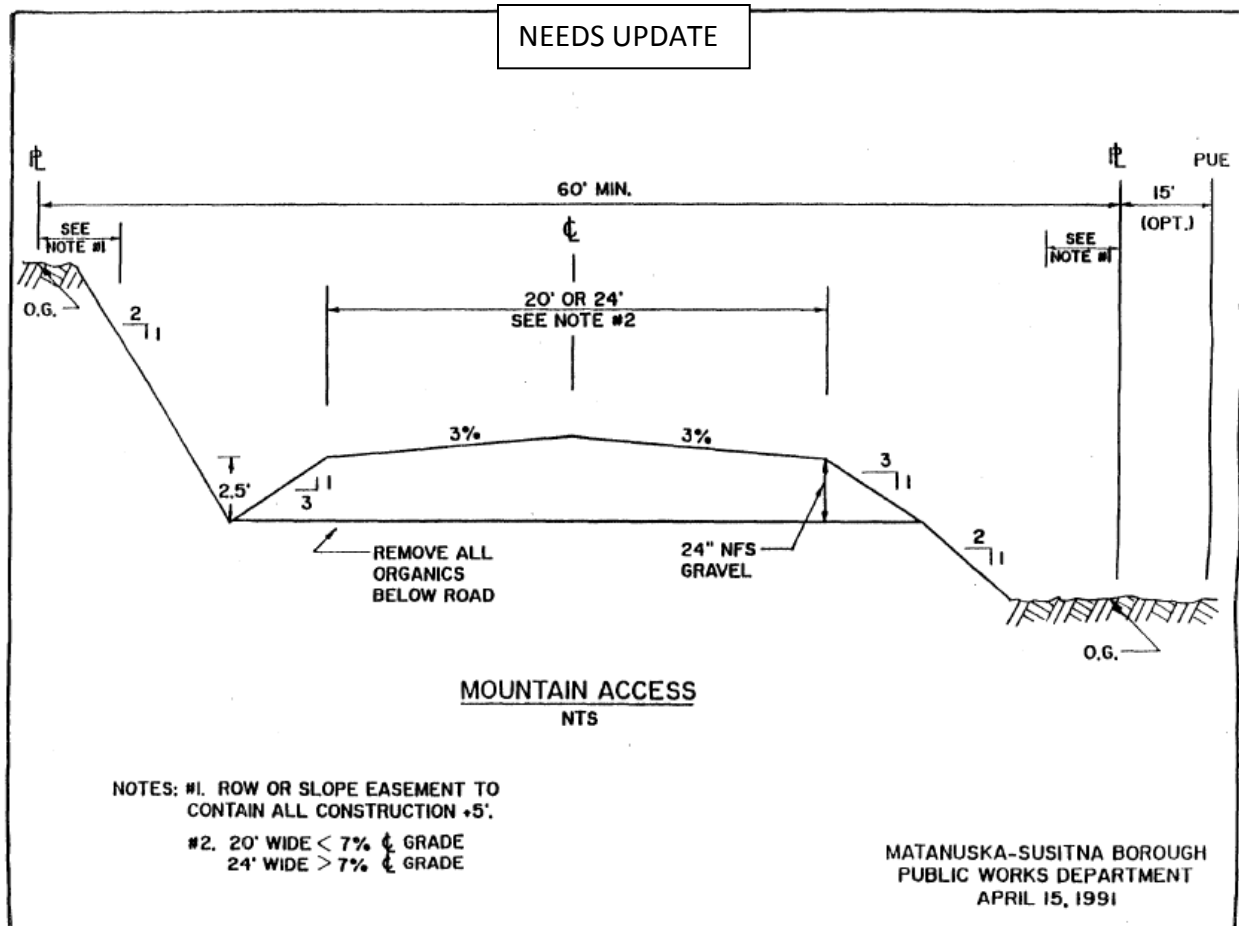


Figure A-7: Mountain Access Typical Section

A09 PIONEER ROADS

A09.1 DESCRIPTION

The purpose of this classification is to establish a minimum requirement for any road providing access where allowed by the current subdivision code.

A09.2 ENGINEERING CRITERIA

Pioneer Roads shall meet the engineering design criteria and turnaround dimensions for Residential streets. DPW may require the upgrading of Pioneer Roads where grades exceed 7% in the interest of public safety.

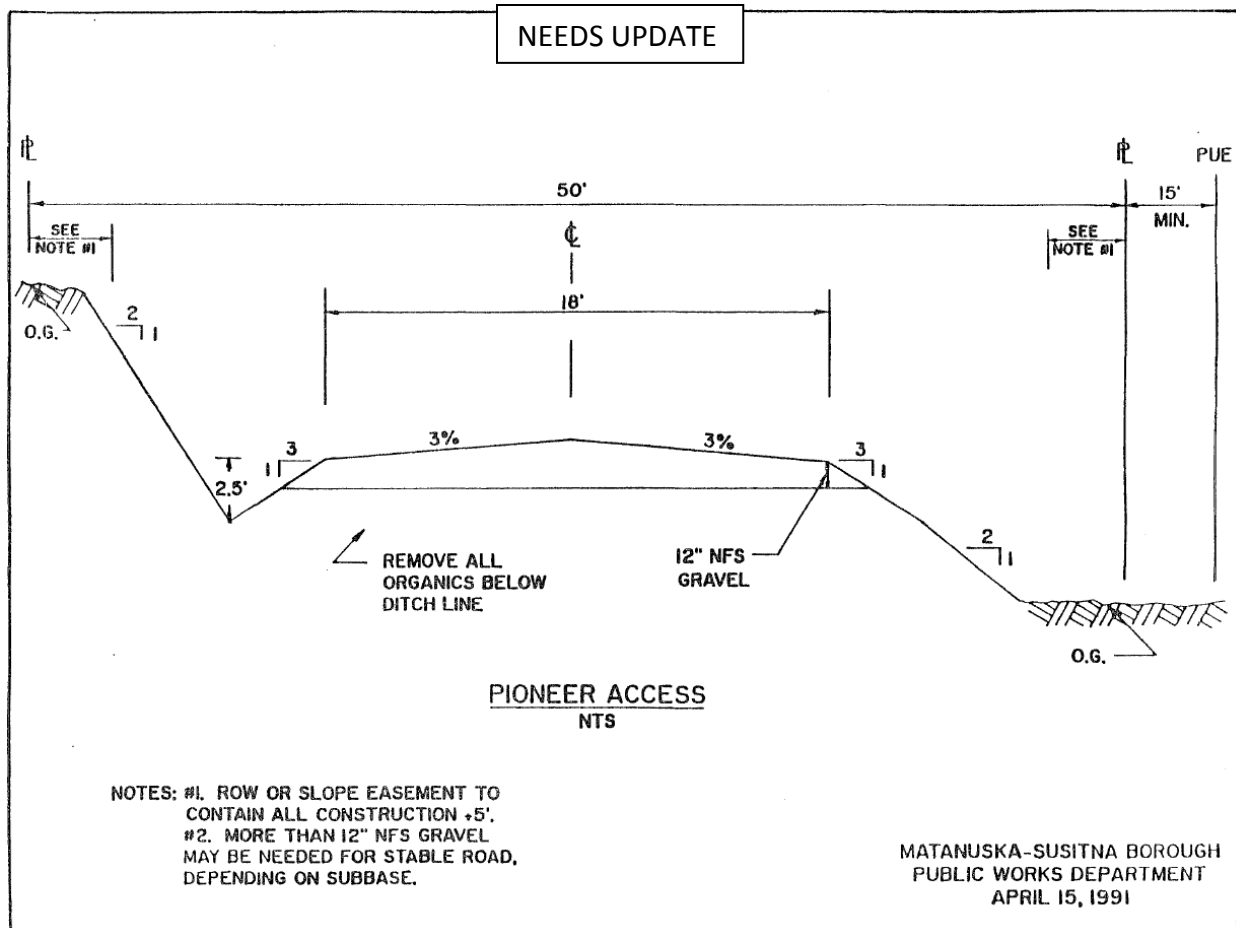


Figure A-8: Pioneer Road Typical Section

A10 FRONTAGE STREETS

A10.1 CLASSIFICATION AND DESIGN

Frontage streets are required as an alternative to allowing access to or from lots along existing or proposed collectors or higher classification streets. Frontage streets shall be classified and designed to conform to the design standards and service restrictions of either Residential streets or Residential Subcollector streets as anticipated average daily traffic may dictate.

A10.2 INTERSECTION SPACING

The minimum distance between intersections of the frontage street with residential collectors shall be 300 feet and with higher classification streets shall be determined by DPW and approved by the Platting Board based upon the traffic characteristics of the higher classification street

A10.3 DISTANCE BETWEEN TRAFFICWAY

A minimum distance of 30 feet shall be provided between the frontage street shoulder and the higher classification street shoulder. This area may be used to provide a visual screen between the roadways by landscaping and/or use of a berm.

A11 STUB STREETS

A11.1 RESIDENTIAL AND RESIDENTIAL SUB-COLLECTOR STUB STREETS

Residential and Residential Subcollector stub streets may be permitted within subsections of phased development for which the proposed street extension in its entirety has been included as part of an approved preliminary plat or master plan.

A11.2 RESIDENTIAL COLLECTOR STUB STREETS TO UNDEVELOPED PARCELS

Residential Collector stub streets may be required by DPW provided that the future extension of the street is deemed desirable by DPW or would conform to the Long Range Transportation Plan (LRTP) or Official Streets and Highways Plan (OS&HP).

A11.3 TEMPORARY TURNAROUNDS

All stub streets requiring construction will be provided with a constructed turnaround meeting the standards of that class of street. No turnaround construction is required if the stub street is less than 200 feet long and provides access to two or fewer lots, though a turnaround easement may be required. See A16 for signage requirements. A 120 foot diameter temporary easement will be provided at the turnaround which will automatically terminate upon extension of the street.

A11.4 STUB STREET CONSTRUCTION

No construction is required if physical access is provided to all lots by adjoining streets.

A12 HALF STREETS

Half width trafficways are prohibited. The full trafficway width for all street classifications will always be provided.

A13 INTERSECTIONS

A13.1 CORNER SIGHT DISTANCE

- a) Whenever a proposed street intersects an existing or proposed street of higher order the street of lower order shall be made a stop street, unless alternate intersection control is used as allowed by this section. Intersecting streets shall be designed to provide corner sight distance as specified in this section and Table A-3

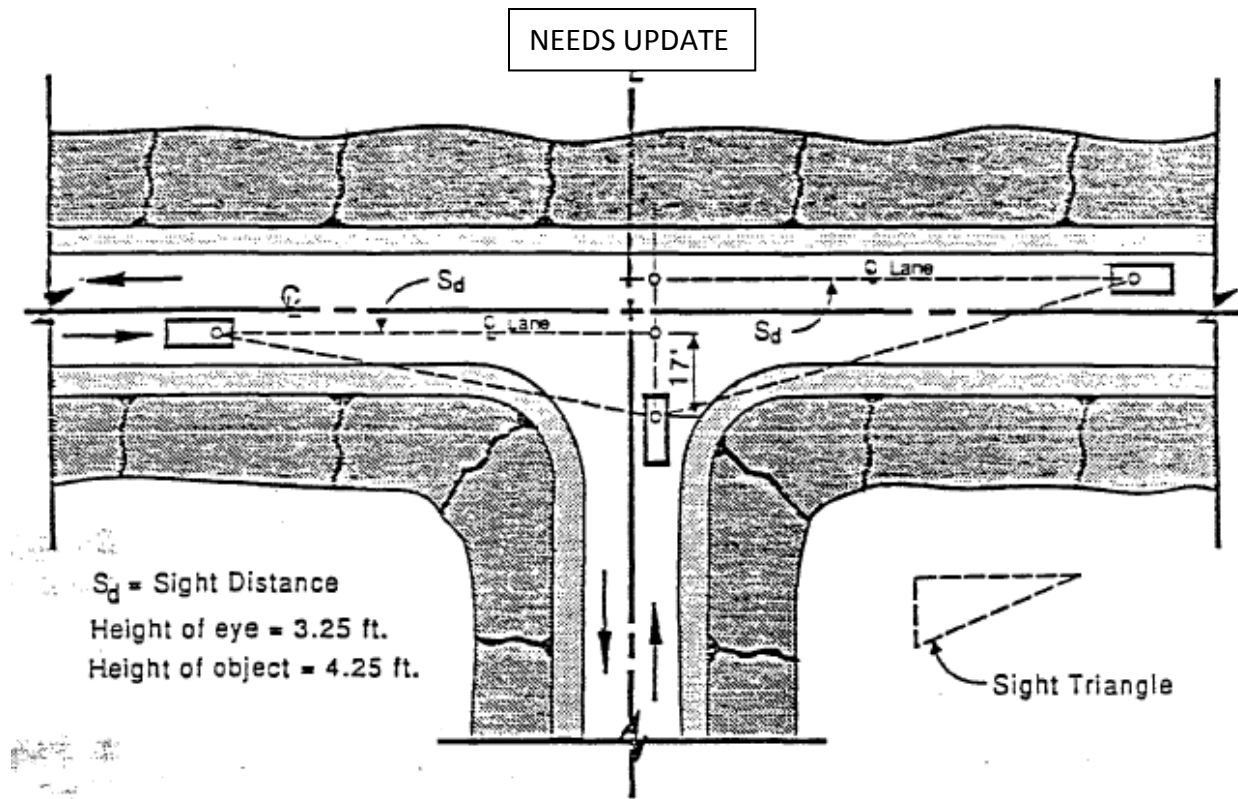


Figure A-9: Intersection Sight Distance

Table A-3: Desirable and Minimum Intersection Sight Distance

Design Speed or Posted Speed Limit (MPH) (whichever is greater)	S_d Desirable (ft)	S_d Minimum (ft)
25	370	280
30	450	335
35	580	390
40	750	445
45	950	500
50	1180	555
55	1450	610
60	1750	665
65	2100	720

- b) The entire area of the sight triangle shall be designed to provide an unobstructed view from point B to all points 4.25 feet above the roadway along the lane centerlines from point A to point D.

- c) Sight distances less than the desirable shall only be used when there are topographical or physical constraints and with DPW approval.
- d) The minimum sight distances listed above are for a passenger car to turn onto a two-lane undivided street with grades of 3% or less. For other conditions, the minimum sight distance should be calculated by the developer's engineer according to *A Policy on Geometric Design of Highways and Streets* (AASHTO).
- e) Sight distances less than the minimum, where no other options exist, will require alternate intersection control or warning signs as determined by the developer's engineer and approved by DPW.

A13.2 TRAFFICWAY CORNER

Corner radii shall be determined by the highest class of street at the intersection according to the classifications specified below:

Residential and access streets:	20 feet
Residential Subcollector:	25 feet
Residential Collector:	30 feet
Higher order streets:	40 feet

A13.3 INTERSECTION SPACING

- a) Minimum centerline to centerline distance between intersections on either side of the street shall be:
 - (1) 150 feet on Residential or Residential Subcollectors
 - (2) 330 feet on Residential Collectors
 - (3) 650 feet on higher class of road where other access standards do not exist.
- b) Where preexisting conditions do not allow for the above spacing and no other legal access exists, smaller spacing may be allowed provided the greatest possible distance between intersections is maintained.

A13.4 MINIMUM INTERSECTION ANGLE

Streets should intersect at an angle as close to 90° as possible for a minimum of 100 feet from the intersection centerline, but in no event at an angle less than 70°.

A13.5 PAVED APRON

Whenever a proposed street intersects an existing paved street, a 50-foot paved apron with 30-foot paved radii shall be provided from the edge of the existing trafficway.

A14 RIGHT OF WAY

A14.1 RIGHT OF WAY

Minimum ROW shall be provided as follows:

Residential Street	60 feet
Residential Subcollector	60
Residential Collector	60
Special Purpose streets:	
Frontage Street	60
Mountain Access	60
Pioneer Access	60
Alleys	20

A14.2 INCREASE IN RIGHT OF WAY WIDTH

- a) If proposed lots are large enough for further subdivision or the road provides access to unsubdivided parcels, which, if subdivided, may change the street classification in the future to a higher class of street, DPW may recommend to the Platting Board that the ROW width for a higher classification street be provided.
- b) If terrain dictates, ROW widths in excess of the minimum established in Section A14.1 may be required to contain all cut and fill slopes plus at least 5 feet outside the cut or fill catches.

A15 DRIVEWAYS

A15.1 DRIVEWAYS TO SINGLE-FAMILY LOTS

- a) Driveways shall be located not less than 40 feet from the tangent point of the radius return of any intersection. Driveways to lots bordered by multiple streets shall gain access from the street of lowest classification, unless otherwise authorized by the permitting authority. Lots with 50 feet of frontage or less must be limited to one driveway.
- b) The standards which shall apply to the driveway apron at the edge of the trafficway are: driveway width at the trafficway edge shall be 10 feet with 6-foot radii which equals 22 feet total. Maximum driveway width at the trafficway edge shall be 25 feet with 20-foot radii which equals 65 feet total.
- c) Driveways which access a paved street shall be paved with a two-foot apron the full driveway width at the trafficway edge.
- d) Driveways are not usually required to be constructed within the ROW at time of road construction. However, if a developer chooses to construct driveways, driveway permits are

required. A driveway permit application can be obtained from the MSB Permit Center or at www.matsugov.us/permits/driveway.

A15.2 NON-RESIDENTIAL, SHARED RESIDENTIAL, OR MULTI-FAMILY RESIDENTIAL DRIVEWAYS

- a) All entrance drives serving 4 or fewer dwelling units may be designed to single family driveway standards above.
- b) All entrance drives serving more than 4 dwelling units, but which may be expected to convey less than 200 ADT, shall be laid out to conform to the design, service, and access standards for residential streets.
- c) All entrance drives which may be expected to convey greater than 200 ADT but less than 500 ADT, shall be laid out to conform to the minimum design, service, and access standards for Residential Subcollector streets.
- d) All entrance drives which may be expected to convey greater than 500 ADT shall be laid out to conform to the minimum design, service, and access standards for Residential Collector streets.
- e) Driveways shall not drain onto the roadway and should not exceed 4% grade within 50 feet of the road shoulder.

A16 SIGNAGE

A16.1 SIGNS

Signs will be designed and placed in conformance with the latest edition of the *Alaska Traffic Manual* (ADOT&PF).

- a) Roads will be identified and street signs will be installed by the developer.
 - (1) Each road within a subdivision will be identified and signed at its point of egress and ingress. Cul-de-sac roads will be signed and identified at their point of ingress
 - (2) Stop signs will be provided at designated intersections within the confines of the subdivision and at the intersection to the access road, if applicable.
 - (3) If a constructed stub street provides access to two or fewer lots and has no turnarounds a sign indicating a dead-end street shall be posted.
 - (4) If a dedicated stub street is not constructed, no signs are required.
- b) Install signs according to the criteria in Figure A-10, Figure A-11, and Figure A-12.

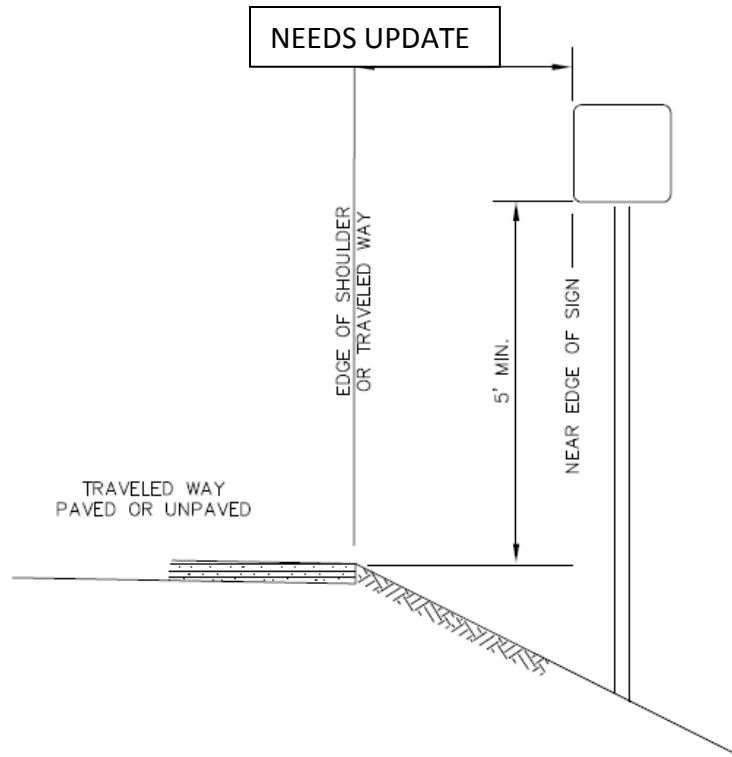


Figure A-10: Sign Placement

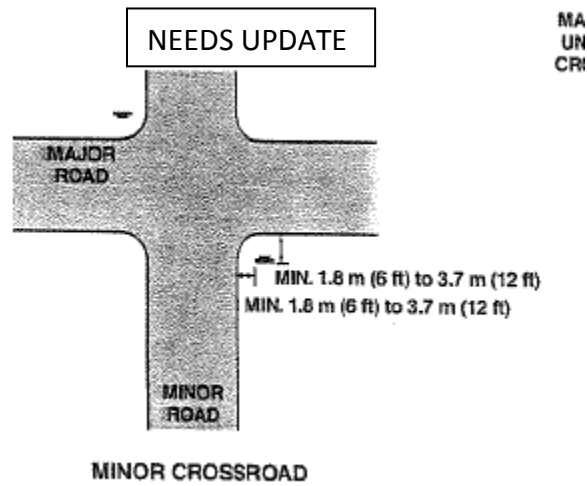
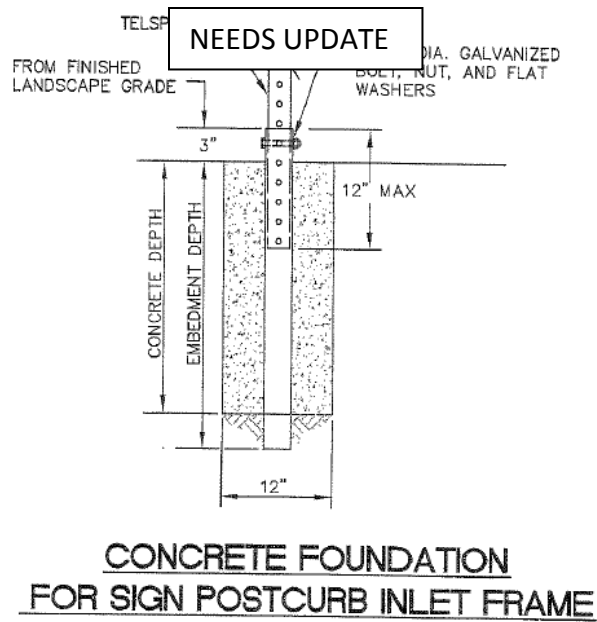


Figure A-11: Stop Sign Location



PERFORATED STEEL TUBES (P.S.T.) (12ga. - .105" Wall Thickness)			
SIGN SURFACE AREA SQ. FT.	POST SIZE	EMBEDMENT DEPTH	CONCRETE DEPTH
7' OR LESS	2" X 2"	27"	24"
GREATER THAN 7'	2 1/2" X 2 1/2"	33"	30"

Figure A-12: Sign Post Detail

A17 TRIP GENERATION RATES

Streets will be designed for specific traffic volumes. ADT will be calculated using the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.

SECTION B MAJOR ROAD CORRIDORS

B01 PURPOSE

This section provides a guideline for the design and construction of major collectors, arterials, and highways within the MSB. Design and construction standards that apply to these classes of roadways are found in the following publications:

- a) "A policy on Geometric Design of Highways and Streets", AASHTO (current edition).
- b) "Standard Specifications for Highway Construction", ADOT&PF (current edition); with MSB standard modifications.
- c) [reserved]
- d) "Alaska Highway Preconstruction Manual", AKDOT&PF (latest revision)

B02 RIGHT OF WAY AND SURFACE WIDTHS

Classification	Min. ROW	Standard Lane Width	Shoulder Width
Arterial	100	12 ft	4-8 ft

B03 FUTURE CORRIDORS

Streets that are located along routes proposed for future upgrade as designated in the LRTP or OS&HP shall have ROW established up to a maximum of 100 feet in width plus slope easements. Additional widths as designated in the LRTP or OS&HP shall be reserved by building setbacks which will prohibit the location of any permanent structure within the setback area. The area within the setback shall be excluded from any minimum useable area calculations. These areas shall be labeled on the Final Plat as "Proposed Road Corridor."

SECTION C CONSTRUCTION REQUIREMENTS

C01 GENERAL

This section establishes minimum construction requirements to be followed by the developer.

C01.1 CLEARING AND GRUBBING

The area within the ROW, slope easements and utility easements is to be cleared and grubbed at the time of road construction. Debris is to be disposed of in an area designated by the developer, or their engineer, outside of all ROW and utility easements. Slit trenches are not allowed in the ROW, slope easements or adjoining utility easements.

C01.2 ROAD CONSTRUCTION

- a) Top soil is to be removed and disposed of as appropriate in a location where overlay embankment is not proposed. All organics shall be removed from the area below the road prism.
- b) Road embankment to a depth of at least 24 inches below finished grade (excluding the upper 6 inches), shall:
 - (1) be aggregate containing no muck, frozen material, roots, sod, or other deleterious matter; and
 - (2) have a plasticity index not greater than 6 as tested by Alaska Test Method (ATM) 204 and ATM 205; and
 - (3) contain less than 10% passing the No. 200 sieve by weight determined on the 3-inch minus portion of the sample as tested by ATM 304.
- c) The upper 6 inches of the road embankment (topping) shall:
 - (1) be gravel, free from clay balls, vegetable matter, or other deleterious matters; and
 - (2) have no material larger than 1.5 inches in its largest diameter; and
 - (3) contain between 5% and 15% passing the No. 200 sieve by weight as tested by ATM 304; and
 - (4) be finished with a 3% crown.
- d) Topping may be substituted with 4 inches of D-1 and 2 inches of HMA Type II, Class B in accordance with the Standard Specifications for Highway Construction (AKDOT&PF). The width of the pavement shall be equal to the trafficway width and finished with a 2% crown. Pavement edges shall be backed with additional D-1 graded flush with the pavement

surface and tapered to the edge of the roadway. The pavement shall be washed or swept immediately following this work.

- e) Road embankment shall be placed in lifts not to exceed 8 inches (uncompacted) for the full width of the embankment and compacted as specified below before the next lift is placed.
- f) The entire road prism is to be compacted to not less than 95% of the maximum density.
- g) All loose material exceeding 6 inches in size is to be removed from the ditches and foreslopes and trackwalked in to the backslopes.

C01.3 LOW AREA

In areas that show peat or other types of wet material, place geotextile separation fabric in accordance with the Standard Specifications for Highway Construction (AKDOT&PF) and a minimum of 24 inches of road embankment as defined in C01.2(b). The final grade is to be a minimum of 12 inches above the surrounding ground and embanked to a depth that will produce a stable road surface.

C01.4 PIONEER ROAD CONSTRUCTION REQUIREMENTS

Pioneer roads, whether proposed or existing, shall have a minimum surface width of 20 feet and at least 12 inches of road embankment as defined in C01.2(b). Additional road embankment may be required to provide a stable road surface. Topping is not required. Cross drainage culverts, minimum 24 inch diameter, will be installed where determined necessary and 30 inch ditches will be provided for drainage.

C01.5 WINTER CONSTRUCTION

Winter construction may be allowed. DPW will not accept any roads until all ground has thawed and any settlement areas corrected. Generally no road inspections will be performed by DPW from October 31st to May 1st.

C01.6 ADDITIONAL APPROVAL

Alternate road construction criteria, except for road widths, may be submitted by the developer or their engineer that will more appropriately fit the conditions of the specific road locations, following general engineering practices. Final acceptance of such plans must be approved by DPW and the Platting Board.

C02 TRAIL HEAD

For access to subdivision without a constructed road. See Figure C-1.

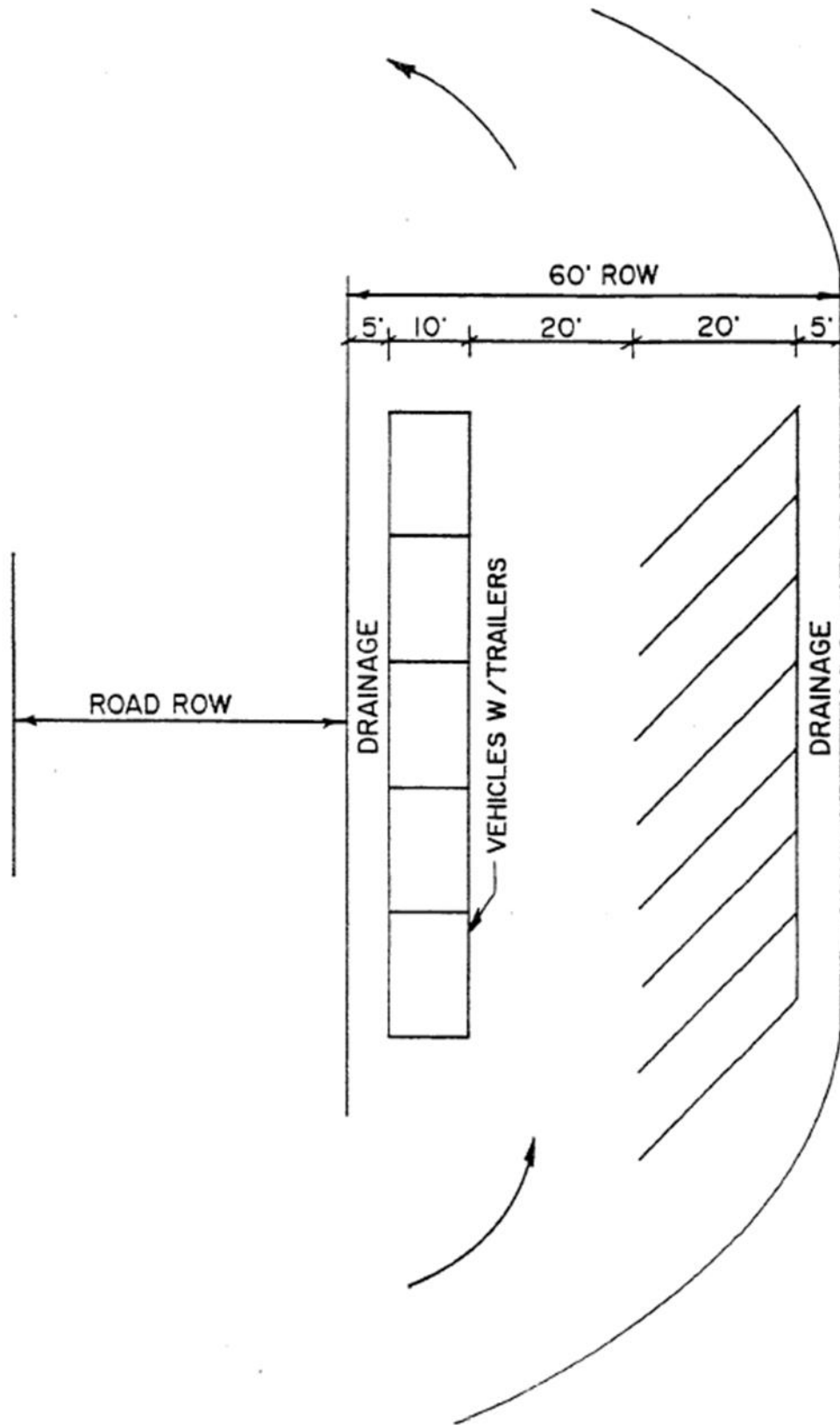


Figure C-1: Trail Head Parking Example

C03 LAKE ACCESS

Easement or other public access to lakes. See Figure C-2.

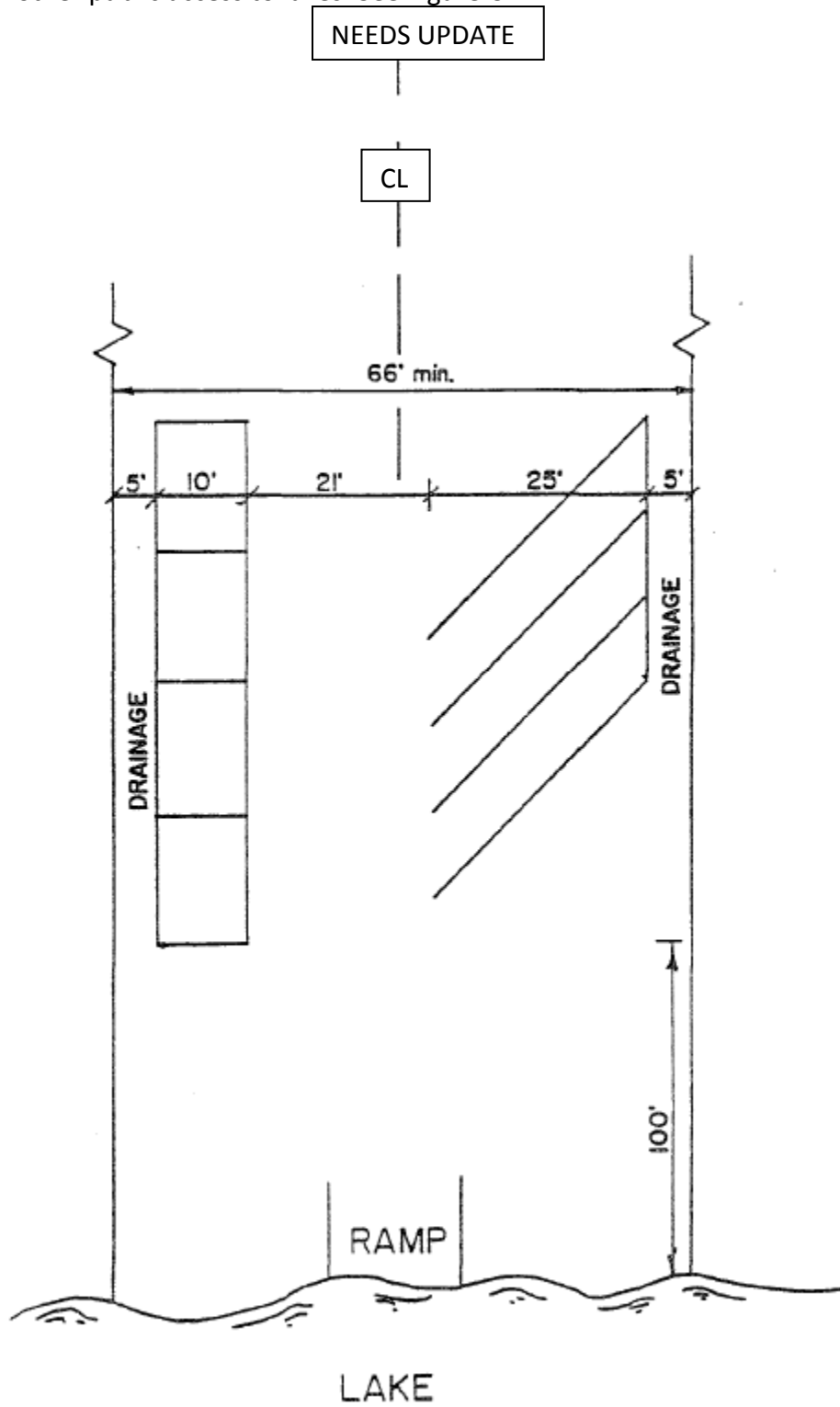


Figure C-2: Lake Access Parking Example

SECTION D DRAINAGE REQUIREMENTS

D01 GENERAL

A drainage plan for the proposed subdivision is to be submitted with the preliminary plat showing the following:

- a) 2 foot contour interval topography with horizontal and vertical accuracy meeting the latest edition of the Alaska Society of Professional Land Surveyors Standards of Practice Manual.
- b) Existing drainage patterns.
- c) Proposed drainage routing with necessary drainage easements to show positive drainage. Any drainage changes that may affect adjacent property.
 - (1) Drainage improvements shall be designed to retain runoff within the proposed subdivision or routed to a natural drainage course or an existing ditch capable of handling the anticipated flow.
 - (2) Drainage improvements must not adversely impact adjacent property or ROW.
- d) Culvert sizing calculations for any actively flowing streams that exceed the culvert size 24" for a 10 year storm may be identified only at this submittal. Calculations are to be submitted with construction plans.

D02 DRAINAGE DITCHES

Normal ditch depth shall be 30 inches. The depth of ditches along Residential and Residential Subcollector streets may be reduced with DPW approval, provided the following conditions exist:

- a) Drainage is demonstrated to be contained within ditches.
- b) Adequate drainage routes are provided and constructed within the ROW or designated drainage easements.
- c) Ditch lines are established at least 5 feet from the edge of trafficway shoulder.
- d) Minimum 12" corrugated metal culverts are installed under driveways to provide longitudinal drainage.
- e) Ditches are deepened to provide cross drainage through 24" corrugated metal culverts (18" with DPW approval).
- f) Snow storage at least equal to regular ditches is provided.

D03 FISH PASSAGE CULVERTS

- a) If a stream reach is determined to harbor fish, as determined by the Alaska Department of Fish and Game, then stream crossing structures shall be designed, constructed, and maintained so as to maintain the full hydrologic functioning of the water body they are crossing.
- b) Plans shall be submitted to DPW for approval before prior to the pre-construction meeting.

D03.1 STREAM SIMULATION METHOD

All stream crossing structures shall be designed using stream simulation methodologies. Stream simulation means that the crossing structure is designed using reference data from a representative section (reference reach) of the specific water body being crossed. Stream simulation is a crossing design technique that attempts to replicate the natural stream channel conditions found upstream and downstream of the crossing. Sediment transport, flood and debris conveyance, and fish passage are designed to function as they do in the natural channel.

- a) Reference data shall include, at a minimum; channel width at the Ordinary High Water Mark (OHWM), cross-sectional area, gradient, substrate, and ability to pass floating debris.
- b) Under normal flow conditions, the channel within and/under the crossing structure shall not differ from the reference reach condition in regards to the channel width at OHWM, cross-sectional area, gradient, substrate, and ability to pass floating debris.
- c) Substrate material within/under the crossing structure shall remain dynamically stable at all flood discharges up to and including a fifty-year flood. Dynamic stability means that substrate material mobilized at higher flows will be replaced by bed material from the natural channel upstream of the crossing. For culverted crossings without an adequate upstream sediment supply, the substrate material within the crossing shall be designed to resist the predicted critical shear forces up to the 100 year flood. For culverts with a slope of 6% or greater substrate retention sills may be required to allow the bed load to continuously recruit within the culvert barrel.
- d) The width of crossing structures shall not be less than one hundred and twenty percent (120%) of the channel width at the OHWM or use 1.0 times the bankfull width, whichever is greater.
- e) Crossing structures shall be placed within/over the pre-existing channel alignment. Road alignment shall be as close to perpendicular to the channel as possible.
- f) Crossing structures shall maintain the connectivity of wetlands adjacent to stream channels and shall accommodate sheet flow within such wetlands.

- g) Crossing structures shall not interfere with the functioning of floodplains and shall be designed to accommodate at least the 100-year flood flow. If the crossing structure is not designed to accommodate the one hundred-year flow, a route must be established to safely convey flows exceeding the design flow without causing damage to property, endangering human life or public health, or causing significant environmental damage.
- h) In cases of crossings within high entrenchment ratio environments (flood prone width/OHWM width > 2.2), floodplain overflow culverts may be beneficial to floodplain connectivity and can be used to pass the Q100. Minimum width requirements for the primary culvert still apply.
- i) Design Standards
- (1) Culverted stream crossings shall be composed of a single oversize pipe or arch a minimum of one hundred and twenty percent (120%) of the channel width, measured at the OHWM or use 1.0 times the bankfull width, whichever is greater.
 - (2) MSB Bridge Criteria Manual (?) shall be used for design and construction of all new bridges, including buried structures such as culverts, in MSB public property and subdivision streets.
 - (3) Culverts shall have a minimum diameter of three feet.
 - (4) The use of multiple-pipe culvert batteries is discouraged. The use of trash racks or debris interceptors is prohibited
 - (5) Culvert pipes and arches shall be constructed of metal. The use of smooth wall culverts is prohibited.
 - (6) Culvert slope shall be within 25% of the natural stream slope of the selected reference reach.
 - (7) Round culvert pipes shall have a minimum invert burial depth of forty percent (40%) of the culvert diameter into the substrate. Arch culvert pipes (i.e. "squash" pipes), shall have a minimum invert burial depth of twenty percent (20%) of the culvert's rise into the substrate, unless scour analysis shows less fill is acceptable. The minimum depth is 1 foot.
 - (8) Substrate material within the culvert barrel shall incorporate a low flow channel. The low flow channel should mimic the reference reach where possible. If the low flow channel dimensions are not discernable from the reference reach, the low flow channel should have a cross sectional area of 15-30% of the bankfull cross section

- area and a minimum depth of 4 inches for small streams and up to 12 inches for larger streams. The low flow channel should be defined by rock features that will resist critical shear forces up to the 100 year flood.
- (9) The gradation of the substrate material within a culvert shall be designed to be a dense, well graded mixture with adequate fines to ensure that the majority of the stream flows on the surface and the minimum water depth is maintained.
 - (10) If streambanks are constructed through a crossing, the streambanks shall be constructed of rock substrate designed to be stable at the 100 year flood. The streambank width shall be a minimum of 2.0 times the maximum sieve size of the streambed material (D100). The crossing width shall be increased to all for the channel width plus the streambanks.
 - (11) If substrate retention sills are used, they shall have a maximum weir height of one half (0.5) of the culvert invert burial depth (i.e. 20% of diameter for round pipes and 10% of rise for arch pipes). Substrate retention sills shall be spaced so that the maximum drop between weirs is four inches (4"). The use of sills without substrate is not allowed.
 - (12) Culverts shall be aligned in a direction as nearly parallel to the pre-existing direction of water flow as possible.
 - (13) Culvert outlet aprons and inlet protection shall be used as necessary to reduce the risk of scour and perching. If needed, culvert outlet aprons should extend approximately three (3) channel widths downstream from the culvert outlet, and shall be modeled to ensure fish passage if fish are present.

D03.2 HYDRAULIC METHOD

Hydraulically designed culverts are acceptable, in creeks without fish present, or in cases approved by DPW and Alaska Department of Fish and Game (ADFG).

- a) The hydraulic method uses the swimming capability and migration timing of target design species and sizes of fish to create favorable hydraulic conditions throughout the culvert crossing. Information on this methodology is available at Alaska Fish and Game Sport Fish division (<http://www.sf.adfg.state.ak.us/SARR/fishpassage/fishpass.cfm>), the Federal Highway Administration (<http://www.fhwa.dot.gov>) and the USDA Forest Service Stream Systems Technology Center (<http://www.stream.fs.fed.us/fishxing/>).

- b) The design fish shall be a 55 mm (2.16 in.) juvenile coho salmon for anadromous streams and a 55 mm (2.16 in) Dolly Varden char for nonanadromous streams. These criteria may change based on ongoing research by federal and state agencies.
- c) Fish passage high flow design discharge will not exceed the 5% annual exceedance flow or 0.4 times the 2-year peak flow, whichever is lower and has the most supporting hydrologic data.
- d) Fish passage low flow design discharge shall ensure a minimum 6-inch water depth or natural low flow and depth within the reach the crossing occurs. In cases where local conditions preclude natural low flow characteristics, backwatering or in-culvert structures shall be considered.
- e) In cases where flared end sections with aprons are necessary and fish passage is required, water depths and velocities that satisfy fish passage criteria must be demonstrated across the apron in addition to within the culvert
- f) Fish passage criteria for all hydraulically designed culverts must be satisfied 90 percent of the time during the migration season for the design species and age class pursuant to Alaska Statute 41.14.840. Tidally-influenced streams may sometimes be impassable due to insufficient depth at low flow and low tide. If the tidal area immediately downstream of a culvert is impassable for fish at low tide, the 5-percent exceedance criterion shall apply only to the time during which fish can swim to the culvert. Tidally-influenced fish passage structures shall satisfy Alaska Statute 41.14.840 for an average of at least 90% of the tidal cycles, excluding periods when the stream channel is not accessible to fish because of natural conditions at low tide.

SECTION E DEVELOPMENT IMPLEMENTATION

E01 GENERAL

This section describes the procedure that the developer and their engineer are to follow before constructing any improvements required for filing a subdivision plat. The engineer will be the spokesperson for the developer throughout this process.

E01.1 PRELIMINARY PLAT SUBMITTAL

The preliminary plat submittal is to be accompanied by:

- a) Drainage Plan per SECTION D
- b) Road plan and profile if grades exceed 6%, if cuts exceed 5 feet in height measured from the ditch line, or if fills exceed 5 feet in height measured from the centerline.

E01.2 CONSTRUCTION PLANS

Any proposed improvements within the ROW that are outside of the scope of this manual or do not conform to the standards set forth herein must conform to ADOT&PF design criteria and standards. Plans shall be submitted to DPW for approval before construction begins.

E01.3 PRECONSTRUCTION CONFERENCE

- a) The preconstruction conference is for the purpose of reviewing and approving the Subdivision Construction Plan for the required improvements.
- b) Once the preliminary plat has been approved by the Platting Board and the Notification of Action (NOA) has been received, the engineer is to request scheduling of a preconstruction conference with DPW.
- c) The developer and the engineer must attend the preconstruction conference.
- d) The following items will be provided by the developer at the preconstruction meeting:
 - (1) Cost estimate of required improvements
 - (2) Drainage Plan (minimum 11"x17")
 - (3) Fish passage culvert plans (if required by D03)
 - (4) Construction plans (if required by E01.2)
 - (5) Storm Water Pollution Prevention Plan (SWPPP) – if disturbing greater than 1 acre (580 linear feet of road construction) – or a determination by an engineer that one is not needed

- (6) Plan & Profile of proposed roads (if required by E01.1)
 - (7) As-built survey of improvements and utilities within and adjacent to the subdivision
 - (8) Rough plan and time line for construction
 - (9) Copy of any approved permits required for the improvements prior to construction (i.e. ADOT&PF Approach Road Permit, DNR Section Line Easement authorization, USACE wetland fill permit, MSB Flood Hazard Development permit)
 - (10) Easement documents or section line easement verification
 - (11) Material source and disposal site location map
- e) The cost estimate of road construction is used to calculate the inspection fee according to the most recently adopted Schedule of Rates and Fees.
- f) The Subdivision Construction Plan must be signed by the developer and the engineer.
- g) Upon acceptance of the Subdivision Construction Plan by DPW and payment of the inspection fee, the Platting Division will issue a Notice to Proceed (NTP).

E01.4 INTERIM INSPECTIONS

The engineer will supervise all phases of construction. Any proposed changes to the Construction Plan must be submitted to DPW by the engineer. The changes must be approved by DPW prior to being made. Periodic interim inspections may be conducted on all projects by DPW. Interim inspections may also be made at the request of the engineer.

E01.5 FINAL REPORT

When the engineer has determined that construction of the improvements is complete according to the Subdivision Construction Plan, the engineer will submit a Final Report to the Platting Division. Final Reports will only be accepted between May 1st and October 15th.

The Final Report shall include:

- a) Stamped and signed narrative describing at a minimum:
- (1) road construction process and equipment used,
 - (2) material source and disposal areas,
 - (3) road embankment used,
 - (4) road topping or pavement used,

- (5) road standard certification (Pioneer Road, Residential Street, etc.) for each road constructed,
 - (6) road dimensions and shaping (length, roadway width, pavement width, crown, cul-de-sac or t-turnaround dimensions and slope, foreslope, backslope, maximum centerline grade, etc.) for each road constructed,
 - (7) compaction results,
 - (8) drainage, ditch depth, location of drainage easements;
- b) Stamped and signed final Drainage Plan, (minimum 11"x17");
 - c) Compaction tests, (interval?);
 - d) Gradation tests, (interval?);
 - e) Photos of each stage of construction.

E01.6 FINAL INSPECTION

A Final Inspection of the improvements will be conducted by DPW upon receipt of the Final Report. DPW will provide a response within 14 days. If no deficiencies are found, a Certificate of Construction Acceptance will be issued. If deficiencies are found, a punch list will be issued. Upon completion of the punch list, the engineer should notify DPW for re-inspection. No final inspections or re-inspections will be performed by DPW after October 31st.

E01.7 WARRANTY

All improvements are to be guaranteed until October 31st of the calendar year following issuance of the Certificate of Construction Acceptance. Roads within a Road Service Area (RSA) may be accepted for maintenance at the end of the warranty. Pioneer Roads and Mountain Access Roads are not eligible for maintenance, even though they may meet the design standards of this manual.

During the warranty period, the developer is responsible for any road maintenance including, but not limited to: snow removal, maintaining a smooth road surface and crown, maintaining stabilized foreslopes and backslopes, and maintaining positive drainage. If any deficiencies arise during the warranty, DPW will issue a punch list to the developer by September 1st to allow time for completion of repairs. The developer must notify DPW of completion of repairs by October 15th for the roads to be eligible for maintenance. RSA maintenance will begin on November 1st.

If the subdivision plat has not recorded within 6 months of the date of the Certificate of Construction Acceptance or if warranty repairs are not completed by October 15th, the warranty will be extended an additional year and the warranty process will be repeated.

Maintenance may be denied and the Certificate of Construction Acceptance revoked if deficiencies are not corrected to the satisfaction of DPW until such a time that the deficiencies are corrected.

SECTION F (RESERVED)

SECTION G COMMERCIAL AND INDUSTRIAL SUBDIVISIONS

G01 GENERAL

The use of the land will be identified by the developer, or their surveyor or engineer along with the appropriate industrial and commercial traffic rates per the American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highways and Streets" (current edition) or an approved equal. Trafficway widths will be established as the potential traffic rates relate to the roadway classifications and criteria in Sections A & B. Parking will also require consideration in establishing widths unless off street parking is to be provided. Residential Collector streets will be the lowest classification permitted.

SECTION H (RESERVED)

SECTION I UTILITIES

I01 UTILITIES

All utility installation within existing or proposed ROW or utility easements must comply with the provisions of Title 11 Roads, Streets, Sidewalks & Trails and all other applicable sections of MSB code, or as otherwise approved by the MSB. The location of utilities in subdivisions is to be encouraged within utility easements wherever possible. The developer or their representative will be responsible for satisfying any conflicts that may occur in the request for easements from any utility company during the platting process. Utility easements are to be clear of wells, septic systems, house, decks, buildings or other structures; unless the developer has obtained an encroachment permit from the MSB and a "Non-Objection to Easement Encroachment" from the utilities. Utility easements are to be fully useable for utility installation where installation equipment can safely work. Utility easements are not to be placed in swamps, steep slopes, or other unusable areas.

I01.1 UTILITY LOCATION GUIDELINES

a) Rural Areas:

(1) When utility facilities are placed within the road ROW:

- (a) Utility facilities should generally be located as shown in the attached drawing entitled LOCATIONS FOR UTILITIES.
- (b) Back slopes or foreslope which extend into a utility easement should not exceed 4:1. These limits are necessary for construction equipment for utility installation.
- (c) Utility facilities paralleling the ditch line may not be placed closer than ten feet from the edge of the trafficway, the edge of pavement, or a cross culvert, unless otherwise approved by the MSB.
- (d) No shallow utility installation paralleling the road surface will be allowed within the road surface or shoulder areas due to road compaction and/or designated fill requirements. This restriction is not applicable to underground road crossings.
- (e) Underground road crossings require compaction according to the requirements of the permit issued to the utility by the MSB.

(2) When utility facilities are placed outside the road ROW:

- (a) Utility easements as deemed necessary by utility companies will be required.
- (b) A fifteen foot utility easement is needed outside the road ROW to allow for utility installation and maintenance.

b) Urban Area – Paved streets with curbs and/or sidewalks:

Utilities installed in urban areas shall meet the requirements of the City, or if not in a City, shall be by an approved engineered design.

c) Separation of Utilities:

- (1) Overhead - Recommend 5 feet distance horizontally (power pole from underground cable).
- (2) Underground - Recommend minimum one 1 foot separation horizontally between telephone, TV and electric utilities when all are underground.
- (3) Depth of burial - Electric depth of burial is 36 inches except deeper where driveways are planned, etc. TV and telephone burial is 36 inches except 48 inches on crossings.

d) Above Ground Utility Facilities:

- (1) Above ground pedestal, poles, or utility facilities shall not be located within 10 feet of the trafficway edge, unless an alternate design meets clear zone requirements.
- (2) Above ground pedestal, poles, or utility facilities shall not be located within the ROW nearer than 40 feet from the tangent point of the radius return of any existing or proposed intersection.
- (3) Above ground pedestal, poles, or utility facilities shall not be located within 15 feet of a common access point, common access easement, or drainage easement.
- (4) Permanent 5 – 10-foot high snow marker poles shall be installed on all pedestals.
- (5) All guys installed within the ROW or utility easements adjacent to, or near to a roadway shall have a highly visible delineator at eye level.
- (6) Pedestals located within the ROW shall be located within the outer 1 foot of the ROW.

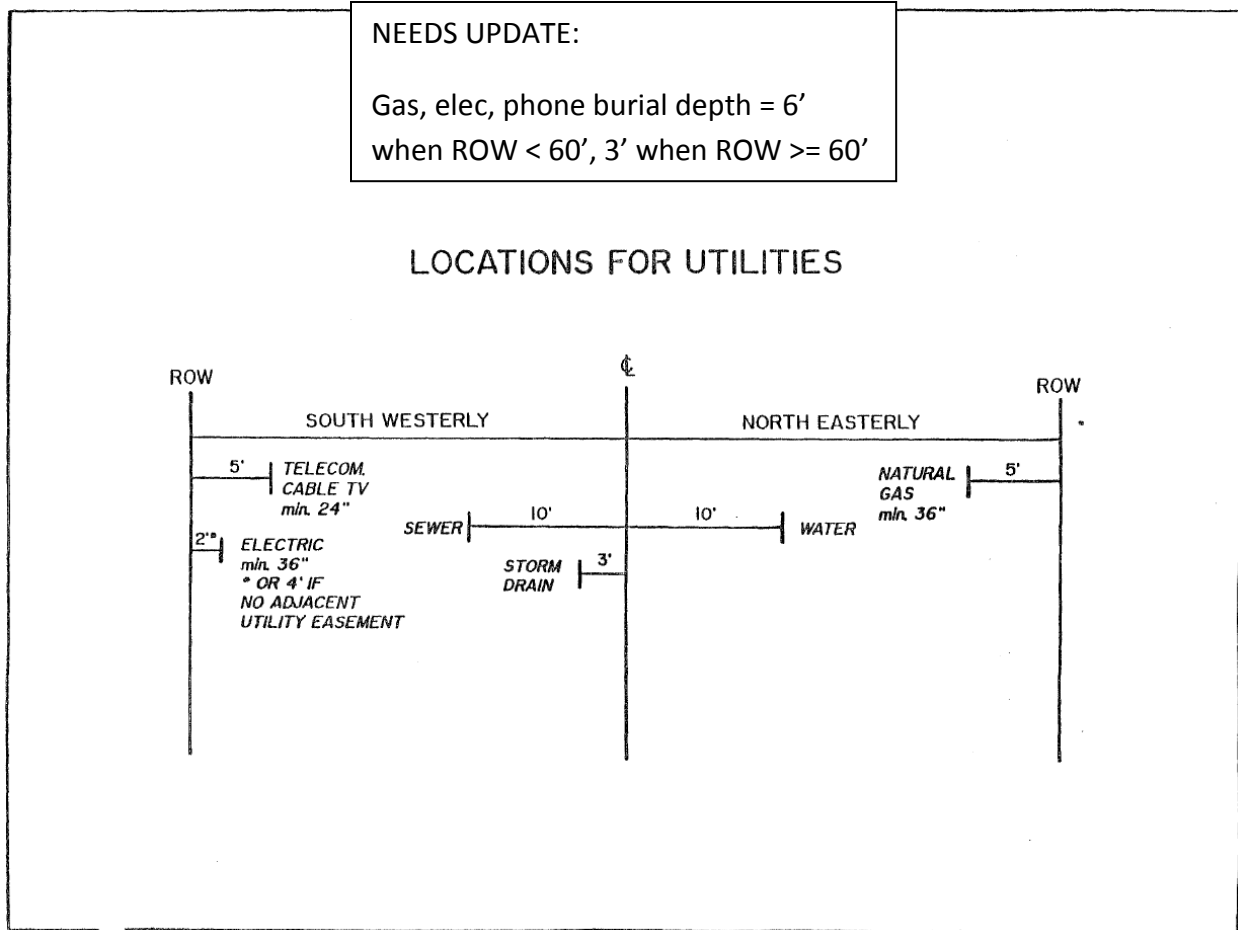


Figure I-1: Locations for Utilities Inside ROW

REFERENCES

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