MEMORANDUM

STATE OF ALASKA

Department of Transportation and Public Facilities
Central Region-Division of Design and Engineering Services
Traffic, Safety, & Utilities Section

To: **Ken Morton, P.E.**
Regional Preconstruction Engineer

Date: March 9, 2012

To: **Gary Lincon, P.E., Chief**
Highway Design Section

Phone No.: 269-0639

From: **Scott E. Thomas, P.E.**
Central Region Traffic Engineer

Subject: Slow Vehicle Turnout Length
1250' Recommendation

This memo documents my recommendation Central Region allow Slow Vehicle Turnouts (SVTs) up to 1250 feet long with tapers. This is based recent actual use and recommendations of other agencies, and based on the findings in this Region to date. This memo could support relevant Design Study Reports as the basis of any revised design lengths:

1. FHWA's 1987 Guide for Low Cost Improvements on Two Lane Roads is the unofficial basis for slow vehicle turnouts to Alaska, Figure 1120-5. Figure 1120-5 illustrates 600 feet maximum length including tapers, leaving 550 feet for deceleration from a point 5 MPH less than the mean speed of through traffic and then stopping before the lane width tapers off.

2. Fig 1120-5 of the DOT/PF Preconstruction Manual is based on FHWA's 1987 Guide. FHWA's guide states they are generally less than 600 feet in length, out of concern "some drivers *may* use them as passing lanes". FHWA's Guide also says drivers tend to avoid turnouts that appear too short. They are good for letting two cars by in our off peak, lower volume situations, but will not work as well under our peak loads. They work better on uphill grades or where the slow vehicle is more likely to comply in using them and find it easy to decelerate. In this Region, we are siting them where they are convenient not only to stop, but to start again as well, with good visibility in both directions.

3. The 2001 AASHTO Green Book (p. 257-258) repeats the same language as the FHWA 1987 Guide. AASHTO also drops the phrase "some drivers *may* use them as passing lanes" leaving only the 600 foot limit. This changes the original guidance which was speculative and unsupported, and inadvertently implies a more certain concern.

4. FHWA and AASHTO both refer to each other, yet contradict each other. FHWA's Draft 2011 Project Development and Design

5. Manual Exhibit 9-3K maintains the same ¼ mile SVT length it published in 2005. At the same time references the AASHTO Green Book for length, which maintains the 600 feet limit through the new 2011 book.

6. Five longer SVT's built in Central Region from 1997 to 2010 (7) under rut repair and maintenance resurfacing projects. These have not demonstrated any operational problems. The two oldest remaining SVT's built in 1997 do not show any passing related

problems. These sites are longer, typically 800 feet, up to 1200 feet because it was efficient to utilize the existing embankment in place and minimize construction.

7. I've observed and utilized existing longer turnouts over several summers. Observation of the MP 113.5 SVT south of the Seward Highway Weigh Station was conducted with the Preconstruction Engineer and the Design Chief on March 2, 2012. This turnout functioned well under lighter traffic volumes, one to three following vehicles, and passenger car use. No driver confusion was evident. ThVehicles were stopping as needed and no passing on the right was observed.

8. Out of a 50 state survey request, 13 responded, and we found only three other states which are currently designing SVT's. All of them allow a maximum length of ¼ mile (Idaho, Washington, and Virginia). Most other states have many highway choices and many multilane highways, so SVT's are less of a concern.

    a. Idaho builds them as space allows. Lengths vary considerably, some only a few hundred feet long.
    b. WashDOT specifies ¼ mile maximum in their Preconstruction Manual and is one of the states used as an example in the 1987 FHWA Guide.
    c. In Virginia and North Carolina, SVT's are used to a limted extent on the Blue Ridge Parkway based on the newer, FHWA 1996 Eastern Federal Lands Highway Project Development and Design Manual. This newer manual indicates a maximum SVT length of ¼ mile.
    d. Oregon was cited in the original FHWA Guide and now no longer uses SVT's, opting for passing lanes.
    e. Maine builds standard climbing lanes.
    f. Michigan builds passing lanes.
    g. West Virginia's District Engineer observes turnouts less than 500 feet long don't work and will get bypassed because the large vehicle must stop.
    h. Minnesota DOT uses left turn bypass lanes of 610 feet with short 15:1 tapers with no concerns. This would be similar to the Parks Highway at Big Lake Junction. Alaska DOT used left turn bypass lanes with ½ speed:1 tapers once, with negative public feeback. Speed:1 tapers are desired for through traffic movement in Alaska.

9. A newer 2007 study in New Zealand reviewed the 1987 FHWA Guide and concluded the recommended 600 foot lengths for SVTS were too short for optimum operation. They observed motorists and passing vehicles getting "pinched" off a the end of the turnout (3) Per the New Zealand study, a longer turnout allows more vehicles to pass by if the slow vehicle does not come to a full stop. A longer turnout is less likely to force a full stop. New Zealand observations and computations show only one or two vehicles can pass a slow vehicle at a turnout of AASHTO's recommended length unless the vehicle stops in the turnout.

10. Reviewing braking distances, one concern in Alaska is slow drivers may be less likely to use a turnout if they perceive that it is too short, same concern as FHWA. Alaska's has a seasonal increase in large trailered vehicles. These vehicles require a longer slowing/stopping distance than smaller slow vehicles. Based on stopping distances for

larger, heavier vehicles lengths up to 1250 feet would better attract and accommodate the full range of vehicle quality, braking configuarations in immediate and more comfortable deceleration conditions. .:

a. A passenger car requires a minimum distance of 500 feet to stop going from 60 MPH to 0 MPH. (Per the AASHTO Green Book Exhibit 2-25) Minus tapers, this leaves little distance for use of SVT's by passenger cars.

b. Minimum SSD is not comfortable stopping, it is immediate stopping. Stopping Sight Distance SSD is 570 feet at 60 MPH per the Green Book. 220 feet is used for reaction time, therefore, 350 feet is needed for a passenger car to come to an immediate stop. Allowing for reaction time and the first 10 MPH of deceleration out in the roadway, down to 50 MPH, motorists still need at least 242 feet for an immediate stop on good pavement.

c. Seward Highway average speeds are about 63 MPH in 65 MPH posted sections. 85th percentile speeds are higher. AASHTO states SVT's are intended to operate with an entry speed of 5 MPH less than the mean or average speed of the highway, which means a 55 to 60 MPH entry.

d. Starting with an entry speed of 60 MPH, at best, minimum tractor-trailer stopping distances are 300 feet for loaded trucks on dry pavement (4). At worst, unloaded tractors with trailers without antilock brakes or poorly maintained brakes, and those with poorer drivers, on wet pavements, will need 538 feet at 55 MPH exiting to 744 feet at 60 MPH exits. This would bring them to a full stop at the very end of a 550 feet SVT or even into the tapered exit before stopping. (From new braking distances in NCHRP 505 on Truck Characteristics in Design, Tables 25 and 26, 2003, computed from the 2001 AASHTO Green Book, by the same author of the FHWA 1987 Guide).

e. It is likely there is less equipment maintanence, regulation, and enforcement for private RV's, loaded campers, and boat trailers than for commercial trucking. I would expect private vehicles may have a larger variation in brake systems and driver skills, thus needing more than 350 feet and possibly more than 550 foot to come to a stop if necessary.

CONCLUSION:

I recommend Central Region continue to design slow vehicle turnout lengths longer than 600 feet where opportunities exist, up to 1250 feet. While the striped turnout may be shorter, a longer runout area should at least be considered. Any potential driver confusion could be mitigated with signing, striping, and delineation. A public education item in each project might also be considered.

This recommendation is based on the research help from Highway Design and Headquarters which shows longer designs in use in West Virginia, North Carolina, Washington, and New Zealand (which considered FHWA 1987 Guidelines). This is also based on Alaska's limited experience with existing SVT's which have functioned adequately since 1997. Similar to Idaho, we are making efficient use of the space we have.

This recommendation is also based on the following two concerns:

1. The queues on the Seward Highway tend to be more than two vehicles long. While passing lanes are the ultimate goal, the few turnouts that exists are not numerous enough to serve our higher seasonal traffic levels or encourage compliance with the current Delay of 5 Vehicles law. If five or more vehicles are being delayed, longer turnouts will allow more vehicles to pass without the slow vehicle coming to a complete stop. This should increase its attractiveness and its use.

2. Slow vehicle turnout lengths of 600 feet taper to taper may work better for passenger cars than larger vehicles. In contrast to the FHWA 1987 Guide which speculates on possible misuse for passing as the primary restriction on length ("may"), there is an even greater indication from truck braking distance studies, from New Zealand observations, from our own in-state observations, and from current other state designs, that larger and recreational vehicles may need up to 750 feet to stop with only minor deceleration on the main highway. In addition, larger vehicles realistically need some distance to "ramp up" to accept a gap to reenter traffic after stopping. Turnouts up to 1250 feet in length will allow for braking and restarting into traffic. Shorter turnouts have a greater impact on braking and restarting decisions, especially for larger vehicles.

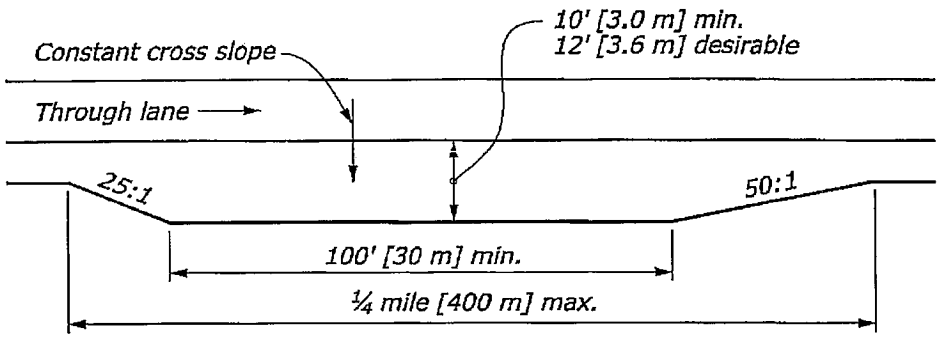
1. AASHTO *A Policy on Geometric Design of Highways and Streets*, Fifth Edition, 2004
2. Harwood, D.W., and C.J. Hoban. *Low-Cost Opportunities for Improving the Traffic Operations of Two-Lane Roads*, Report No. FHWA-IP-87-2, MacLean, Virginia: US Department of Transportation, Federal Highway Administration, 1987
3. Koorey, Glen. *Passing Opportunities at Slow Vehicle Bays*. New Zealand. Journal of Transportation Engineering, Vol. 133, No. 2, February 1, 2007
4. Harwood, D.W., Torbic, D.J., Richard, K.R., and Glauz, W.D. NCHRP Report 505 Review of Truck Characteristics as Factors in Roadway Design, 2003.
5. Gattis, J.L., et al. *Rural Two-Lane Passing Headways and Platooning*. TRR 1579
6. Romana, Manuel G. *Passing Activity on Two-Lane Highways in Spain*. TRR 1678, Paper no. 99-0979
7. Seward Highway SVT's as of 2012: a) MP 52.5 NB (1997 -800'+), MP 113.3 SB (1997 -1200'), b) MP 69 NB (Turnagain Pass Hillcrest 2009 -1000'), MP 43.5 NB (660'), MP 48 NB (785') (Summit Lakes 2009) all five parallel turnouts reclaimed from existing turnouts, put into service under existing lengths rut repair and maintenance resurfacing. Others at MP 71 NB (Turnagain Hill – 800'), MP 62 are no longer in use as nearby passing lanes have been built.
8.

Attachments:
FHWA SVT Design Manual Layout Draft 2011
WDOT SVT Layout 2011
FHWA SVT Layout 2005 used in Virginia, North Carolina – Blue Ridge Parkway
Alaska DOT/PF SVT Layout 2005;
Alaska DOT/PF SVT Layout 1997;

FHWA 2011

located in areas where available sight distance is less than the length shown in the *Green Book* for decision sight distance for avoidance maneuvers C, D or E for the type of road.

Exhibit 9.3-K SLOW-MOVING VEHICLE TURNOUT



¼ MI

9.3.9.11 Parking Pullouts

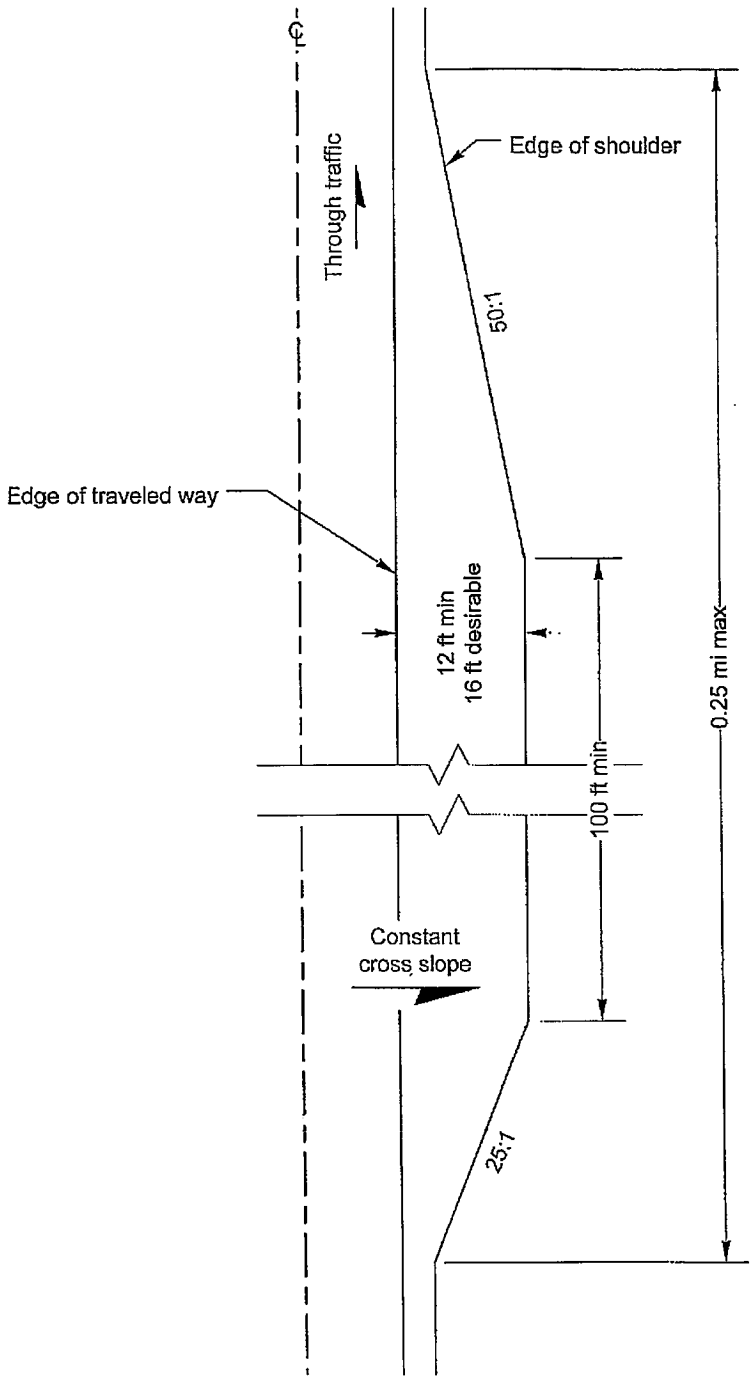
Parking pullouts are advantageous for vehicle checks, orientation, brief driving breaks, vistas, recreation and other purposes. For operating speeds of 45 mph [70 km/h] or less, parking pullouts should be a minimum of 14 ft [4.2 m] wide and 50 ft [15 m] long, excluding tapers, for parallel parking beyond the normal roadway shoulder. For perpendicular or angle parking, pullouts should be a minimum of 40 ft [12 m] wide and 80 ft [24 m] long, excluding tapers, beyond the normal roadway shoulder. Tapers for parking pullouts should be at least 50 ft [15 m] in length. For operating speeds over 45 mph [70 km/h], the pullout and taper dimensions should be increased proportionately to the higher speed. Parking pullouts should not be located in areas where available sight distance is less than the length shown in the *Green Book* for decision sight distance for avoidance maneuvers C, D or E for the type of road.

9.3.9.12 Shoulder Widening for Barriers

Refer to the AASHTO *Roadway Design Guide* for recommended offset distance from the roadway to barriers such as guardrail, terminals, bridge railing, etc. Design sufficient shoulder widening to accommodate the barrier and the offset.

9.3.10 MEDIANS

Refer to the *Green Book*, Chapter 4 §Medians, for guidance on the general design of medians. Specific guidance on the design of medians for collector roads, arterials and freeways is provided in the applicable sections of the *Green Book*.

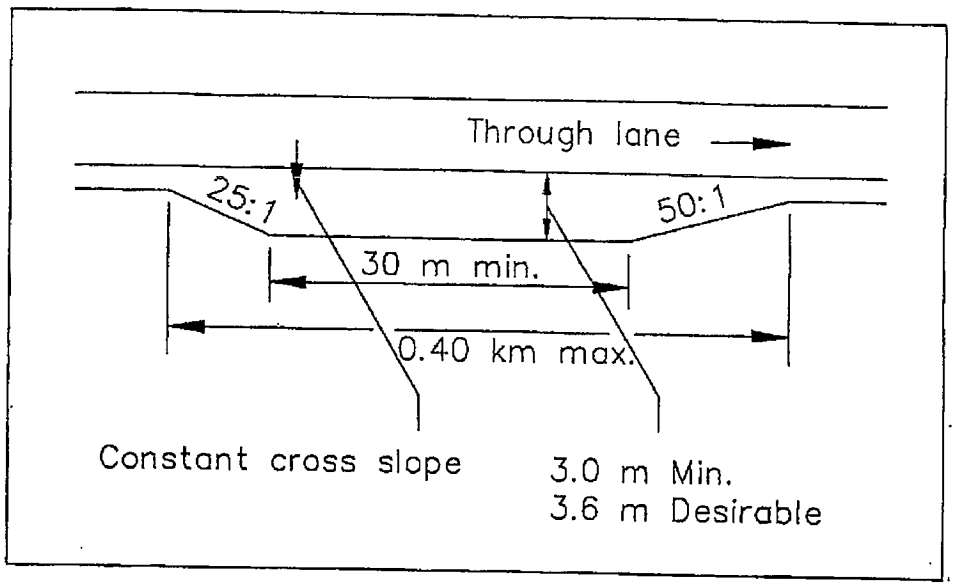


Slow-Moving Vehicle Turnout
Exhibit 1270-9

FHWA: NCDOT VIRGINIA

Figure 9-16 provides guidance for width and length of turnouts. The riding surface of a turnout should be similar to the adjacent travel way. Provide adequate sight distance so the vehicle can re-enter the traffic stream safely. Sign all turnouts to identify their presence.

2005

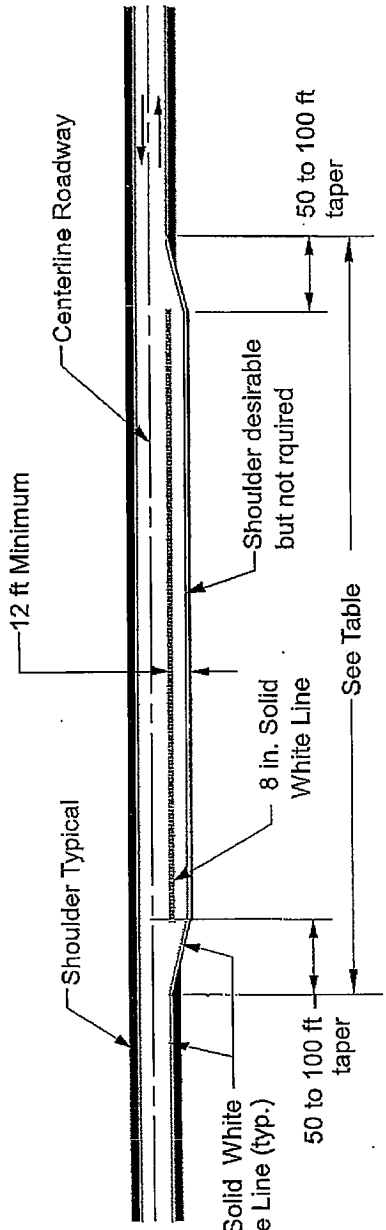


1/4 MI

Figure 9-16
Slow Moving Vehicle Turnout

2005 3R DESIGN

ALASKA
2005



SIGNS

See Alaska Sign Design Manual for applicable signs.

See the Alaska Traffic Manual for sign placement.

APPROACH SPEED (mph) OF SLOW VEHICLE	MINIMUM LENGTH (ft) *
25	200
30	200
40	300
45	350
50	450
55	550
60	600

* Maximum Length should be 600 ft to avoid use as passing lane.

SLOW VEHICLE TURNOUT FOR RURAL TWO LANE ROADWAYS

Figure 1120-5
Slow Vehicle Turnout for Rural Two-Lane Roadways

ALASKA
1997

MEMORANDUM State of Alaska

Department of Transportation and Public Facilities

To:
Gene Kulawik, Director
Maintenance and Operations

Date: July 31, 1997

Thru:

File No.: Morfi963.doc

Telephone No.: 269-0639

From:
Dennis W. Morford, P.E. DM
Regional Traffic Engineer
Traffic, Safety & Utilities

Subject:
Slow Vehicle Turnout Signing
-- Seward Highway
-- Sterling Highway

Per our recent discussions and field trip I have prepared the necessary information for you to install the "Slow Vehicle Turnout" signing requested by John Horn.

Attached is a drawing showing a typical slow vehicle turnout signing plan. On the plan is a table showing the locations and lengths of the 5 slow vehicle turnouts we decided to sign.

Also, attached are drawings showing the sign designs for the three signs to be installed at each of the turnouts.

If you need further information please contact me.

DM/dm

Attachments

Cc: William R. Strickler, P.E., Chief, Traffic, Safety & Utilities
George Church, Superintendent, Soldotna
Bill Mowl, Superintendent, Anchorage

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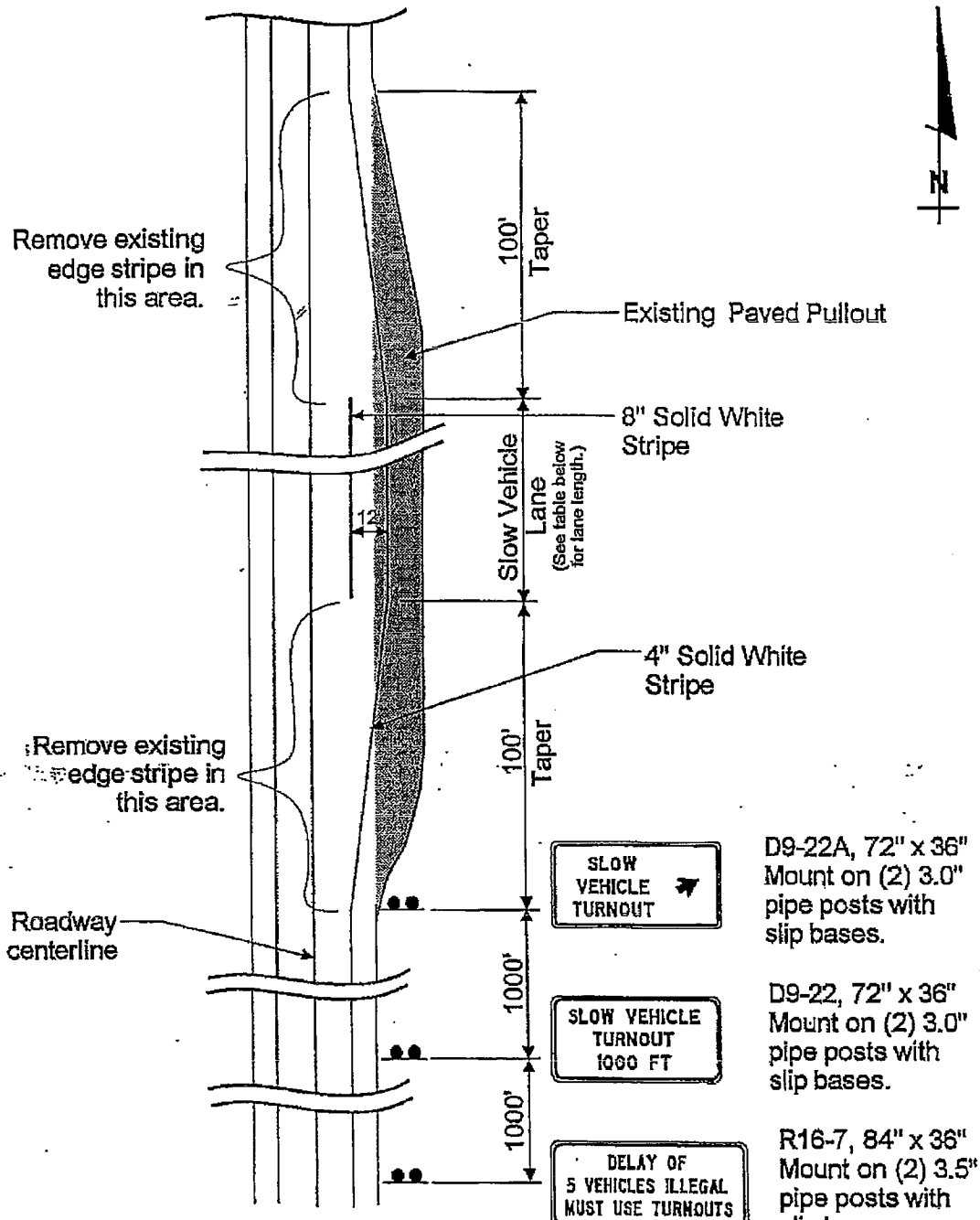
TraffSafe/Signing/Regulatory/Delay of 5 Vehicles/97-07-31 First Turnouts.pdf



D9-22A, 72" x 36" Mount on (2) 3.0" pipe posts with slip bases.

D9-22, 72" x 36" Mount on (2) 3.0" pipe posts with slip bases.

R16-7, 84" x 36" Mount on (2) 3.5" pipe posts with slip bases.

Proposed Locations for Slow Vehicle Turnout Signing

Seward Highway:

Location	Turnout Lane Length
MP 71	800 Feet
MP 69	1000 Feet
MP 52	800 Feet

Sterling Highway:

Location	Turnout Lane Length
MP 53.5	600 Feet
MP 62	2000 Feet

State of Alaska
Department of Transportation & Public Facilities
Central Region
Traffic, Safety & Utilities Section

Slow Moving Vehicle Turnout Signing & Striping Plan

Drawn By: RFM	Date: 7/30/97
Scale:	