ENGINEERING POLICY BALLOT

Effective: July 1, 2022

Level 2

Level two revisions require the approval of the **Assistant Chief Engineer** and the **Federal Highway Administration** only. The **Senior Management Team** is encouraged to review the content and provide comment to the appropriate director. For all other parties, these revisions are posted for information only.

ENGINEERING POLICY BALLOT

Effective: July 1, 2022

Issue 1: Seeding and Mulch

Approval: **Level 2 – Assistant Chief Engineer**

Sponsor: Brian K. Williams – DE, Dennis Brucks – CM

Summary: This is a joint effort between seed and mulch contractors, MoDOT Maintenance, Design, and Construction to improve seeding operations on construction projects. This revision establishes standardized seed mixes for specific regions to stabilize graded areas with vegetation sooner and with greater long-term success. The revisions will also improve our stewardship of the environment by working with our contractors, as well as other state and federal agencies. This includes revisions to the Engineering Policy Guide, Standard Specifications, a new Standard Plan, and updated bid items.

Publication: Secs. 801, 802, 805, 806, Std. Plan 805.00, EPG 802, EPG 805, EPG 806

Issue 2: Embedded Footings and Driven PSST Anchors

Approval: **Level 2 – Assistant Chief Engineer**

Sponsor: Duke M. Leggett – DE, Dennis Brucks – CM

Summary: This revision will better define embedded footings. It will also clarify perforated square steel tube (PSST) anchor installations, method of measure, and payment. This revision includes Engineering Policy Guide, Standard Specification, Standard Plan, D-29 sheet, and bid item changes. The result of these changes will be better contract bids and longevity of PSST signpost installations.

Publication: Secs. 903, 1044, Std. Plan 903.03, EPG 903.3

Issue 3: Sec 304.4.3 for Small Quantities

Approval: **Level 2 – Assistant Chief Engineer**

Sponsor: John Donahue - CM

Summary: This revision will establish a small quantities specification for aggregate base course as well as quality control/quality assurance expectations.

Publication: Sec 304.4.3

Issue 4: Pre-MASH 2016 Temporary Traffic Control Device Sunset Dates

Approval: **Level 2 – Assistant Chief Engineer**

Sponsor: Sarah Kleinschmit – DE, Dan Smith – TS

Summary: MoDOT's MASH Implementation Team has developed sunset dates for non-MASH 2016 temporary traffic control devices.

Publication: Secs. 612, 616, 617, 1063, 1064, EPG 612, EPG 616.6, EPG 616.18, EPG 616.19, EPG 616.23, EPG 617.1, EPG 617.2, EPG 1063, EPG 1064

Issue 5: Asphalt Pavement

Approval: **Level 2 – Assistant Chief Engineer**

Sponsor: Jonathan C. Varner – CM

Summary: This revision establishes a maximum number of contractor QC sublots that can be used for 1 lot of superpave asphalt pavement. The current testing frequency is 1 QA test per 4 QC sublots, thus making 28 sublots a viable maximum number of sublots for an even number of QA tests for comparison.

Publication: Sec. 403.19.2

SECTION 801

LIME AND FERTILIZER

801.1 Description. This work shall consist of the application of agricultural lime and commercial fertilizer and soil preparation for seeding and sodding on areas shown on the plans or designated by the engineer.

801.2 Material.

801.2.1 Material used for soil neutralization, unless otherwise specified, shall be agricultural lime with no less than 90 percent passing the No. 8 sieve containing no less than 65 percent calcium carbonate equivalent.

801.2.2 Agricultural lime shall be furnished from a source that has been tested and certified in accordance with the Missouri Agricultural Liming Materials Act. The quantity of material required to provide the specified pounds of effective neutralizing material (E.N.M.) per acre shall be determined from the producer or distributor's certification of analysis furnished by the Director of the Missouri Agriculture Experiment Station, Columbia, Missouri in accordance with the Missouri Agricultural Liming Materials Act. The contractor shall provide a copy of this certification to the engineer prior to application. If agricultural lime is furnished as a commercially bagged product, pelletized or otherwise, with a guaranteed product analysis shown on the bag listing the elemental properties and gradation, the E.N.M. shall be provided to the engineer. Material may be accepted on the basis of bag label analysis.

801.2.3 Fertilizer shall be a standard commercial product which, when applied at the proper rate, will supply the quantity of total nitrogen (N), available phosphoric acid ($P_2 0_5$) and soluble potash ($K_2 0$), as specified in the ~~contract~~ Missouri Standard Plans for Highway Construction or contract. Material may be accepted on the basis of bag label analysis or supplier's certification, and shall be in accordance with all applicable Missouri fertilizer laws.

801.3 Equipment. Lime and commercial fertilizer shall be applied by mechanical equipment designed for this purpose.

801.4 Construction Requirements.

801.4.1 The area to be limed and fertilized will be the area specified within the limits of construction. The area shall have a uniform surface free from rills, washes and depressions, and shall conform to the finished grade and cross section shown on the plans. ~~The soil shall be thoroughly broken up, worked, tilled and loosened to a minimum depth of 2 inches.~~ The seedbed ~~or sodbed~~ shall be prepared by loosening the existing soil on the slope by surface roughening in accordance with the SWPPP or by other mechanical methods approved by the engineer. Adding loose soil is not an acceptable surface preparation method.~~, rather than by the addition of loose soil.~~

801.4.2 Lime and fertilizer shall be applied evenly at the rates specified in the Missouri Standard Plans for Highway Construction for the applicable region and grass seed mixture type. When a project extends across two regions, the region with the greater acreage of seeding shall be used to determine the lime and fertilizer rates, unless otherwise specified in the contract.~~contract, and~~

~~only when the soil is in a tillable condition~~. ~~After application, the lime and fertilizer shall be thoroughly mixed into the soil to a minimum depth of 2 inches, except when applied hydraulically on slopes steeper than 2:1.~~ Lime and fertilizer shall be applied separately~~, but may be incorporated into the soil in one operation.~~ . Lime and fertilizer shall be applied no more than 48 hours before the seed is sown except when temporary seeding finished areas in accordance with Sec 806.50.2.5~~unless otherwise authorized by the engineer~~.

801.5 Method of Measurement. No measurement will be made for lime or fertilizer. ~~Measurement of the area that has been limed and fertilized will be made to the nearest 1/10 acre.~~

801.6 Basis of Payment. ~~The accepted quantity of liming and fertilizing will be paid for at the contract unit price.~~ No direct payment will be made for lime or fertilizer. All costs for liming or fertilizing shall be included in the applicable seeding item. ~~liming and fertilizing areas for which seeding or sodding items are included in the contract.~~

SECTION 802

MULCHING

802.1 Description. This work shall consist of applying vegetative mulch and a specified stabilization covering as indicated in the contract.

802.2 Material.

802.2.1 Vegetative Mulch. Vegetative mulch shall be prairie hay or straw from oats, rye, wheat or barley. Prairie hay shall consist of any combination of any of the following plants: Big Bluestem, Little Bluestem, Indiangrass, Sideoats Grama and native wildflowers. Mulch may also be composted material from clearing and grubbing operations. If composted material from clearing and grubbing operations are used the particle size shall be such it can be adequately spread and does not exceed 6 inches in length. Mulch shall be free of prohibited weed seed as stated in the Missouri Seed Law and shall be relatively free of all other noxious and undesirable seed. The mulch shall be clean and bright, relatively free of foreign material and shall be dry enough to spread properly.

802.2.2 Mulch Overspray. Mulch overspray shall be either virgin wood cellulose fibers or recycled paper mulch. The mulch shall be produced by either the ground or cooked fiber process, shall not be water soluble and shall have the following properties:

Property	Requirement
Moisture Content, percent by weight, max	15
Organic Matter-Wood Fiber, percent by weight, min	80
pH	4.3-8.5

802.2.3 Certification. The contractor shall furnish a certification for mulch and a manufacturer's certification that the mulch overspray material ~~are~~ is in accordance with these specifications.

802.3 Construction Requirements. All seeded areas shall be mulched in conjunction with the initial application of temporary or permanent seeding. When overseeding, re-mulching will not be required except for areas that lack vegetative growth and the original mulch no longer adequately covers the ground. Disturbed areas outside of authorized construction limits shall be seeded and mulched at the contractor's expense.

802.3.1 Application. Vegetative mulch shall be applied at a minimum rate of 2 1/2 tons per acre. All mulch shall be distributed evenly within 24 hours following the seeding operation. Following the mulching operation, precautions shall be taken to prohibit foot or vehicular traffic over the mulched area. Any mulch that is displaced shall be replaced ~~at once, but only after the work preceding the mulching which was damaged as a result of the displacement has been repaired~~ to the satisfaction of the engineer. The contractor may use erosion control blankets in lieu of mulch.

802.3.2 Stabilization. Vegetative mulch shall be secured from movement by ~~either~~ mulch overspray ~~or embedment as indicated in the contract documents~~, or other methods as approved by the engineer.

~~**802.3.2.1 Mulch Overspray.**~~ Mulch overspray shall be applied over the vegetative mulch as a separate operation. Mulch overspray shall be applied in accordance with the manufacturer's recommendations at a minimum rate of 750 pounds per acre.

~~**802.3.2.2 Vegetative Mulch Embedment.** Mulch shall be embedded in the soil a sufficient depth to prevent the loss of mulch by wind or water erosion and approximately parallel to the roadbed grade.~~

802.4 Method of Measurement. Measurement of Mulch will be made to the nearest 1/10 of an acre of area mulched. ~~This item will not be measured for payment.~~

802.5 Basis of Payment. ~~No direct payment will be made for providing and securing mulch. The accepted quantities of mulch will be considered completely covered by the contract unit price for seeding.~~ The accepted quantities of mulch will be paid at the contract unit price.

802.5.1 No direct payment will be made for maintaining mulch prior to acceptance for maintenance. Mulch re-applied to overseeded areas in accordance with Sec 802.3 shall be at the contractor's expense. On previously accepted mulched areas, the engineer may authorize areas to be repaired in accordance with Sec 104.3.

802.5.2 No additional payment will be made for erosion control blankets used in lieu of mulch at the contractor's option.

SECTION 805

SEEDING

805.1 Description. This work shall consist of furnishing and sowing seed as specified in the contract. All disturbed areas shall be seeded except for sodded areas, surfaced areas, solid rock, and slopes consisting primarily of broken rock.

805.2 Material.

805.2.1 The seed shall be grown and processed in the United States or Canada and shall comply with the requirements of the Missouri Seed Law. Certain lots of seed may be desirable for the advancement of a local ecotype when specified, and will be the only seed permitted. The following percentages for purity and germination or pure live seed will be the minimum requirements in the acceptance of seed, unless otherwise permitted by the engineer.

SEED REQUIREMENTS				
Non-native Grasses	**Scientific Name**	**Purity**	**Germination[a]**	**Pure Live Seed**
Bermuda Grass	Cynodon dactylon	95	80	
Smooth Bromegrass	Bromus inermis	85	80	
Kentucky Bluegrass	Poa pratensis	85	80	
Orchardgrass	Dactylis glomerata	85	80	
Perennial Ryegrass	Lolium perenne	98	85	
Tall Fescue	Festuca arundinacea	97	85	
Red Fescue	Festuca rubra	97	85	
Timothy	Phleum pratense	98	85	
Cereal or Cover Crop		**Purity**	**Germination**	**Pure Live Seed**
Annual Ryegrass	Lolium multiflorum	98	85	
German Millet	Setaric italica	98	85	
Redtop	Agrostis alba	92	85	
Oat Grain	Avena sativia	98	85	
Rye Grain	Secale cereale	98	80	
Teff Grass	Eragrostis tef	97	80	
Wheat Grain	Triticum aestivum	97	85	
Wildrye, Virginia	Elymus virginicus			60
Wildrye, Canada	Elymus canadensis			60
Legumes		**Purity**	**Germination**	**Pure Live Seed**
Korean Lespedeza	Lespedeza stipulacea	98	85	

Alsike Clover	Trifolium hybridum	98	85	
Red Clover	Trifolium pratense	98	85	
White Clover	Trifolium repens	98	85	
Hairy Vetch	Vicia villosa	97	80	
Partridge Pea	Chamaecrista fasciculate	98	80	
Native Grasses	**Scientific Name**	**Purity**	**Variety(s)**	**Pure Live Seed**
Big Bluestem	Andropgon gerardii		Mo. Ecotype Roundtree Kaw	40
Blue Grama	Bouteloua gracilis			40
Buffalograss	Buchloe dactyloides		Mo. Ecotype Sharp's Improved Texoka	65
Indiangrass	Sorghastrum nutans		Mo. Ecotype Rumsey Cheyenne	50
Little Bluestem	Schizachyrium scoparium		Mo. Ecotype Aldous Cimmaron	40
Eastern Gamagrass	Tripsacum dactyloides		Mo. Ecotype	
River Oats	Chasmanthium Latifolium		Mo. Ecotype	40
Sideoats Grama	Bouteloua curtipendula		Mo. Ecotype El Reno Trailway	40
Switchgrass	Panicum virgatum		Mo. Ecotype Trailblazer Cave-in-Rock	80
Wildrye, Virginia	Elymus virginicus			60
Wildrye, Canada	Elymus canadensis			60
Cluster Fescue	Festuca paradoxa		Mo. Ecotype	
Rough Dropseed	Sporobolus compositus		Mo. Ecotype	
Prairie Dropseed	Sporobolus heterolopus			
Prairie Cordgrass	Spartina pectinata			

[a]Will not apply if unhulled or unscarified seed is specified.

WILDFLOWERS (FORBS) (PLS for all wildflowers shall be 80)	
Common name	**Scientific name**
Annual black-eyed Susan	Rudbeckia hirta
Golden Alexanders	Zizua aurea
Greyhead coneflower	Ratibida pinnata
Lanceleaf coreopsis	Coreopsis lanceolata
Milkweed	Asclepias syriaca
New England aster	Aster novae-angliae
Prairie blazing star	Liatris pycnostachya
Purple coneflower	Echinacea purpurea
Purple prairie clover	Dalea purpurea
Sky blue aster	Aster oolentangiensis
Swamp milkweed	Asclepias incarnata
White prairie clover	Dalea candida

805.2.2 If the specified quantity is in pounds of seed, no reduction will be permitted in the specified quantity of seed if the purity or germination or both, are higher than the minimum required by the specifications. If the specified quantity is in pounds of pure live seed, the pure live seed quantity shall be determined from the actual percentage shown by the supplier for native grasses or by multiplying the actual percentages of purity times the actual percentage of germination, including hard seed for other seed.

805.2.3 All leguminous seed shall be inoculated or treated with the proper quantity of cultures approved for the particular legume to be sown. ~~Leguminous seed will include alsike clover, Korean lespedeza, red clover, white clover, hairy vetch, partridge pea and slender bush clover.~~

805.2.3.1 The inoculant for treating leguminous seed shall be a nitrogen-fixing bacteria culture. The inoculant containers shall be plainly marked with the expiration date for use. The manufacturer's recommendations for inoculating seed shall be followed.

805.2.3.2 Native grasses shall be a local ecotype variety adapted for growth in Missouri. In the event a local ecotype is unavailable, the contractor shall promptly provide documentation to the engineer substantiating the variety is unavailable. As part of the documentation, the contractor shall propose an alternative variety source. Alternate ecotype varieties may be used, provided acceptable results are achieved.

805.3 Construction Requirements.

805.3.1 The seedbed shall be prepared in accordance with Sec 801. Seeding shall be done before the seedbed becomes eroded and in accordance with the Missouri State Operating Permit for land disturbance. The grass seed mix type (cool season or warm season) shall be as indicated in the plans, or as directed by the engineer. Grass ~~S~~seed mixes and application rates shall be as specified in the Missouri Standard Plans for Highway Construction for the region that corresponds with the project location. When a project extends across two regions, the region with the greater acreage of seeding shall be used to determine seed mixes and rates, unless otherwise specified in the contract. Seed shall be uniformly applied at no less than the rates identified in the plans~~specified~~.

805.3.1.1 Cool Season Grasses. Full seeding periods for cool season grasses include the months of December through May, August, and September. When seeding during these months, the full rate of lime, fertilizer, seed, and mulch shall be applied. When seeding of cool season grasses is necessary during the months of June, July, October, or November, lime fertilizer, seed and mulch shall be applied at the following rates:

Lime	100 percent of the specified rate
Fertilizer	75 percent of the specified rate
Seed	50 percent of the specified rate
Mulch	100 percent of the specified rate

When the partial application has been made during June, July, October, or November, overseeding of the partially seeded areas shall occur during August, September, December, January, or February. Overseeding requires the application of fertilizer and seed at the following rates.

Fertilizer	25 percent of the specified rate
Seed	75 percent of the specified rate

805.3.1.2 Warm Season Grasses. Warm season grass mixes shall be placed during the period of October 15 through April 15 both dates inclusive. During this period, the rate specified for lime, fertilizer, seed and mulch shall be applied to the prepared seedbed. When grading of an area designated to receive warm season grasses is completed from April 16 through October 14, temporary seeding shall be applied in accordance with Sec 806 and the full amount of lime specified for the warm season grass mix shall be applied. The temporary seeded area shall be overseeded with the warm season grass seed mix, and fertilizer, at the full rates specified in the standard plans, during the next allowable period. No additional lime should be applied with the overseeding.

805.3.2 Disturbed areas outside of authorized construction limits shall be seeded, mulched, limed, and fertilized at the contractor's expense.

805.3.3 All seeded areas shall be limed and fertilized in accordance with Sec 801 and mulched in accordance with Sec 802.

805.4 Acceptance. Acceptance of permanent seeding will be made when seeded ~~disturbed~~ areas meet the requirements for final stabilization as defined in the current state operating permit for land disturbance. Inspection for acceptance of cool season grasses will be made within 60 days after seeding, excluding seeding dates that fall between September 30 and March 1. Cool Season ~~S~~seeding that occurs between September 30 and March 1 will be inspected no earlier than May 1. Inspection for acceptance of warm season grasses will be made no earlier than May 1.

805.5 Time Exception. The contractor shall notify the engineer in writing when final seeding cannot be completed within the specified contract time due to contractual seeding period limitations. The notification shall include a proposed work schedule that shows prompt completion of final seeding during the next allowable seeding period. If the delay of final seeding past the contract completion date is deemed of no fault of the contractor, the engineer will grant an exception to the contract time to allow completion of final seeding without assessment of liquidated damages. This time exception shall not apply to any other uncompleted work.

805.~~5~~6 Certification. The contractor shall certify the seed and seed mixture meets the contract requirements and be in accordance with Sec 805. The certification shall list the seed type, lot numbers, pure live seed, percent germination, and quantity used for each lot. In lieu of listing the lot specific information, the certification may include attached individual bag label analysis for all seed used.

805.~~6~~7 Corrective Action. Inadequate stands shall be reworked and reseeded within the time period agreed upon at the contractor's expense. On previously accepted seeded areas, the engineer may authorize eroded areas to be repaired in accordance with Sec 104.3.

805.~~7~~8 Method of Measurement. Measurement of ~~seeding~~ seeded areas will be made ~~of the area seeded~~ to the nearest 1/10 acre.

805.~~8~~9 Basis of Payment. The accepted quantity of seeding will be paid for at the contract unit price for cool season and warm season grasses. No direct payment will be made for ~~liming, fertilizing or~~ seedbed preparation or any costs associated with overseeding. The cost of lime and fertilizer will be considered included in the cost of seeding. Payment for mulch will be made separately in accordance with Sec 802.

SECTION 806.50 TEMPORARY SEEDING ~~AND MULCHING~~.

806.50.1 Description. This work shall consist of furnishing and applying fertilizer and~~,~~ seed, ~~vegetative mulch or other acceptable cover,~~ in disturbed areas authorized by the engineer. Mulch shall be applied following temporary seeding in accordance with Sec 802. Temporary seeding and mulching is utilized ~~to establish a quick ground cover~~ provide interim stabilization of ~~that reduces erosion in~~ disturbed areas where staging requires the area to be disturbed again at a later date, and for areas to be seeded with warm season grasses that are finish-graded, but application of permanent seeding is disallowed per Sec 805.3.1.2 ~~that are complete but current seasonal conditions are not favorable for applying permanent seeding~~. Finish grading will not be required except for areas that will not receive further grading prior to permanent seeding.. Hydraulic seeding and fertilizing in accordance with Sec 805 will be permitted.

806.50.2 Construction Requirements. Seeding and mulching shall be a continuous operation on all cut and fillslopes, excess material sites and borrow pits during the construction process. All disturbed areas shall be seeded and mulched as necessary to control erosion in accordance with the Missouri State Operating Permit. Seed bed shall be prepared in accordance with Sec 801. ~~When a project is shown in the contract to be constructed in stages and operations in those staged areas are suspended for a significant amount of time, the contractor shall receive payment for temporary seed and mulch.~~ When the engineer allows the contractor to disturb additional ground beyond the restrictions in Sec 806.4.4 solely to enhance the contractor's operation, the contractor shall not receive compensation for temporary seed or mulch, as required by the engineer, for ground cover for areas exceeding the restrictions in Sec 806.4.4.

806.50.2.1 The contractor shall provide permanent seeding and mulching ~~as shown on the plans~~ following temporary seeding in accordance with Sec 805. Any preparation of the seed bed that might be necessary prior to permanent seeding to ensure germination shall be considered incidental to temporary seeding. All washouts and rills shall be repaired at the contractor's expense prior to permanent seeding.

806.50.2.2 Temporary seeding mixtures of cereal grains shall be applied at a minimum rate of 100 pounds per acre. All erodible seeded areas shall provide a minimum of 20 plants of the species planted per square foot on at least two random counts per acre in representative areas of the field. For areas with a large percentage of rock, the number of living plants shall be proportional to the percentage of erodible surface, as determined by the engineer. The counts will be conducted 60 days after the species is planted.

~~**806.50.2.3** Mulch placed over temporary seed mixtures shall be applied in accordance with Sec 802.~~

806.50.2.~~4~~3 Fertilizer shall be applied at a rate of 40 pounds nitrogen (N) per acre.

806.50.2.~~5~~4 Lime will not be required for temporary seeding of unfinished areas. In finished areas, where temporary seeding is placed due to warm season grass planting time restrictions, 100 percent of the lime specified for warm season grasses shall be applied at the time of temporary seeding.

806.50.3 Method of Measurement. Measurement of temporary seeding areas will be made to the nearest tenth of an acre. ~~No measurement will be made for mulch..~~

806.50.4 Basis of Payment. The accepted quantities of temporary seeding will be paid for at the contract unit price per acre. Payment for fertilizer ~~and mulch~~ shall be included in the cost of temporary seeding. When lime is applied in accordance with Sec 806.50.2.4, upon request from the contractor, payment for the lime application will be made as a partial payment for Seeding-Warm Season Mixtures. The remaining payment for Seeding – Warm Season Grasses will be made after permanent seeding is complete.

REGION 1

COOL SEASON GRASSES

LIME 0 LBS ENM/AC — FERTILIZER 80-160-80

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
COOL SEASON		COOL SEASON	
TALL FESCUE	70 LBS/AC	ORCHARDGRASS	20 LBS/AC
KENTUCKY BLUEGRASS	20 LBS/AC	TIMOTHY	10 LBS/AC
PERENNIAL RYEGRASS	10 LBS/AC	RED FESCUE	20 LBS/AC
BUFFALO GRASS	15 PLS/AC	SMOOTH BROME	10 LBS/AC
RED TOP	4 LBS/AC		
LEGUME		LEGUME	
WHITE CLOVER	8 LBS/AC	RED CLOVER	5 LBS/AC
		ALSIKE CLOVER	4 LBS/AC
TOTAL SEED/ACRE	148		

WARM SEASON GRASSES

LIME 0 LBS ENM/AC — FERTILIZER 40-80-40

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
WARM SEASON		WARM SEASON	
BUFFALO GRASS	15 PLS/AC	RED FESCUE	5 LBS/AC
BIG BLUESTEM	10 PLS/AC	PRAIRIE CORDGRASS	10 PLS/AC
LITTLE BLUESTEM	5 PLS/AC	PRAIRIE DROPSEED	2 PLS/AC
INDIAN GRASS	10 PLS/AC	RIVER OATS	10 PLS/AC
SIDE OATS GRAMA	5 PLS/AC		
SWITCH GRASS	3 PLS/AC		
RED TOP	2 PLS/AC		
PERENIAL RYEGRASS	10 PLS/AC		
LEGUME		LEGUME	
WHITE CLOVER	5 LBS/AC	RED CLOVER	5 LBS/AC
WILDFLOWER / POLLINATOR		WILDFLOWER	
LANCELEAF COREOPSIS	0.5 LBS/AC	GOLDEN ALEXANDERS	0.25 LBS/AC
BLACK EYED SUSAN	0.5 LBS/AC	SKY BLUE ASTER	0.25 LBS/AC
GRAY HEADED CONEFLOWER	1 LBS/AC	PRAIRIE BLAZING STAR	0.25 LBS/AC
PURPLE CONEFLOWER	2 LBS/AC		
NEW ENGLAND ASTER	0.25 LBS/AC		
COMMON MILKWEED	0.5 LBS/AC		
SWAMP MILKWEED	0.25 LBS/AC		
WHITE PRAIRIE CLOVER	0.25 LBS/AC		
PURPLE PRAIRIE CLOVER	0.25 LBS/AC		
PARTRIDGE PEA	0.5 LBS/AC		
TOTAL SEED/ACRE	92		

REGION 2

COOL SEASON GRASSES

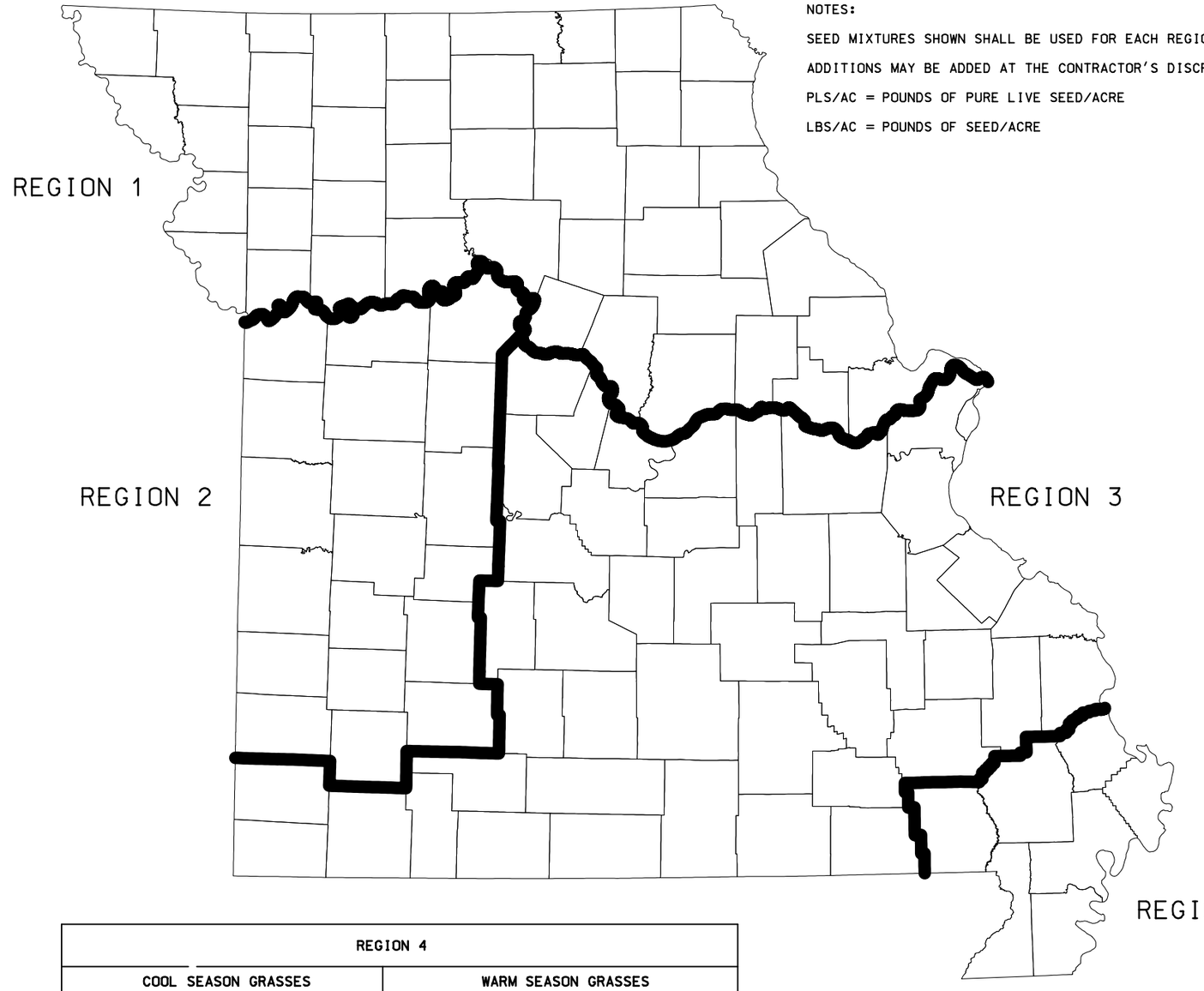
LIME 1000 LBS ENM/AC — FERTILIZER 80-80-80

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
COOL SEASON		COOL SEASON	
TALL FESCUE	70 LBS/AC	ORCHARDGRASS	20 LBS/AC
KENTUCKY BLUEGRASS	10 LBS/AC	TIMOTHY	10 LBS/AC
PERENNIAL RYEGRASS	10 LBS/AC	RED FESCUE	20 LBS/AC
BUFFALO GRASS	15 PLS/AC	SMOOTH BROME	10 LBS/AC
RED TOP	4 LBS/AC		
BERMUDA GRASS	10 LBS/AC		
LEGUME		LEGUME	
WHITE CLOVER	8 LBS/AC	RED CLOVER	5 LBS/AC
		ALSIKE CLOVER	4 LBS/AC
TOTAL SEED/ACRE	148		

WARM SEASON GRASSES

LIME 600 LBS ENM/AC — FERTILIZER 40-40-40

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
WARM SEASON		WARM SEASON	
BUFFALO GRASS	15 PLS/AC	RED FESCUE	5 LBS/AC
BIG BLUESTEM	10 PLS/AC	PRAIRIE CORDGRASS	10 PLS/AC
LITTLE BLUESTEM	5 PLS/AC	PRAIRIE DROPSEED	2 PLS/AC
INDIAN GRASS	10 PLS/AC	RIVER OATS	10 PLS/AC
SIDE OATS GRAMA	5 PLS/AC		
SWITCH GRASS	3 PLS/AC		
RED TOP	2 PLS/AC		
PERENIAL RYEGRASS	10 PLS/AC		
LEGUME		LEGUME	
WHITE CLOVER	5 LBS/AC	RED CLOVER	5 LBS/AC
WILDFLOWER / POLLINATOR		WILDFLOWER	
LANCELEAF COREOPSIS	0.5 LBS/AC	GOLDEN ALEXANDERS	0.25 LBS/AC
BLACK EYED SUSAN	0.5 LBS/AC	SKY BLUE ASTER	0.25 LBS/AC
GRAY HEADED CONEFLOWER	1 LBS/AC	PRAIRIE BLAZING STAR	0.25 LBS/AC
PURPLE CONEFLOWER	2 LBS/AC		
NEW ENGLAND ASTER	0.25 LBS/AC		
COMMON MILKWEED	0.5 LBS/AC		
SWAMP MILKWEED	0.25 LBS/AC		
WHITE PRAIRIE CLOVER	0.25 LBS/AC		
PURPLE PRAIRIE CLOVER	0.25 LBS/AC		
PARTRIDGE PEA	0.5 LBS/AC		
TOTAL SEED/ACRE	92		



NOTES:

SEED MIXTURES SHOWN SHALL BE USED FOR EACH REGION.

ADDITIONS MAY BE ADDED AT THE CONTRACTOR'S DISCRETION FOR NO DIRECT PAY.

PLS/AC = POUNDS OF PURE LIVE SEED/ACRE

LBS/AC = POUNDS OF SEED/ACRE

REGION 3

COOL SEASON GRASSES

LIME 1500 LBS ENM/AC — FERTILIZER 80-240-80

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
COOL SEASON		COOL SEASON	
TALL FESCUE	70 LBS/AC	ORCHARDGRASS	20 LBS/AC
KENTUCKY BLUEGRASS	10 LBS/AC	TIMOTHY	10 LBS/AC
PERENNIAL RYEGRASS	10 LBS/AC	RED FESCUE	20 LBS/AC
BUFFALO GRASS	15 PLS/AC	SMOOTH BROME	10 LBS/AC
RED TOP	4 LBS/AC		
BERMUDA GRASS	10 LBS/AC		
LEGUME		LEGUME	
WHITE CLOVER	8 LBS/AC	RED CLOVER	5 LBS/AC
		ALSIKE CLOVER	4 LBS/AC
TOTAL SEED/ACRE	148		

WARM SEASON GRASSES

LIME 1000 LBS ENM/AC — FERTILIZER 40-120-40

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
WARM SEASON		WARM SEASON	
BUFFALO GRASS	15 PLS/AC	RED FESCUE	5 LBS/AC
BIG BLUESTEM	10 PLS/AC	PRAIRIE CORDGRASS	10 PLS/AC
LITTLE BLUESTEM	5 PLS/AC	PRAIRIE DROPSEED	2 PLS/AC
INDIAN GRASS	10 PLS/AC	RIVER OATS	10 PLS/AC
SIDE OATS GRAMA	5 PLS/AC		
SWITCH GRASS	3 PLS/AC		
RED TOP	2 PLS/AC		
PERENIAL RYEGRASS	10 PLS/AC		
LEGUME		LEGUME	
WHITE CLOVER	5 LBS/AC	RED CLOVER	5 LBS/AC
WILDFLOWER / POLLINATOR		WILDFLOWER	
LANCELEAF COREOPSIS	0.5 LBS/AC	GOLDEN ALEXANDERS	0.25 LBS/AC
BLACK EYED SUSAN	0.5 LBS/AC	SKY BLUE ASTER	0.25 LBS/AC
GRAY HEADED CONEFLOWER	1 LBS/AC	PRAIRIE BLAZING STAR	0.25 LBS/AC
PURPLE CONEFLOWER	2 LBS/AC		
NEW ENGLAND ASTER	0.25 LBS/AC		
COMMON MILKWEED	0.5 LBS/AC		
SWAMP MILKWEED	0.25 LBS/AC		
WHITE PRAIRIE CLOVER	0.25 LBS/AC		
PURPLE PRAIRIE CLOVER	0.25 LBS/AC		
PARTRIDGE PEA	0.5 LBS/AC		
TOTAL SEED/ACRE	92		

REGION 4

COOL SEASON GRASSES

LIME 0 LBS ENM/AC — FERTILIZER 80-160-80

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
COOL SEASON		COOL SEASON	
TALL FESCUE	70 LBS/AC	ORCHARDGRASS	20 LBS/AC
KENTUCKY BLUEGRASS	10 LBS/AC	TIMOTHY	10 LBS/AC
PERENNIAL RYEGRASS	10 LBS/AC	RED FESCUE	20 LBS/AC
BUFFALO GRASS	15 PLS/AC	SMOOTH BROME	10 LBS/AC
RED TOP	4 LBS/AC		
BERMUDA GRASS	10 LBS/AC		
LEGUME		LEGUME	
WHITE CLOVER	8 LBS/AC	RED CLOVER	5 LBS/AC
		ALSIKE CLOVER	4 LBS/AC
TOTAL SEED/ACRE	148		

WARM SEASON GRASSES

LIME 0 LBS ENM/AC — FERTILIZER 40-80-40

SEED MIXTURE		ADDITIONS	
COVER CROP		COVER CROP	
ANNUAL RYEGRASS	5 LBS/AC	VIRGINIA RYE	5 LBS/AC
TEFF GRASS	4 LBS/AC	CANADA RYE	5 LBS/AC
GERMAN MILLET	2 LBS/AC	WHEAT GRAIN	10 LBS/AC
OATS	10 LBS/AC		
WARM SEASON		WARM SEASON	
BUFFALO GRASS	15 PLS/AC	RED FESCUE	5 LBS/AC
BIG BLUESTEM	10 PLS/AC	PRAIRIE CORDGRASS	10 PLS/AC
LITTLE BLUESTEM	5 PLS/AC	PRAIRIE DROPSEED	2 PLS/AC
INDIAN GRASS	10 PLS/AC	RIVER OATS	10 PLS/AC
SIDE OATS GRAMA	5 PLS/AC		
SWITCH GRASS	3 PLS/AC		
RED TOP	2 PLS/AC		
PERENIAL RYEGRASS	10 PLS/AC		
LEGUME		LEGUME	
WHITE CLOVER	5 LBS/AC	RED CLOVER	5 LBS/AC
WILDFLOWER / POLLINATOR		WILDFLOWER	
LANCELEAF COREOPSIS	0.5 LBS/AC	GOLDEN ALEXANDERS	0.25 LBS/AC
BLACK EYED SUSAN	0.5 LBS/AC	SKY BLUE ASTER	0.25 LBS/AC
GRAY HEADED CONEFLOWER	1 LBS/AC	PRAIRIE BLAZING STAR	0.25 LBS/AC
PURPLE CONEFLOWER	2 LBS/AC		
NEW ENGLAND ASTER	0.25 LBS/AC		
COMMON MILKWEED	0.5 LBS/AC		
SWAMP MILKWEED	0.25 LBS/AC		
WHITE PRAIRIE CLOVER	0.25 LBS/AC		
PURPLE PRAIRIE CLOVER	0.25 LBS/AC		
PARTRIDGE PEA	0.5 LBS/AC		
TOTAL SEED/ACRE	92		

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

SEEDING

DATE EFFECTIVE: 07/01/2022
DATE PREPARED: 3/25/2022

805.00

SHEET NO. 1 OF 1

Category:802 Mulching

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Contents

Design Guidance for Sec 802

Description (Sec 802.1)

Mulch is a vital component to stabilization efforts necessary to establish vegetative cover in disturbed areas. All exposed areas to be seeded shall be covered with mulch, erosion control blanket, in accordance with Article 806.1.11, or other commercially available products used to facilitate vegetative growth and reduce erosion and sedimentation such as fiber reinforced matrix (FRM), see article 806;1;10.

Planned Quantities (802.1.2)

Areas to be temporary seeded ,in accordance with Sec 806, or initial applications of permanent seeding, in accordance with Sec 805, shall be calculated to receive mulch to the nearest 10th of an acre. Mulching will not be required for final seeded areas where temporary seeding is planned for temporary stabilization of areas to receive warm season grasses.

Construction Inspection Guidance for Sec 802.2

Description (Sec 802.~~1~~2.1)

Mulch is a temporary ground cover treatment~~, and is used to prevent erosion of the ditch until permanent vegetation is established~~that provides multiple benefits to vegetation establishment . Mulching is applied to check erosion, preserve moisture, and moderate soil temperatures. Reducing the impact of rain is a significant factor in checking erosion. Mulch is the default type of ~~ditch~~ ground cover protection and is used in all ~~ditches~~ disturbed areas where sod, rock ditch liner, erosion control blankets, ~~or~~ paving, or other permanent building materials are not used.

Material (Sec 802.2.2)

Vegetative Mulch (Sec 802.2.2.1 The contractor shall provide a written certification that the mulch is in compliance with the specification.

Mulch Overspray (Sec 802.2.2.2)

The contractor shall provide a manufacturer's certification that the overspray is in compliance with the specifications.

Mulch Overspray acceptance shall be by certification. The certification shall state that mulch overspray meets standard specifications and complies with contract requirements.

Construction Requirements (Sec 802.2.3)

All seeded areas are mulched in conjunction with the initial application of temporary and permanent seeding.

Proper application of mulch is critical keeping in mind that there is no constant relationship between weight and thickness. If the application is too light, the ground becomes susceptible to erosion and the lack of mulch would allow moisture necessary for plant growth to escape. If it is too heavy, the mulch will choke out any native plant species sowed. A lighter mulch application may be sufficient for moisture retention purposes on flat grades where erosion due to runoff is a minor threat. Slopes should have the specified applied rate. In areas more susceptible to runoff erosion, the contractor might elect to use a blanket to minimize erosion to control runoff damage while providing seed with a protective cover.

Acceptance

Areas where mulch has blown away usually identify a potential seeding failure. The contractor is responsible for the proper density of plants. Attention is warranted in the areas with thin mulch cover.

Method of Measurement (Sec 802.2.4)

Mulch is measured to the 1/10 of an acre. ~~is incidental to the seeding contract bid item~~ Areas with vegetative cover from temporary seeding in warm season grass areas will not require mulching unless excessive bare areas exist with no vegetative cover or areas where original mulch no longer exists.~~.~~

Basis of Payment (Sec 802.2.5)

Mulch is paid at the contract unit price. The contractor is responsible to maintain mulch prior to acceptance, and for proper plant density. Areas that require mulch during overseeding operations due to lack of temporary vegetative growth or original mulch application shall be ~~If a lack of a stand is due to sheet and rill damage, the repairs are~~ the responsibility of the contractor. If gully washouts are created by linear flow from outside the seeded areas, the contractor is not responsible for damage.

Category:805 Seeding

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Contents

805.1 Design Guidance for Sec 805

805.1.1 Description

MoDOT is obligated to stabilize disturbed areas with permanent building materials or perennial vegetative cover to minimize erosion and sedimentation of disturbed areas as outlined in the current Missouri State Operating Permit for land disturbance. Vegetative cover helps slow down sheet flow runoff and promote infiltration, reduce pollutant loading of runoff, and stabilize slopes to improve the integratory of the roadway template.

805.1.2 Seed Mixes

As outlined in Sec 805, it is MoDOT's intention to plant cool season and warm season grasses within the right-of-way. Cool season grasses provide a dense stand of grasses in a reduced time over warm season grasses. Cool season mixes grow better in the early spring and late fall when soil and air temperatures are cooler. Warm season grasses take a bit longer to establish growth, but they provide deep root systems that require less moisture, fertilizer, and pesticides.

Job special provisions will no longer be required for seeding mixes. Standard seed mixes, fertilizer, and lime rates have been developed and can be found in the Standard Plans based on soil type regions throughout the state. Projects shall be developed following the standard seed mixes, fertilizer, and lime rates shown in the standard plan. When designing large corridor projects, the Roadside Management Specialist, Maintenance, (573) 751-8647 should be contacted for consideration to refine fertilizer and lime rates as well as if any changes to the standard seed mixes are necessary.

805.1.3 Planned Quantities

When developing quantities for cool and warm season grasses, the intended objective is to provide a landscape that supports MoDOT's mowing policy. MoDOT Roadside Vegetative Management policy can be found in EPG article 822.

Seeding quantities for major road shall be computed based on the following:

- Cool season mixes shall be planted in the first 30 Ft. from the travel way;
- Medians less than 60 Ft. shall be planted in cool season grasses.
- Warm season grasses shall be planted beyond 30 Ft from the travel way;
- Medians greater than 60 Ft. shall be planted with cool season grasses 20 Ft. from the travel way and warm season grasses within the remaining median.

Seeding quantities for minor roads shall be computed based on the following:

- Cool season grasses shall be placed from the edge of pavement or shoulder to the back of the ditch.
- Warm season grasses shall be placed in backslope areas to the right-of-way.

Maintenance Roadside Management Specialist shall be consulted if alternate seeding configurations are considered.

Temporary seeding should be set up for all grading projects as outlined in EPG article 806.1.8.

805.1.4 Design Considerations for Seeding

Seeding operations are typically the last operation a contractor completes on a project. The critical component of opening a road to traffic as quickly as possible is still desirable but final project closeout requires the project to obtain final stabilization among other obligations. When native grasses will be placed on a project, completion dates need to take in to account the warm season grass planting season outlined in Sec 805. The specifications include a provision for projects that will not be able to complete seeding within the contract completion date due to the planting season, but accounting for seeding when setting completion dates will eliminate potential risk for the contractor that may be reflected in the bid. Relying on the exception in the specifications should not be a default approach to addressing seeding and mulch operations and completion dates but an exception to extenuating circumstances within the project.

805.X Construction Inspection Guidance for Sec 805

Description (Sec 805.1)

This work shall consist of furnishing and sowing seed as specified in the contract. Areas to be seeded include earth shoulders, medians, and the entire roadway outside of the roadbed limits, excluding sodded areas, surfaced areas, solid rock, and rock fill slopes consisting primarily of broken rock. The standard plans specify the seeding mixture~~,~~ and the rate of application. ~~, and the~~The areas to be seeded will be shown in the plans in acres. The seeding item includes the cost for fertilizing~~,~~ and liming. ~~, and m~~Mulch ~~materials and their applications~~will be paid for by the acre in accordance with Sec 802.

Material (Sec 805.2)

Seeds shall be grown and processed in the United States or Canada and must comply with requirements of Missouri State Laws. These laws require that each container of agricultural seeds bear a plainly written or printed label, or tag, giving certain information which includes lot number, percent pure seed, percent germination, percent hard seed, etc. Local ecotype native seeds adaptive to grow in Missouri should be used when available. Planting with local ecotypes varieties increases the likelihood that plants will survive and thrive in the local climate. When local ecotypes are not available, this should be documented by the contractor and submitted to the RE with a recommended alternative variety.

The contractor shall provide a certification with the lot number, percent pure seed, percent germination, percent hard seed, etc. prior to applying seed on the project. Certification should carry a statement to the following effect, "This seed is certified to meet all requirements of the Missouri Standard Specifications for Highway Construction." If the seed for the project is mixed prior to arriving on the project, the contractor shall certify the seed mix proportions comply with contract requirements and shall present the required documentation for the inspector in the field.

In addition to requirements of Missouri Seed Law, the specifications list minimum percentages of purity and germination, which govern unless otherwise permitted by the engineer. Intent of this specification is that seed will not be furnished with less than the percent purity and/ or germination required. Standard seed mixes have been developed with permissible additional seed species that may be added to the standard mix at the option of the contractor for no additional pay. Requests may be received to modify the standard seed mixes, ~~However, requests may be received for permission to apply increased quantities of seed deficient in purity and/or germination to compensate for deficiency. In~~in such cases, the resident engineer should consult with the Roadside Management ~~Supervisor~~Specialist, Maintenance, (573) 751-8647, for approval and revised application rates. Additional consideration may be necessary if requests are submitted for permission to apply increased quantities of seed deficient in purity and/or germination to compensate for ~~This~~deviation from the specification. The Roadside Management S~~upervisor~~pecialist should be consulted for approval and revised application rates. This procedure will not normally be allowed as it is intended that the contractor furnish seed of specified quality. If approval is granted, the revised rate will not give credit for any excess purity and/or germination that may exist.

Under no condition is approval to be given to reduce specified amounts of seed per acre even if certification and test results indicate purity and/or germination greater than minimums specified.

Stored seed should be protected from moisture, heat, and rodents.

Construction Requirements (Sec 805.3)

The seedbed shall be prepared in accordance with Sec 801. The seeding operation follows after lime and fertilizer has been ~~worked into~~applied to the soil. Before lime, fertilizer, and seed application, the seedbed should be inspected to determine that soil conditions conform to intent of the specifications. Seed should not be applied to eroded, dry, crusted, or frozen soil. Soil with high silt or clay content may crust over following a light shower and deter proper seed application. Soil should be firm, but uncompacted, with a relatively fine texture. Ground preparation when soil is so wet that it clings to equipment is not only impractical but unsatisfactory because soil is not being broken down into fine particles. Preparation when soil is frozen is undesirable for the same reason.

Sowing

Grass mixes, fertilizer, and lime rates shall be based on the zone indicated in the standard plan for seeding in which the project falls. It is the contractor's responsibility to ensure vegetative growth. Projects that fall in multiple zones should follow the recommended fertilizer and lime rates for that zone.

Cool Season Grasses - The preferred time to seed cool season grasses is outlined in Sec 805.3. Full seeding periods include the months of December~~,~~ through May, August, and September. During these months, all lime, fertilizer, seed, and mulch shall be applied. When seeding of cool season grasses occurs during the months of June, July, October, or November, partial fertilizer~~,~~ and seed shall be applied at the rates specified in Sec 805.3. Overseeding, to include the specified rates of seed and fertilizer, shall be applied during the months of August, September, December, January, or February. Lime will be applied at the full rate during the initial installation and will not require additional application at the time of overseeding. Likewise, additional mulch will not be required for overseeding, unless there are bare spots that require correction, as directed by the engineer. No additional payment for mulch will be made for any areas of correction.

Warm Season Grasses – Seeding of warm season grasses shall only occur during the period of October 15 through April 15 both dates inclusive. Temporary stabilization efforts necessary to comply with the statewide operating permit for land disturbance from April 16 through October 14 shall be done with temporary seeding in accordance with Sec 806.50 and 100 percent of the necessary lime for the permanent seed application. The temporary seeded areas shall be overseeded with warm season grasses during the next October through April seeding period at the full rate specified for seed and fertilizer in the standard plans. It is not necessary that additional lime be applied. Mulching will not be required in overseeded areas unless areas lack temporary vegetation or original mulch is no longer adequately covering the ground.

This is a performance-based specification; therefore, it is the contractor's responsibility to furnish materials in quantities according to areas and rates specified. The seeding is to be applied at no less than the rates specified in the contract. The inspector's count of number and weight of bags of seed used is part of ~~his~~ their record for approving partial payment for areas completed. The inspector must document when an area is seeded as acceptance is made within 60 days of seeding.

It is usually necessary to mix seed on the project in proportions to provide the proper amount of each seed per acre. The inspector should carefully observe mixing operations to be sure a thorough blend is obtained.

Various methods of sowing are available to the contractor. Each has their advantages and disadvantages. The inspector should note the method used in a diary or daily work report.

Dry Seeding

Broadcast distribution of dry seed is a~~e~~ffected by winds. Drills may be used without regard to wind. Normally, a drill operating in one direction produces satisfactory distribution of seeds. Drills have a tendency to place seed too deep. Mechanical seeders should produce satisfactory coverage when operated in one direction only. When seeding is by hand or by mechanical hand seeder, in order to obtain desirable seed distribution, it should be done in two directions, at right angles to each other. Raking, or other approved method, covers the seed to a desirable depth. Care should be taken to preserve proper seed distribution. Seed may also be sufficiently covered by dragging brush, chain, or timber over the seeded area if soil is loose and easily pulverized at the surface, particularly if fine seeds have been sown.

Hydraulic Seeding

Hydraulic application is done by what is frequently called the "slurry method". On slopes steeper than 2 to 1 fertilizer and seed may be mixed with water and sprayed on the area in one application. On other slopes seed and fertilizer are applied separately. No seed should be applied which has been mixed with water for more than 4 hours as germination may be effected.

Application Rate

Minimum application rates are required by the ~~contract~~standard plans and applicable JSPs in the contract, based on the location of the project. Rate of seeding should be checked as soon as possible after beginning operations, and frequently thereafter, by comparing areas seeded with the measured quantity of seed used. Area dimensions, type of seed, and quantities applied should be recorded in the diary or daily work report.

Acceptance (Sec 805.4)

Acceptance of permanent seeding is based on the final stabilization requirements as specified in the current state operating permit for land disturbance. The current permit requires that vegetative cover to be at least 70% perennial plant density over 100% of the disturbed area.

In order to obtain the permanent vegetation desired, job seed mixtures are tailored for the region. Standard seed mixes, fertilizer, and lime rates have been developed and can be found in the Standard Plans based on soil type regions throughout the state. Initial plant growth typically will be

from the annual seeds included in the mix. Competition from annual cover crop species can affect the success of permanent vegetative establishment. For this reason, the contractor should not be allowed to increase the percentage of the annual cover crop seeds in the mix above what is allowed in the seed mixes~~.~~. The contractor shall only use acceptable additional seed species unless approved by the engineer and the Maintenance Roadside Manager.

Inspection for acceptance is dependent on when the seeding occurred (see Basis of Payment below for when an evaluation for acceptance should be made). ~~typically made approximately 60 days following final seeding, or by May 1 for cool season grasses if sowing was done between September 30 and March 1, and no earlier than May 1 for warm season grasses.if sowing was done between September 30 and March 1~~. Careful examination is ~~necessary~~ critical to ensure that the vegetative cover is from the permanent seeding mix and not a temporary cover crop or other foreign plant. It may be necessary to ask for assistance from Roadside ~~Develop~~Management staff in the Maintenance Division, if there is a question regarding plant species present. The seed species picture guide is available to assist with general inspection and acceptance of vegetative covers allowed by specification. Documentation of final acceptance should be made for all seeded areas.

Seed Species Picture Guide {Link}

Seed acceptance shall be by certification. Certification shall state that seed meets Sec 805 and seed mixture complies with contract requirements~~.~~, and shall be presented to the inspector on the project, prior to application.

Please refer to the example for acceptable form of certification.

Report (Records)

Seed shall be reported through AASHTOWARE Project (AWP). A copy of the certification for the seed is to be retained as part of the project files. The report is to show a Status of Accepted/Complete or Rejected/Fail. Appropriate remarks, as described in EPG 106.20 Reporting, are to be included in the report to clarify conditions of acceptance or rejection. Free form report should be attached to the AWP record with any additional information. The AWP record shall be the responsibility of the project inspection personnel upon incorporation into the project.

Acceptance of sufficient seed growth, shall be noted in AWP in a daily work report. Final seed growth may be listed as an exception on the semi-final inspection.

Time Extension (Sec 805.6

When seeding operations cannot be completed within the specified contract timeframe due to seeding period limitations, an extension of time can be requested by the contractor. The request shall include a proposed work schedule showing final seeding operations being completed promptly during the next available seeding period. The request must document why the delay is at no fault of the contractor. The extension shall not apply to any other uncompleted work. If approved, time extensions are to be granted without assessment of liquidated damages.

Corrective Action (~~Sec 805.5~~Sec 805.7)

If an area has not been accepted for seeding and erosion exists due to the lack of ground cover, the contractor will be responsible for the repair. Cost to repair erosion from sheet and rill flow is the contractor's responsibility. In the event gulley erosion results from linear flow drainage from outside the construction area, the resident engineer should authorize payment to the contractor to make the necessary repairs.

Method of Measurement (Sec 805.6)

Follow the specification.

Basis of Payment (Sec 805.7)

After full seeding has been applied on a properly prepared seed bed, and all applicable material certifications have been received (i.e. certifications for seed, lime, fertilizer, etc.), a partial payment of 80% should be made unless additional withholding is justified. If cool season seeding is applied during the partial seeding period, where 50% of the specified rate is applied to the seeded area, a partial payment of 40% should be made. An additional 40% shall be paid upon overseeding of those areas. The balance of the payment due should be withheld until final stabilization has been achieved in accordance with the state operating permit for land disturbance, and as follows:

For cool season grasses applied during the full seeding period from March 1 through May 31 and August 1 through September 30, the engineer's initial evaluation for acceptance should occur between 45 and 60 days from the date the seed was applied, but no later than 60 days. A notification of the results of the evaluation shall be promptly submitted to the contractor so that any re-seeding work can be scheduled.

For cool season grasses applied during the partial seeding period from June 1 through July 31 and October 1 through November 30, the engineer's initial evaluation for acceptance shall not be made until overseeding during the specified timeframe is performed. Evaluation for acceptance shall be based on the time period of the overseeding, not the partial seeding.

For all warm season grasses and cool season grasses applied during the full seeding periods applied between December 1 and February 28, the engineer's initial evaluation for acceptance should occur on or shortly after May 1 (i.e. May 1-7). A notification of the results of the evaluation shall be promptly submitted to the contractor so that any re-seeding work can be scheduled.

Evaluation of any re-seeding work should be based on the time period of the re-seeding and not the time period of the original seeding.

~~After seeding is completed, the contractor can request partial payment. Material certification and invoices must be provided to authorize the initial 80% payment. Additional payment for the seeding should be made when growth is obtained, with the exception of the winter months of November through February. Final acceptance of the seeding is to be delayed until the end of the 60-day or May 1 for winter seeding.~~

Where temporary seeding is used for vegetative stabilization in areas where warm season grasses will be placed and 100% of the lime is provided in accordance with Sec 806.50, the contractor may request an initial compensation payment of 10% of the warm season grass bid to compensate the contractor for lime placed.

~~**Winter Seeding**~~

~~The winter exclusion period for seeding after September is included to ensure against a winterkill. This exclusion can create undue hardship on a subcontractor as a substantial expenditure is made with a possible 7-month delay for full payment. As the subcontractor can not predict the month of the year when final seeding will be necessary, the subcontractor must either bid risk and possibly lose the job or bid without regard to risk and absorb any loss due to the necessity of winter kill rework. Seeding done in October is less prone to winterkill than seeding performed in late November. It is recommended a percentage payment be made when acceptable winter growth is obtained. The following chart offers the recommended percentage of payments for winter seeding. Winter progress payments for seeding must not be made without verifying acceptable growth is present.~~

~~**Seeding Percentages**~~

OCT	NOV - FEB	MARCH	APRIL
85%	80% WHEN SEEDED	85%	90%

Note: Pay 80% when seeding is completed and 100% when final accepted. For the months, October through April, pay the percentages indicated by the table when acceptable growth is obtained. For months, May through September, pay 95% when acceptable growth is obtained.

No direct payment should be made for overseeding.

Repairs

When the engineer waives contractor responsibility for damaged areas, payment it is determined damaged areas is the department's responsibility, the contractor is to be reimbursed for repairing the seedbed and reseeding shall be made as provided in Sec 109.4 of the Standard Specifications. A change order should be processed to document the additional work, as the charges are an overrun to the contract.

EPG Table 805.2.4, Species Guide		
Non-native Grasses		
Bermuda Grass	 Seedling	 Mature Growth
Kentucky Bluegrass	 Seedling	 Mature Growth

Orchardgrass	 Seedling	 Mature Growth
Perennial Ryegrass	 Seedling	 Mature Growth
Red Fescue	 Seedling	 Mature Growth

Smooth Bromegrass	 Seedling	 Mature Growth
Tall Fescue	 Seedling	 Mature Growth
Timothy	 Seedling	 Mature Growth

Cereal or Cover Crop		
Annual Ryegrass	 Seedling	 Mature Growth
German Millet	 Seedling	 Mature Growth

Oat Grain	 Seedling	 Mature Growth
Redtop	 Seedling	 Mature Growth

Rye Grain	 Seedling	 Mature Growth
Teff Grass	 Seedling	 Mature Growth

Wheat Grain	 Seedling	 Mature Growth
Wildrye, Canada	 Seedling	 Mature Growth
Wildrye, Virginia	 Seedling	 Mature Growth

Legumes		
Alsike Clover	 Seedling	 Mature Growth
Hairy Vetch	 Seedling	 Mature Growth
Korean Lespedeza	 Seedling	 Mature Growth

Partridge Pea	 Seedling	 Mature Growth
Red Clover	 Seedling	 Mature Growth
White Clover	 Seedling	 Mature Growth

Native Grasses		
Big Bluestem	 Seedling	 Mature Growth
Blue Grama	 Seedling	 Mature Growth

Buffalograss	 Seedling	 Mature Growth
Cluster Fescue	 Seedling	 Mature Growth
Eastern Gamagrass	 Seedling	 Mature Growth

Indiangrass	 Seedling	 Mature Growth
Little Bluestem	 Seedling	 Mature Growth
Prairie Cordgrass	 Seedling	 Mature Growth

Prairie Dropseed	 Seedling	 Mature Growth
River Oats	 Seedling	 Mature Growth
Rough Dropseed	 Seedling	 Mature Growth

Sideoats Grama	 Seedling	 Mature Growth
Switchgrass	 Seedling	 Mature Growth
Wildrye, Canada	 Seedling	 Mature Growth

Wildrye, Virginia	 Seedling	 Mature Growth
Wildflowers		
Annual Black-eyed Susan	 Seedling	 Mature Growth
Golden Alexanders	 Seedling	 Mature Growth

Greyhead Coneflower	 Seedling	 Mature Growth
Lanceleaf Coreopsis	 Seedling	 Mature Growth
Milkweed	 Seedling	 Mature Growth

New England Aster	 Seedling	 Mature Growth
Prairie Blazing Star	 Seedling	 Mature Growth
Purple Coneflower	 Seedling	 Mature Growth

Purple Prairie Clover	 Seedling	 Mature Growth
Sky Blue Aster	 Seedling	 Mature Growth

Swamp Milkweed	 Seedling	 Mature Growth
White Prairie Clover	 Seedling	 Mature Growth

806.1.2 BlankMulch Covering

~~Applying mulch over steep slopes may be used as a temporary erosion control BMP. Applying mulch covering over disturbed ground will reduce the potential for erosion by as much as 94%. Bark or chip mulches do not require crimping like vegetative mulches such as straw. Mulches may need to be removed or modified prior to final seeding operations. Mulch covering should be considered if clearing and grubbing operations produce an abundance of available material.~~

806.1.8 Temporary Seeding ~~and Mulching~~

This work shall consist of preparing and fertilizing a seedbed, furnishing and sowing of seed, and mulching. The purpose of temporary seeding and mulching is to produce a quick ground cover to reduce erosion in disturbed areas that are expected to be re-disturbed at a later date or if groundcover needs to be established in non-favorable seeding seasons.

806.1.8.1 Design Considerations

Temporary Seeding and mulching will be a critical component of temporary stabilization for projects with land disturbance. Temporary seeding shall follow Sec 806.50 and mulching shall be included as a separate bid item in accordance with Sec 802. Temporary seeding quantities for large scale projects should be set up at 50% of final seeding quantities, and for small scale projects temporary seeding quantities should be set up at 100% of final seeding quantities. ~~Projects to be constructed in stages where it is known that areas will be shut down for a significant amount of time (generally 14 days or more), designers are to include temporary seeding in the bid documents.~~ Additional mobilization should be provided on projects where construction activities disturb an acre or more over the life of a project (see EPG 618 Mobilization).

806.1.8.2 Construction Considerations

Temporary ~~Seeding~~ seeding ~~and/or mulching~~ and mulch applications ~~will~~ are to be a continuous operation on all cut and fill slopes, waste sites, and borrow pits during the construction process. All disturbed areas shall be seeded and mulched with permanent seeding during allowable seeding timeframes outlined in EPG 805. When permanent seeding cannot be placed due to seeding time restrictions, or when work will be halted in an area for more than 14 days, temporary seeding shall be used to establish temporary stabilization ~~when and where necessary~~ to eliminate erosion. Seeding ~~and/or~~and mulching shall be done as soon as possible after completion of the earthwork, not to exceed 14 days, weather permitting. ~~MoDOT does not pay for temporary seed or mulch that is used to establish ground cover that is solely established to allow the contractor to disturb additional ground beyond those restrictions in Sec 806.50 of the Missouri Standard Specification for Highway Construction.~~

~~Temporary m~~Mulch placed over temporary seed mixtures shall be applied in accordance with the provisions of Sec 802~~.2.1~~ of the Missouri Standard Specifications for Highway Construction. Fertilizer shall be applied at the rate specified ~~for permanent seeding~~in Sec 806.50 of the Missouri Standard Specifications for Highway Construction. Lime will usually not be required for temporary seeding but will be applied according to governing specifications when a permanent seed mixture is used.

806.8.6.3.2 ~~Mulching and Crimping~~BLANK

~~Application of mulch without seed may be used as a temporary best management practice if approved by the engineer. This temporary stabilization practice is most applicable in late fall or early winter when grass seed would have little or no opportunity to germinate. Straw mulch should be applied with a mulch blower, or by hand, and must be anchored (crimped or otherwise tackified) immediately after spreading to prevent windblow. Application rates will vary based on the percent slope. Bark mulch and/or wood chips do not require crimping. The engineer will determine whether or not the wood chip mulch may remain in place, be cultivated or be modified for permanent seeding.~~

806.8.6.3.8 Seeding and Mulching

806.8.6.3.8.1 Temporary Seeding and Mulching (MO Specifications Sec 802 and Sec 805)

Temporary seeding and mulching will be used to produce a quick ground cover of annual grasses to reduce erosion in disturbed areas that are expected to be either re-disturbed or permanently seeded at a later date. It should be used as necessary to prevent erosion and decrease reliance on costly maintenance of sediment control BMPs. For project planning purposes, it is important to understand that temporary vegetative cover will begin to lose its effectiveness within 6 to 12 months depending on site conditions.

Disturbed areas shall be seeded and mulched when and where necessary to eliminate erosion or establish temporary stabilization in areas for warm season grasses when outside the planting season. In designated areas, seeding and~~/or~~ mulching shall begin no later than 7 days after earthwork operations have ceased and shall be completed within 14 days (7 days on slopes steeper than 3:1 or greater than 3% and longer than 150 Ft. in length), weather permitting. Projects planned over multiple years~~,~~ shall stabilize ~~Most~~ disturbed areas, with the exception of the road grade itself, ~~shall be temporary stabilized~~ during the fall to prevent erosion. If final grade has been achieved, this operation should consist of establishing permanent vegetation in areas where planting is in season~~, not temporary~~.

806.8.6.3.8.2 Permanent Seeding and Mulching (MO Specifications Sec 805)

Permanent seeding and mulching following the temporary seeding will be performed. It is important to remember that temporary seeding and mulching can be used to cover up bare soil during times that are not conducive to applying permanent seeding. Then, when conditions are more suitable for permanent seeding, it can be applied over/through the temporary seeding stubble. ~~In some cases, it may be necessary to mow the temporary seeding stubble and then apply permanent seeding.~~

Any revisions or deviations from contract seed mixtures and applications must be approved by the Roadside Section of MoDOT's Maintenance Division

SECTION 903

HIGHWAY SIGNING

903.1 Description. This work shall consist of furnishing and installing highway signs as shown on the plans. All signs shall be in accordance with the MUTCD. Any signs not detailed on the plans shall be in accordance with *Standard Highway Signs* by the U.S. Department of Transportation, Federal Highway Administration.

903.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section/Specification
Reinforcing Steel for Concrete	1036
Highway Sign Material	1042
Delineators, Mile and Marker Posts	1044
Paints for Structural Steel	1045
Electrical Conduit	1060
Expansive Mortars	1066
Carbon Steel Bolts, Nuts and Washers	1080
Structural Carbon Steel	1080
Structural Low Alloy Steel	1080
Low-Carbon Steel Anchor Bolts	ASTM F1554, Grade 36
High-Strength Anchor Bolts and Nuts	ASTM F1554, Grade 55
High-Strength Bolts, Nuts and Washers	1080
Galvanized Coating of Structural Steel, Tubular Steel Sign Supports, Sign Trusses and Appurtenances	1081

903.2.1 Sign Posts and Tubular Steel Sign Supports.

Item	Section/Specification
Perforated Square Steel Tube Posts	1044
Wood Posts	1050
Steel Pipe Posts	ASTM A53, Grade B, or ASTM A500, Grade B
Galvanizing of Steel Pipe Posts	ASTM A53
Structural Steel Welding Electrodes	AWS A5.1 or AWS A5.5
Structural Steel Posts	AASHTO M270 Grade 50 or 50w
U-Channel Posts	ASTM A499, Grade 60

903.2.2 Overhead Sign Trusses.

Item	Specification
Aluminum Extruded Tube	ASTM B221, 6061-T6

Aluminum Permanent Mold Castings	ASTM B108, A 356.0-T61
Aluminum Sand Castings	ASTM B26, 356.0-T6
Aluminum Plate	ASTM B209, 6061-T6
Aluminum Structural Shapes	ASTM B308, 6061-T6
Aluminum Pipe Handrail	ASTM B241, 6061-T6 or 6063-T6
Aluminum Pipe Fittings for Schedule 10 Pipe	ASTM B26, 356.0-T6 or ASTM B108, A 356.0-T61
Aluminum Grating Bearing Bars Cross Bars	 ASTM B211, 6061-T6 or ASTM B221, 6061-T6 or 6063-T6 ASTM B211, 6061-T6 or ASTM B221, 6061-T6 or 6063-T5 or T6
Aluminum Washers	ASTM B209, 2024-T4 or Alclad 2024T4
Aluminum Beveled Washers	ASTM B221, 2024-T4
Filler Wire for Welding Aluminum	AWS A 5.10 ER5356, ER5556
Stainless Steel U-Bolts	ASTM A276 Chromium-Nickel Grade, min. yield 30,000 psi
Stainless Steel Bolts, Nuts, Screws and Washers	ASTM A320 or SAE J405D, Austenitic Steel, min. yield 30,000 psi
Structural Steel Welding Electrodes	AWS A 5.1 or AWS A 5.5

903.2.3 Hardware. Anchor bolts, bolts, nuts and washers specified to be galvanized shall be galvanized in accordance with AASHTO M 232 (ASTM A153), Class C or mechanically galvanized in accordance with ASTM B695, Class 55. Except for anchor bolts, galvanizing thickness shall not exceed 6 mils. For high strength bolts, the contractor shall furnish to the engineer a copy of the manufacturer's inspection test report for each production lot or shipping lot furnished, and shall certify the bolts furnished are in accordance with Sec 1080.

903.2.4 Concrete. Concrete shall be of the class specified in the contract. Material, proportioning, mixing, slump and transporting of concrete shall be in accordance with Sec 501 for the specific class specified. Concrete shall be placed, finished and cured in accordance with Sec 703.

903.2.5 Equipment and Material. Equipment and material shall be of new stock unless the contract provides for relocation of existing units or use of units furnished by others. New equipment and material shall meet the approval of the engineer.

903.3 Construction Requirements.

903.3.1 Footings for Trusses and Posts.

903.3.1.1 Bolt-Down Installations. Bolt-down footings and end supports are those in which anchor bolts are cast into the footing, such as for overhead sign trusses and tubular steel sign supports. Class B concrete shall be used to construct bolt-down footings. ~~all footings and end supports for overhead sign trusses, tubular steel sign supports and posts with bolt-down bases.~~ Footings shall be formed, unless in the judgment of the engineer, soil conditions permit excavation to be made to the neat lines of the footings and the footings cast against the undisturbed vertical soil face. In all cases, the top 12 inches below finished ground line shall be formed. Footings shall be placed on firm, stable, undisturbed soil to the minimum depth shown on the plans. Backfill shall be thoroughly compacted, and care taken to prevent damage to finished concrete. Backfill shall be brought up level with the finished ground line. Anchor bolts shall be firmly held in proper position, supported at the top, during placement of concrete.

903.3.1.2 Embedded Installations. Embedded installations are defined as footings for pipe posts and structural steel posts only. Class B or B-1 concrete, or concrete of a commercial mixture meeting the requirements of Sec 501, or prepackaged dry commercial concrete mixture meeting the requirements of Sec 903.3.1.2.1 shall be used for the footings for embedded-type sign posts~~, except as otherwise allowed herein~~. Posts shall be supported in proper position until the concrete or other approved material has set. Excavation and backfill shall be in accordance with Sec 903.3.1.1, except forming will not be required unless soil conditions warrant forming. Tops of footings shall be finished flush with the slope of the ground. Footings shall be visually inspected for acceptance by the engineer.

903.3.1.2.1 ~~In lieu of the concrete material requirements in Sec 903.3.1.2, the contractor may use a p~~Pre-packaged dry commercial concrete mixture used for embedded footings shall have ~~that has~~ a manufacturer's 28-day compressive strength rating of no less than 4,000 psi for the footings for embedded-type sign posts. The concrete shall be thoroughly mixed in accordance with the manufacturer's recommendations. Strength requirements shall meet or exceed Class B concrete as specified in Sec 501.

~~**903.3.1.2.2** In lieu of concrete, the contractor may use a quick-setting polyurethane foam for the footings for embedded-type sign posts. The foam shall have a minimum compressive strength of 80 psi (550 kPa), in the direction of rise, when tested in accordance with ASTM D1621, and shall have a minimum density of 4 pounds per cubic foot (65 kg/m^3) when tested in accordance with ASTM D1622. Foam shall not be placed in water. Polyurethane foam shall be mixed in accordance with manufacturer's recommendations. Polyurethane foam will not be permitted if soil conditions are such that forming is necessary.~~

903.3.1.3 Perforated Square Steel Tube Post Anchor Installations. Construction requirements and concrete material requirements for perforated square steel tube (PSST) anchor installations shall be in accordance with Sec 903.3.1.2. In lieu of concrete, polyurethane foam meeting the requirements of Sec 903.3.1.3.1 may be used, except that, concrete shall be used for post anchor installations for Emergency Reference Markers.

903.3.1.3.1 Polyurethane foam shall be a quick-setting hydrophobic, closed cell, high density polyurethane foam with a minimum compressive strength of 80 psi (550 kPa), in the direction of rise, when tested in accordance with ASTM D1621, and shall have a minimum density of 4 pounds per cubic foot (65 kg/m3) when tested in accordance with ASTM D1622. Foam shall not be placed in standing water. Polyurethane foam shall be mixed in accordance with manufacturer's recommendations. Polyurethane foam will not be permitted if soil conditions are such that forming is necessary. Material shall be tested in the presence of the engineer in accordance with Sec 625.10.2.1.4.

903.3.1.~~3~~4 Optional Footings. Substructures for butterfly and cantilever overhead sign trusses and posts may be either drilled shafts or spread footings.

903.3.1.~~3~~4.1 The quantities shown on the plans reflect the total cubic yards of substructure, based upon drilled shaft quantities.

903.3.1.~~3~~4.2 No adjustment in payment will be made for providing the equivalent spread footing design that differs in area from the specified drilled shaft design.

903.3.1.~~3~~4.3 If rock is encountered and the depth of drilled shafts is adjusted accordingly, cubic yard quantities will be recalculated for those locations and payment will be adjusted accordingly. Cubic yard quantities will not be recalculated for spread footings if rock is encountered, unless it is considered differing site conditions in accordance with Sec 104.2 of the standard specifications.

903.3.2 Posts for Ground Mounted Signs.

903.3.2.1 Post Lengths. Post lengths shown on the plans for ground-mounted signs are for bidding purposes only. The contractor shall be responsible for determining post lengths to provide the vertical clearance shown on the plans. Field cutting of posts will be permitted.

903.3.2.2 Post Alignment. Sign posts shall be vertical. Any post bent or otherwise damaged to the extent that the post is considered unfit for use shall be removed and replaced with an acceptable post at the contractor's expense.

903.3.2.2.1 Structural Steel Posts. Structural steel sign posts for ground mounting of signs shall be fabricated and erected as shown on the plans. Welds shall be of full section and sound throughout. Posts with dimensional defects and structural discontinuities will be rejected. Posts built up by welding two lengths together will be permitted, provided the welds are ground smooth and flush with the base metal. Posts and appurtenances shall be hot-dip galvanized after fabrication. Posts with breakaway assemblies shall be cut at the hinge prior to galvanizing, except for field cutting. Hinge plates shall not be attached to the posts at the time of galvanizing. All welds shall be cleaned before galvanizing. All exposed steel areas and damaged galvanizing shall be repaired in accordance with Sec 1081.

903.3.2.2.2 Pipe Posts. Pipe posts shall be fabricated as shown on the plans and shall be hot-dip galvanized after fabrication. Welds shall be of full section and sound throughout. Posts with dimensional defects and structural discontinuities will be rejected. All welds shall be cleaned before galvanizing. Exposed steel areas and damaged galvanizing shall be repaired in accordance with Sec 1081. Friction caps for pipe posts shall be of the dimensions shown on the plans and may be galvanized steel or aluminum alloy.

903.3.2.2.3 Perforated Square Steel Tube Posts. Perforated square steel tube posts (PSST) shall be installed at locations shown on the plans. Exposed steel areas and damaged galvanizing shall be repaired in accordance with Sec 1081. A six foot 2.25" PSST insert shall be installed inside the 2.5" PSST post, above the breakaway assembly, when required per the plans.

903.3.2.2.4 U-Channel Posts. U-Channel posts shall be installed at locations shown on the plans. Exposed steel areas and damaged galvanizing shall be repaired in accordance with Sec 1081.

903.3.2.2.5 Wood Posts. Wood posts shall be installed at locations shown on the plans.

903.3.2.3 Certification. The contractor shall furnish to the engineer ~~three copies of~~ the fabricator's certification that the material supplied is in accordance with the requirements specified.

903.3.3 Tubular Steel Sign Supports. Tubular sign supports for overhead mounting of signs shall include span, cantilever and butterfly types, complete with poles, beams, mast arms, sign bracket assemblies and other specified appurtenances. All steel shall be hot-dip galvanized after fabrication in accordance with Sec 1081. All welds shall be cleaned before galvanizing. Shop drawings will not be required for these supports.

903.3.3.1 Tapered Steel Poles and Beams. Tapered steel poles and beams shall be a continuous taper tube, fabricated from one length of open hearth sheet steel with one continuous welded longitudinal seam. After fabrication, the material shall have a minimum yield strength of 48,000 psi. Straight steel arms shall be standard or extra heavy pipe, of the dimensions and grades shown on the plans. Bolts, nuts, washers, clamps and sign bracket assemblies shall be hot-dip galvanized or of stainless steel. Clamps shall be fabricated of low alloy steel.

903.3.3.2 Certification. The contractor shall furnish to the engineer ~~three copies of~~ the manufacturer's certification that the tubular steel sign supports are in accordance with the requirements specified.

903.3.3.3 Surfaces. Galvanized material shall be handled to avoid damage to the surfaces. Any material on which the galvanizing has been bruised or broken will be rejected or may, with approval from the engineer, be repaired in accordance with Sec 1081.

903.3.4 Overhead Sign Trusses. Overhead sign trusses shall be steel or aluminum, and shall include all structural steel, structural aluminum, aluminum castings, pipe railing, gratings, supports and appurtenances above the top surface of the concrete footings. Shop drawings in accordance with Sec 1080 shall be furnished to the engineer for approval.

903.3.4.1 Testing and Certification. The contractor shall furnish to the engineer a copy of certified mill test reports on all material furnished, providing the actual chemical analysis and the actual results of physical tests. In lieu of mill test reports for secondary members, the contractor may furnish a certification from the fabricator certifying the material supplied is in accordance with the requirements of these specifications. All test reports and certifications shall be furnished to the engineer before any requests for shop inspection are made.

903.3.4.2 Steel Fabrication and Erection. Structural steel fabrication and erection shall be in accordance with Secs 712 and 1080, except as hereinafter specified.

903.3.4.3 Welder Qualifications. Before starting fabrication of structural aluminum, all welders shall be qualified in accordance with the latest edition of ANSI/AWS D1.2 – Structural Welding Code, Aluminum. The test specimens shall be made using a base metal of aluminum alloy 6061-T6 using filler metal acceptable for welding this alloy and inert gas shield arc. Requalification may be required any time there is specific reason to question the welder's ability.

903.3.4.4 Welding Inspection. All aluminum welds shall be inspected by the fabricator to verify the reliability of production as follows:

(a) Visual inspection of all welds, proof testing of welds, and sufficient destructive testing of weld samples fabricated during the production welding.

(b) Poor welding workmanship noted by visual inspection will be sufficient cause for rejection.

903.3.4.5 Contact Surfaces. Contact surfaces of aluminum flange castings shall be finished to provide at least 50 percent contact after assembly, as indicated by the Standard Machinist's Blue Test.

903.3.4.6 Fabrication of Aluminum Alloy. Fabrication of aluminum alloy material shall be in accordance with the manufacturer's recommendations and the following requirements. Flame cutting will not be permitted. All holes in castings shall be machined for final fit. Welding shall be done by the inert gas shielded arc method, and flux shall not be used. Precautions shall be taken to avoid scoring or marring of aluminum surfaces. The engineer will reject any scoring or marring that gives an objectionable appearance. Cast parts shall have all casting irregularities removed. Tubing shall be seamless, and exterior and interior surfaces shall be clean, smooth and free from slivers, laminations, grooves, cracks or other defects.

903.3.4.7 Shop Inspection. Shop inspection will be in accordance with Sec 1080.

903.3.4.8 Wind Testing. Simulated wind-shop test loading for aluminum trusses will be required as shown on the plans. The load in kips and location of the point of application shall be indicated on the shop drawings.

903.3.4.9 Handling and Storage. Handling and storage of material shall be in accordance with Sec 712. If specified, galvanized high strength bolts and washers shall be in accordance with Sec 903.2.2. Bolts shall be snugly tightened. Connections in which steel and aluminum are in contact shall be protected as shown on the plans.

903.3.4.10 Surfaces. Galvanized and aluminum material shall be handled to avoid damage to the surfaces. Any material on which the galvanizing has been bruised or broken will be rejected or may, with approval from the engineer, be repaired in accordance with Sec 1081.

903.3.5 Sign Storage, Certification and Erection.

903.3.5.1 Storage of Signs. Signs delivered for use on a project shall be stored in a manner meeting the approval of the engineer. Any sign damaged, discolored or defaced during transportation, storage or erection may be rejected.

903.3.5.2 Fabricator's Certification. The contractor shall furnish to the engineer, prior to sign erection, the fabricator's certification stating, "I hereby certify that only material and manufacturing processes in full compliance with the Missouri Department of Transportation job specification requirements were used in the fabrication of signs for Job _____, Route _____, County _____."

903.3.5.3 Erection of Signs. Sign posts shall be set vertically true to line such that the signs will be level, at the proper angle with the roadway, and with the minimum clearances shown on the plans. Mounted signs shall present a smooth flat surface varying no more than 3/8 inch from a 4-foot straightedge placed in any position on the face of the sign after erection. Signs on traffic signal posts shall be mounted with strap or clamp type sign supports as shown on the plans or as approved by the engineer. Signs shall not be mounted on light poles.

903.3.6 Delineators. Delineators shall be installed vertically and any delineator considered unfit for use by the engineer shall be removed and replaced at the contractor's expense.

903.4 Final Cleanup. Final cleanup of right of way shall be in accordance with Sec 104.11.

903.5 Method of Measurement. Final measurement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity. Where required, measurements will be made in the following manner.

Measurement of concrete for bolt-down footings and embedded footings will be made separately to the nearest 0.01 cubic yard for each footing and to the nearest 0.1 cubic yard for the total, as shown on the plans. ~~end supports for overhead sign trusses, tubular steel sign supports and posts bolt down bases, including all concrete, excavation, backfilling, reinforcing steel, anchor bolts and nuts, grout and other incidental items shown on the plans, will be made to the nearest 0.1 cubic yard. Concrete for footings for embedded type posts~~ No measurement will be made for concrete or polyurethane foam used in footings for perforated square steel tube posts (PSST). ~~including perforated square steel tube, u channel and wood shall be incidental.~~

903.5.1 Measurement of the weight of structural steel and pipe posts will be made to the nearest pound for each post and to the nearest 10 pounds for the total, as shown on the plans. Weights will be computed using the theoretical weight of the various sections.

903.5.2 Measurement of sign areas will be made to the nearest 1/10 square foot for each sign and to the nearest square foot for the total. The area of each sign will be that of the smallest rectangular, triangular or trapezoidal shape that will encompass the sign panel.

903.5.3 Measurement of perforated square steel tube, u-channel and wood posts will be made to the nearest linear foot for each post, as shown on the plans.

903.5.4 Measurement of post anchors for PSST will be made per each for each post anchor type. Measurement of breakaway assemblies for PSST will be made per each complete assembly.

903.5.54 Measurement of delineators will be made per each.

903.6 Basis of Payment.

903.6.1 Breakaway assemblies for pipe posts and structural steel posts, including the base connection, hinge plate, fuse plate, structural bolts and all other fabrication, complete in place, are incidental, regardless of the post size or shape. Breakaway assemblies for perforated square steel tube posts, complete in place, will be paid for at the contract unit price each, regardless of the post size.

903.6.2 Highway signing will be paid for at the contract unit price for each of the items included in the contract. No direct payment will be made for incidental items necessary to complete the work, unless specifically provided as a pay item in the contract.

903.6.3 Delineator posts will be paid for at the contract unit price. No direct payment will be made for reflective sheeting or post anchors.

903.6.4 Perforated square steel tube (PSST), u-channel and wood posts will be paid for at the contract unit price for each of the items included in the contract. PSST post anchor installations will be paid for separately for each anchor type. All costs for PSST footing installations shall be considered included in the cost of the post anchor.

903.6.5 Concrete footings for bolt-down and embedded installations will be paid for separately at the contract unit price. Excavation, backfilling, reinforcing steel, anchor bolts and nuts, grout and other items shown on the plans will be considered included in payment for concrete footings. No payment will be made for concrete or polyurethane foam used for the installation of PSST footings.

903.6.6 Structural steel and pipe posts will be paid for at the contract unit price for each of the items included in the contract.

SECTION 1044

POSTS FOR MARKERS AND DELINEATORS

1044.1 Scope. This specification covers galvanized steel and flexible posts used for mounting mile and object markers, delineators, drain and right of way markers ~~signs~~ and other similar purposes.

1044.2 Steel Posts. Posts shall be rerolled rail steel, in accordance with the mechanical requirements of ASTM A 499, Grade 60, and to the chemical requirements of ASTM A 1.

1044.2.1 Shape and Dimensions. Posts shall be of a channel or modified channel section. Posts for mile markers, object markers and delineators shall be of the dimensions and weights (masses) shown on the plans.

1044.2.2 Drainage and Right of Way Markers. Posts for drainage and right of way markers shall weigh no less than 1.80 or more than 2.25 pounds per foot, all tolerances included, and shall be of the lengths shown on the plans. Permissible variations in length will be a maximum of one inch under and 2 inches over that shown on the plans. Posts shall have no less than five drilled or punched 3/8-inch holes along the centerline of the web. Holes shall be on 2-inch centers, beginning one inch from the top of posts. Anchors or pointed ends on posts will not be required.

1044.2.3 Fiberglass Composite Right of Way Markers. Fiberglass reinforced polymer composite posts for right of way markers shall be 3 and 3/4 inches wide of a multi rib design weighing no less than 0.35 pounds per foot and shall be of the color and length as shown on the plans. The markers shall have a right of way decal meeting the description as shown on the plans. The markers shall be pointed on one end for installation into the ground to the depth as shown on the plans.

1044.2.4 Galvanizing. Posts shall be galvanized after fabrication in accordance with AASHTO M 111.

1044.3 Channel Post Delineator. Channel post for delineators shall be manufactured from ductile ASTM A 36 or ASTM A 1011 Gr 60 and as shown on the plans. Posts shall be hot dipped galvanized after manufacture in accordance with Sec 1080. Damaged coating shall be repaired in accordance with Sec 1081. The contractor shall furnish to the engineer three copies of the fabricator's certification that the material supplied is in accordance with the requirements specified.

1044.4 ~~Square Steel Perforated~~Perforated Square Steel Tube Posts.

1044.4.1 Material.

1044.4.1.1 Steel. Steel shall be in accordance with ASTM A 1011, Grade 50, for hot rolled carbon sheet steel, structural quality. The average minimum yield strength after cold-forming shall be a minimum of 50,000 psi.

1044.4.1.2 Coating. Posts shall be galvanized in accordance with ASTM A 653, G90. The corner weld shall be zinc coated after the scarfing operation. The steel shall also be coated with a chromate conversion coating and a clear organic polymer topcoat. Both the interior and the exterior of the post shall be galvanized.

1044.4.2 Dimensions.

1044.4.2.1 Dimensional Tolerances. All dimensional tolerances shall be in accordance with ASTM A 513, excepted as noted.

1044.4.2.2 Length. The length of each post shall be as shown on the plans.

1044.4.2.3 Weight Per Foot. The weight per foot shall be in accordance with the following or as specified:

~~Square Steel Perforated~~Perforated Square Steel Tube Post Requirements			
Size	Thickness	**Weight**	**Tolerance**
2 in. x 2 in.	12 Gauge	2.42 lbs/f~~oo~~t	± 0.12 lbs/ft

1044.4.3 Cross Section. The cross section of the post shall be square tube formed of 12 gage steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii.

1044.4.4 Hole Punching. All holes shall be 7/16 ± 1/64 inch in diameter on one-inch centers on all four sides down the entire length of the post. The holes shall be on the centerline of each side in true alignment and opposite each other directly and diagonally.

1044.4.5 Telescoping Properties. Finished posts for telescoping post systems shall be in accordance with the general dimensional requirements and shall permit consecutive square tubes to telescope freely, for no less than 10 feet without the necessity of matching any particular face to any other face. The finished posts shall be straight, and shall have a smooth, uniform finish. All holes and ends shall be free from burrs, and ends shall be cut square.

~~**1044.4.6 Bases.** If bases are specified on the plans, one of the following FHWA accepted "Breakaway Anchor" systems shall be used.~~

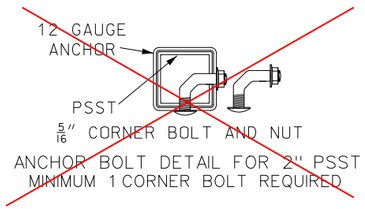
~~a) Single. The anchor shall be one size larger than the signpost and driven using an appropriate sized drive cap. All anchors shall be driven into the ground leaving one to two holes exposed for signpost connection.~~

~~b) Two-Piece. An additional 18-inch outer sleeve, one size larger than the anchor, shall be used to double the anchor wall thickness at the critical bending area.~~

1044.4.~~7~~6 Connecting Bolts and Nuts. Bolts used to connect posts to bases shall be 5/16 inch, 18NC threads, bent-truss head bolts in accordance with ASTM A 307, Grade A. The bolts shall be mechanically zinc galvanized in accordance with ASTM B 695, Class 25. The nuts shall be 5/16 inch, 18NC threads, serrated flange nuts in accordance with ASTM A 194 and zinc electroplated in accordance with ASTM B 633.

1044.4.~~8~~7 Certification. The fabricator shall furnish to the engineer, a certification stating that the posts furnished comply with all requirements of this specification. The certification shall include or have attached specific results of tests of the mechanical and chemical properties. The certification shall accompany each shipment of the material to the destination.

1044.5 Acceptance. Acceptance of posts furnished under this specification will be based on Sec 1040.2 and on the results of any tests deemed necessary by the engineer at destination to ascertain compliance with these specifications. If requested, two posts shall be furnished for testing purposes from such lots as the engineer may determine.

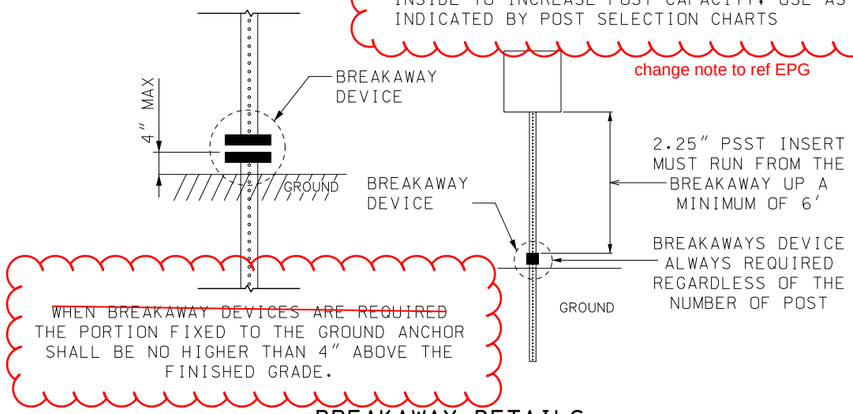


~~ANCHOR BOLT DETAIL FOR 2" PSST MINIMUM 1 CORNER BOLT REQUIRED~~

ANCHOR BOLT DETAIL

2.5" + 2.25" POST COMPRISED OF A 2 1/2" PSST POST WITH A 2.25" PIECE OF PSST INSERTED INSIDE TO INCREASE POST CAPACITY, USE AS INDICATED BY POST SELECTION CHARTS

change note to ref EPG



~~WHEN BREAKAWAY DEVICES ARE REQUIRED~~ THE PORTION FIXED TO THE GROUND ANCHOR SHALL BE NO HIGHER THAN 4" ABOVE THE FINISHED GRADE.

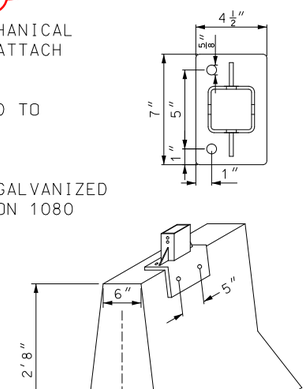
BREAKAWAY DETAILS
2.5" + 2.25" POST DETAIL

ANCHOR TUBE SHALL BE 7 GUAGE

1/2" X 4 1/2"GALVANIZED MECHANICAL FASTENERS SHALL BE USED TO ATTACH ANCHOR TO BARRIER WALL

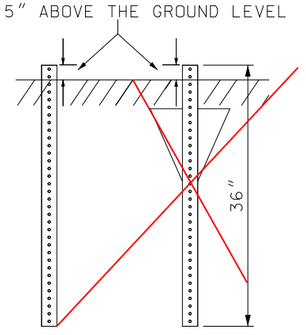
SHOULDER BOLTS SHALL BE USED TO ATTACH PSST POST TO ANCHOR (SEE STANDARD PLAN 903.03)

ANCHOR SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION PER SECTION 1080



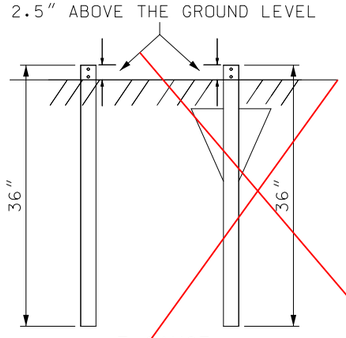
BARRIER WALL MOUNTING DETAIL

THE ANCHOR SHOULD BE A MAXIMUM OF 2.5" ABOVE THE GROUND LEVEL



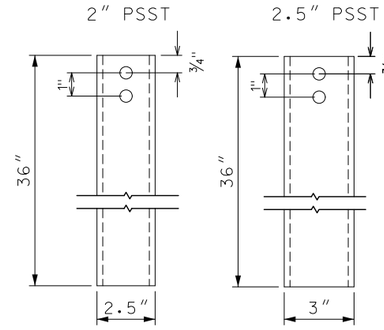
12 GAUGE

THE ANCHOR SHOULD BE A MAXIMUM OF 2.5" ABOVE THE GROUND LEVEL



7 GAUGE

ANCHOR INSTALLATION DETAIL



- BOLT HOLE DIAMETER - 17/32"
- 2 PER SIGN ON ALL 4 SIDES

7 GAUGE ANCHOR FABRICATION DETAIL

POST AND ANCHOR DATA TABLE

POST		ANCHOR ~~NORMAL OR OMNI-DIRECTIONAL~~		BREAKAWAY NEEDED NUMBER OF POSTS		
GUAGE	SIZE	GUAGE	Actual SIZE	1	2	3
12	2"x2"	12	2.25" X 2.25" X 36" OD	NO	NO	YES
		7 *	2.5" X 2.5" X 36" OD	NO	NO	YES
12	2.5"x2.5"	7 *	3" X 3" X 36" OD	NO	YES	YES
12	(2.5"x2.5")+(2.25"X2.25")	7 *	3" X 3" X 36" OD	YES	YES	YES

* TO BE USED WITH CONCRETE FOOTINGS OR IS AN OPTION IN ROCK SOIL CONDITIONS

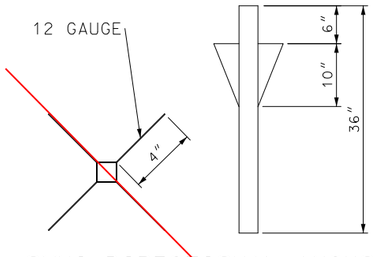
NOTES:

FOR GENERAL NOTES, SEE SHEET 1 OF 16.

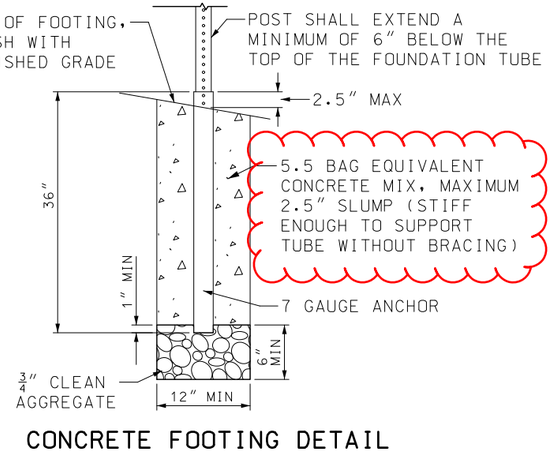
FOR MOUNTING HEIGHT AND OFFSET DETAILS, SEE SHEET 10 OF 16.

ALL BREAKAWAY DEVICES USED ON AN INSTALLATION SHALL BE CERTIFIED NCHRP 350 COMPLIANT.

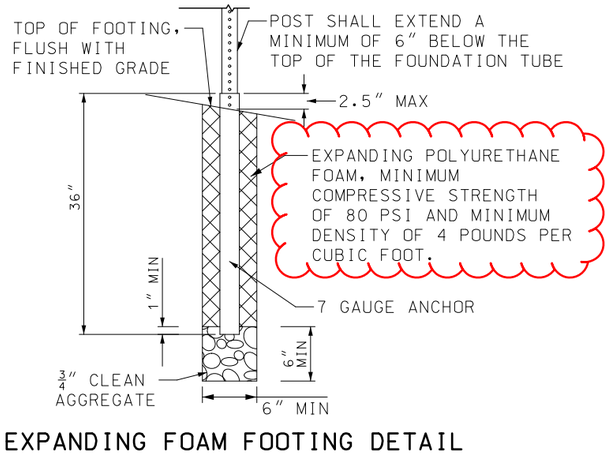
~~48" FOOTINGS MAY BE USED WITH 12 GAUGE OR 7 GAUGE ANCHORS.~~



4-PIN OMNI-DIRECTIONAL ANCHOR DETAIL FOR ~~BOTH~~ 12 AND 7 GAUGE



CONCRETE FOOTING DETAIL



EXPANDING FOAM FOOTING DETAIL

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

STATE OF MISSOURI
NICOLE A. KOLB HOOD
NUMBER PE-2001018754
PROFESSIONAL ENGINEER
THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

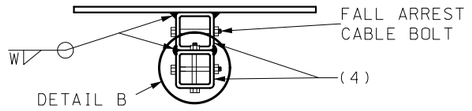
POST INSTALLATION DETAILS
PERFORATED SQUARE STEEL TUBE (PSST)

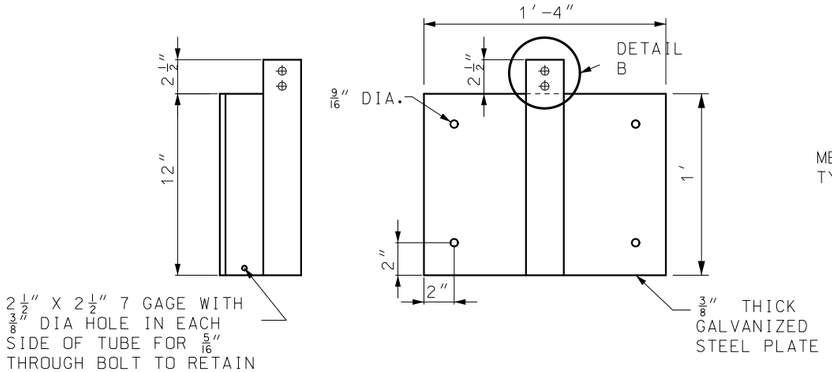
DATE EFFECTIVE: 01/01/2021
DATE PREPARED: 10/14/2020

903.03BN

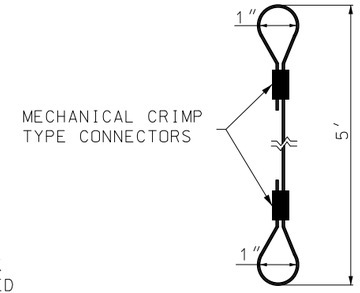
SHEET NO. 7 OF 16

REV.

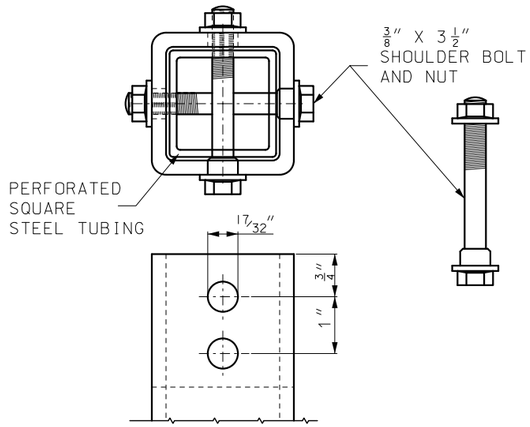




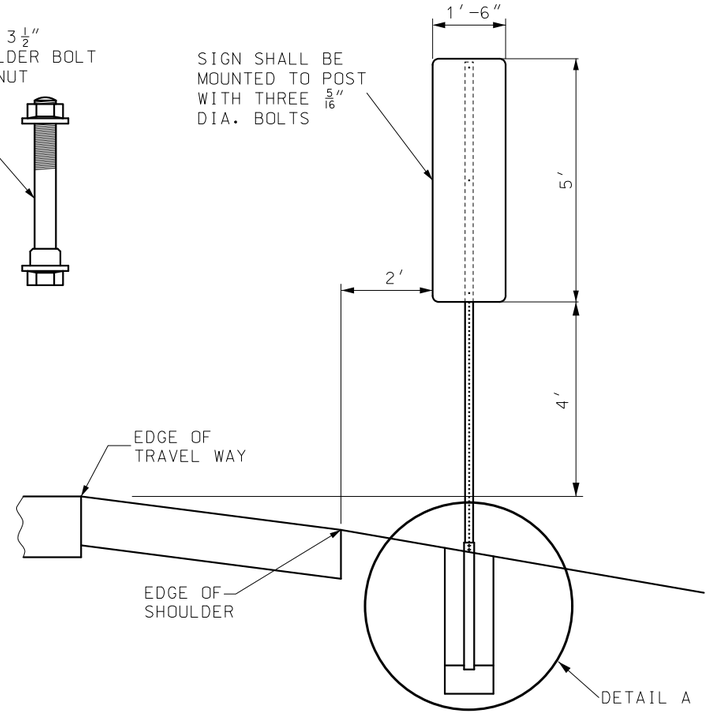
MOUNTING PLATE DETAIL



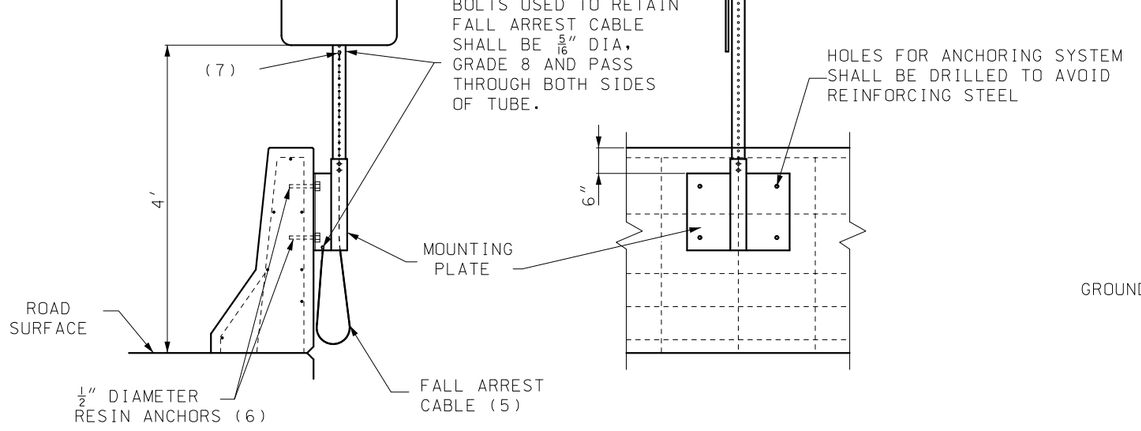
FALL ARREST CABLE DETAIL



DETAIL B SHOULDER BOLT



GROUND INSTALLATION



BARRIER WALL INSTALLATION

(1) PERFORATED SQUARE STEEL TUBE 2″ X 2″ (O.D.) 12 GAUGE. TUBE SHALL EXTEND A MINIMUM OF 6″ BELOW THE TOP OF THE FOUNDATION TUBE.

(2) TUBE TO EXTEND ABOVE FOUNDATION ONLY ENOUGH TO ALLOW BOLT TO BE INSERTED 2½″ MAXIMUM.

(3) CONCRETE MIX TO HOLD FOUNDATION TUBE PLUMB WITH-OUT BRACING SHALL HAVE A MINIMUM OF 5.5 SACKS OF CEMENT PER CUBIC YARD AND A MAXIMUM SLUMP OF 2½″.

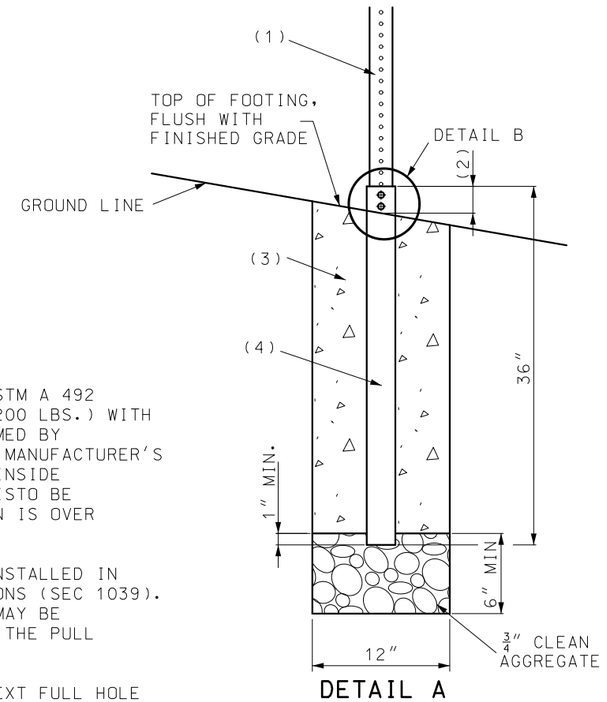
(4) 2½″ × 2½″ (O.D.) SQUARE TUBE GALVANIZED 7 GAGE WITH TWO 17/32″ DIAMETER HOLES IN EACH FACE ¾″ BELOW TOP OF TUBE.

material same as sheet 7

(5) ⅛″x 5′ LONG STAINLESS STEEL CABLE (ASTM A 492 TYPE 304 MINIMUIM BREAKING STRENGTH 200 LBS.) WITH A 1″ DIA. LOOP AT EACH END LOOPS FORMED BY MECHANICAL CRIMP TYPE CONNECTION PER MANUFACTURER'S SPECIFICATIONS. CABLE IS TO BE RUN INSIDE PERFORATED SQUARE STEEL TUBE. CABLE ISTO BE USED ONLY WHEN SIGN MOUNTING LOCATION IS OVER ANOTHER TRAVELWAY.

(6) ½″ DIAMETER RESIN ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH STANDARD SPECIFICATIONS (SEC 1039). AN APPROVED MAECHANICAL TYPE ANCHOR MAY BE USED IF THE DEVICE EQUALS OR EXCEEDS THE PULL TEST REQUIREMENTS OF SEC. 1039.

(7) FALL ARREST CABLE TO BE SECURED TO NEXT FULL HOLE BELOW SIGN



DETAIL A

NOTES:

FOR GENERAL NOTES, SEE SHEET 1 OF 16.

PERFORATED SQUARE STEEL TUBE SHALL BE SECURED TO FOUNDATION TUBE OR BARRIER WALL MOUNTING PLATE WITH A SHOULDER BOLT PER PERFORATED SQUARE STEEL TUBE MANUFACTURER'S SPECIFICATION.

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

STATE OF MISSOURI
NICOLE A. KOLB HOOD
NUMBER PE-2001018754
PROFESSIONAL ENGINEER
THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

SIGN MOUNTING DETAILS
EMERGENCY REFERENCE MARKERS

DATE EFFECTIVE: 01/01/2021
DATE PREPARED: 10/14/2020

903.03BN

SHEET NO. 16 OF 16

ITEM NO.	UNIT	TYPE	ITEM DESCRIPTION	LAST UPDATED 04/01/2022
9028812	EA	1.00	PULL BOX, PREFORMED CLASS 3	
9028816	EA	1.00	PULL BOX, PREFORMED CLASS 5	
9028820	EA	1.00	PULL BOX, CONCRETE, STANDARD	
9028821	EA	1.00	PULL BOX, CONCRETE, DOUBLE, TYPE A	
9028824	EA	1.00	PULL BOX, CONCRETE, DOUBLE TYPE B	
9029100	CUYD	0.10	BASE, CONCRETE	
9029400	LS	1.00	TEMPORARY TRAFFIC SIGNALS	
9029401	LS	1.00	TEMPORARY TRAFFIC SIGNALS AND LIGHTING	
9029404	LS	1.00	TEMPORARY TRAFFIC DETECTION, INDUCTION DETECTOR PROBES	
9029405	LS	1.00	TEMPORARY TRAFFIC DETECTION, INDUCTION LOOP DETECTORS	
9029406	LS	1.00	TEMPORARY TRAFFIC DETECTION, MICROWAVE DETECTORS	
9029407	LS	1.00	TEMPORARY TRAFFIC DETECTION, VIDEO DETECTION SYSTEM	
9029901	LS	1.00	MISC.	
9029902	EA	1.00	MISC.	
9029903	LF	1.00	MISC.	
9029907	CUYD	1.00	MISC.	
9031010	CUYD	0.10	CONCRETE FOOTINGS, EMBEDDED	
9031020	CUYD	0.10	CONCRETE FOOTINGS, BOLT DOWN	
9031026	CUYD	0.10	OPTIONAL OVERHEAD SIGN TRUSS SUBSTRUCTURES	
9031210	LB	10.00	STRUCTURAL STEEL POSTS	
9031220	LB	10.00	PIPE POSTS	
9031241	EA	1.00	BREAKAWAY ASSEMBLY (PERFORATED SQUARE STEEL TUBE)	
9031242	EA	1.00	36 IN. SURFACE-MOUNT DELINEATOR POST	
9031250A	LF	1.00	U-CHANNEL POST, 3 LB	
9031252	EA	1.00	7 FT. CHANNEL POST DELINEATOR, DOUBLE STACKED WHITE	
9031253A	EA	1.00	7 FT. CHANNEL POST DELINEATOR, DOUBLE STACKED YELLOW	
9031256	EA	1.00	7 FT. CHANNEL POST DELINEATOR, WHITE	
9031257A	EA	1.00	7 FT. CHANNEL POST DELINEATOR, YELLOW	
9031258	EA	1.00	7 FT. CHANNEL POST DELINEATOR, WHITE/RED	
9031259A	EA	1.00	7 FT. CHANNEL POST DELINEATOR, YELLOW/RED	
9031260	LF	1.00	WOOD POST, 4 IN. BY 4 IN.	
9031261	LF	1.00	WOOD POST, 4 IN. BY 6 IN.	
9031262	LF	1.00	WOOD POST, 6 IN. BY 6 IN.	
9031270A	LF	1.00	2 IN. PSST POST - 12 GA.	
9031271	~~LF~~ EA	1.00	DRIVEN POST ANCHOR FOR 2 IN. PSST - 12 GA.	
9031272	~~LF~~ EA	1.00	2.25 IN. PSST POST INSERT (6 FOOT) - 12 GA.	
9031273	~~LF~~ EA	1.00	DRIVEN POST ANCHOR FOR 2 IN. PSST - 7 GA.	
~~9031278~~	~~LF~~	~~1.00~~	~~OMNIDIRECTIONAL POST ANCHOR FOR 2 IN. PSST - 12 GA.~~	
~~9031279~~	~~LF~~	~~1.00~~	~~OMNIDIRECTIONAL POST ANCHOR FOR 2 IN. PSST - 7 GA.~~	
9031280	LF	1.00	2.5 IN. PSST POST - 12 GA.	
9031281	~~LF~~ EA	1.00	DRIVEN POST ANCHOR FOR 2.5 IN. PSST - 7 GA.	
~~9031282~~	~~L~~	~~1.00~~	~~OMNIDIRECTIONAL POST ANCHOR FOR 2.5 IN. PSST - 7 GA.~~	
9035004A	SQFT	1.00	SH-FLAT SHEET	
9035011A	SQFT	1.00	ST-STRUCTURAL	
9035069A	SQFT	1.00	SHF-FLAT SHEET FLUORESCENT	
9035071A	SQFT	1.00	STF-STRUCTURAL FLUORESCENT	
9036030	EA	1.00	TUBULAR SUPPORT, TYPE C-1710-12	
9036031	EA	1.00	TUBULAR SUPPORT, TYPE C-1710-18	
9036032	EA	1.00	TUBULAR SUPPORT, TYPE C-1310-12	
9036033	EA	1.00	TUBULAR SUPPORT, TYPE C-1310-18	
9036034	EA	1.00	TUBULAR SUPPORT, TYPE C-2315-12	
9036035	EA	1.00	TUBULAR SUPPORT, TYPE C-2315-16	
9036036	EA	1.00	TUBULAR SUPPORT, TYPE C-2315-20	
9036037	EA	1.00	TUBULAR SUPPORT, TYPE C-2315-24	
9036038	EA	1.00	TUBULAR SUPPORT, TYPE C-2318-18	
9036039	EA	1.00	TUBULAR SUPPORT, TYPE C-2318-22	
9036040	EA	1.00	TUBULAR SUPPORT, TYPE C-2318-26	
9036041	EA	1.00	TUBULAR SUPPORT, TYPE C-2018-24	
9036042	EA	1.00	TUBULAR SUPPORT, TYPE C-2018-28	
9036043	EA	1.00	TUBULAR SUPPORT, TYPE C-2018-34	
9036050	EA	1.00	TUBULAR SUPPORT, TYPE B-2018, 12 FT. OR 3.7 M ARM LENGTH	
9036051	EA	1.00	TUBULAR SUPPORT, TYPE B-2018, 16 FT. OR 4.9 M ARM LENGTH	
9036052	EA	1.00	TUBULAR SUPPORT, TYPE B-2018, 20 FT. OR 6.1 M ARM LENGTH	
9036053	EA	1.00	TUBULAR SUPPORT, TYPE B-2018, 24 FT. OR 7.3 M ARM LENGTH	
9036060	EA	1.00	TUBULAR SUPPORT, TYPE B-23318, 18 FT. OR 5.5 M ARM LENGTH	
9036061	EA	1.00	TUBULAR SUPPORT, TYPE B-23318, 22 FT. OR 6.7 M ARM LENGTH	

ADD BID ITEM:
EA- CONCRETE POST ANCHOR FOR 2 IN. PSST - 7 GA.

ADD BID ITEM:
EA- CONCRETE POST ANCHOR FOR 2.5 IN. PSST - 7 GA.

EFFECTIVE 07-01-2022

SIGNS (902 SIGNAL SIGNS TABULATED ON D-37A SHEET)						FOOTINGS		STRUCTURAL STEEL POSTS ✳						PIPE POSTS ✳					BACKING BARS ✳✳				U-CHANNEL POST	PERFORATED SQUARE STEEL TUBE												REMARKS AND OTHER REQUIRED ITEMS
																								2 IN. POST						2.5 IN. POST						
																											ANCHORS						ANCHORS			
SIGN NO.	SIGN SIZE	STATION	HORZ CLEAR IF NOT STD	LOCATION	SIGN DTL. SHT. NO.	EMBD ITEM NO. 9031010 CY	BOLT DOWN ITEM NO. 9031020 CY	POST DES NO.	POST NO.1 LF	POST NO.2 LF	POST NO.3 LF	LBS PER FT	TOTAL ITEM NO. 9031210 LBS	PIPE SIZE IN.	POST NO.1 LF	POST NO.2 LF	LBS PER FT	TOTAL ITEM NO. 9031220 LBS	NO. EACH	2" X 3/8" BARS @ 2.55 LBS PER FT LGTH IN.	TOTAL LF	TOTAL LBS	ITEM NO. 9031250 A LF	POST NO.1 LF	POST NO.2 LF	TOTAL ITEM NO. 9031270A LF	12-GA. DRIVEN ITEM NO. 9031271A EA	7-GA. DRIVEN ITEM NO. 9031273A EA	7-GA. CONCRETE ITEM NO. 90312--- EA	POST NO.1 LF	POST NO.2 LF	TOTAL ITEM NO. 9031280 LF	2.25" INSERT ITEM NO. 9031272A EA	7-GA. DRIVEN ITEM NO. 9031281A EA	7-GA. CONCRETE ITEM NO. 90312--- EA	BREAK-AWAY ASSEMBLY ITEM NO. 9031241 EA	
SUBTOTAL																																				
TOTAL																						✳✳														

✳ BREAKAWAY ASSEMBLY IS INCIDENTAL FOR STRUCTURAL STEEL AND PIPE POSTS.
✳✳ BACKING BARS ARE TOTALED WITH STRUCTURAL STEEL OR PIPE POSTS.

ROUND PIPE POST AND FOOTING DATA TABLE

NOM. SIZE (IN.)	WEIGHT LBS/FT	WEIGHT LBS/IN	STUB LENGTH	FOOTING DIA.	FOOTING DEPTH	CONCRETE C.Y.
2½	5.79	0.48	4'-3½"	12"	4'-6"	0.13
3	7.58	0.63	4'-3½"	12"	4'-6"	0.13
4	10.79	0.90	5'-3½"	18"	5'-6"	0.36

STRUCTURAL STEEL POST AND FOOTING DATA TABLE

POST DES. NO.	POST NOM. SIZE	POST WEIGHT LBS/FT	POST WEIGHT LBS/IN	POST STUB LENGTH	FOOTING DIA.	FOOTING LEVEL GROUND DEPTH	FOOTING LEVEL GROUND C.Y.	FOOTING 6:1 GRADE DEPTH	FOOTING 6:1 GRADE C.Y.	FOOTING 4:1 GRADE DEPTH	FOOTING 4:1 GRADE C.Y.	FOOTING 3:1 OR 2:1 GRADE DEPTH	FOOTING 3:1 OR 2:1 GRADE C.Y.
1	W6	9.0	0.75	3'-0"	15"	3'-0"	0.14	3'-2"	0.15	3'-3"	0.16	3'-6"	0.17
2	W6	15.0	1.25	4'-0"	24"	4'-0"	0.47	4'-2"	0.50	4'-3"	0.51	4'-6"	0.54
3	W8	18.0	1.50	4'-6"	28"	4'-6"	0.71	4'-8"	0.73	4'-9"	0.74	5'-0"	0.78
4	W10	22.0	1.83	5'-0"	36"	5'-0"	1.31	5'-2"	1.36	5'-3"	1.39	5'-6"	1.45
5	W10	26.0	2.17	5'-0"	36"	5'-0"	1.31	5'-3"	1.37	5'-5"	1.43	5'-9"	1.52
6	W12	35.0	2.92	5'-6"	36"	5'-6"	1.44	5'-9"	1.52	5'-11"	1.56	6'-3"	1.65

DATE PREPARED 3/17/2022
ROUTE | STATE MO
DISTRICT | SHEET NO.
COUNTY
JOB NO.
CONTRACT ID.
PROJECT NO.
BRIDGE NO.

DESCRIPTION | DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

903.3.4 Ground-Mounted Sign Support Selection

Support. The majority of MoDOT signs are installed and supported on one of 5 types of ground-mounted sign supports or sign-posts. The selection of sign-post is based on many factors, but primarily on the size of sign being installed and the type of roadway the sign is being installed along. There is some overlap in sign-post applications; more than one sign-post may be applicable to a given installation. The final selection of the post type is based on the attributes needed for a support as discussed in each classification of sign-post below.

The number of posts needed to support a sign is primarily based on the width of a sign. Typically, signs 48 inches wide~~in width~~ and wider are installed on two or more posts. This requirement is based on two factors, the capacity of the post and the long-term stability of the assembly. A wide sign installed on one post will place a torsional force onto a post and in windy conditions can result in an assembly not staying plumb and, in some cases, an actual failure of the post itself.

Standard. The selection of the proper size of sign-post shall be based on the sign-post selection tools listed ~~below~~above. These tools will specify if a post type has the capability to support the sign in question and then specify what size post is required based on the requirements of the installation. Before the correct size of PSST or Wide Flange post can be selected, the length of the longest post must first be determined. ~~In order t~~To determine this, the offset and mounting height must first be determined.

903.3.4.1 U-Channel Posts

903.3.4.2 Wood Posts

Support. MoDOT's specs permit three sizes of wood posts to be used, 4 in. x 4 in., 4 in. x 6 in., or 6 in. x 6 in. MoDOT's wood posts are pressure treated to promote longer life and resist rot and insect damage. Wood posts were once MoDOT's primary post to support signs on two lane roadways; however, due to issues with material stability PSST posts have become MoDOT's standard post.

When used, wood posts are capable of supporting most sign assemblies on two lane roadways, from route marker assemblies, speed limit signs, warning signs and distance and destination signs. The use of a high quality wood post and proper installation is the key to a successful installation.

Guidance. The continued use should take into consideration the special characteristics listed in EPG 903.3 Ground-Mounted Sign Supports.

Proper installation is also critical for the stability of the sign assembly. The wood post should be placed a minimum of 36 inches into the ground, deeper for larger signs or in areas where the soil is weak or sandy, to keep the sign-post plumb. When backfilling the hole, material should be added in lifts, or levels, in order to properly compact the backfill. Loose or fine materials, such as sand, sandy soil or dry concrete mix typically will not provide a long term solid backfill and can result in the post falling out of plumb over time.

MoDOT's specifications should be followed when purchasing wood sign-posts. These specifications address a posts load capacity, breakaway attributes and the compatibility between the pressure treatment chemicals and our aluminum signs and sign hardware.

Option. While the soil originally removed from the hole can be used to back fill around the post other alternatives may be used, such as smaller quarry rock with the crushing fines mixed in, concreted mix or expanding ~~urethane~~ polyurethane foam.

903.3.4.3 Perforated Square Steel Tube Posts (PSST)

Support. MoDOT utilizes two sizes of PSST posts, 2 in. and 2.5 in., both being made from 12-gauge steel. PSST became MoDOT's standard post for most sign installation applications on two lane roadways in the early 2000's, replacing wood posts. PSST usage has since expanded to some applications on freeways and expressways.

Unlike U-channel or Wood posts, PSST utilizes a ground anchor, or footing, within which the post is then ~~inserted~~placed. MoDOT has several options in its specifications with respect to ground anchor/foundation systems, the use~~s~~ of each option is heavily based on the soil condition. ~~s in the area of the installation and the direction district operations has chosen based on what they have found to work the best for each of their areas. All MoDOT PSST anchors/footings are a minimum of 36" deep, the~~

~~PSST posts alongside interstates, freeways and expressways should have concrete footings. District operations should be consulted to determine the most appropriate footing for PSST posts alongside other roadways.~~ The anchor/footing types for PSST are:

- 12-~~-~~Gauge PSST Anchor – this is the basic direct driven anchor for 2 in. PSST posts, a 12-gauge anchor does not exist for 2.5 in. PSST posts.
- ~~12- Gauge Omnidirectional PSST Anchor – this is a 12-gauge PSST anchor with 4 soil stabilization plates added to the anchor to increase soil surface area to help keep signs plumb in weaker soils and/or in windy areas.~~
- 7-~~-~~Gauge Anchor – this is a heavy wall box tube anchor which is the basic direct driven anchor for 2.5 in. PSST posts. ~~and~~ It is also an optional heavy anchor for 2 in. PSST posts~~. This anchor is typically used for 2 in. PSST posts~~ in rocky ground where a 12-gauge anchor may deform when driven. The 7-gauge anchor is also the anchor that must be used when installing a concrete or polyethene footing. ~~7- gauge anchors only have holes at the top of the tube. The connection between a 7- gauge anchor and a PSST post is accomplished using two shoulder bolts installed at 90- degree angles to each other.~~
- ~~7- Gauge~~ Omnidirectional, or ~~S~~stabilization, Anchor – this is ~~a~~ the appropriate 12-gauge or 7-gauge direct driven anchor with 4 soil stabilization plates added to the anchor to increase soil surface area to help keep signs plumb in weaker soils and/or in windy areas. A JSP will be needed to specify this anchor type on a project. ~~, available for both 2 in. and 2.5 in. PSST posts.~~
- Concrete Footings – In some applications it may be desired to install a concrete footing for PSST, similar to the footings for ~~a~~ Pipe Post or Wide Flange Post. Concrete footings ~~can~~ provide a stronger ~~footing~~ foundation compared to ~~one of~~ the directly driven anchors listed above. A concrete footing may also be required in cases where the ground is too hard or rocky to direct drive ~~an~~ the anchor and a hole ~~for the anchor~~ may need to be dug in order to install the anchor. All concrete footing installations use a 7-gauge anchor (which only has holes at the top of the tube) ~~to provide both a durable foundation and to eliminate~~ because concrete ~~from flowing~~would flow through the holes of a normal 12-gauge PSST anchor. ~~PSST posts alongside freeways and expressways should have concrete footings. District operations should be consulted to determine the most appropriate footing for PSST posts alongside 2-lane roads.~~

- ~~Expanding U~~Polyurethane Foam Footings – This is an alternate to a concrete footing for PSST post installations. This permits the footing and the sign to be installed in one trip compared to concrete, which requires a second trip to allow the concrete to cure. The installation requirements for an expanding foam footing are the same as a concrete footing except for the diameter of the footing, which is smaller. It is important to make sure the expanding foam used meets MoDOT specifications as not all foam products are acceptable to support a breakaway sign.

The connection between the PSST posts and ~~A~~anchors ~~also~~ var~~y~~ies based on the anchor gauge:

- 12-gauge anchor ~~/ 12-gauge post~~ - The connection between a 12-gauge anchor and the PSST post is accomplished using a corner bolt. The corner bolt pulls the post into a corner of the anchor and eliminates any slack or play between the post and the anchor.
- 7-gauge anchor ~~/ 12-gauge post - Unlike a 12-gauge anchor and 12-gauge post which telescope together with limited slack or play, t~~The fit between a 7-gauge anchor and ~~12-gauge~~the PSST post is much looser and the radii of each do not match so a corner bolt will not eliminate the slack or play between these two devices. ~~The corner~~Shoulder bolts installed at 90-degree angles corrects this issue; the shoulder of the bolt will pass through the holes in the 7-gauge anchor, but not through the holes in the post. As a result, the two bolts push and lock the post in two directions making a solid connection.
- Add-on breakaway devices – when required/used, the manufacture's recommendations and hardware (if supplied) need to be used to connect the anchor, breakaway and post together.

Breakaway aspects of PSST are a little more complicated compared to other MoDOT posts, the requirement for an add-on breakaway device heavily depends on the size and number of posts needed to support the sign. It is important to follow the guidance found in the sign post selection tools and MoDOT's standard plans to determine when an add-on breakaway device is required and when it is not. In applications where add-on breakaway devices are not required/used, PSST breaks away like a U-channel post in a yielding fashion, typically staying attached to the ground and lying down in front of the vehicle so the vehicle can pass over the assembly. However, when an add-on breakaway device is used the breakaway function changes and the assembly is designed to break away from the ground and permit the vehicle to pass under the airborne assembly.

Standard. If PSST posts are used, they shall be either 2 in. or 2.5 in. 12-gauge posts. The size and number of posts, as well as the requirement for ~~add~~ add-on breakaway devices, shall be determined using the post selection tools. PSST posts shall be installed in accordance with Standard Plans 903. PSST posts ~~alongside~~installed on interstates, freeways and expressways ~~should~~shall be installed using ~~have~~ concrete footings.

Guidance. District operations should be consulted to determine the most appropriate footing for PSST posts alongside other roadways as footing requirements vary based on soil conditions.

903.3.4.4 Pipe Posts

304.4.3 Small Quantities. Small quantities are less than 50 ton, and will apply to individual projects, individual projects in combination contracts or projects with short discontinuous sections. The following acceptance procedures shall be used:

(a) QC/QA tests for gradation, deleterious material, plasticity index, density and DCP index will not be required.
(b) Each lift will be compacted by a minimum of three complete coverages with a 5-ton roller until there is no visible evidence of further consolidation.
(c) Acceptance will be based on visual inspection of each compacted lift by the engineer.

In lieu of this section, the contractor has the option of electing in the QC Plan to use all testing frequencies in accordance with Sec 304.4.1 for each separate aggregate base course type qualifying as a small quantity.

SECTION 612

IMPACT ATTENUATORS

612.1 Description. This work shall consist of furnishing, installing, operating, maintaining, cleaning, relocating, replacing and removing impact attenuators as shown on the plans or as directed by the engineer in accordance with the manufacturer's recommendations.

612.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as shown below. Rock salt shall meet the satisfaction of the engineer.

Item	Section
Sand	1005
Retroreflective Sheeting	1042
Temporary Traffic Control Devices	1063

612.3 Safety Requirements. All impact attenuators shall be manufactured specifically for traffic control purposes and shall be in accordance with the MUTCD and any applicable safety and design codes. Non MASH 2016 impact attenuators manufactured prior to January 1, 2023 may be used until January 1, 2030. All impact attenuators manufactured after January 1, 2023 shall meet MASH 2016 Test Level 3 crash test requirements. The contractor shall submit the manufacturer's certification that units supplied comply with crash test requirements of NCHRP 350, Test Level 3 or MASH 2016 Test Level 3. ~~and have received FHWA acceptance.~~

SECTION 616

TEMPORARY TRAFFIC CONTROL

616.1 Description. This work shall consist of furnishing, installing, operating, maintaining, cleaning, relocating and removing temporary traffic control devices and equipment, and the removal and relocation or covering and uncovering of existing signs and other traffic control devices in accordance with the contract documents or as directed by the engineer. For purposes of this specification, the work zone will be defined as the area between the first and last temporary traffic control device as shown on the plans for the work being performed.

616.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Temporary Traffic Control Devices	1063

616.3 Safety Requirements.

616.3.1 All traffic control devices shall be in accordance with the MUTCD and any applicable safety and design codes.

616.3.2 The contractor shall ~~furnish~~ submit a manufacturer's certification of crashworthiness, per NCHRP 350 ~~or AASHTO Manual for Assessing Safety Hardware (~~MASH~~)~~ 2016 Evaluation Criteria, for FHWA Category 1 temporary traffic control devices and appurtenances. The contractor shall ~~furnish~~ submit the manufacturer's certification of crashworthiness per NCHRP 350 or MASH 2016 Test Level 3 criteria for all FHWA Category 2 and Category 3 temporary traffic control devices and appurtenances. ~~the FHWA acceptance letter for FHWA Category 2 and Category 3 traffic control devices and appurtenances. The FHWA acceptance letter shall indicate that the device and appurtenance complies with the crash test requirements of NCHRP 350 or (MASH), Test Level 3 (TL-3).~~ Non MASH 2016 Category 2 temporary traffic control devices and appurtenances manufactured prior to January 1, 2023 may be used until January 1, 2026. Non MASH 2016 Category 3 temporary traffic control devices manufactured prior to January 1, 2023 may be used until January 1, 2030. All Category 2 and Category 3 temporary traffic control devices and appurtenances manufactured after January 1, 2023 shall meet MASH 2016 Test Level 3 crash test requirements. The contractor shall submit a manufacturer's certification of crashworthiness per NCHRP 350 or MASH 2016 for FHWA Category 4 temporary traffic control devices when available.Regardless whether the device meets NCHRP 350 or ~~(~~MASH~~)~~ 2016 criteria, the engineer reserves the right of final approval. Installation of a device prior to the engineer's approval will be at the contractor's risk.

SECTION 617.20 TEMPORARY TRAFFIC BARRIER.

617.20.1 Description. This work shall consist of furnishing, installing, relocating and removing temporary traffic barrier as shown on the plans or as directed by the engineer. For purposes of this specification, temporary concrete traffic barrier will be defined as Type F three-loop concrete traffic barrier or approved alternate barrier system that meets ~~MASH or~~ NCHRP 350 or MASH 2016 criteria. ~~and has FHWA acceptance.~~

617.20.2 Material. All material shall be in accordance with Division 1000 Materials Details and Sec 1064.2.2.1.

617.20.2.1 All Type F temporary barrier shall be in a serviceable condition during installation and relocation as determined by the engineer. Reference the *Missouri Quality Standards for Temporary Traffic Control Devices* for evaluation criteria on serviceable condition.

617.20.2.2 Use of t~~T~~wo-loop ~~or three loop~~ temporary Type F concrete traffic shall not be allowed after January 1, 2023. ~~barrier may be used at the option of the contractor.~~

~~**617.20.2.2.1** For two-loop style temporary traffic barrier, as well as two-loop and three-loop styles used in combination, the bottom washer, retainer bolt and nut will be required. Visual cracks in the loop steel will be cause for rejection of the barrier unit by the engineer.~~

~~**617.20.2.2.2** Existing two-loop concrete barrier owned by contractors or previously accepted two-loop concrete barrier in a manufacturer's stockpile (inventory) will be allowed for use on MoDOT projects if:~~

~~(a) The barrier was fabricated prior to January 1, 2004.~~

~~(b) Either the MoDOT acceptance stamp is legible on the barrier or certification is provided by the contractor stating that the barrier was fabricated prior to January 1, 2004, and in accordance with MoDOT specifications.~~

~~(c) The barrier is in acceptable condition.~~

617.20.2.3 Other types of temporary traffic barrier will be allowed if the barrier has been approved in accordance with Sec 1064 and meets the project specific need as approved by the engineer.

617.20.3 Certification. Prior to use ~~The~~ the contractor shall submit ~~provide~~ to the engineer a ~~barrier~~ manufacturer's certification of crashworthiness per NCHRP 350 or MASH 2016 for portable concrete barrier or other approved temporary barrier. Non MASH 2016 temporary barriers manufactured prior to January 1, 2023 may be used until January 1, 2030. All temporary barriers manufactured after January 1, 2023 shall meet MASH 2016 crash test requirements.~~that the barrier furnished is in accordance with the contract documents prior to use.~~

SECTION 1064

TEMPORARY TRAFFIC BARRIER

1064.1 Scope. This specification covers temporary traffic barrier for use in highway construction.

1064.2 Type F Temporary Concrete Barrier.

1064.2.1 Acceptance.

1064.2.1.1 Three-Loop Concrete Barrier. The manufacturer shall provide certification to the contractor that the barrier is in accordance with the contract documents.

1064.2.1.2 Two-Loop Concrete Barrier. The use of two-loop Type F temporary concrete barrier shall be discontinued January 1, 2023. ~~District material personnel when notified to re-stamp previously accepted barrier will be responsible for re-stamping the barrier if the previous acceptance stamp is legible and if the barrier is not damaged to the extent that it is felt that the barrier cannot perform properly. Reasons for rejection will be, but not limited to:~~

~~(a) Exposed steel reinforcement.~~

~~(b) Damage or cracks in the connecting loops.~~

~~(c) Missing chunks of concrete.~~

~~(d) Excessive marring or scarring.~~

~~(e) Extensive scaling of the concrete.~~

~~(f) Misalignment of the connecting loops that would hinder insertion of the keeper pin.~~

1064.2.2 Material.

1064.2.2.1 All material, in the manufacturing of three-loop type F temporary concrete barrier, shall be in accordance with the following specifications:

Item	Specification
Reinforcing Steel for Concrete	AASHTO M 31, Grade 60
Connection Rod	A36 Steel
Anchor Bolts	ASTM A307
Connection Rod Assembly	AASHTO M 183
Retainer Bolt and Nut	SAE Grade 8
Asphalt Pin	A36 Steel
Thrie Beam	Nested 12 Gage or 10 Gage
Thrie Beam Bolts	ASTM A307

1064.2.2.1.1 All reinforcing steel shall be deformed bar. Loop steel shall be 0.75-inch smooth steel bars with a minimum yield of 60 ksi, shall have a tensile strength of no less than 1.25 times the yield strength, but a minimum of 80 ksi, a minimum 14 percent elongation in 8 inches, and passing a 180-degree bend test using a 3.5 times diameter pin bend diameter. The loops shall be installed within 0.125 inch of the plan dimensions.

1064.2.2.1.2 The manufacturer shall retain, at a minimum, all compressive strength test results, entrained air content records, and reinforcing steel certification for at least five years.

1064.2.3 Manufacture.

1064.2.3.1 Welding of loop steel shall be limited to the minimum surface welding necessary to maintain the position required for placement.

1064.2.3.2 Visual cracks in the loop steel will be cause for rejection.

1064.2.3.3 Concrete shall be air-entrained with 28-day compressive strength of 5,000 psi. Concrete shall be continuously cured until 5,000 psi is attained. Fine and coarse aggregate shall be in accordance with Sec 1005, except that gradation requirements and percent passing the No. 200 sieve will not apply. Temporary concrete traffic barrier shall be manufactured in accordance with industry standard practices for pre-cast construction.

1064.2.3.4 All temporary concrete traffic barrier units shall be permanently marked with the name and location of the manufacturer, and the month and year of manufacture in a location visible after installation. Paint or other liquid marking will not be permitted.

1064.2.3.5 The surface of temporary concrete traffic barrier shall be smooth and non-deformed and substantially free of honeycomb, surface spalls and surface defects. Barrier units shall be straight and square on the ends and shall meet the following tolerances:

Dimension	Tolerance
Length	+ 3/4 inch
Width	+ 1/4 inch
Height	+ 1/4 inch

1064.3 Alternative Temporary Traffic Barrier.

1064.3.1 Approval. Prior to approval and use, the ~~manufacturer~~ contractor shall submit to MoDOT, the manufacturer's name, the product brand name or model number, a copy of the MASH or NCHRP 350 test results, ~~a copy of the FHWA acceptance letter,~~ shop drawings and any other information requested by the engineer.

1064.3.2 Acceptance. Acceptance of the material will be based on the manufacturer's certification and upon satisfactory field performance.

SECTION 1063

TEMPORARY TRAFFIC CONTROL DEVICES

1063.1 Scope. This specification covers material to be used for temporary traffic control devices.

1063.2 General Requirements. All temporary traffic control devices shall be manufactured as shown on the plans and as specified, in accordance with MUTCD requirements and shall be NCHRP 350 or MASH 2016 compliant. FHWA Category 1 temporary traffic control devices are not required to be crash tested unless modified. Non MASH 2016 FHWA Category 2 temporary traffic control devices manufactured prior to January 1, 2023 may be used until January 1, 2026. Non MASH 2016 FHWA Category 3 temporary traffic control devices manufactured prior to January 1, 2023 may be used until January 1, 2030. All FHWA Category 2 and Category 3 temporary traffic control devices manufactured after January 1, 2023 shall meet MASH 2016 Test Level 3 crash test requirements. MASH 2016 FHWA Category 4 temporary traffic control devices should be used when available. Nominal dimensions will be permitted for dimensional lumber where applicable. All temporary traffic control devices shall exhibit good workmanship and shall be free of objectionable marks or defects that affect appearance or serviceability. The brand name or model number shall be permanently identified on each traffic control device.

1063.11 Truck or Trailer Mounted Attenuators. ~~Each Truck or Trailer Mounted Attenuator (TMA) shall be in accordance with Test Level 3 criteria as set forth in NCHRP 350 or MASH.~~ Each TMA shall have a standard trailer lighting system, including brake lights, taillights, turn signal lights and Federal Motor Carrier Safety Administration identification bar lights. In the operating position, the rear facing of the TMA shall be marked with alternating 8-inch yellow and 8-inch black retroreflective sheeting forming an inverted “V” at the center and slope downward at an angle of 45 degrees toward each side of the unit or a checkered board pattern consisting of 12-inch square red and 12-inch square white retroreflective sheeting. The TMA may be marked with the same operating pattern or red and white DOT conspicuity tape to simulate the looks of a standard van body trailer when traveling. The TMA shall have the same standard trailer lighting system noted above when the unit is in the transport position.

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612.1.1 Truck- and Trailer-Mounted Attenuators

Truck/Trailor-mounted attenuators (TMAs) are energy-absorbing devices attached to the rear of the trucks and used as protective vehicles, thus protecting the motorist and the protective vehicle's driver upon impact.

Trailer-Mounted Attenuator

The National Cooperative Highway Research Project 350 (NCHRP 350) and the 2016 AASHTO Manual for Assessing Safety Hardware (MASH 2016) set the crash criteria for TMAs. TMAs purchased by MoDOT meet these requirements.

Damaged TMAs are to be removed from service and either repaired or replaced.

~~NCHRP 350 and MASH crash-tests straight-on and offset collisions, not side impacts. TMAs are not designed for side impacts.~~

Articles on MoDOT's Maintenance Planning Guidelines for Impact Attenuators are available upon request.

612.3 Construction Inspection Guidelines

Material (for Sec 612.2) Certifications are to be collected on both the sand and retroreflective sheeting used in or on the sand-filled impact attenuators.

Safety Requirements (for Sec 612.3) The inspector is to request a copy of the manufacturer's certification that states the units comply with the crash test requirements of NCHRP 350 or MASH 2016, Test Level 3~~, and have FHWA acceptance~~. This information is to be kept in the project files.

Truck-Mounted Attenuator (for Sec 612.4.1) TMAs are to be inspected to make sure they are structurally sound, the frames are not bent and that they appear to be in good working order. In some cases, the contractor may elect to add TMAs when TMAs are not required. Elective TMAs need to be NCHRP 350 or MASH 2016, Test Level 3~~,~~ compliant, and therefore ~~so~~ the certification still needs to be collected. Typically, TMAs are only required and paid for under conditions where the contractor is operating without a lane drop set up (cones, channelizers, etc.). TMAs ~~that~~ the contractor voluntarily adds to an operation are typically not paid for.

Sand-Filled Impact Attenuator Array (for Sec 612.4.2) The inspector is to request a copy of the manufacturer's installation instructions for the particular brand of sand-filled impact attenuator the contractor is using. The use of more than one manufacturer's sand barrels in an array is not allowed. When inspecting the sand-filled impact attenuator arrays, make sure that the array is in the location as shown in the temporary traffic control plans, and set up and filled in accordance with the

manufacturer's recommendations. All lids are to be on and secured. MoDOT requires rock salt intermixed with the sand so that any water that gets into the barrels will not freeze and create a safety hazard. When checking the contents of the barrels, rock salt should be visible in the sand mix. During periods of extended cold weather, the sand should be checked periodically to make sure it has not~~n't~~ frozen because the salt content has been exhausted. If this condition is found, the contractor will need to add more salt or replace the sand/salt mixture.

Work Zone Crash Cushions (for Sec 612.4.2~~3~~). The inspector is to request a copy of the manufacturer's installation instructions for the particular brand of crash cushion the contractor is using. When inspecting the work zone crash cushion, make sure that the crash cushion is in the location as shown on the temporary traffic control plans and set up in accordance with the manufacturer's recommendations. If the crash cushion is water-filled, MoDOT requires a mixture content per manufacturer's recommendations so that the crash cushion will not freeze and create a safety hazard. During periods of extended cold weather, the crash cushion(s) should be checked periodically to make sure it has not frozen. If this condition is found, the contractor will need to correct and/or replace the mixture. In the event the work zone crash cushion is damaged and needs to be replaced, it is considered incidental and replaced at no cost to the Commission.

616.6 Temporary Traffic Control Work Zone Devices (MUTCD 6F)

616.6.1 Types of Devices (MUTCD 6F.01)

Guidance. The design and application of Temporary Traffic Control (TTC) devices used in ~~TTC~~ work zones should consider the needs of all road users (motorists, bicyclists and pedestrians), including those with disabilities.

Support, MoDOT policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System (NHS) and all state funded roadways and/or projects meet NCHRP 350 or MASH 2016 ~~the~~ crashworthy performance criteria ~~contained in the National Cooperative Highway Research Program (NCHRP) Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*. The FHWA website identifies all such hardware and includes copies of FHWA acceptance letters for each of them. In the case of proprietary items, links are provided to manufacturers' websites as a source of detailed information on specific devices. The website also contains an "Ask the Experts" section where questions on roadside design issues can be addressed.~~

Crashworthiness and crash testing information on devices described in AASHTO's *Roadside Design Guide* (see EPG 900.1.11).

As defined in EPG 900.1.13, "crashworthy" is a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

FHWA Category 2 and~~&~~ 3 TTC devices~~products~~ shall indicate the compliance of NCHRP 350 or MASH 2016 Test Level 3 (TL-3). For contract or permit projects, documentation from the contractor or permittee shall be furnished to the engineer. For maintenance work, all products should be crashworthy based on statewide bids and purchasing documents.

In this photo probably dating from the 1930s, the safety equipment included a "danger" flag and a black and white barrier.

Standard. Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, private roads open to public travel (see definition in EPG 900.1.13), pedestrian facility, or bikeway by authority of a public body or official having jurisdiction.

All traffic control devices used for construction, maintenance, utility, or incident management operations on a street, highway, or private road open to public travel (see definition in EPG 900.1.13) shall comply with the applicable provisions within MoDOT's EPG.

616.6.2 General Characteristics of Signs (MUTCD 6F.02)

Support. TTC work zone signs convey both general and specific messages by means of words, symbols, and/or arrows and have the same three categories as all road user signs: regulatory, warning and guide.

Standard. The colors for regulatory signs shall follow the Standards for regulatory signs in EPG 903.5 Regulatory Signs. Warning signs in TTC work zones shall have a black legend and border on an orange background, except for the Grade Crossing Advance Warning (W10-1) sign which shall have a black legend and border on a yellow background, and except for signs that are required or recommended in EPG 903.6 Warning Signs to have fluorescent yellow-green backgrounds. Colors for guide signs shall follow EPG 903.7 Conventional Road Guide Signs and EPG 903.8 Freeway and Expressway Guide Signs, except for guide signs as otherwise provided in EPG 616.6.55.

Standard. All signs used at night shall be ~~either~~ retroreflective with a material that has a smooth, sealed outer surface.

Option. Signs may be made of rigid or flexible material.

Guidance. Where the color orange is required, the MoDOT fluorescent orange color should be used, unless specifically stated in the plans.

Support. The fluorescent version of orange provides higher conspicuity than standard orange, especially during twilight.

616.6.2.1 Existing Sign Use

Option. Existing warning signs that are still applicable may remain in place. The ~~temporary traffic control~~TTC plan ~~(TTCP)~~ is to contain details showing the location of each work zone sign. All existing signs within the project limits are shown on the traffic control plan with a descriptive note indicating "UIP" (use in place), "cover" or "remove".

To ensure maximum visibility, existing signs and other physical features (trees, sidewalks, billboards, commercial signs, etc.) must be considered when locating work zone signs.

In order to maintain the systematic use of yellow or fluorescent yellow-green backgrounds for pedestrian, bicycle, and school warning signs in a jurisdiction, the yellow or fluorescent yellow-green background for pedestrian, bicycle, and school warning signs may be used in TTC work zones.

616.6.2.2 Flags and Advance Warning Rail System on Signs

Examples of ROAD WORK AHEAD and Flagger Ahead signs

Example of flag assembly, viewed from behind the temporary sign

Specific signs shall be enhanced with flags as listed below, but only during daytime hours. Flags should not be used on signs at night, except that it is allowable to leave flags on signs when the work carries over from day to night. At the district's discretion, additional signs within the work zone may be enhanced with flags, however such practice should be infrequent. For any flag assemblies used in contract work (FLAGGER SYMBOL and TRUCK CROSSING signs only), a note should be included on the plans designating the cost of the flags as being included in the cost of the sign. Flags shall not be of mesh material.

Flag assemblies shall be used on the following signs (daytime only):

1. The first occurrence of the ROAD/BRIDGE WORK AHEAD (WO20-1) signs placed on the mainline roadway for short-duration operations (i.e., tasks < 30 minutes, such as litter pick-up or pothole patching). Most contract work operations exceed 30 minutes, thus, do not require flags on the ROAD/BRIDGE WORK AHEAD sign.

2. Flagger Symbol (WO20-7) signs, regardless of the location within the work zone.

Typical Sign and AWRS Assembly

3. TRUCK CROSSING (WO8-6) signs, regardless of the location within the work zone.

Standard. When standard orange flags are used in conjunction with signs, they shall not block the sign face.

The "Advance Warning Rail System" (AWRS) shall consist of three barricade rails used to enhance the target value of certain advance warning signs on long-term stationary operations (i.e., the work zone is in place at the same location for more than 3 days and the signs are left up 24 hrs./day).

Specifically, the AWRS is installed on the “active” first occurrence of the ROAD/BRIDGE WORK AHEAD (WO20-1) and ROAD CLOSED AHEAD (WO20-3) signs on the mainline roadway. Active signs provide information to the traveling public, whereas signs that are covered or laid down each day are not deemed active. Refer to Standard Plan 616.10 for details on sizing. The following are common ways to install the AWRS:

1. The three barricade rails may be attached to U-channel, wood or PSST posts, according to the minimum sign area (sign and rails) as located in Table B of Standard Plan 616.10.

2. A crashworthy skid-mounted sign and rail assembly.

3. The sign and three-rail system may be mounted as separate crashworthy devices. The rail system shall be located directly in front of the sign with 7 ft. to 10 ft. separating the two devices.

616.6.2.3 Sign Dimension

Work zone warning signs are typically ~~be~~ 48 in. x 48 in., diamond-shaped, black on orange signs with MoDOT fluorescent orange sheeting. Work zone regulatory signs are identical to permanent regulatory signs with MoDOT Type 3 sheeting. Work zone guide signs are generally rectangular in shape and have a black legend on orange background with MoDOT fluorescent orange sheeting; but may come in different sizes, shapes, colors and sheeting depending on type and purpose of the signing. Sometimes a plate or plaque is affixed to a work zone sign or mounted below it to customize the sign. For additional discussion on enhancements, refer to EPG 616.6.2.2 Flags, Advance Warning Rail System and Warning Lights on Signs.

Sign dimensions for contract projects are located in Standard Plan 616.10 and for maintenance projects are located in the MGS-04-01 Roll-up Signs. Maintenance projects may require other signs, NO CENTER LINE, SHOULDER DROP-OFF, UNEVEN LANE, BUMP, etc., which dimensions are located in Standard Plan 616.10.

Non-standard work zone signs (i.e., legends or sizes not shown on Standard Plan 616.10) are to be designed with the assistance of Traffic. Correspondence with Traffic on this design is to indicate these are work zone signs. The non-standard work zone signs are to be detailed in the plans and listed under “Miscellaneous Signs” on the D-2BS sheet.

616.6.3 Sign Placement (MUTCD 6F.03)

616.6.3.1 Sign Location

Guidance. Signs should be located on the right-hand side of the roadway unless otherwise provided in the EPG. Examples of signs located on both the left-hand and right-hand side of the roadway is divided highways. Sign location information is located in EPG 616.8 Typical Applications and EPG 903 Highway Signing.

616.6.3.2 Sign Height

Support. The provisions of this Section regarding mounting height apply unless otherwise provided for a particular sign elsewhere in the EPG.

Standard. Rural Undivided Highways: The minimum height, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement, of signs installed at the side of the road in rural areas shall be 5 ft. (see Standard Plan 616.10).

Urban or Rural Divided Highways: The minimum height, measured vertically from the bottom of the sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be 7 ft. (see Standard Plan 616.10).

The minimum height, measured vertically from the bottom of the sign to the sidewalk, of signs installed above sidewalks, bicycle facilities, or areas designated for pedestrian or bicycle traffic shall be 7 feet.

Guidance. Further guidance for the above Rural Undivided Highway and Urban or Rural Divided Highways paragraphs. For long-term duration projects, post or type 1 portable sign supports should be 5 ft. or 7 ft. depending on rural or urban applications. For short-term duration projects (up to 3 days), signs may be mounted on type 2 portable sign supports and should have a minimum height of 12 inches. Additional mounting heights for signs located on barrier and vehicles are located in Standard Plan 616.10.

Option. The height to the bottom of a secondary sign or plaque mounted below another sign may be 1 foot less than the height provided as shown in Standard Plan 616.10.

Guidance. Neither portable nor permanent sign supports should be located on sidewalks, bicycle facilities, or areas designated for pedestrian or bicycle traffic. If the bottom of a secondary sign that is mounted below another sign is mounted lower than 7 ft. above a pedestrian sidewalk or pathway (see EPG 616.4.2), the secondary sign should not project more than 4 in. into the pedestrian facility.

Standard. Where it has been determined that the accommodation of pedestrians with disabilities is necessary, signs shall be mounted and placed in accordance with Section 4.4 of the “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (see EPG 900.1.11).

Signs mounted on barricades and barricade/sign combinations shall be crashworthy (EPG 616.6.68).

616.6.3.3 Sign Mounting and Payment

Standard. Sign mounting shall be crashworthy. Standard Plan 616.10 show the following: sign mounting requirements, post size and quantities requirements, and post installation details. The standard drawings show detail information for use of signs on posts, barrier, vehicles, and barricades. Where large signs having an area exceeding 50 sq. ft. are installed on multiple breakaway posts, the clearance from the ground to the bottom of the sign shall be at least 7 feet.

Support. If alterations are made to specific traffic control device supports that have been successfully crash tested in accordance with NCHRP ~~Report~~ 350 or ~~AASHTO Manual for Assessing Safety Hardware (~~MASH 2016~~)~~, the altered supports might not be considered ~~to be~~ crashworthy.

The sign mounting method is dependent upon the contractor’s operations and is not to be dictated on the plans. See Standard Plan 616.10 for mounting methods and post installation requirements. Sign relocation is only paid for post-mounted signs. MoDOT does not pay for temporary or portable sign relocations. If the designer judges post-mounted signs will be used on a project, a pay item for Relocated Signs (616-10.10) is to be included in the contract documents. Sign quantities are tabulated on the plans and are paid for by the square foot. The tabulation and any notes concerning the signs shall be consistent throughout the traffic control plan.

Signs may be supported in one of four methods: on a portable support, post-mounted, vehicle-mounted or barrier-mounted.

Portable signs are temporary traffic control signs affixed to a portable support such as an easel, fold- up sign stand, self-driving post, skid, barricade, etc..

These signs are to be constructed of either a rigid or flexible substrate, as required, to meet crashworthiness requirements.

A minimum mounting height of one ft., measured vertically from the bottom of the sign to the near edge of the pavement, is recommended. However, higher mounting heights should be considered on higher volume highways, on multi-lane highways, in urban settings, and where the sign is located in line with other traffic control devices to increase visibility of the sign. Mounting heights for regulatory and guide signs are as specified for post-mounted signs.

Portable signs may be located adjacent to or within the roadway itself. However, a minimum lateral clearance of three ft., measured horizontally from the edge of the sign to edge of the designated traveled way, is recommended.

Signs mounted in this manner may be left in place for up to three days. An exception to this duration is any crosswalk/sidewalk closure, any road closure, Horizontal Arrow, Double-Headed Horizontal Arrow, Chevron, DETOUR (within arrow) or Gore Exit sign. These sign may be left in place for over three days.

When not in use, consideration should be given to removing portable signs from the temporary traffic control zone to discourage theft and limit potential hazards within the right of way.

Picture 1: Easel portable sign. Pictures 2 & 3: Fold-up signs at 1-ft. and 5-ft. heights.

Picture 4: Self-driving post. Picture5: Skid-mounted sign

Post-mounted signs are temporary traffic control signs affixed to a breakaway support such as perforated square steel tube, u-channel, wood, etc..

These signs are constructed of a rigid substrate.

A minimum mounting height of seven ft., measured vertically from the bottom of the sign to the near edge of the pavement, is recommended for urban highways and rural divided highways. A minimum mounting height of five ft., measured vertically from the bottom of the sign to the near edge of the pavement, is recommended for rural undivided highways. If a supplemental sign is mounted below another sign, the mounting height of the supplemental sign may be one ft. less than the heights specified.

A minimum lateral clearance of two ft., measured horizontally from the edge of the sign to the edge of the roadway, is recommended for installations on roadways with curbed sections. A minimum lateral clearance of six ft., measured horizontally from the edge of the sign to the edge of the traveled way, is recommended for installations on roadways without curbed sections.

U-Channel Post-Mounted Sign

Vehicle-mounted signs, when allowed in this manual, are temporary traffic control signs affixed to a protective vehicle or pilot car at a recommended minimum height of four ft., measured vertically from the bottom of the sign to the pavement surface.

For additional information, review Standard Drawing 616.10 or EPG 616.6.17.3 Signing for Mobile Operations.

Vehicle-Mounted Signs

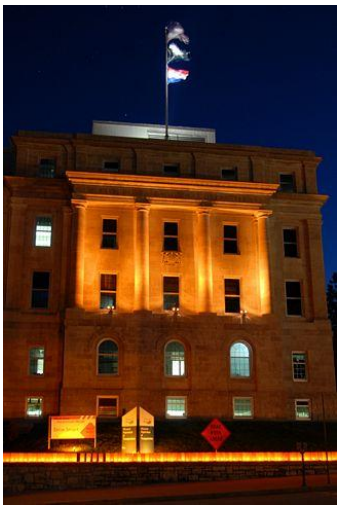
Barrier-mounted signs are temporary traffic control signs affixed to the top portion of a temporary or permanent traffic barrier. The method of attachment to the barrier must assure a positive connection and minimize potential for vehicle snagging. Mounting heights for regulatory and guide signs are as specified for post-mounted signs.

In order to accommodate narrow medians, it may be necessary to reduce the sign size; clip the sign corners or edges; or possibly both. For additional information see 616.6.17.2 Signs in Narrow Medians.

Barrier-Mounted Signs

If the sign cannot be mounted by a method specified by EPG 903.4 Overhead Guide Sign Mounting, Standard Plan 616.10 or Standard Plan 903.03, the mounting method is also to be specified in the plans.

616.18 Construction Inspection Guidelines for Sec 616



Traffic Control Plan (for Sec 616.1)

The traffic control plan set up in the contract is to be studied very carefully. Generally, traffic control plans are custom designed for each project. This plan is to cover all construction phases needed to construct the project, but it may be necessary to adjust it to adequately protect the public or the workers. If changes to the traffic control plans are being considered, the project designers and/or district traffic staff are to be consulted based on the magnitude of the proposed changes.

Material (for Sec 616.2)

All traffic control devices used on a project need to meet the requirements of MoDOT and the *Manual on Uniform Traffic Control Devices, (MUTCD)*. The *MUTCD* and the standard plans include drawings and dimensions for the most commonly used traffic control devices. The construction inspector is responsible to collect the required certifications for devices and materials used on the project, check devices against the approved products lists of Material's Qualified Lists and Traffic's Approved Products List, to do a visual inspection to ensure devices conform to the "MUTCD" and our specifications and are not damaged. Confirmation of this information is entered in to AASHTOWARE Project (AWP).

Figures

Estimate Based Documentation Records

Worksheet

The MoDOT Temporary Traffic Control Inspection Worksheet

Approved Products Lists

Traffic's Approved Products List

More Information

Missouri Department of Transportation Policy for the Use of Dynamic/Changeable Message Signs

Generally certifications are required for sign sheeting and other temporary traffic control devices as described in Sec 1063.

Safety Requirements (for Sec 616.3)

For Sec. 616.3.1

All workers within highway right of way shall wear approved ANSI/SEA 107 Performance Class 2 or 3 safety apparel, including safety glasses and safety footwear. See EPG 616.4.3 Worker Safety Considerations for worker apparel and EPG 616.5.2 High-Visibility Safety Apparel for flagger apparel. Safety apparel should consist of two material types: background and retroreflective. Background material is normally a colored fluorescent material intended to be highly conspicuous but not retroreflective. Retroreflective material should reflect light back to a light source (ex. vehicle headlights) in low light or nighttime conditions.

Class 2 apparel should cover the torso area and normally consists of a vest or shirt. Class 2 apparel should consist of a minimum of 775 sq. in. of background material and at least 201 sq. in. of retroreflective material.

Class 3 apparel should provide greater visibility for the wearer and should provide a full range of body movements. Class 3 apparel normally consists of a full-sleeved top or a Class 2 vest or shirt with Class E pants. Class 3 material should consist of 1,240 sq. in. of background material with at least 310 sq. in. of retroreflective material.

All manufactured safety apparel should have a tag inside the collar stating if the apparel meets Class 2 or Class 3 requirements.

Additional Safety Apparel Information

OSHA Rules

FHWA Worker Visibility Rules

ANSI/ISEA 107-2004 Standards

ANSI-ISEA 107-2004 Quick Reference

For Sec. 616.3.2

The ROAD CLOSED sign may now be placed on the Type 3 barricade face. The sign does not need to be placed on a separate sign support post. Placement on the barricade face will require the use of a roll-up sign, lightweight plastic sign substrates or corrugated plastic sign panel to be considered crashworthy. Metal signs are not allowed. The use of ordinary hardware snaps (two male fasteners, with screw, on each of the top two rails and a female fastener near each of the sign corners) make for an efficient means of affixing a roll-up sign, with or without its ribs, to the face of a Type 3 barricade, while providing an effective and safe installation.

Coldmilled areas not intended to be the final driving surface on a roadway, specifically on milling and resurfacing projects, but are opened to traffic prior to being resurfaced, may present hazardous conditions for motorcyclists and drivers of small vehicles or other passenger vehicles with certain type of tire treads. For this reason, where coarse milled surfaces are present as the driving surface, the contractor shall, at the contractor's expense, deploy advance signing on the roadway to inform

motorists of this condition. The signing may be in the form of either changeable message signs (CMS) or static signs, (refer to Standard Plan 616.10). The deployment of these signs shall be located far enough in advance to allow motorists the opportunity to take an alternate route or to slow to an acceptable speed to negotiate safely through that section of roadway. Specific guidelines are as follows:

- Signing is to be present only when the milled surfaces are open to traffic.
- Signing is to be deployed in advance of an exit from the mainline prior to the milled area to allow motorists an opportunity to take an alternate route.
- Signing is also to be placed on any ramps leading into the area.
- For the mainline roadway, the recommended display on CMS boards is a two-phased message as follows:

  First Phase Message:

  GROOVED

  PAVEMENT

  XX MILES

  Second Phase Message:

  GROOVED

  PAVEMENT

  (1)

  (1) This line is to be left blank if both lanes are milled. If the milled surface is in only one lane, then this line should state which lane, specifically, LT LANE ….RT LANE.

- For on-ramps or other accesses, the recommended display on CMS boards is a two-phased message as follows:

Grooved Pavement Ahead

First Phase Message:

GROOVED

PAVEMENT

AHEAD

Second Phase Message:

GROOVED

PAVEMENT

(2)

(2) This line is to be left blank if both lanes are milled. If the milled surface is in only one lane, then this line should state which lane, specifically, LT LANE ….RT LANE.

The deployment of this signing is to be limited. Although not a contract requirement, on most milling and resurfacing projects, the resurfacing operation follows closely behind the milling operation. However, this condition may be present when the contractor elects to do otherwise or when weather conditions stop operations prior to finishing the resurfacing of milled areas.

For Sec. 616.3.23

All traffic control devices used on a project must also be NCHRP 350 or MASH 2016 Test Level 3 ~~or NCHRP 350~~ compliant. ~~Documentation of compliancy for~~ The manufacturer's NCHRP 350 or MASH 2016 ~~or NCHRP 350~~ certification is required for each FHWA Category 2 and 3 ~~type of~~ devices and shall~~needs to~~ be placed in the project files. FHWA Category 1 devices, ~~Small items~~ like channelizers are self-certified by the manufacturer. Certifications for Category 1 devices is also kept with the project files. ~~Larger devices such as sign stands, barricades, etc. require an FHWA acceptance letter. The FHWA identifies their acceptance letters with a "WZ" number~~

For Sec 616.3.34

When the contract requires the contractor to designate a trained person at the project level with the primary responsibility for implementing the traffic management plan and other safety and mobility aspects of the project, the name of that person and proof, as required by the contract documents, should be provided by the contractor prior to work starting on that project, preferably at the preconstruction meeting.

616.19.2.7 Changeable Message Sign/Flashing Arrow Panels/Traffic Signals

Trailer mounted devices such as changeable message signs (CMS), flashing arrow panels (FAP), portable traffic signals and work area lighting are considered ~~NCHRP 350~~ FHWA Category 4 devices for both NCHRP 350 and MASH 2016 (see below).

FHWA Explanation of Category 4~~IV (4) Category IV~~ devices, are devices which have proven to have significant value in the work zone by contributing to safer traffic operation though these devices may cause great harm to occupants of impacting vehicles. We believe that, as currently configured and deployed, these devices provide a net benefit to motorists. Substantial crash experience to date shows that crashes with these devices are rare. They have been identified by FHWA as portable, usually trailer-mounted, devices such as area lighting supports, flashing arrow panels, temporary traffic signals, and changeable message signs which are often used in or adjacent to the traveled way. ~~The AASHTO / FHWA agreement calls for these devices to be studied and an implementation date announced by October 1, 2000. We would not expect to identify any new category IV devices unless they have a proven substantial operational benefit.~~

Picture 1 shows the correct flashing arrow panel (FAP) display, all lights are working and have the proper intensity. Picture 2 shows one lamp out in the arrow head which is unacceptable. Picture 3 shows a truck blocking a FAP which is unacceptable. Below are items that would make the FAP installation unacceptable.

- More than one lamp, of those to be energized, out in stem and one or more lamps out in the arrow head(s) when in the arrow (single- or double-headed) and one or more lamps out when in the caution (four corners) modes.
- Not appropriately dimmed at night

Acceptable Examples

The CMS messages in Pictures 1, 2 and 3 are acceptable. The messages provide information that static signs cannot provide to the traveling public. The CMS are placed further upstream of the work zone or at strategic locations to provide information about the upcoming work zone to the traveling public. The channelizer placement in Picture 1, 2 and 3 shows the correct number of channelizers (5) and the correct placement (approximate 100 ft. taper). Channelizers are not required if the CMS is more than 15 ft. from the edge of shoulder (edge of the roadway if there is no shoulder), beyond

ditch line, or behind curb or physical TTB (see Std. Plan 616.10 for further details). Picture 4 shows a Dynamic Message Sign (DMS) providing information of a work zone.

Messages on CMS boards should consist of no more than two phases and each phase should consist of no more than three lines of text. The maximum line of text should be no more than 8 characters.

Unacceptable Examples

Pictures 5, 6 and 7 are examples of CMS that are unacceptable due to the lights being either too dim or out, as they are not providing a clear and concise message to the traveling public.

Pictures 8 and 9 show active CMS in nighttime operations. Picture 8, message is too dim and not visible. Picture 9, message is too bright and creates glare. The CMS should be appropriately dimmed so the lights are not too bright for the traveling public.

Picture 10 shows a CMS where the lights are out or turned off. If the lights are not working, the CMS is unacceptable. If the CMS is not being used it should be turned off and rotated away from traffic as shown in Picture 11 or removed from the project. If the CMS is used when lane drops are used every day to 3-4 days, then rotating the sign would be appropriate. If the CMS will not be needed for a week or more, then removal may be appropriate until it is needed again. Note: The taper length should be 100 ft. long with five channelizers.

Picture 12 shows a permanent sign blocking the CMS. In Picture 13, the truck should not be placed in front of the CMS board. For Picture 13, the speed limit message is just a reminder of the speed limit. A temporary sign should be used instead, and the CMS removed. Actual enforcement of the speed limit requires a regulatory sign.

616.23.2.5 Temporary Traffic Control Devices

Temporary traffic control devices are the medium through which traffic is informed of and guided through a temporary traffic control zone or otherwise protected from an unsafe condition. The most common devices include signs, portable changeable message signs, flashing arrow panels, channelizers, barricades, temporary traffic barriers, pavement markings, lighting devices, temporary traffic signals, crash cushions, protective vehicles and truck mounted attenuators.

Due to the placement of these devices in relation to traffic, these devices shall be crashworthy. This requires that all temporary traffic control devices ~~conform to~~comply with ~~the National Cooperative Highway Research Program (~~NCHRP~~) Report~~ 350 or MASH 2016. ~~Exceptions to this crashworthiness rule are those state-owned devices that have received grandfather status (e.g. pre-10/98 TMAs and pre-10/00 sign stands and barricades).~~

It may become necessary to ballast some of these devices to inhibit their movement due to natural and vehicle-induced wind in the field. This is particularly the case for portable sign supports and channelizers. Ballast shall be selected and installed such that the ballast itself does not become a hazard if impacted by a vehicle. When in doubt on ballasting, consult the device's manufacturer for their recommendation.

In order for these devices to perform the functions noted previously, they must command the public's respect. This means the correct devices are installed according to the traffic control plan and they function as intended. Furthermore, the devices are maintained throughout the life of the operation and removed when no longer needed. Devices that are damaged or have lost their functionality should be replaced or, when acceptable, repaired. Refer to EPG 616.19 Quality Standards for Temporary Traffic Control Devices for guidelines regarding acceptability of devices.

617.1 Temporary Traffic Barriers

Temporary traffic barrier prevents vehicles from entering the work area or to separate vehicles in temporary two-lane, two-way traffic on normally divided highways. The use of temporary traffic barrier instead of standard temporary traffic control measures is based on engineering judgment. However, temporary traffic barrier is required on roadway excavation edge drop-offs (refer to Standard Plan 619.10), bridge rehabilitation jobs with bridge rail replacement and/or full depth repair, and is to be considered for any other type of long-term bridge repair work. When specified, quantities are calculated and shown on the plans.

Older Version of Temporary Concrete Traffic Barrier

Barrier design has several critical components to perform properly:

1) Lateral Deflection – The distance that the barrier travels laterally, after an impact, under the guidance of NCHRP 350 or MASH 2016.

2) Buffer Area (Lateral) – Normally the area behind the barrier, equal to lateral deflection, that must be free of storage items (material, equipment, etc.) that may hinder the barrier's crashworthiness.

3) Minimum Deployment Length – Minimum length of barrier needed to perform as tested under NCHRP 350 or MASH 2016 criteria.

Appropriate channelizing devices and pavement marking are always used in front of barrier tapers for lane closures, shoulder closures or transition areas for temporary bypasses or connections. Wherever practical, a lateral shy distance is to be provided between the edge of the driving lane and the barrier, and a longitudinal buffer area is to be provided between the channelizer taper and the barrier taper.

At times, the placement of barriers may require a minimum buffer area, since many types of barriers can be anchored on asphalt and concrete pavements to reduce the lateral deflection. Bridge Division and the district core team shall determine and coordinate when anchoring barriers is needed on a particular project. If a particular barrier type and anchoring system is not specified, the plans shall provide guidance of the placement of barrier and the appropriate buffer area needed for the project.

Relocating Temporary Traffic Barrier

When traffic barrier is required to be moved as part of the staging or construction sequence proposed by MoDOT, the appropriate pay item for relocating temporary traffic barrier should be included. Use of the relocating pay item should be limited to the shifting of furnished barrier for traffic switches between phases, but in the same general area. In other words, relocation should only be used when the barrier can be reasonably picked up and re-set with a single piece of equipment. Conversely, if barrier must be loaded and trucked to a new location, separate payment should be provided for "furnishing" at the new location. For example, for a project with 3 bridge deck overlays that requires 600 feet of barrier per bridge, and the barrier must be shifted to the opposite side of centerline between phases, you would set up 1,800 feet of furnishing barrier and 1,800 feet of relocating barrier. This would be the case even if the contract disallowed the bridges to be worked on concurrently. This method is due to the fact that the cost to load and truck barrier is very near the cost of "furnishing". Also, the summary of quantities table and traffic control plan should clearly demonstrate the designer's intent for payment of "relocating" barrier vs. "furnishing" barrier (location, length, phase, etc.).

Contractors are not required to paint temporary concrete traffic barriers because delineators are used. Delineators for temporary concrete traffic barriers are provided at no direct pay as shown on Standard Plan 617.20 and stated in Sec 617. Delineator pay items are used only to retrofit existing permanent concrete traffic barrier.

An abbreviated description of several types of barriers are described below. For additional information and standard drawings refer to End Terminal and Barrier Systems.

617.1.1 Temporary Concrete Traffic Barrier – Type F

The preferred installation method for temporary concrete traffic barrier is freestanding and requires a minimum 2 ft. buffer area behind the barrier to allow for lateral deflection into both work areas and lane separation situations. A buffer area is an unprotected or unshielded area. Freestanding installations when used near unprotected bridge decks (refer to project bridge plans) or open roadway excavations (refer to Standard Plan 619.10) both require 3 ft. buffer area behind the barrier.

On projects where freestanding installations cannot be used and lateral deflection must be limited further, then tie-down straps system, anchor bolt system through deck, or anchor pin system shall be used. (Refer to Standard Plan 617.20.)

On projects with asphalt material tie-down straps system and anchor bolt system cannot be used because of the different bending abilities of the bolts when placed in asphalt compared to concrete. On these projects barriers may be installed with an asphalt barrier pin system as shown in Standard Plan 617.20. The use of asphalt pin system shall have a minimum of 2 in. of asphalt material on concrete and/or soil. The asphalt pad shall be a minimum of 30 in. wide through the pinned down area.

Projects may have freestanding barrier transition into anchored barriers or permanent barriers. The major concern of transitioning freestanding barriers into anchored/permanent barriers is pocketing the vehicle into the barrier system. Each transition situation has a specific design (refer to Standard Plan 617.20).

Pay items are available for Temporary Traffic Barrier, Temporary Traffic Barrier Anchored and Stiffness Transition Section as well as pay items for relocating Temporary Traffic Barrier, Temporary Traffic Barrier Anchored and Stiffness Transition Section.

Delineators usually are at 50-ft. intervals

617.1.2 Alternative Temporary Traffic Barrier

617.1.2.1 10 ft. Cross Bolt Temporary Concrete Barrier

The preferred installation method for this traffic barrier is freestanding and requires a minimum 2 ft. buffer area behind the barrier to allow for lateral deflection in both work areas and lane separation situations. When freestanding installations are used on unprotected bridge decks, a 27 in. buffer area shall be provided for roadway excavation edge drop-offs and equipment and material storage locations. At this time, the 10 ft. Cross Bolt Temporary Concrete Barrier does not have a anchoring system to further reduce the lateral deflection.

617.1.2.2 30-foot Cross Bolt Temporary Concrete Barrier

The preferred installation method for temporary concrete traffic barrier is freestanding and requires a minimum 19 in. buffer area behind the barrier to allow for lateral deflection in both work areas and lane separation situations. When freestanding installations are used on unprotected bridge decks, a 19 in. buffer area shall be provided for roadway excavation edge drop-offs and equipment and material storage locations. At this time, the 30 ft. Cross Bolt Temporary Concrete Barrier does not have a anchoring system to further reduce the lateral deflection.

617.1.2.3. Proprietary Temporary Traffic Barrier

Proprietary temporary traffic barrier (PTTB) may be used in lieu of Type F temporary concrete traffic barrier. When PTTB is used for work areas or lane seperation situations, the required buffer area shall be based upon the dynamic deflection exhibited in the manufacture's crash testing results.

When freestanding installations are used on unprotected bridge decks, a buffer area shall be required based on the NCHRP 350 or MASH 2016 TL-3 ~~or TL-4~~ dynamic lateral deflection roadway excavation edge drop-offs and equipment and material storage locations. NCHRP 350 or MASH 2016 TL-3 ~~or TL-4~~ tested anchoring systems may be used to reduce the above buffer area, dependent on manufacturer's recommendation.

617.1.2.4 Water-Filled Barrier

Besides being just a temporary traffic barrier, water-filled barriers (WFB) have been proven to be a channelization enhancement to the work zone. The core team may consider the use of WFB within urban areas.

The core team may consider using WFB as channelization enhancement to:

a) Clearly define entrances and exits.

b) Provide a separation between pedestrian and traveled way in areas of 45 mph or less. For higher speeds, a lateral deflection and buffer area review will be required for the separation of pedestrians and travel way.

c) Define traffic lanes with a wall separating or keeping the traffic in the proper lanes.

Many WFB systems do not need an end treatment since the WFB system create their own work zone end treatment.

617.1.2.5 Moveable Traffic Barrier System

Moveable Traffic Barrier Systems (MTBS) are barrier segments that can be frequently transferred from one lane to another lane by way of a specialized machine. This system allows quick increases in the directional capacity of the roadway. The optimum use of the MTBS is when work zones will affect the number of lanes for commuting traffic.

Due to the expense, the core team shall perform a benefit/cost study for the use of the system. Since the MTBS use will be minimal, the use of the Moveable Traffic Barrier JSP will need to be inserted into the contract.

617.1.3 Temporary Concrete Traffic Barrier End Treatments

Exposed temporary concrete traffic barrier ends are treated in one of the following methods (see Figure 616.1.2).

617.1.3.1 Barrier Flare

The barrier run may be flared to the limits of the clear zone. The existing shoulder slope or median slope may be too steep for this type of installation. If this is the case, temporary grading should be provided or a different end treatment should be used. The Roadside Design Guide contains recommended barrier placement in non-level medians. These guidelines also apply to outside shoulders.

617.1.3.2 Barrier Height Transition

A barrier height transition is designed to redirect traffic away from the blunt end of the barrier. A barrier height transition, as shown on Standard Plan 617.00, is installed on the exposed end of the barrier where the posted speed prior to construction on an existing facility is 35 mph or less. When specified, quantities are calculated and shown on the plans.

617.1.3.3 Crash Cushion

Crash cushions are designed to absorb energy of an impacting vehicle and reduce the force on a passenger to an acceptable level. An approved crash cushion is installed on the exposed end of the barrier where the posted speed prior to construction on an existing facility or the anticipated posted speed of a temporary facility is greater than 35 mph. A crash cushion will be required on the upstream end for divided facilities, and on both ends for all two-way facilities. Sand barrels are discussed in EPG 612.2 Sand-Filled Impact Attenuators (Sand Barrels). Applicable pay items are included in the plans. Special provisions are provided in the plans for non-standard devices. The types of crash cushions currently used are as follows:

- **617.1.3.3.1 Impact Attenuators (Sand Barrels).** This system consists of a group of freestanding sand barrels and is discussed in EPG 612.2 Sand-Filled Impact Attenuators (Sand Barrels).

- **617.1.3.3.2 Work Zone Crash Cushions.** These alternate crash cushions may be used when sufficient width is not available for sand barrels. These are typically used on the ends of temporary two-lane, two-way sections on divided highways. For temporary installations, refer to End Terminals, Crash Cushions and Barrier Systems for a list of approved work zone crash cushions.

Maintenance Concerns

617.1.4 Temporary Glare Screens

Temporary glare screens in work zones consist of modular units installed on top of temporary concrete traffic barrier. Temporary glare screens prevent headlight glare. Glare screens may also be used to block the driver's view of construction activities. Glare screens are not used where they could restrict driver visibility and sight distance. Use of these units are limited due to installation and maintenance concerns to areas where work zone activities could impact the flow of traffic, or geometrics could create a blinding effect on drivers. When specified, quantities are calculated and shown on the plans.

617.2 Construction Inspection Guidelines for Sec 617

Type C Permanent Concrete Traffic Barrier

Permanent Concrete Traffic Barrier (for Sec 617.10) The several different types of permanent concrete traffic barrier are:

- Type A – is the conventional two-sided “New Jersey” barrier that has two slopes on the face.
- Type B – is a single-sided version of the Type A.
- Type B (MSE wall) – is a modified Type B used on MSE walls.
- Type C – is a two-sided single slope barrier.
- Type D – is a single-sided version of the Type C.
- Type D (MSE wall) – is a modified Type D used on MSE walls.

Type A and B barriers have a single rebar near the top of the barrier. Type C and D barriers have an extensive cage of reinforcing steel throughout the barrier.

Stepped versions of Types A and C are used where there is a difference in elevation in the median.

Material (for Sec 617.10.2) The inspector is to collect all necessary certifications for materials and/or check prequalified lists similar to the procedure for any other concrete pavement pour.

Construction Requirements (for Sec 617.10.3) The inspector is to perform all necessary quality assurance measures similar to the procedure for any other concrete pavement pour such as slump tests, air tests, etc. Check the plans ahead of time to find out what types of accommodations need to be made for any appurtenances such as guardrail, lighting or sign bases, drains, bridge columns, etc. Details on attachments are to be located in either the contract documents for customized items or in the respective section of the standard plans for standardized items.

For Sec 617.10.3.2 The shape of the concrete traffic barrier is critical since crash tests were performed on the specifically shaped barrier. Concrete traffic barrier is to be constructed to the dimensions shown in Standard Plan 617.10.

Prior to concrete placement, the inspector is to check that the placements of the steel reinforcement, bar sizes, clearances, etc. are according to the plans. Improper alignment of steel could cause the slipform machine to snag or later cause steel popouts. Bars are to be clean of any oil, concrete or other contaminants. The contractor are to mark joint locations prior to slipforming or pouring to minimize the possibility of cutting through steel when sawing joints later. The finished barrier is to be true to line and grade with a smooth and even appearance, free of honeycombed areas or cracks. The finished surface is to be textured, which is typically done with a broom.

Inspector's diaries are to contain sufficient notes to establish that any barrier constructed was built according to plan.

Temporary Concrete Traffic Barrier (for Sec 617.20)

Type F barrier with three loops is the latest crash-tested temporary barrier. The Type F barrier shall be used on all projects when a temporary barrier is specified.

Certification (for Sec 617.20.3) The inspector needs to collect certifications on Type F temporary concrete traffic barrier. The date of manufacture is stamped on the barrier. The date needs to be checked to verify certification. 617.20.4 Construction Requirements.

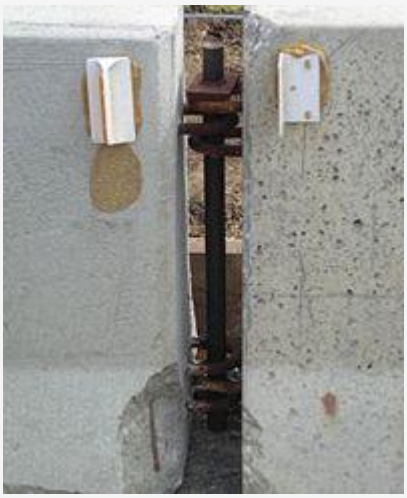
For Sec 617.20.4.1 Used Type F barriers are allowed on the job. If used barriers are brought on the job, they shall be inspected prior to being installed on a project. The inspector needs to make sure there is no exposed reinforcing steel, bent loops, large sections of concrete missing, significant cracks or other apparent defects that could impact the performance of the barrier.

It is the contractor’s responsibility to maintain the barrier in acceptable condition. The inspector must notify the contractor of any unacceptable pieces and ensure they are replaced in a reasonable fashion.

~~The two-loop Type F barrier uses a connection rod with an keeper pin assembly consisting, of a retainer bolt and nut and washer, to connect the sections.~~

There are two variations of Type F barrier, ~~ that currently are allowed, the older~~ two-loop version and the ~~newer~~ three-loop design. The use of two-loop Type F barrier shall be discontinued January 1, 2023.

~~2 and~~ 3-Loop Type F Barrier Connections



Proper connections: Two examples of proper connections of two 3-loop Type F barriers without bottom washer and retainer bolt and nut. The three loop connections provide enough friction so the connection rod will not come out on impact.

Improper Connection: One 3-loop Type F barrier was turned 180 degrees and the two ends have four loops on top and two loops on the bottom. Care must be taken when installing barrier for proper loop connections.

~~When installing two 2-loop barriers or one 3-loop barrier and one 2-loop barrier, the connection rod shall have a bottom washer and retainer bolt and nut.~~

~~**Proper Connection:** The bottom washer with retainer bolt and nut.~~

~~**Improper Connection:** No washer or retainer bolt.~~

For Sec 617.20.4.2 ~~Two-loop barrier that is manufactured before January 2004 may be used on a project. Any two-loop barrier manufactured after January 2004 must be rejected. Acceptance of two-loop barrier may be based on certification provided by the contractor stating that the barrier was fabricated prior to January 1, 2004 and in accordance with MoDOT specifications in effect at the time of fabrication. A legible MoDOT acceptance stamp on individual segments of barrier as required by the specifications may be waived if certification, as stated above, is provided by the contractor.~~

The three-loop barrier uses a connection rod with an optional keeper pin assembly consisting, of a retainer bolt and nut and washer, to connect the sections. The use of the retainer bolt and nut and bottom washer is at the contractor's option.

~~Two-loop and three-loop barrier may be used in combination. The contractor must use the connection rod and keeper pin assembly, consisting of the retainer bolt and nut and washer, if the two temporary barrier types are used in combination. Refer to the box, "2- and 3-Loop Type F Barrier Connections", to the right.~~

All exposed Type F barrier ends are to be protected with an approved end treatment. This may include a barrier flare, barrier height transition or crash cushion. Type F height transitions are not to be used where the posted speed prior to construction is greater than 35 mph.

When Type F barrier is hit, the localized area of impact usually bunches up several sections of barrier and makes connecting the barriers back together impossible without extending the barrier back out to its original location. Although overlapping of the barrier is acceptable at these locations, to be crashworthy the overlap needs to consist of , at minimum, six sections of barrier, i.e., 75 ft. (23 m) of barrier. Instead of requiring an overlap of 75 ft., it is recommended that the contractor be required, when possible, to extend the barrier back out to its original length thereby eliminating the overlap and allowing the units to be connected back together as designed. This can be accomplished without much effort if equipment (such as a forklift) operating to the rear of the barrier lift and push individual sections back together. If the barrier cannot be realigned, then the contractor will have no other choice but add sections to the barrier to provide the required 75-ft. overlap or to anchor the barrier.

If a contractor is interested in anchoring overlapping sections of barrier, contact Construction and Materials for details.

It is imperative that the Type F barrier be connected together as designed or properly anchored or overlapped when individual barrier sections cannot be properly pinned together. Anything less will not meet NCHRP 350 or MASH 2016~~and may make MoDOT liable if the barrier is hit~~.

For Sec 617.20.4.4 Equipment or material shall not be stored near temporary barriers within the limits shown on the plans or as approved by the engineer.

For Sec 617.20.4.5 Type F barrier may be anchored to the pavement and bridges as shown on the plans. The barrier is to be anchored on bridges when lateral deflection cannot be tolerated. The method of anchoring on bridge decks will be determined by Bridge and will be shown on the bridge plans.

Concrete Traffic Barrier Delineators (for Sec 617.30).

Material (for Sec 617.30.2) For permanent barrier installations, the inspector needs to collect certification on the sheeting used on the delineators and ensure that all delineators meet Sec 1065.

Construction Requirements (for Sec 617.30.3) The face of barrier is no longer painted by the contractor. The delineators take the place of painting the barriers. The delineators are used because they are more retroreflective, above the splash zone and are designed to adhere to the barrier better than paint. If temporary barriers are provided with existing painted faces, the painted face should turned away from traffic if possible or at least positioned so the existing painted face matches the color of the adjacent edgeline. Permanent barriers may be painted by district forces at the district's discretion after the job is complete.

Category:1063 Temporary Traffic Control Devices

This article establishes procedures for inspecting and acceptance of temporary traffic control devices. Refer to Sec 1063 for MoDOT's specifications.

MGS Information

Current General Services Specifications (MGS) By Subject

1063.1 Apparatus

No apparatus is necessary for field evaluation.

1063.2 Procedure

All temporary traffic control devices are to be manufactured as shown on the plans and as specified, in accordance with MUTCD requirements and be NCHRP 350 or MASH 2016 compliant. Nominal dimensions will be permitted for dimensional lumber where applicable. All temporary traffic control devices should exhibit good workmanship and should be free of objectionable marks or defects that affect appearance or serviceability. The brand name or model number is to be permanently identified on each traffic control device. For specific material requirements for each device, refer to Sec 1063.

1063.3 Basis of Acceptance

All temporary traffic control devices that appear to be specification compliant are accepted on certification. Some materials may be on a qualified list that can be used as a basis for acceptance.

1063.4 Report

Since all temporary traffic control devices are accepted on certification and visual inspection by Construction personnel although Material inspectors may be asked to assist them, Construction is responsible for reporting all devices through AASHTOWARE Project (AWP).

Distribution of reports for temporary traffic control devices purchased under a MoDOT purchase order is to be as described in EPG 1101 Materials Purchased by a Department Purchase Order.

Category:1064 Temporary Concrete Traffic Barrier

Moving the temporary concrete traffic barrier

This article establishes procedures for inspection and acceptance of temporary concrete traffic barrier. It provides the material inspection guidelines for Sec 1064.

Apparatus

No apparatus is necessary for field evaluation of Three-Loop Barrier. The use of Two-Loop Barrier on projects is to be discontinued January 1, 2023~~still requires a stamp.~~

~~(a) OK – MoDOT stamp.~~

Procedure

Three-Loop Concrete Barrier

~~All barriers manufactured after January 1, 2004 must be Three-Loop barrier.~~ The manufacturer is to provide certification that the barrier is in accordance with the specifications. District materials personnel may be requested by construction personnel to perform field inspection to determine if the barrier is damaged to the extent that the barrier cannot perform properly. Reasons for rejection would be as specified below in Reasons for Rejection.

Two-Loop Concrete Barrier

Only Two-Loop barrier manufactured before January 1, 2004 may be considered for acceptance until January 1, 2023. District materials personnel may be requested by the fabricator or contractor to re-stamp previously accepted, stamped barrier. Barrier not previously accepted and stamped will not be accepted. The barrier should be re-stamped if the previous acceptance stamp is legible and if the barrier is not damaged to the extent that it is felt that the barrier cannot perform properly.

MGS Information

Current General Services Specifications (MGS) By Subject

Basis of Acceptance

Barrier that appears to be specification compliant may be accepted on certification. District Materials shall visit each plant a minimum of once each year and confirm that materials and barrier comply

with specifications. More visits are justified when the plant's processes ~~are~~ indicate potential for error and production that might not be specification compliant. District Materials shall have no responsibility for the NCHRP 350 or MASH 2016 Certification.

Reasons for rejection

These reasons are, but are not limited to:

(a) Exposed steel reinforcement.

(b) Damage to the connecting loops.

(c) Missing chunks of concrete.

(d) Excessive marring or scarring.

(e) Extensive scaling of the concrete.

(f) Misalignment of the connecting loops that would hinder insertion of the keeper pin.

Report

Barrier is accepted on certification and visual inspection by Construction personnel, and although Material inspectors may be asked to assist them, Construction will be responsible for reporting it through AASHTOWARE Project (AWP).

Distribute the reports for materials purchased under a MoDOT purchase order as described in EPG 1101 Materials Purchased by a Department Purchase Order.

Certification (for Sec 1064~~.5~~)

For Sec 1064~~.5.1~~ The manufacturer shall provide certification to the contractor that the barrier is in accordance with the contract documents. In place of a stamp on Two-Loop barrier, a certification may be provided stating the production date was before January 1, 2004.

SECTION 403

ASPHALTIC CONCRETE PAVEMENT

403.19.1 Random Numbers. The engineer will generate random numbers.

403.19.2 Lots. The lot size shall be designated in the contractor's QC Plan. Each lot shall contain no less than four sublots and no more than 28 sublots. The~~with a~~ maximum sublot size shall be~~of~~ 1,000 tons. Sublots from incomplete lots shall be combined with the previous complete lot for determination of pay factors. When no previous lot exists, the mixture shall be treated in accordance with Sec 403.23.7.4.1. A new lot shall begin when the asphalt content of a mixture is adjusted in accordance with Sec 403.11.