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# **COCHISE COUNTY**

**Highway & Floodplain**

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## **Road Design & Construction Standards & Specifications For Public Improvements**

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2017 EDITION

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## ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials	Ft	Foot/Feet
AB	Aggregate Base (used in this document to refer to both Aggregate Base and to the subsequent pavement section, also known as Aggregate Base Course)	ITE	Institute of Transportation Engineers
		in.	Inch/Inches
AC	Asphalt Concrete	LOS	Level of Service
ADOT	Arizona Department of Transportation	MAG	Maricopa Association of Governments
AADT	Annual Average Daily Trips	mph	Miles per Hour
ADEQ	Arizona Department of Environmental Quality	MUTCD	Manual on Uniform Traffic Control Devices
ADT	Average Daily Trips	NCHRP	National Cooperative Highway Research Program
ADWR	Arizona Department of Water Resources	PCC	Portland Cement Concrete
A.R.S.	Arizona Revised Statute	RV	Recreational Vehicle
AZPDES	Arizona Pollutant Discharge Elimination System	SEAGO	South Eastern Arizona Governments Organization
CCH&FD	Cochise County Highway & Floodplain Department	SVMPO	Sierra Vista Metropolitan Planning Organization
Cfs	Cubic Feet per Second	TBST	Triple Bituminous Surface Treatment
DBST	Double Bituminous Surface Treatment; Chip-Seal	TRB	Transportation Research Board
FHWA	Federal Highway Administration	USDOT	United States Department of Transportation
Fps	Feet per Second		



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## SECTION A

### INTRODUCTION

#### 1. PURPOSE

The purpose of the Road Design & Construction Standards & Specifications for Public Improvements manual (hereafter Cochise County Design Standards) is to provide consistent design standards and specifications for the roadway network in Cochise County. It also supports the specific infrastructure management goal of Cochise County's (County) Strategic Plan to prudently manage and preserve the County's infrastructure investments.

Cochise County has long had operations and maintenance manuals to guide the County's roadway network development but it was not until the 1970s that County Engineers began to sign and seal specific details for general use. Prior to 1978, County highway work was under the direct supervision of each of the County Supervisors. Resolution 78-44 delegated this authority to the County Engineer and, six years later, Resolution 84-80 designated a Floodplain Control Board and appointed a Floodplain Engineer. Under their guidance previous roadway typical sections and construction details were combined into a 1996 Design Standard Handbook. The Board of Supervisors formally adopted Cochise County Design Standards in May of 2003. Revisions were undertaken in April 2005 and again in October of 2005. This 2017 update was adopted by the Board of Supervisors on **Month, Date, Year.**

When the application of a standard or specification is required, the words "must" or "shall" are used. When there is flexibility, the words "may" or "should" are used. This update reflects the experience of Cochise County highway/floodplain engineers and operations foremen, changes in applicable standards and publications, and evolving policies and practices regarding the County's transportation infrastructure.

These Design Standards may not apply to all situations. They are intended to assist the professional engineer's competent work but not to substitute for it. It is recognized that each roadway project is likely to have conditions that require site-specific treatment. These Design Standards are not a substitute for the design engineer's experience, professional judgment, comprehensive understanding of the referenced material, or ongoing communication with reviewers.

These Design Standards are also not intended to unreasonably limit any innovative or creative effort that might result in higher quality or cost savings for the public. Proposed variances from these adopted standards must be submitted to the Cochise County Engineer and approved before the project design is finalized. In the event of differences between these Design Standards and the scope of work or provisions of an executed County design contract, the executed contract shall govern.



## 2. APPLICABILITY

These Design Standards shall govern all construction and reconstruction of transportation facilities in County Right-of-Way or Right-of-Way that is intended to be dedicated to Cochise County.

The functional classification, future traffic characteristics (vehicle types and volumes), and topography of the area are the basic criteria used to determine the design standards to be used.

Before the County accepts a road into the County Road System for maintenance, it shall meet the standards contained herein. If field conditions change after plan approval, improvements shall be made, as necessary, to bring the transportation facilities up to these standards. These standards should be used by private parties, land development engineers, consulting firms, public utilities and agencies, and the Cochise County Highway and Floodplain Department (CCH&FD) staff. New roads or other public improvements will only be considered for acceptance into the County's maintenance system if they have direct access to another County-maintained road or another road that is maintained by a governmental entity.

These Cochise County Design Standards do not apply to routine maintenance, preservation, rehabilitation, or reconstruction of existing County-maintained roads that do not meet these standards.

For the purposes of these Cochise County Design Standards, the following definitions for maintenance, preservation, rehabilitation/reconstruction, and construction shall be used:

- Roadway maintenance is defined as any work that is preformed to maintain the condition of the roadway or to respond to specific conditions or events that create a need to restore the roadway to a functional state of operation.
- Roadway preservation is defined as any work that is planned and performed to improve or sustain the condition of the roadway in a state of good repair. Preservation activities generally do not add capacity or structural value, but do restore the overall condition of the roadway.
- Roadway rehabilitation or reconstruction is defined as any work that extends the service life of existing roadways either by restoring or reconstructing the pavement surface. Such work may include scarifying and mixing deteriorated pavement structure into a compacted sub-base or repair of age-related cracking of pavement surface with treatments like crack sealing, slurry seals, or micro-surfacing techniques.
- Roadway construction is defined as any work that changes the geometric prism or surface type of the roadway or completely removes and replaces the existing pavement structure. Such work may include roadway widening, chip seal on existing gravel/dirt surfaces, overlays greater than two inches, and major drainage improvements.

## 3. VARIANCE REQUESTS

Variances from these Design Standards may only be granted by the Cochise County Engineer. Any proposed departure from these standards will be judged on if the requested variance is in the



public interest and would not compromise public safety or the County's infrastructure investment. A request for a variance must be made in writing and include the following:

1. Standard or specification requested to be varied;
2. Alternative design or construction standard proposed;
3. Why the request is being made; and
4. Justification for the request – specifically addressing the potential impact on the public infrastructure system (safety, functionality, maintainability).

Documentation and exhibits to support the request must be included. Additional information, studies, reports, and/or alternative design, sealed by a civil engineer licensed to practice in Arizona, may be requested by the County Engineer prior to making a decision on the variance request. A written decision will be conveyed within 20 business days after receipt of a complete submittal.

#### 4. DEVELOPMENT OF PLANS AND SPECIFICATIONS

Except where these standards provide otherwise, testing, report preparation, principles, practices, design, design details, workmanship, construction, and materials shall be in accordance with the latest edition and current revision of the following publications:

- A Guide for Erecting Mailboxes on Highways, as distributed by the American Association of State Highway and Transportation Officials (AASHTO)
- A Policy on Geometric Design of Highways and Streets, as distributed by AASHTO and defined in this document as AASHTO Green Book
- Arizona Department of Transportation (ADOT) Traffic Control Design Guidelines
- Arizona Manual of Approved Signs (MOAS), as distributed by ADOT
- Arizona Supplement to the Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, ADOT
- Cochise County Floodplain Regulations, Cochise County Flood Control District
- Design of Riprap Retention, Hydraulic Engineering Circular 11 (HEC-11), as distributed by U.S. Dept. of Transportation (USDOT), Federal Highway Administration (FHWA)
- Guide for the Development of Bicycle Facilities 2012, 4<sup>th</sup> Edition, published by AASHTO
- Guidelines for Geometric Design of Very Low-Volume Local Roads (Average Daily Traffic [ADT] ≤ 400 vehicles per day [vpd]), as distributed by AASHTO
- Highway Capacity Manual, as distributed by the Transportation Research Board (TRB)
- Highway Drainage Design Manual, Volume 2, Hydrology, ADOT
- Highway Drainage Design Manual, Hydraulics, ADOT



- Hydraulic Design of Energy Dissipaters for Culverts & Channels, Hydraulic Engineering Circular 14 (HEC-14), USDOT, FHWA
- Hydraulic Design of Highway Culverts, Hydraulic Design Series (HDS) No. 5, USDOT, FHWA
- MUTCD for Streets and Highways, as distributed by the USDOT, FHWA; and as amended and approved by ADOT
- Materials Preliminary Engineering and Design Manual, prepared by ADOT
- Roadside Design Guide, as distributed by AASHTO
- Roadway Lighting Design Guide, published by AASHTO
- Roundabouts: An Informational Guide, as distributed by USDOT, FHWA
- State Standards, Arizona Department of Water Resources (ADWR) Flood Mitigation Section, SS1-97, SS2-96, SS3-94, SS4-95, SS5-96, SS6-05, SS7-98, SS8-99, SS9-02, SS10-07 and SS10-09
- Traffic Control Devices Handbook, 2<sup>nd</sup> Edition, or update, as distributed by the Institute of Transportation Engineers (ITE)
- Traffic Engineering Handbook, ITE.
- Traffic Impact Analyses, Section 240 of ADOT Traffic Engineering Guidelines and Processes
- Trip Generation Manual, 9<sup>th</sup> Edition or update, as distributed by ITE
- Trip Generation Handbook, 2<sup>nd</sup> Edition or update, as distributed by ITE
- Uniform Standards Specifications and Details for Public Works Construction, sponsored and distributed by the Maricopa Association of Governments (MAG). See Section D and E for Cochise County amendments to MAG Standards.

### 5. TIME LIMITATION OF CONSTRUCTION PLAN APPROVAL

The approval of road construction plans shall be valid for a period of three years from the date of final design approval by the County. Improvements not under construction within this period must be resubmitted to and reapproved by the County unless a longer time period has been specifically authorized by the County Engineer with the County's original approval.

Requests for extensions must be submitted in writing with appropriate justification warranting such an extension. Road construction plans may be required to be revised to meet with updated standards, if changes have occurred since the date of original approval.

A written decision will be conveyed within 20 business days of receipt of complete submittal.

## SECTION B

### ROADWAY FUNCTIONAL CLASSIFICATION

#### 1. SYSTEMS AND CLASSIFICATIONS

Functional classification is the system by which rural and urban roads are grouped into classes according to the type of service they are intended to provide. The basic functional systems are arterials, collectors, and local access roads. Travelers use a combination of arterial, collector, and local roads for their trips.

Each type of road has a specific purpose or function. Arterials provide for long-distance travel; collectors provide travel mobility between the higher-volume, higher-speed roads to the lower-volume, residential roads; and local roads connect travelers into the transportation network.

A transportation system consists of each street type, as shown to the right, and described in Table B-1, below.

#### Proportion of Service

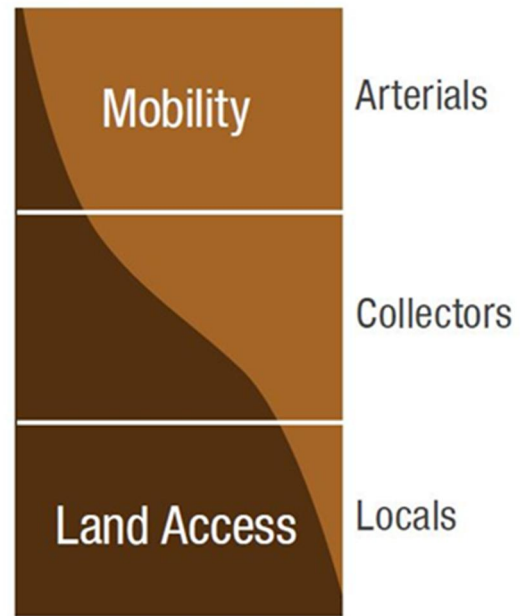


Table B-1 – Roadway Functional Classification

Functional Classification	Ideal Character and Function of the Roadway	Types
Arterial	Provides the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control. These are the best developed roads within the roadway network.	Serves major activity and economic centers; connects dense urban areas; provides linkages to other arterials; connects to the Interstate system.
Collector	Provides a less highly developed road with a lower speed; collects traffic from local roads and connects them with arterials; provides alternative routes to higher classed roadways.	Serves smaller-scaled activity and economic centers as well as important community traffic generators like schools, specialty retail; provides linkages within the County.
Local	Consists of all roads not defined as arterials or collectors; multiple access points for individual users; lowest speeds for shorter distances on the least developed roads.	Provides access to land with little or no through movement; individualized access at the neighborhood scale; typically serves residential or rural ranch/agricultural areas.

Specific criteria guide the designation of roadways as a Federal Functional Classified roadway, as opposed to a County-level designation. Both a Federal and a County classification



designation serve as a basis for establishing speed limits, design standards, and access controls. However, an important distinction is that the use of most Federal or State funds for roadway improvements is limited to those roadways designated as a Federal Functional Classified roadway.

This section discusses both Federal and County functional classifications for County roadways. There are nine types of roadways that make up the Cochise County transportation network.

Table B-2: Roadway Classifications

Classification	Detail	Roadway Type	Lane Width	Paved Shoulder	Pavement Surface
County	CC010	Commercial/Industrial Road	12' to 20'	2' to 8'	AC
Federal	<i>By Design</i>	Minor Arterial Road	12'	8'	AC
Federal	CC011	Major Collector Road	12'	6'	AC
Federal	CC012	Minor Collector Road	12'	4'	AC
County	CC013	County Collector Road	12'	0'	DBST
County	CC014	Major Access Local Road	12'	0'	DBST
County	CC015	Minor Access Local Road	12'	0'	AB
County	CC016	Context Sensitive Road	9'-10'	0'	Native
ARS § 6706	<i>Not a standard</i>	Primitive Road	varies	0'	Native

The desired Level of Service (LOS) designations for each County functional classification is used in traffic analysis to support roadway function classifications, sizing of roads, and determining the number of intersection auxiliary lanes that are required during peak hours.

Federal Functional Classification definitions are adapted from the FHWA *Highway Functional Classification Concepts, Criteria and Procedures, Chapter 3, Criteria*.

**2. FEDERAL FUNCTIONAL CLASSIFICATIONS**

**Minor Arterial Road**

Minor arterial roads offer connectivity to the State or Interstate system, linking activity and economic centers to the regional network. These roadways are fairly long, cross-jurisdictional boundaries and, together with Principal Arterials (Interstate) carry the largest volume of traffic in the regional network. In Cochise County, these types of roadways are, with the exception of Naco Highway, all on the State Highway system or within the incorporated City of Sierra Vista.

Minor arterial roads consist of roads with the following service characteristics:

- A. Link cities and larger towns (and other major destinations capable of attracting travel over long distances) and form an integrated network providing interstate and inter-county service
- B. Be spaced at intervals, consistent with population density, so that all developed areas are within a reasonable distance of an arterial roadway



- C. Provide service to corridors with trip lengths and travel density greater than those served by collectors and local roads and with relatively high travel speeds and minimum interference to through movement
- D. Annual average daily trips (AADT) 3,000 to 14,000
- E. Desired LOS B

Design Standards for this classification will be developed by the Design Engineer, consistent with the reference guidance noted in Section A, and as approved by the County Engineer.

Example: Naco Highway, US 191, SR 92

#### Major Collector Road

Major Collectors typically connect to State or Interstate routes or provide service to communities not directly served by the State or Interstate systems. They provide access to clustered business areas or community facilities, like schools. Generally, major collector routes are longer in length than most of the roads in a regional network; have higher speed limits; have higher annual average traffic volumes; and have more travel or turning lanes than minor collector roads.

Major collector roads consist of roads with the following service characteristics:

- A. Provide service to any county seat not on an arterial route, to the larger towns, or census-designated places not directly served by the higher systems, and to other traffic generators or destinations of intra-county importance
- B. Links destinations with nearby larger towns and cities or with arterial routes
- C. Serve the most important intra-county travel corridors
- D. AADT between 2,600 and 6,300
- E. Desired LOS B

See Standard Detail CC011, Major Collector Road for design standards.

Example: Dragoon Rd, Davis Road, Kansas Settlement Road, Charleston Road

#### Minor Collector Road

Minor collector roads move traffic from local roads to major collectors or arterial roads. They tend to feed residential traffic to higher volume roads but also provide access to local businesses. Generally, minor collector roads have moderate speeds over a fairly long distance but allow for multiple access points.

Minor collector roads consist of roads with the following service characteristics:

- A. Provides access to adjacent land
- B. Provides service to travel over short distances as compared to higher classification categories
- C. In more urbanized areas carries little or no through traffic movement
- D. Constitutes the mileage not classified as part of the Arterial and Major Collector systems
- E. AADT between 1,110 and 6,300
- F. Desired LOS B



See Standard Detail CC012, Minor Collector Road ADT >2000 for design standards.

Example: Gleeson Road, Noland Road, Apache Pass Rd, Lochiel Road

### 3. COCHISE COUNTY FUNCTIONAL CLASSIFICATIONS

#### Commercial/Industrial Road

Commercial/Industrial roads serve heavy industrial employment centers or areas. These types of roads provide access and traffic circulation for sites that have larger volumes of freight that require a stronger pavement section and larger turning radii. They also may be appropriate in urbanizing areas with clustered commercial uses. Commercial/Industrial roads have the following service characteristics:

- A. Traffic movements internal to a clustered commercial or industrial site
- B. Traffic turning movements are designed for high volumes of freight
- C. Development frequently fronts directly on the road
- D. Signal spacing is two miles or less
- E. Right-of-Way width typically between 80 to 100 feet (ft)
- F. AADT over 250
- G. Desired LOS B

See Standard Detail CC010, Commercial/Industrial Road for design standards.

Example: Monsanto Drive, DeMuro Drive, Ten Pond Place

#### County Collector Road

In Cochise County, collector roads tend to connect to state or interstate routes, which are typically classified as arterial routes. These roads can also provide service to larger communities not directly served by the arterial system but do not always generate enough traffic to warrant a federal functional classification in rural areas. County collector routes serve traffic generators of regional importance such as economic generators, ecotourism destinations, or a cluster of community facilities in rural communities. County collector roads consist of roads with the following service characteristics:

- A. Two-lane undivided roads with intersections at grade, and allows for individualized access to both commercial and residential parcels
- B. Serves traffic movements between local roads and the federally functional classified collector or arterial roads
- C. Traffic movements between smaller communities, or locally important traffic generators and developed areas
- D. Striped for one lane in each direction
- E. Right-of-Way width typically between 80 to 100 ft, depending on drainage
- F. AADT between 1,110 to 2,600
- G. Desired LOS B

See Standard Detail CC013, County Collector Road for design standards.

Example: Ghost Town Trail, Foothills Drive, Towner Avenue



#### Major Access Local Road, Double Bituminous Surface Treatment

Major local roads serve primarily to provide access to adjacent land uses and connect them to collector and arterial roadways. The main function of most local roads is to provide movement for travelers to and from residences. Roads in this classification are maintained by Cochise County and because their higher levels of local traffic, typically over 400 vehicles per day (VPD), a double bituminous surface treatment/chip-seal is preferred. These streets provide direct access to abutting properties and provide access into and through subdivisions.

Major access local roads consist of roads with the following service characteristics:

- A. Two-lane undivided paved roads with intersections at grade
- B. Traffic movements between collectors and adjacent lands
- C. Traffic movements involving relatively short distances
- D. Right-of-Way width typically between 60 and 80 ft, depending on drainage
- E. AADT between 400 to 1,110
- F. Desired LOS A

See Standard Detail CC014, Major Access Local Road, Double Bituminous Surface Treatment for design standards.

Example: Montezuma Canyon Road, Douglas Avenue, Oak Street, Ocotillo Road

#### Minor Access Local Road, Unpaved, Low Volume

Minor local roads provide access to adjacent land uses and connect them to collector roadways. The primary function of most local roads is to get travelers to and from residences. In the more rural areas of the County these local roads may also serve agricultural and ranching areas.

Local roads in this classification are low-volume unpaved roads that have been declared as a county highway. This standard was developed as an option for rebuilding deteriorating paved surfaced roadways. This standard may be an appropriate interim measure when paving is not feasible due to funding constraints. These roads should serve a minimum of 250 VPD or provide service to key community activity centers, like schools/health clinics or economic generators. These streets provide direct access to abutting properties and connect to collector roadways. This standard may not be used for any new or subdivision roads that are intended to be brought into the County's maintenance system.

Minor local roads typically have the following service characteristics:

- A. Two-lane undivided unpaved roads with intersections at grade
- B. Traffic movements between collector roads and adjacent lands
- C. Traffic movements involving relatively short distances
- D. Right-of-Way width between 60 and 80 ft
- E. AADT less than 400
- F. Desired LOS A

See Standard Detail CC015, Minor Access Local Road - Unpaved, Low Volume for design standards.

Example: This is a new design standard and no examples of this road cross section currently exist.

#### Context Sensitive Road, Unpaved, Low Volume

Cochise County has several areas with extraordinary environmental, ecological or culturally significant features. In some cases, these unique areas require additional consideration to balance access and safety with preservation of these valued resources. Flexibility in design standards, allowing accommodation of site specific concerns, may make the use of a Context Sensitive Road standard as the most appropriate design to apply to mitigate potential adverse impacts on the topography, water courses, wildlife habitat, vegetation, cultural resources or the integrity of the area as a whole.

Context sensitive roads are typically unpaved and generally provide local access to residences or public lands. These roadways are signed in a manner consistent with MUTCD, warning the traveling public that they are on a roadway that is only minimally maintained. These may include signs that state "Scenic Road" together with "Narrow Width, Limited Shoulder" with speed limits signs for 25 mph or less. Maintenance of adjacent drainage ditches and shoulders are typically limited to not more than two ft on each side of the roadway.

This standard was developed as an alternative to a minor access local road that would allow, in unique circumstances, a narrow road with reduced clear zones. The development of a context sensitive design for a roadway allows consideration of safety and mobility needs balanced in harmony with an area's unique aesthetic, cultural, or environmental features. This designation requires a finding that a roadway segment meets the criteria of this standard by the County Engineer before being signed and maintained as a context sensitive roadway. This standard may not be used for any new or subdivision roads intended to be brought into maintenance.

Context sensitive roads have the following service characteristics:

- A. Unpaved road that does not follow a straight or direct corridor
- B. Located in an area with unique characteristics that could be damaged or degraded by construction disturbance
- C. Has topographic and/or drainage constraints that limit cross-section lane widths
- D. Right-of-Way between 25 ft and 50 ft
- E. May potentially be signed for a 25 mph or less speed limit
- F. AADT less than 250
- G. Requires designation by the County Engineer

See Standard Detail CC016, Context Sensitive Road, Unpaved, Very Low Volume, for maintenance standards.

Example: Ramsey Canyon Road, Turkey Creek Road, Portal Road

#### Primitive Road, Unpaved, Low Volume

There is one other roadway designation in Cochise County that is not a design standard. It may not be used for the construction of any new roads to be brought into the County's



maintenance system. Per ARS §28-6705 and ARS §28-6706 the Board of Supervisors may designate roads meeting specific criteria, set forth in the statute, as primitive roads solely for the purposes of limited maintenance activities. Signs warning the traveling public must be posted stating: "Primitive Road, Caution, Use At Your Own Risk. This surface is not regularly maintained".

Primitive roads have the following service characteristics:

- A. Defined by State Statute and established per Cochise County Resolution 94-87
- B. Limited maintenance is allowed under state statute
- C. Primitive roads must be reclassified from this designation by the Board of Supervisors and brought into the County's declared highway system before expending public funds for improvements

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## SECTION C

### ELEMENTS OF ROADWAY DESIGN

#### 1. DESIGN STANDARDS

This section highlights the important considerations and requirements in designing and preparing plans for new and reconstructed Cochise County roadways. The use of widely accepted industry standards typically reduces design and review timeframes. Reference documents are cited in this section and are also listed in Section A. Note that these documents are revised periodically; therefore, users should use the most recent version of the document specified.

Cochise County minimum design standards are described in the current edition of *A Policy on Geometric Design of Highways and Streets*, published by AASHTO, commonly referred to as the Green Book.

The typical road cross-sections for Cochise County roadways are shown in Section D. For roadways which may be annexed in the near future by a city or town, Cochise County may elect to incorporate elements of the adjacent city's or town's standards into the design.

#### 2. NEW ROADS ACCESSING A COUNTY-MAINTAINED ROAD

A road is any vehicular travelway that serves two or more lots or parcels. New public and private roads accessing a County-maintained road shall require an approved Right-of-Way permit prior to construction.

All roads intersecting a federally functionally classified arterial, major or minor collector road shall do so at a 90-degree angle. All roads intersecting with a county collector or local road shall not vary from the 90 degrees by more than 15 degrees.

Intersecting roads that do not directly align to the common roadway shall have centerline offsets that are a minimum of 200 ft apart on local and minor collector roads and 300 ft apart on all other roads.

At road intersections, the edge of pavement shall be rounded to accommodate turning movements with a minimum radius of 25 ft for county collector and local access roads and maximum radius of 50 ft for federally functionally classified and commercial/industrial roads. When acceleration or deceleration lanes are present, curve radii may be reduced to 25 ft. It may be necessary to round the property line corner(s) to accommodate wide turning movements and/or surface drainage requirements.

The centerline tangents, prior to any horizontal curve, shall be a minimum of 50 ft for local roads and 100 ft for all other roads, measured from the intersected roadway's Right-of-Way line.

The crossover crown of a roadway being intersected shall not exceed an algebraic difference of 4 percent for arterial and collector roads and 8 percent for local roads.

Clear visibility with adequate stopping sight distance, shall be provided to drivers in both directions, along the centerline of all intersecting roads.

Intersections should be located along tangent sections of roadway. In no case shall an intersection be located on or near the inside of a sharp curve.

The provision of exclusive right-turn or left-turn lanes should be considered at major intersections and at locations where safety is significantly improved by providing a deceleration lane for vehicles turning out of the major roadway through lanes to make left or right turning movements onto a cross road or driveway. Turn lane design shall be per ADOT Traffic Engineering Guidelines & Processes 430, Turn Lanes Design. Specific design values and markings for turn lanes are as described by ADOT or MUTCD in reference manuals or as modified in Sec E of these Design Standards.

### Roadway Access Apron

The surface type of the roadway apron shall meet or exceed the surface type of the intersected County-maintained roadway. Uncurbed intersections shall include concrete ribbon curb along the radii returns to prevent pavement raveling. See Detail CC205-3.

Any roadway access apron shall be designed to adequately handle roadside drainage. Stormwater from the new roadway should not result in stormwater overtopping any part of the existing County-maintained travelway or cause erosion or deposition within the County Right-of-Way. Any new roadway or roadway access apron should be designed in such a way as to ensure that there is no increase in stormwater drainage onto neighboring properties.

Adequate stopping sight distance shall be provided at all intersections. Both horizontal and vertical curves should be as flat as possible at intersections and driveways where vehicles decelerate, stop, and accelerate.

Obstructions in both the horizontal plane and the vertical plane must be reviewed when designing intersections. Sight triangles identify areas at the corners of intersections of roads and driveways where views of approaching traffic should not be obstructed. Sight distance triangles shall be identified and shown at all road intersections and noted on the final subdivision plat and on commercial site plans, see Detail CC300. These areas are required to remain free of all obstructions that would interfere with a driver's visibility between the heights of 3 ft and 10 ft to include, but not be limited to, structures, trees, shrubbery, and signs. Exceptions are utility poles, fire hydrants, and traffic control signs that cannot be reasonably relocated.

## 3. DRIVEWAYS

A driveway is any access constructed within the public Right-of-Way, connecting the public roadway with an adjacent property. There are three general driveway categories and corresponding details: Residential Driveways, Detail CC205-1; Commercial Paved Driveways, Detail CC205-2; and Roadway Access Aprons, CC205-3. Roadway access aprons are required for private roads that provide access to two or more parcels.



A Right-of-Way permit is required prior to construction of a driveway. Though each type has typical guidelines for layout, application, and typical materials, all driveway configurations must receive approval by the County Engineer before installation. General requirements for driveways are listed below, followed by specific requirements for each classification.

**Spacing:** The location and spacing of driveways has an impact on both safety and capacity of the roadway. The distance between adjacent driveways shall be adequate to allow driveway vehicles to safely queue, accelerate, decelerate, and cross conflicting traffic without excessive interference with through traffic or adjacent driveway traffic. Whenever possible, it is preferred that driveways align directly across from any other established driveway on the opposite side of the roadway.

A minimum of 150 ft, measured at the Right-of-Way line, shall separate the nearest pavement edge of any entrance or exit driveway onto any commercial/industrial, major, minor, or county collector road and the nearest intersecting road. Driveways onto local access or context sensitive roads shall be a minimum of 50 ft from the nearest intersecting road. Driveways near median openings shall either be centered with the center of the median opening or be a minimum of 100 ft from the median opening. Joint access will be required for two adjacent developments where a proposed new access will not meet these spacing requirements.

**Length and Width:** The design of a driveway should consider the space necessary to accommodate all vehicles using the driveway (adequate storage length). This applies to both vehicles making a left turn from the roadway and to vehicles stopped on the driveway waiting to enter the roadway. The potential for larger vehicles, such as recreational vehicles (RVs) or livestock trailers, should be taken into account in the driveway design.

**Skew:** Driveway design shall seek to make the driveway alignment at a 90-degree angle (perpendicular) to the road they are accessing. When parcel circumstances cannot accommodate 90 degrees, a reduction of less than 90 degrees, to a minimum of 60 degrees, may be considered for approval by the County Engineer.

**Sight Distance:** Adequate sight distance shall be provided for vehicles exiting and entering a driveway. The location should be evaluated to determine whether a sight obstruction exists, such as buildings, signs, vegetation, parked vehicles, or horizontal or vertical roadway alignments, etc. In all cases, stopping sight distance for the approaching traffic on both sides of the accessed roadway shall be provided. See Detail CC300.

**Vertical Alignment/Grades:** Adequate design of driveway grades should reflect consideration for the basic functions of the adjacent street and the site that the driveway serves. Sufficient clearance between the vehicle and the driveway surface must be provided.

**Drainage:** Adequate drainage shall be provided at each driveway and consider the surrounding terrain, on- and off-site flows and the capacity needs (or requirements) for any drainage structures. Drainage structures shall be provided under driveways when necessary. Flows that can be accommodated with less than the minimum 18-in. culvert size may use a

concrete or paved low-flow drainage crossing, see Detail CC205-4. The Design Engineer shall provide details of the ditch or channel design and the embankment slopes with any protection requirements, including rip rap gradation.

### A. Residential Driveways

Residential driveways typically provide access to one single-family residence. These driveways can be chamfered or have radii, and may be constructed of native or stabilized earth. Residential driveways may also be constructed of many different types of materials including gravel, concrete, Aggregate Base (AB), Chip-Seal (DBST), and Asphalt Concrete (AC). Driveways within new subdivisions shall be consistent throughout the subdivision, as approved by the County Engineer.

Residential driveway return radii shall be 4 ft to 10 ft for intersection roadway speeds of 35 mph or less and 25 ft for greater than 35 mph. Radii or chamfers if used, must remain within the projection of the subject parcel's property lines and shall not encroach upon any part of adjacent properties. The standard driveway width ranges from 12 ft minimum to 30 ft maximum. Preferred residential driveway width is 16 ft.

New residential driveways on parcels that have potential for access onto two different roadways (e.g. corner lots) shall place the access on the street with the lesser classification. Parcel access would be constructed onto the local road instead of the higher-volume collector road to preserve the higher speeds on the higher-volume roadways.

See Detail CC205-1 RESIDENTIAL DRIVEWAYS for additional information and requirements.

### B. Commercial Driveway

Commercial driveways typically provide access to an office, retail, or institutional building or to clustered residential units, such as an apartment building. Commercial and industrial driveways must take into consideration the needs of truck traffic and shall be designed using the appropriate turning template. These driveways can be chamfered or have radii, and can be constructed of different types of hard-surfaced materials including concrete, Aggregate Base (AB), Chip-Seal (DBST), and Asphalt Concrete (AC). For these driveways, the pavement surface must match, or be more durable than, the connecting roadway.

Commercial driveways shall have a minimum return radius of 35 ft, with a maximum return radius based on the specific traffic needs of the commercial land use. Radii or chamfers must remain within the projection of the subject parcel's property lines and shall not encroach upon any part of adjacent properties frontage on the roadway.

Commercial driveways shall have a minimum width of 16 ft. A two-lane commercial driveway minimum to accommodate one-way traffic on and off the site is 24 ft in width and a maximum of 40 ft. Driveways having three or more lanes shall follow the design standards for street intersections. Where necessary for the safe and efficient movement of traffic, the County may require a Traffic Report (Traffic Impact Statement or Traffic Impact Analysis) with specific recommendations and design for the access driveway(s). These types of driveways may be required to be geometrically designed to provide for only limited turning movements.



The vertical profile of a driveway should allow a smooth transition to and from the roadway. A minimum 20-ft-long landing area, of no greater than 3 percent slope, shall be provided for commercial/industrial driveways.

Construction of curb, gutter, sidewalk, or pathway may be required as a condition of commercial permit approval. MAG Detail 220-1 Curb and Gutter, Type B ribbon curb is typically desired for commercial driveways constructing curb and gutter. Commercial driveways that are taking access from a commercial/industrial road or from a major or minor collector roadway shall either continue curb and gutter or provide for a flush ribbon curb 6 in. to 12 in. wide and 12 in. to 18 in. deep.

See Detail CC205-2 COMMERCIAL PAVED DRIVEWAYS for additional information and requirements.

### C. Driveway Access for Multiple Parcels

Private roads that provide access to two or more residential parcels shall provide a roadway access apron in lieu of a single-use driveway. See Detail CC205-3 ROADWAY ACCESS APRON and reference the information in this section 2A: Roadway Access Apron for additional information and requirements.

## 4. UTILITIES WITHIN PUBLIC RIGHT-OF-WAY

This section applies to all public and private utilities including, but not limited to, electric power; gas; water; sewer; cable television; irrigation; and communications networks such as, but not limited to, telephone or fiber optics; and similar facilities that are located on and under roadways on the County's maintained roadway network.

All new overhead utility lines, utility poles, and other above-ground utility structures shall be constructed outside the clear zone of the roadway. Underground utilities shall be constructed outside the paved areas of the roadway section (except for crossings). Fire hydrants shall be located a minimum of 6 ft from back of curb, 1 ft from back of sidewalk, or 10 ft from edge of pavement, if no curb is present. Utility poles and any other above-ground streetscape elements shall be located within 5 ft of the Right-of-Way line or 10 ft from the travel lane, whichever is most restrictive. Warning tape shall be installed a minimum of 1 ft above underground utilities.

Where it is necessary for underground utility lines to cross a roadway, the crossing for such utility lines shall be constructed per Cochise County Design Standards Section E: Specifications and per the Right-of-Way permit. Existing and new underground utility and culvert locations shall be appropriately shown in paving and drainage profiles.

## 5. DESIGN CONSIDERATIONS

This section provides information about design features that should be considered when assessing a site and preparing public infrastructure plans. These include, but are not limited to,

site traffic circulation, multimodal connections and amenities, roadway clear zones, roadway lighting, need for traffic signals or regulatory signs, and other features that may be needed for a complete design (cattle guards, guard rails, medians, pavement striping).

### A. Traffic Circulation

Community-scaled traffic circulation, including multimodal provisions, should be considered during street layout and design of residential subdivisions and commercial development. Early consideration can minimize future speeding problems, decrease potential conflicts between pedestrians and vehicles, and improve the livability of the neighborhood and accessibility of commercial sites.

Engineered solutions (e.g. traffic calming) to reduce vehicle speed, the volume of cut-through traffic, and to integrate pedestrian and bicycle travel is appropriate in some cases. Traffic calming can be achieved through design features such as striping, landscaping, roundabouts, and sometimes, physical barriers. Speed humps or speed tables may be appropriate in some cases; however, designing to avoid these types of physical barriers is preferred. See Detail CC210.

Subdivision streets should be designed to encourage 85th percentile speeds to be the same as the design speed. Intersection return radii may be reduced to 15 ft for local to local road connections. Road tangents (straight segments) ideally should not exceed 500 ft in length. Long tangent sections can be segmented by T intersections or conditions that require reduced speeds such as horizontal curves or knuckles. Tangent sections greater than 1,000 ft should include engineered features to encourage drivers to travel at, or below, design speeds.

### B. Clear Zone

The clear zone is the lateral distance from the edge of the traveled way that is available for the safe use of errant vehicles. A recovery area or clear zone is the area outward from each outer travel lane that should be free of obstruction and non-traversable side-slopes. The clear zone width shall be per the AASHTO Roadside Design Guide.

Where obstructions exist behind vertical curbs or curb and gutter sections, a minimum horizontal clearance of 1.5 ft shall be provided beyond the face of curb to the obstruction. All roadways shall maintain a minimum vertical clearance of 16 ft over the entire roadway. Rigid obstacles and certain other features with less than the minimum clear distance shall be adjusted so that:

- Obstacles which may be removed should be eliminated
- Obstacles which may not be removed entirely should be relocated laterally or to a more protected location
- Obstacles which may not be moved should be reduced in impact severity; Breakaway devices and flattened side slopes for improved vehicle recovery offer such an improvement.
- Obstacles which may not be otherwise treated should be shielded by crash-worthy or guardrail devices

Obstacles and features which need to be analyzed include, but are not limited to, such items as:



- Rough rock cuts
- Rocks over 4 in. in diameter
- Streams or permanent bodies of water more than 2 ft deep
- Shoulder drop-offs with slopes steeper than 3:1 and heights greater than 2 ft
- Signs, traffic signals, and luminary supports with a concrete base extending 6 in. or more above ground
- Bridge piers and abutments
- Retaining walls and culverts
- Trees with an expected mature size greater than 4 in. in diameter, measured 12 in. above ground
- Wood poles or posts with a cross sectional area greater than 16 square in.
- Culverts, culvert ends, exposed pipes, cattle guards, and headwalls. Drainage structures should extend beyond the clear zone limits.
- Embankments
- Fire hydrants
- Non-standard mailboxes

### C. Roadway Lighting

Continuous roadway lighting is typically not installed. However, at the beginning of each project, Cochise County will identify the intersections and roadway sections, if any, for which lighting is required.

Road lighting design shall meet or exceed average illuminance per the AASHTO Roadway Lighting Design Guide; pole locations per the AASHTO Roadside Design Guide and light distribution per the applicable Cochise County regulations.

Equipment and material standards shall be per ADOT Standards.

### D. Traffic Signals

Traffic signals shall be installed at any location shown to be warranted by a traffic study.

For new or upgraded signal installations, the number of signal indications and faces and their location shall conform to requirements in Part IV of the MUTCD. All signal lenses shall be 12 in. in diameter. Equipment and installation procedures shall conform to ADOT Standards.

### E. Cattle Guards

Cattle guards, with or without gates, may be required to prevent livestock from interfering with roadway traffic or to maintain range control. To prevent livestock from entering the Right-of-Way, the construction of cattle guards may be required at side roads or private entrances. The number of units required should be determined by the width of the roadway in which they are installed. See Details CC261-1 thru CC261-5.

## 6. ROADWAY DESIGN CRITERIA

This section provides additional specifications and requirements related to design criteria for designing roadways and other related improvements in Cochise County.



### A. Survey and Road Monuments

Permanent survey monuments shall be installed to designate road centerline at all horizontal angle points, at points of curvature, at points of tangency for horizontal curves, and at the centerlines of all road intersections.

After all improvements have been installed, the developer shall be responsible for having a registered land surveyor set and stamp the monuments and certify as to their accuracy prior to final inspection. See Details CC121-1 and CC121-2.

### B. Design Controls

Two primary roadway design controls are design speed and the design vehicle. Design speed is the selected speed used to determine the various geometric features of the roadway. The design vehicle is the largest vehicle likely to use the road with considerable frequency.

For all roads with an anticipated posted speed of 30 mph or less, the design speed shall be 5 mph over the posted speed limit. For all roads with an anticipated posted speed of 35 mph or greater, the design speed shall be 10 mph over the posted speed limit. Design speeds may be increased based upon the road classification or as deemed necessary by the County Engineer.

The design vehicle for local streets shall be the single-unit truck (SU), for collector streets the S-BUS-40, and on commercial/industrial roads or arterials streets the WB-40.

### C. Geometric Design: Horizontal Alignment

Design of horizontal alignment must consider safety, vertical alignments, access, and intersection location(s). The two primary factors which provide the framework for horizontal alignment are design speed and stopping sight distance.

Stopping sight distance shall be provided on all roads per Tables 3-1 and 3-2 in the AASHTO Green Book. The use of compound circular curves should be avoided. In rare cases where topography or Right-of-Way constraints require the use of compound curves, the radius of the flatter curve should not exceed 1.5 times the radius of the sharper curve.

Where topographic or Right-of-Way constraints require the use of reverse simple curves, a minimum tangent separation between the curves shall be 100 ft or equal to at least 4/3 the super-elevation runoff length, whichever is greatest. When using reverse curves, special attention must be given to the roadway's drainage requirements. An angle point is acceptable for breaks in tangent horizontal alignments of less than 1 degree.

The normal two-way crown section (2 percent for AC or 3 percent for DBST) shall be used. Local roads and two-lane residential collectors with design speeds of 35 mph or less should generally not be super-elevated at curves. The minimum and maximum radius of curvature, for given design speeds, shall comply with the AASHTO Green Book.

Typical shoulder widths and slopes are shown in the County's standard typical sections for the respective roadway classifications, Details CC010-CC017. If the local terrain requires modification of the shoulder slopes, the design control (cross slopes) of the roadway and the graded earthen shoulder at the edge of pavement are preferred to be equal, but may have



a maximum algebraic difference of 8.0 percent. Thus, for a roadway with a cross slope of 2%, the shoulder maximum grade could be up to 10% or 10:1. In super-elevated sections greater than 2%, the graded shoulder slope shall be a continuation of the pavement slope. Exceptions based on engineering judgment shall be presented for approval by the County Engineer.

The maximum super-elevation permitted is 0.04 ft/ft for urban classifications and 0.06 ft/ft for rural classification roadways. Super-elevation must be designed to show respective lengths of super-elevated section, crown runoff and crown runout. See example sheet CC022 in Section D.

Sharp horizontal curves must not begin near the top of pronounced crest vertical curves or near the low point of pronounced sag vertical curves.

Knuckles may be approved on an exception basis for urban local streets with 200 ADT or less, intersecting at angles between 60 degrees and 90 degrees.

When a proposed roadway will directly connect with an existing roadway of a different width, it is necessary to install a shifting transition taper between the two. Minimum taper lengths shall be 100 ft in urban areas and 200 ft in rural locations. Taper lengths shall be calculated using the MUTCD taper formulas, as amended and approved by ADOT.

#### D. Geometric Design: Vertical Alignment

Vertical curves should be designed to provide adequate sight distance, safety, comfortable driving, good drainage, and a pleasant appearance. They should be made as long as possible to provide greater stopping sight distance. Adequate stopping sight distance shall be provided along the entire length of a curve.

Grade breaks with an algebraic difference of 1.0 percent or less do not require a vertical curve. The minimum length of vertical curve shall be determined by the greater of the following two criteria:

For comfort: Input the design speed into the following equations:

$$L = 3 \cdot V^3 \quad \text{where: } L = \text{length of vertical curve (ft)}$$

$$V = \text{design speed (mph)}$$

For stopping sight distance:

$$L = K \cdot A \quad \text{where}$$

$$L = \text{length of vertical curve (ft)}$$

$$K = \text{rate of vertical curvature (ft/ percent)}$$

$$A = \text{algebraic difference in grades (percent)}$$



Table C-1: Minimum K Factor of Vertical Curves

Design Speed (mph)	25	30	35	40	45	50	55	60	65
Kmin (Crest Curves)	12	19	29	44	61	84	114	151	193
Kmin (Sag Curves)	26	37	49	64	79	96	115	136	157

Minimum rate of vertical curvature (K) for crest and sag vertical curves for stopping sight distance.

*Source: A Policy on Geometric Design of Highways and Streets, as distributed by the American Association of State Highway and Transportation Officials (AASHTO), 2011.*

To ensure proper longitudinal drainage near the high point of a crest vertical curve, the rate of vertical curvature (K) should not exceed 167. If K is larger than 167, special attention is needed to ensure proper drainage to obtain a minimum grade of 0.25 percent.

There shall be a minimum grade of 0.25 percent along all roads; a maximum grade of 7 percent on arterial, major collector or section-line roads; and a maximum of 10 percent on minor collector or local roads for a distance not to exceed 600 ft.

#### E. Geotechnical Evaluation and Pavement Section

County roads shall have a pavement structural section based on the ADT, functional classification for the roadway, and bearing capacity of soils and/or sub-base materials under the roadway. Some roadways will be paved with AC, while others have a DBST/Chip-Seal. On rare occasions, there may be a TBST chip-sealed surface. There are also structural depth requirements for unpaved County roads for stabilized AB cross-sections, and standard AB cross-sections, as well as for re-compacted native material. Pavement and base course design shall be in accordance with "Materials Preliminary Engineering and Design Manual" by ADOT, 1992 and as amended, and as applicable. See cross-sections CC010 thru CC016 and specifications.

The pavement as designated on the typical cross-section, shown on the Section D Details, shall be considered a preliminary requirement, not approved for construction, until substantiated by acceptable test results of the actual subgrade soil. Approval by the County Engineer of the final design shall be obtained prior to approval of the construction plans.

Field sampling of the existing subgrade soil shall be required to determine the actual depth of aggregate base required. Soil samples should be taken a minimum of every 1,000 ft per lane and within 0.5 ft from finished subgrade. More frequent testing may be required depending on the existing soil or as directed by the County Engineer to accurately determine the soil profile. Imported soils/materials shall also be tested as directed by the County Engineer.

The testing and analysis of soils and materials shall be by a person who is authorized and certified under Title 32-142 of the Arizona Revised Statutes (ARS). Laboratory reports shall be submitted showing sieve analysis, plasticity index (PI), and percent minus 200 of all subgrade samples taken. Submittal of the findings of all other material and construction testing previously made on or for the required public improvements is also required. Sieve analysis shall be per ASTM D422, PI per ASTM D4318 and #200 wash per ASTM D1140.



**F. Drainage**

The drainage design report for the complete development shall comply with the current adopted version of the Floodplain Regulations for Cochise County, as amended and with the Cochise County Design Standards. A Right-of-Way-permit shall be obtained from the CCH&FD before installing culverts.

Hydraulic calculation for pipe and box culverts should use the methodology of Hydraulic Design Series (HDS) No. 5, Hydraulic Design of Highway Culverts, or other generally accepted programs or publications. Culvert outlets and overflow sections should also be designed in accordance with HEC-14, Hydraulic Design of Energy Dissipater for Culverts & Channels, or other applicable methodology approved by Cochise County. The potential for sedimentation within the culvert or overflow dip sections and/or at the inlet or outlet shall be considered. At a minimum, a self-cleaning velocity of 3 ft per second (fps) should be provided for all culverts and dip crossings.

When flows cross the roadway alignment the drainage structures shall be designed to pass a design storm under the roadway based on the road classification as follows:

Table C-2: Design Storm

Road Class	Qstorm under road (Design Storm)
Arterial & Major Collector	25-year
Minor Collector	10-year
Local	5-year

Drainage crossings and channels shall be designed to convey the above storm events under the roadway with the provision that the 100-year storm be conveyed through an overflow/dip section without adversely impacting adjacent properties as defined by the Floodplain Regulations. Increases of flood heights and flow velocities over existing conditions are not desired but may be allowed if demonstrated that the level of increase does not adversely affect adjacent properties. The road surface shall be stabilized with AC, DBST, or Portland Cement Concrete (PCC) depending on velocity.

For at-grade crossings, a minimum 6-in. x 18-in. cutoff wall shall be provided outside the edges of the roadway pavement to prevent erosion and to maintain a stable roadbed under overflow conditions. Actual depth of wall shall be verified by scour calculations. Cut-off walls shall be placed at least 4 ft from the upstream and downstream edge of pavement lines. The pavement shall be widened to the upstream and downstream cut-off walls. Cut-off walls shall extend to the developed 100-year flow width. Drainage crossings and channels shall be designed to convey Q100 within the Right-of-Way. Diversion of flow from one basin to another is prohibited. For additional guidance reference MAG Detail 552.

At intersecting local roads for design storm flows less than 10 cubic ft per second (cfs), a 6-ft concrete valley gutter may be used per MAG Detail 240. Drainage crossings at intersections shall line up with gutters and/or roadside ditches entering and exiting the intersection.

Drainage channels, other than adjacent roadside ditches, shall be laid out in such a manner so that changes in flow direction do not exceed 45 degrees.



Inverted crowns, or similar road designs, should only be used in extraordinary circumstances.

Channel flow velocities for the design storm shall not exceed that generally accepted as “non-erodible” for the type of soil and/or channel lining in drainage channels and overflow dip sections. Channel bank protection shall be provided for velocities of 4 fps or greater. Bank stabilization shall comply with ADWR State Standard 7-98 “Watercourse Bank Stabilization.”

Banks, slopes of channels, and roadbeds are to be protected or stabilized at all locations where changes in direction of channel flows could result in erosion or scour.

The minimum culvert diameter for roadway crossings shall be 24 in. and 18 in. for driveways. All culverts shall have flared-end sections or headwalls installed. Culverts 48 in. and greater shall have concrete headwalls.

A driveway accessing on minor collector and higher classified roads shall have the finished grade lower than the edge of pavement of the adjacent travel lane. This is to prevent any driveway overflow drainage from impacting the through travel lane. Driveway culvert maintenance is the responsibility of the home or business owner. Failure to maintain a driveway culvert that results in diverting water onto the travel way portion of a County road may result in removal of the culvert at the owner’s expense and revocation of the permit.

The minimum inside height of box culverts shall be 4 ft above the natural streambed elevation. The minimum height of an arch culvert shall be 4.5 ft. In desert wash areas, the preferred minimum height of box culverts is 5 ft and their inverts shall typically be set 6 in. below the existing streambed flow. Handrails shall be installed for headwalls located in areas where pedestrians may be present.

Culvert profile drawings, showing appropriate hydraulic data, shall be included within the construction plans. A note shall be included that defines the design storm frequency, flow, and velocity for all drainage structures.

All drainage structures should extend beyond the clear zone limits for the roadway. If this is not feasible, they shall be suitably protected with traffic barriers.

All culverts shall be placed in the natural flow line of the channel. A detail showing the layout of proposed culvert(s) will be required. The detail will include, but shall not be limited to, invert elevations, top-of-road elevations, headwalls, inflow and outflow channel geometry, erosion protection, other utilities, fill cover etc.

Minimum cover of fill over culverts must be provided to maintain the structural integrity of the pipe under anticipated loading conditions. Culvert manufacturers provide minimum cover and spacing requirements for prefabricated pipe.

## G. Landscaping

Landscaping within the Right-of-Way may be permitted, in compliance with the Roadside Design Guide, provided the landscaping does not impede recommended sight distance or cause visibility problems, does not introduce safety hazards, and does not create the potential to damage the road and drainage system infrastructure. If installed within any part of a roadside drainage channel or on side-slopes, all materials used shall not impede the drainage flow or decrease the cross-sectional area of the channel. See Detail CC205-4.

Plantings which bear fruit, nuts, or seeds that, when dropped, will interfere with or impede storm water drainage flow shall not be permitted.

Irrigation systems may be permitted to be installed within the Right-of-Way provided that installation includes features to keep water from ponding or becoming trapped near or under the roadway. Plans and specific details outlining the proposed landscaping, irrigation system, and/or underdrains that are to be installed shall be approved by the CCH&FD. A Maintenance Agreement shall be entered into with the CCH&FD stipulating the developer's irrigation maintenance schedule and responsibility before work takes place in the public Right-of-Way.

The review and approval of landscaping plans that are part of an overall landscape plan for a development shall be coordinated with the Planning Department.

## H. Raised Median Curb, Gutter, and Sidewalk

Raised medians may be placed at subdivision entrances or can be used to create a divided roadway. All medians greater than 6 ft in width shall have a natural native drought tolerant landscape in accordance with the applicable Cochise County regulations and a maintenance agreement from a homeowners' association (HOA) or other group. Any median less than 6 ft shall be constructed of concrete or as otherwise approved by the County Engineer.

Curb, gutter, and sidewalk may be required to be installed in growth areas A and B and/or adjacent to incorporated cities or towns or as required by the County Engineer. Sidewalks and sidewalk ramps shall conform to the requirements of the Americans with Disabilities Act (ADA) of 2010, and current updates. Pedestrian curb ramps shall be designed per MAG Detail 235-1 thru 235-5.

Development occurring adjacent to public lands or recreational areas may be required to provide shared use paths, recreational trails, or recreational trailheads with or without parking. See Details CC232, CC233-1 and CC233-2.

## I. Guardrail

Guardrail shall be provided where necessary for the safety of the traveling public, as well as protection for adjacent properties. The need for guardrail should be determined at the early stages of design to ensure that road sections are designed with enough width to facilitate the guardrail installation and that drainage pipes have sufficient cover for the installation of posts and are extended to accommodate the necessary adjustments in the embankments and slopes.



The face of the guardrail shall be a minimum 3.5 ft in front of the obstacle. In fill sections, the back of the guardrail post shall be 2 ft in front of the hinge point of the slope to ensure adequate lateral soil resistance for the posts during impact.

If a curb is used with a guardrail, the face of the curb should be no closer to the traveled way than the face of the guardrail.

The following minimum guidelines for guardrail installation are based on AASHTO Roadside Design Guide. However, it should be noted that guardrail may be required in some locations that do not necessarily meet these criteria based on the judgment of the County Engineer. Such factors as traffic volumes, speed of traffic, accident history, road curvature, slopes of recovery area, presence of curb and gutter, and location of trees, utility poles, etc. must all be considered when determining if guardrail is warranted in a specific location.

Guardrail is typically required on sections of roadway when any of the following conditions exist within the clear zone, as defined in 6B:

- A roadside parallel embankment (fill slope) of 3:1 or steeper and a depth of 4 ft or more
- A water hazard with a depth of 2 ft or more
- A ditch section with a depth of 3 ft or more
- A fixed object (such as a culvert, pipe, headwall, retaining wall, bridge pier, or abutment)
- Other hazards as determined by the County Engineer

The County Engineer shall make the final determination as to whether guardrail is warranted along a section of roadway based on a review of the plans, a field inspection after rough grading has been completed, and/or prior to final acceptance.

See the AASHTO Roadside Design Guide for direction on all types of approved barriers, required lengths, and end treatments. New roadside barriers shall meet the crash test requirements established by National Cooperative Highway Research Program (NCHRP) Report 350 and approved for use by FHWA and ADOT.

## J. Pavement Markings and Signs

All required pavement markings, traffic control devices, and road name signs for new and/or existing roads shall be shown on the improvement plans and installed or paid for by the developer.

Refer to Signing and Marking Specifications in Section E and the following documents (current versions):

- Arizona Department of Transportation (ADOT) Traffic Control Design Guidelines
- Arizona MOAS as distributed by ADOT
- Arizona Supplement to MUTCD for Streets and Highways 2009 Edition, ADOT
- MUTCD for Streets and Highways, as distributed by the USDOT, FHWA; and as amended and approved by ADOT

Signs indicating that a stub roadway will be extended in the future shall be installed at the end of stub roads as a part of the subdivision development. The sign shall have a message that



indicates the following: "This Road is to be extended with Future Development. For More Information Contact the Cochise County Planning Department." This sign is to be provided by the developer and fabricated using a 0.080-in. gauge aluminum sign blank and fully reflective (minimum engineering grade material) sheeting and designed per MUTCD.

## 7. PUBLIC INFRASTRUCTURE IMPROVEMENT PLANS

The developer shall be responsible for having a registered engineer, being licensed in the State of Arizona, and preparing a complete set of improvement plans to include typical sections, roadway plan and profiles, signing and striping plans, drainage details, roadway cross sections, Engineer's Estimate of Construction Cost, and special provisions for all public infrastructure improvements.

No construction shall commence until improvement plans are reviewed and approved by CCH&FD and a Right-of-Way permit, with an approved Traffic Control Plan, is obtained. Such review and approval is intended to ensure general compliance with the Cochise County Design Standards. This review is not intended to ensure completeness and/or accuracy of all plan details or assume any design responsibility from the Design Engineer. At the time of submittal of plans, plan check fees shall be paid based on current adopted fee schedules.

The following provides required plan formatting so that significant design elements are clearly shown in a consistent manner and plan reviews are facilitated. See Detail CC220 for illustrative example.

Plans shall be drawn on a 24-in. x 36-in. sheet at no smaller than a horizontal scale of 1 in. = 40 ft and a vertical scale of 1 in. = 4 ft. A larger horizontal scale may be required (such as 1 in. = 10 ft or 5 ft) where necessary to clearly show details. An index sheet to a set of detailed plans in excess of five sheets should be presented. Symbols to be used should conform to ADOT Drafting Guidelines or other widely accepted and clearly defined set of standards symbols.

The sheet(s) shall be oriented in such a way that north is to the top or to the right with roadway stationing increasing from left to right. Stationing shall be south to north and west to east for roadway improvements, and in the "looking down station" orientation for drainage improvements. The initial stationing shall be large enough to preclude the possibility of negative station should the project limits be expanded. Provide match lines (call-outs) for plans and details that, due to size or scale, must be broken between sheets or different locations on a single sheet. Provide details, text, and other drawing components at a sufficient size and clarity to be legible when reduced to half size. Minimum lettering height shall be 0.10 in. Stick-on materials, other than standard blue-Stake stickers, shall not be allowed on plan originals.

All existing culture (site features, typography, utilities) shall be shown with a minimum of 1-ft contour lines. For projects without drainage concerns, the use of 2-ft contour lines may be approved by the County Engineer, if sufficient detail for the project is still achieved. Horizontal limits shall extend a minimum of 25 ft beyond the Right-of-Way, left and right, with elevations given at average natural ground. All ditch flow lines, tops of banks, tops of linings, culverts, inverts, tops of headwalls, building slab elevations, and similar features shall be obtained and clearly noted. Existing culverts, washes, and ditches shall be profiled along their existing



alignments with skew angles and angle points identified. The width of ditches, berms, and similar structures shall be identified.

Major drainage features shall require additional cross sections, both upstream and downstream, a minimum 300 ft beyond the project limits. Existing edge of pavements, major driveways, traffic signals, traffic striping, and traffic signs shall be surveyed a minimum of 300 ft beyond the end of the project. Existing grades shall be shown on 50 ft intervals and new grades on 100 ft intervals.

At a minimum, curve, vertical and horizontal geometric data and drainage features shall be shown on design plans. Vertical control shall, as a minimum, consist of a single-line profile and add super-elevation profile for each direction of travel. Drainage features shall list design flow and velocity. Label street names, lateral dimensions of streets, and Rights-of-Way, curb return data, drainage structures, etc. Indicate finished elevations, including Point of Vertical Curve (PVC), Point of Intersection, and Point of Vertical Tangency (PVT) of vertical curves; intersection points; and all other points needed for good vertical control for construction. Include any additional information needed to clarify profiles or deal with special conditions.

A typical section is needed for each condition encountered and should be clearly identified as to where it is applicable. Typical sections shall show both existing grade and proposed grades for the structural section and the proposed road template. Typical sections shall show materials, thickness, compaction, and application for selected materials; prime coat; AC; DBST; AB; curb and gutter; sidewalk; and drainage structures, as applicable.

Plan and profile sheets shall show the locations of street pavements including all features and structures for proper drainage. Provide adequate detail of all structures. Original ground and design grade shall be plainly labeled. Other plans shall show the location, size, type, construction, and material of the improvements. Plans should also contain a blue stake alert and reference any utility/improvement plans. If applicable, water and sewer plans shall be submitted for reference. Water and sewer plans shall be submitted to and approved by the Arizona Department of Environmental Quality (ADEQ) and copies of the applications/approvals sent to CCH&FD.

Location, size, elevation, and other appropriate description of any existing facilities or utilities shall be shown on the drawings. Where crossing of underground utilities occur, vertical separations need to be shown. If any utility company imposes special conditions or precautions concerning their utility, notation of those instructions shall be included on the plans. Accurate elevation and alignment of all utilities shall be shown on the plans. Potholing shall be utilized in determining utility elevations and alignment if necessary.

Construction note(s) and details shall be provided to ensure clarity and prevent confusion or misunderstanding during construction. Notes shall be clearly worded and symbols consistent throughout the plan sheets(s). Intersection staking diagrams, culverts, and other items appearing on more than one sheet shall be cross-referenced. Standard Drawings and Details shall be referred to by number and included as part of the plan set.



Section corners, quarter corners, sixteenth corners, and other monuments that define existing alignments and Rights-of-Way and/or lie within the project limits shall be incorporated into the horizontal control network. Construction control lines shall be located by distance and angle measurements from section monumentation. All section monuments necessary to describe the adjacent Right-of-Way shall be located and shown on project plans. Any monuments disturbed during the construction phase must be relocated per A.R.S. §33-103 standards and a Corner Record filed with the Cochise County Recorder's Office as stipulated by A.R.S. §33-106. Such monuments shall conform to Detail CC121-1 or CC121-2.

North American Vertical Datum of 1988 (NVAD 88 –National Geodetic Survey) shall be used unless otherwise authorized by Cochise County. The horizontal and vertical datum shall be tied to one Cochise County geodetic monument.

Survey monument installation shall be indicated on the plans at street intersections, Points of Curvature (PC)s, Points of Intersection (PI)s, Points of Tangency (PT)s, etc.

The design engineer shall prepare Special Provisions for construction items not contained in or adequately covered by the MAG Uniform Standard Specifications and Cochise County Supplement to the MAG Specifications. Special provisions shall ensure each construction item is clearly defined and all material and construction requirements are identified. Special Provisions shall be written and arranged in the same format as the MAG Specifications. The design engineer shall prepare and submit sealed Special Provisions to be included with the construction documents submitted for review.

The design engineer shall provide Cochise County with a sealed and signed Engineer's Estimate of Construction Cost. The estimate shall contain a comprehensive itemized listing of individual components with quantities, estimated unit costs, and extended total cost identified for each item.

For roadway projects, cross sections shall be provided showing the roadway section, existing ground, underground utilities, and new and existing drainage structures. Cross sections shall be at 50-ft intervals, and at critical changes in the typical section (such as the beginning and end of roadway tapers, walls, medians or additional lanes). Earthwork requirements shall be provided and calculated based on end-area method from these cross sections and the quantities included at the front of the plan set or coversheet.

Title, name of firm, address, stamp, registration seal, signatures of the engineer, and date, including revisions dates, shall be shown on the drawings. A vicinity map, project title, developer, and engineering firm names and addresses shall be shown on the cover sheet.

Once the improvement plans are approved, the original reproducible plans shall be submitted to CCH&FD to date and stamp: Reviewed for Compliance with Cochise County Standards. The developer shall then submit 5 complete full size sets and one half-size set of the construction plans to CCH&FD, along with an electronic version PDF of the final stamped plans.



## 8. CONSTRUCTION AND INSPECTION

All construction within the existing or proposed County Right-of-Way shall be completed under the general inspection and approval of the CCH&FD. No construction shall be commenced until a Right-of-Way permit has been issued by the CCH&FD. Unless otherwise specified on the approved construction plans or Right-of-Way permit, all materials, testing, construction methods, installations, specifications, and standards shall conform to these Design Standards.

Existing roads that are, or will be, incorporated into a subdivision circulation system and serve existing development shall be maintained to the current level of service during construction of the new subdivision roads or as approved by the County Engineer per an approved Traffic Control Plan. Existing street and traffic signs shall be maintained during construction and relocated by the developer/contractor as directed by the County Inspector.

Primary responsibility for control of the construction and quality of the improvements in subdivisions remains with the developer. Quality control of public improvements, for subdivisions and other developments, shall be made by the developer's design engineer, as agent for the developer. The design engineer is responsible for monitoring construction activities, documenting all field changes, and summarizing all testing results and inspections. It should not be expected that inspection by the CCH&FD will in any way eliminate need for regular inspection during the entire construction period by the Design Engineer.

The Design Engineer is responsible for the correctness and completeness of the plans and associated documents. The property owner and/or developer is responsible for the construction and implementation of the project. The County will not bear any responsibility for the cost of corrections to the plans or extra work resulting from changes which may be required during construction due to errors and/or omissions on the plans. Any difficulties encountered during construction will be resolved by the Developer and Design Engineer, at their sole expense.

Adequate construction inspections assure compliance to Cochise County Design Standards and are the basis for the County Engineer's acceptance of public improvements for County maintenance. Plans and specifications describe in detail the work that is to be constructed including the materials to be used, the workmanship required, and certain construction procedures to be followed. Inspections by CCH&FD are to verify general conformance with the approved construction plans and specifications. The County Inspector, under the direction of the County Engineer, is authorized to inspect all work performed in connection with public improvements. Although inspectors are not required to inspect an item until it is complete they will periodically observe work in progress and assist the contractor in avoiding rework and stoppages.

Geometric control, survey, construction layout, construction procedures, and installation of all improvements in conformance with the approved construction plans and specifications is the responsibility of the Developer and Design Engineer. It is the responsibility of the developer's Design Engineer to conduct the necessary inspections required to certify to the County that construction has proceeded according to his/her design and the approved plans.



All improvements shall be constructed in accordance with the approved construction plans and specifications. Any field revisions shall be issued by the Design Engineer, in writing, and approved, in writing, by the County Engineer. The revision shall be sent to the field by the Design Engineer as a plan revision. No work of any kind shall be allowed without approved construction plans and specifications.

The developer shall be responsible for having a person who is authorized and certified under ARS §32-142 to perform and conduct all materials testing used in the design and construction of the improvements. The results of all tests shall be provided to the Design Engineer and County Inspector prior to applicable items being inspected. The developer is responsible for the cost of all sampling and testing necessary to substantiate the design or acceptability of construction quality of the improvements. The County Inspector shall be on site during testing and has the authority to select locations for tests to be made and to require additional tests of suspect areas or at apparent visible changes in soil types.

The pavement design determination process assumes that the properly compacted subgrade soil will produce a stable platform for pavement construction. If an unsuitable subgrade (wet, soft, unstable, or unsuitable material) is encountered, it must be removed down to a firm foundation and replaced with adequately compacted material of suitable quality. Prior to the placement of the sub-base/base layer, the subgrade must be inspected by the CCH&FD for grade, compaction, and wheel load tested. A wheel load test is to be performed with a full water truck. Additional inspections and wheel load tests shall be required on each subsequent base or pavement course. The base course shall be inspected for smoothness and wheel load tested before placement of pavement or DBST. Subgrade and base course shall be density tested a minimum of every 500 ft, per lane. The County Inspector shall be on site to observe pavement construction procedures in compliance with Section E.

All storm drainage facilities installed must be inspected and approved. No backfilling is permitted on any pipe installation until it has been inspected. A flow test shall be done prior to final backfill. All storm pipes shall be flushed and thoroughly cleaned prior to the final inspection.

The minimum inspections by the County Inspector will be performed, but not limited to, the following stages:

- Subgrade Completion – all utilities, culverts, ditches, shaping to finished subgrade, etc. complete in place
- AB complete in place
- Pavement course, AC, DBST or PCC, complete in place
- Final

Pavement course shall not be placed before base course has been approved and base course shall not be placed until subgrade has been approved by the County Inspector. No paving construction shall be started until all utility lines under the proposed paved area are completed.



It shall be the responsibility of the contractor and/or developer to notify the County Inspector a minimum of two working days in advance of required inspection. Cochise County will conduct the formal inspection on a total-stage completion basis and not on a partial-stage completion basis.

The Design Engineer shall document, verify, and report all pertinent information relative to quality control for all improvements being installed. All laboratory reports deemed necessary for quality control and testing, along with compaction test results, shall be submitted to the County Inspector by the inspecting firm as backup data to the Design Engineer's report. The responsibility for the construction of all projects shall lie with the developer. The cost for all required quality control shall be the sole responsibility of the developer. Any questions as to construction standards, interpretation of results, or methods of construction, shall be brought to the County Engineer's attention and interpretation.

The developer shall certify that all bills for labor and materials incorporated in the work have been paid and agree to indemnify and hold harmless the County against any and all liens, claims of liens, suits, actions, damages, charges, and expenses whatsoever, which the County may suffer arising out of the failure of the developer to pay for all labor performed and materials furnished in the construction of the required improvements.

The developer shall submit itemized construction costs of all dedicated public improvements.

The final inspection shall be scheduled at least five working days in advance. It is the responsibility of the developer to have all necessary persons in attendance at the final inspection, including the Design Engineer and Contractor. When the final inspection is complete, a written punch list will be sent to the developer, Design Engineer, and the Contractor. Once all punch list items are complete, CCH&FD will prepare the required documentation to accept the public improvements.

## 9. POST CONSTRUCTION DOCUMENTATION

After completion of the construction of any public roadway or related improvements it is the responsibility of the developer and/or contractor with the Design Engineer to prepare and provide all post-construction documents for the County records and reference. These include, but may not be limited to, Record Drawings, Survey Monument certifications and any work completed under warranty.

### A. Record Drawings (As-Builts)

The developer shall have the Design Engineer submit final, stamped as-built plans, in one full-sized hard copy, one half-sized hard copy and one electronic PDF version, showing all streets, drainage structures, and other improvements as constructed/changed and copies of final as-built utility plans showing all utilities constructed within the public Right-of-Way. Upon request of the County Engineer, one electronic copy of the Record Drawings will be provided in an editable AutoCAD file.

The Design Engineer shall submit a final report summarizing all field changes, test results, and inspections and a statement that the public improvements have been constructed in



conformance with his/her design and the approved lines, grades, specifications, and standards.

All documentation shall be submitted before a request for release of lots will be considered.

#### **B. Survey Documentation**

After all improvements have been installed, the developer shall be responsible for having a registered land surveyor set and stamp the monuments and certify as to their accuracy prior to final inspection. See Section D, Details CC121-1 and CC121-2.

#### **C. Warranty Period**

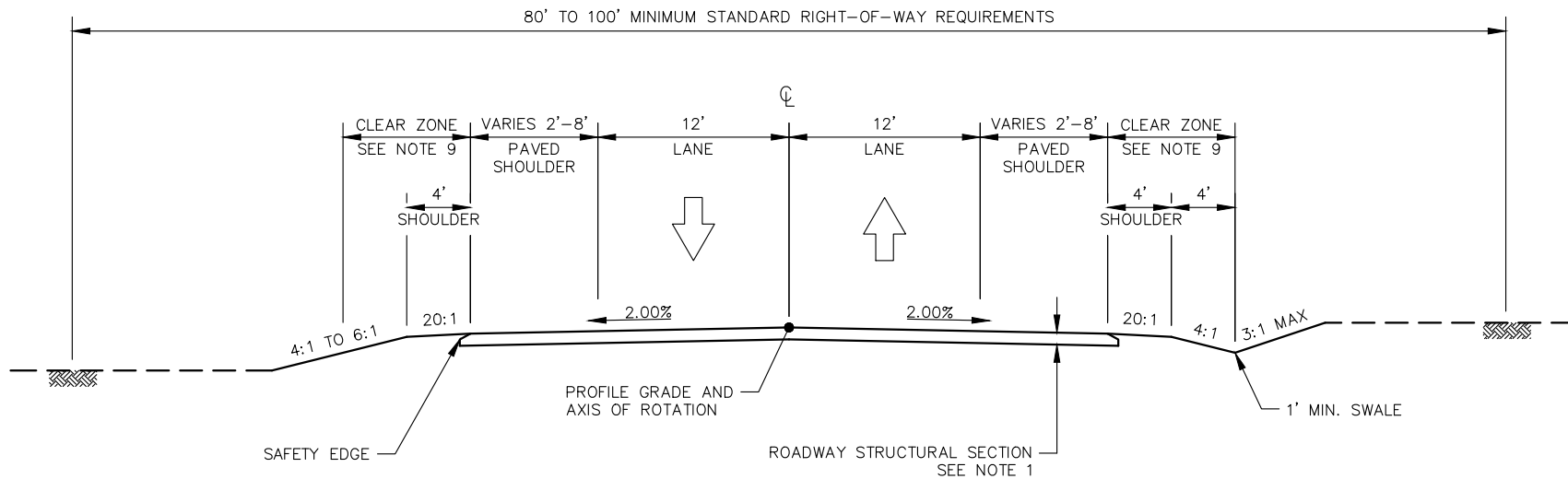
The two-year warranty period shall commence once the documentation to accept the constructed public improvements is signed by the County Engineer. The developer is responsible to maintain all Arizona Pollutant Discharge Elimination System (AZPDES) requirements during the two-year warranty period.

DRAFT

**STANDARD  
TYPICAL SECTIONS  
for  
CONSTRUCTION  
within**

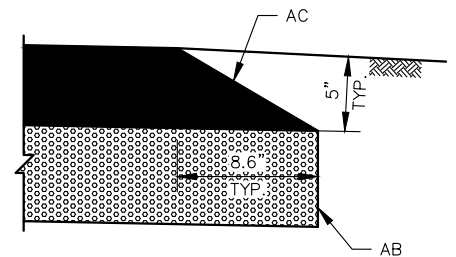


Draft FINAL August 2017  
**HIGHWAY AND FLOODPLAIN  
DEPARTMENT  
STANDARD**

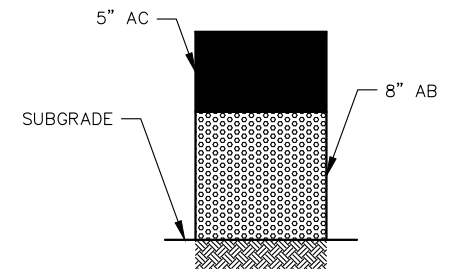


**NOTES:**

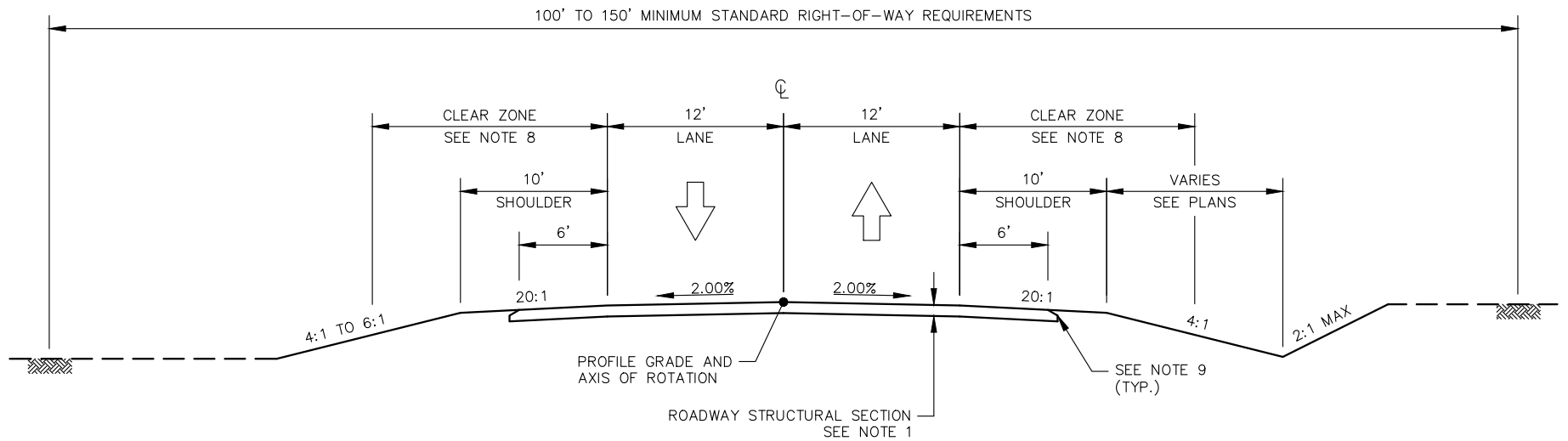
1. 5" MINIMUM ASPHALTIC CONCRETE (AC) OVER 8" MINIMUM AGGREGATE BASE (AB) OVER 6" COMPACTED NATIVE MATERIAL. ACTUAL ROADWAY STRUCTURAL SECTION TO BE DETERMINED BY GEOTECHNICAL EVALUATION, CONSISTENT WITH DETAIL CC208-1 OR SN  $\geq$  1.92.
2. SAFETY EDGE SLOPED AT  $30^\circ \pm 5^\circ$ ; PLACED AT FULL DEPTH AC PAVEMENT LIFTS. SEE DETAIL THIS SHEET AND MAG SECT. 326. REQUIRED UNLESS OTHERWISE DIRECTED BY THE COUNTY ENGINEER.
3. AGGREGATE BASE SHALL BE COMPACTED TO 100% OF MAXIMUM DRY DENSITY.
4. SUBGRADE PREPARATION SHALL BE A MINIMUM 6" DEPTH OF SCARIFICATION AND RE-COMPACTION OF NATIVE MATERIAL TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY.
5. ROADWAY EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY.
6. DRAINAGE DITCH AS REQUIRED.
7. MINIMUM R/W REQUIREMENTS 80' TO 100'; TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
8. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROAD IS TYPICALLY OVER 250 VEHICLES PER DAY; INTENSIVE INDUSTRIAL LAND USES WITH HIGHER VOLUMES OF TRUCK TRAFFIC.
9. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
10. LANE WIDTH AND MINIMUM DRIVEWAY RADII TO BE DETERMINED BY TRAFFIC ENGINEER IN STAMPED TRAFFIC REPORT AND APPROVED BY COUNTY ENGINEER.



**SAFETY EDGE DETAIL**

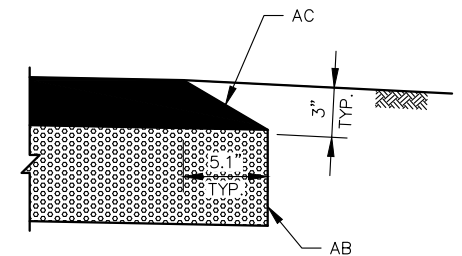


**ROADWAY STRUCTURAL SECTION**  
TOTAL THICKNESS = 13"

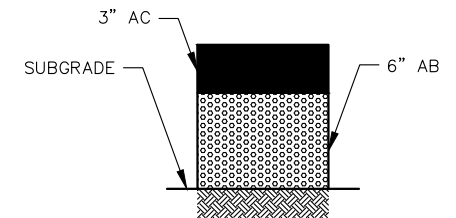


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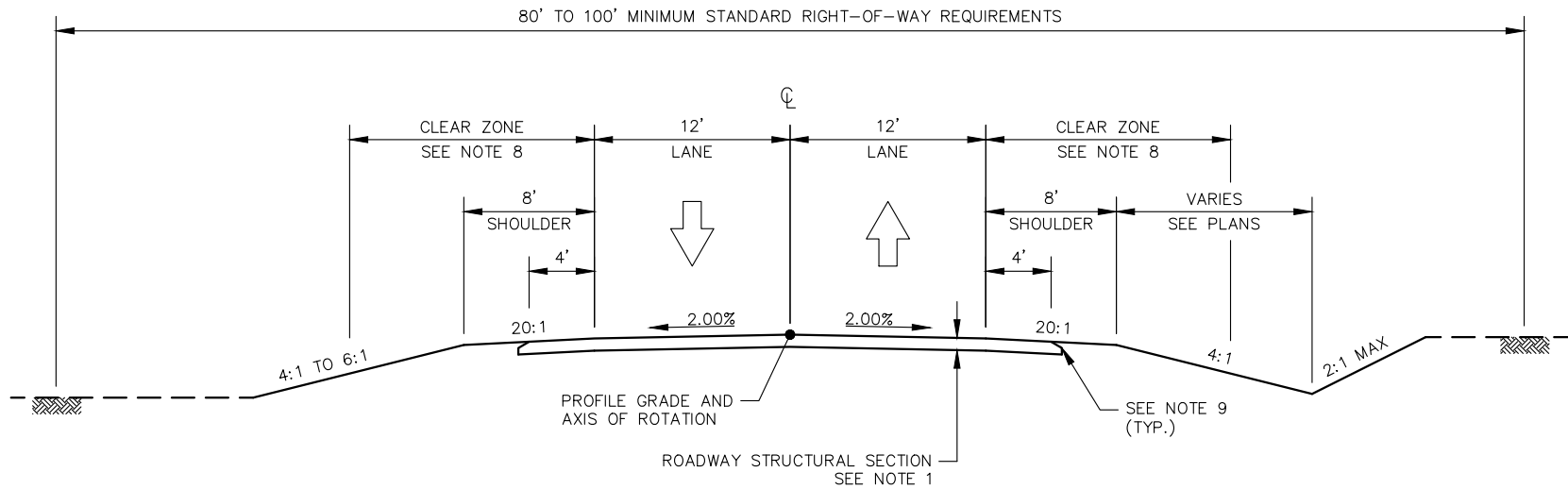
1. 3" MINIMUM ASPHALTIC CONCRETE (AC) OVER 6" MINIMUM AGGREGATE BASE (AB) OVER 6" COMPACTED NATIVE MATERIAL (SUBGRADE). ACTUAL ROADWAY STRUCTURAL SECTION TO BE DETERMINED BY GEOTECHNICAL EVALUATION, CONSISTENT WITH DETAIL CC208-1 OR SN  $\geq$  2.36.
2. AGGREGATE BASE SHALL BE COMPACTED TO 100% OF MAXIMUM DRY DENSITY.
3. SUBGRADE PREPARATION SHALL BE A MINIMUM 6" DEPTH OF SCARIFICATION AND RE-COMPACTED OF NATIVE MATERIAL TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY.
4. ROADWAY EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY.
5. DRAINAGE DITCH AS REQUIRED.
6. MINIMUM R/W REQUIREMENTS 100' TO 150'; TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
7. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROADWAY IS OVER 2,600 VEHICLES PER DAY OR HAS BEEN DESIGNATED AS A MAJOR COLLECTOR IN THE FEDERAL FUNCTIONAL CLASSIFICATION SYSTEM.
8. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
9. SAFETY EDGE SLOPED AT  $30^\circ \pm 5^\circ$ , PLACED AT FULL DEPTH AC PAVEMENT LIFTS OR TOP 5", WHICHEVER IS LESS. SEE DETAIL THIS SHEET AND MAG SECT. 326. REQUIRED UNLESS OTHERWISE DIRECTED BY THE COUNTY ENGINEER.
10. IDENTIFYING BICYCLE LANES WITH APPROPRIATE STRIPING AND SIGNING SHOULD BE CONSIDERED, WHERE FEASIBLE.



**SAFETY EDGE DETAIL**

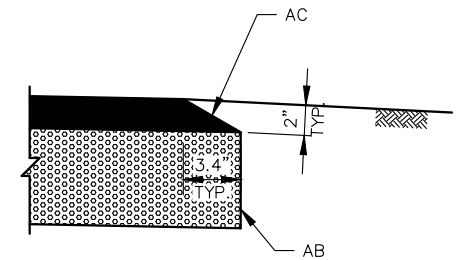


**ROADWAY STRUCTURAL SECTION**  
TOTAL THICKNESS = 9"

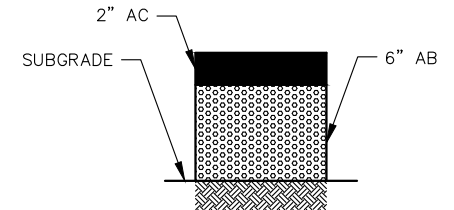


**NOTES:**

1. 2" MINIMUM ASPHALTIC CONCRETE (AC) OVER 6" MINIMUM AGGREGATE BASE (AB) OVER 6" COMPACTED NATIVE MATERIAL (SUBGRADE). ACTUAL ROADWAY STRUCTURAL SECTION TO BE DETERMINED BY GEOTECHNICAL EVALUATION, CONSISTENT WITH DETAIL CC208-1 OR SN  $\geq$  1.92.
2. AGGREGATE BASE SHALL BE COMPACTED TO 100% OF MAXIMUM DRY DENSITY.
3. SUBGRADE PREPARATION SHALL BE A MINIMUM 6" DEPTH OF SCARIFICATION AND RE-COMPACTION OF NATIVE MATERIAL TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY.
4. ROADWAY EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY.
5. DRAINAGE DITCH AS REQUIRED.
6. MINIMUM R/W REQUIREMENTS 80' TO 100', TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
7. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROADWAY IS BETWEEN 1,110 AND 6,300 VEHICLES PER DAY OR HAS BEEN DESIGNATED AS A MINOR COLLECTOR IN THE FEDERAL FUNCTIONAL CLASSIFICATION SYSTEM.
8. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
9. SAFETY EDGE SLOPED AT  $30^\circ \pm 5^\circ$ , PLACED AT FULL DEPTH AC PAVEMENT LIFTS OR TOP 5", WHICHEVER IS LESS. SEE DETAIL THIS SHEET AND MAG SECT. 326. REQUIRED UNLESS OTHERWISE DIRECTED BY THE COUNTY ENGINEER.

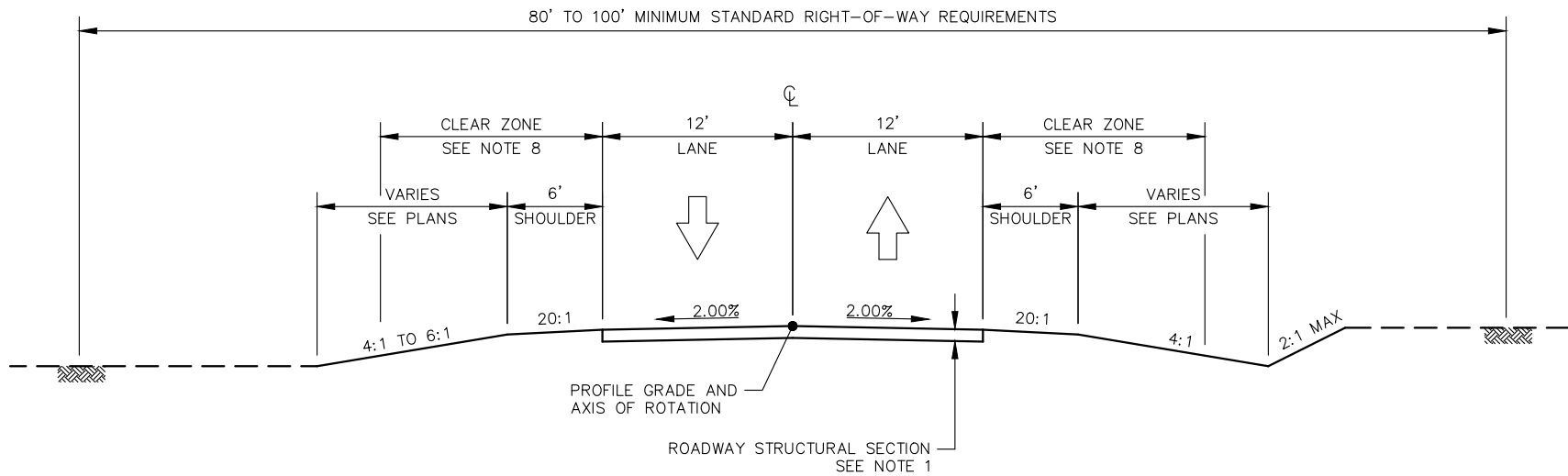


**SAFETY EDGE DETAIL**



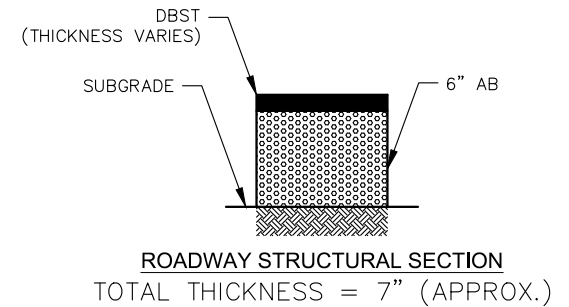
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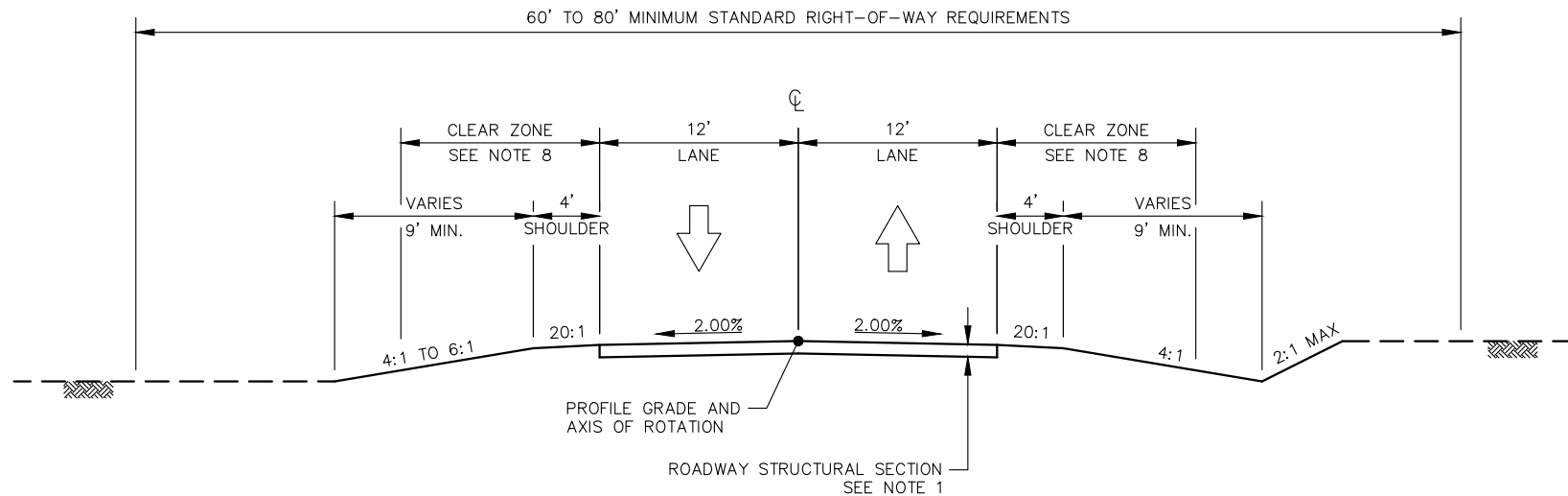




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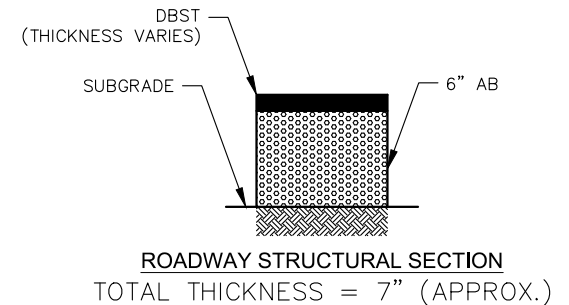
1. DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) OVER 6" MINIMUM AGGREGATE BASE (AB) OVER 6" COMPACTED NATIVE MATERIAL (SUBGRADE). ACTUAL ROADWAY STRUCTURAL SECTION TO BE DETERMINED BY GEOTECHNICAL EVALUATION, CONSISTENT WITH DETAIL CC208-2.
2. AGGREGATE BASE SHALL BE COMPACTED TO 100% OF MAXIMUM DRY DENSITY.
3. SUBGRADE PREPARATION SHALL BE A MINIMUM 6" DEPTH OF SCARIFICATION AND RE-COMPACTION OF NATIVE MATERIAL TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY REQUIRED.
4. ROADWAY EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY.
5. DRAINAGE DITCH AS REQUIRED.
6. MINIMUM R/W REQUIREMENTS 80' TO 100', TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
7. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROADWAY IS BETWEEN 1,110 AND 2,600 VEHICLES PER DAY.
8. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).

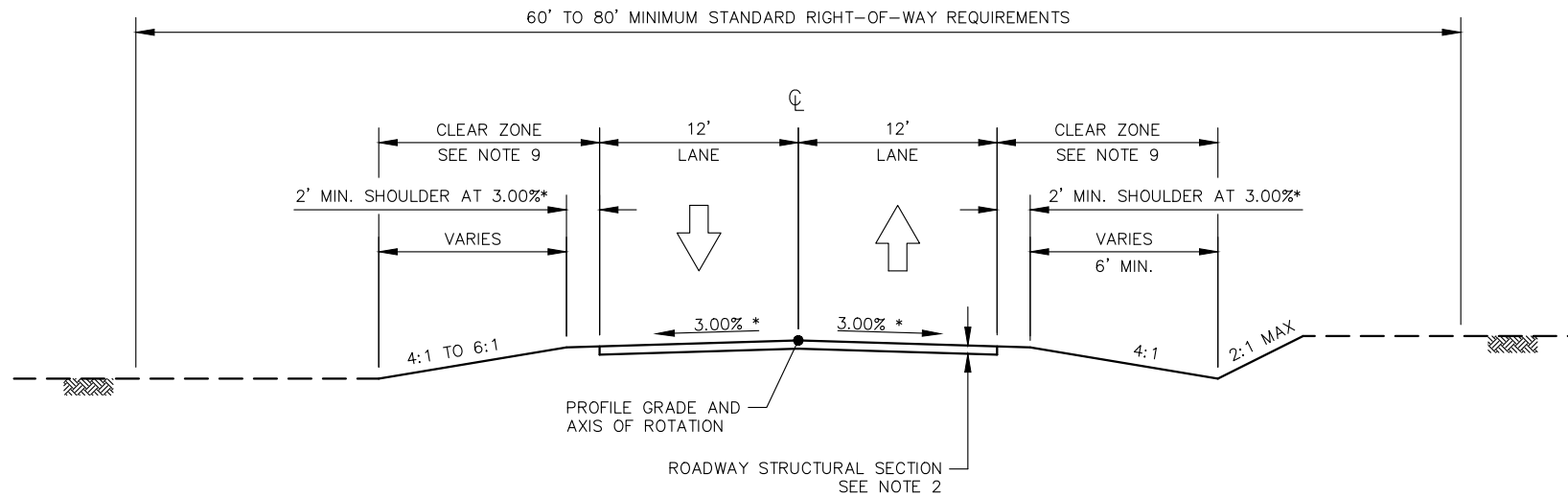




**NOTES:**

1. DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) OVER 6" MINIMUM AGGREGATE BASE (AB) OVER 6" COMPACTED NATIVE MATERIAL (SUBGRADE). ACTUAL ROADWAY STRUCTURAL SECTION TO BE DETERMINED BY GEOTECHNICAL EVALUATION, CONSISTENT WITH DETAIL CC208-2.
2. AGGREGATE BASE SHALL BE COMPACTED TO 100% OF MAXIMUM DRY DENSITY.
3. SUBGRADE PREPARATION SHALL BE A MINIMUM 6" DEPTH OF SCARIFICATION AND RE-COMPACTION OF NATIVE MATERIAL TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY REQUIRED.
4. ROADWAY EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY.
5. DRAINAGE DITCH AS REQUIRED.
6. MINIMUM R/W REQUIREMENTS 60' TO 80', TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
7. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROADWAY IS BETWEEN 400 AND 1,110 VEHICLES PER DAY.
8. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).

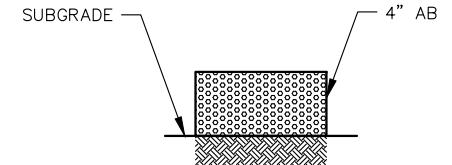




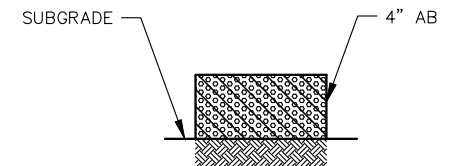
\* CROSS SLOPE: 3.00% MINIMUM, 4.00% MAXIMUM

**NOTES:**

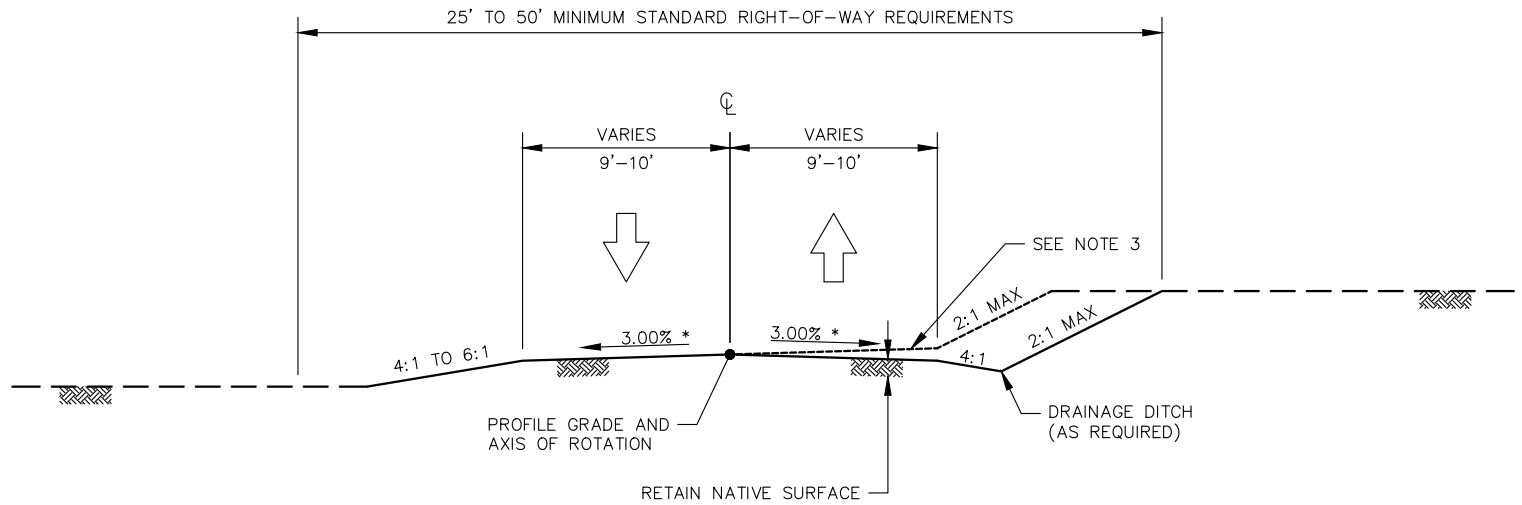
1. INTENDED FOR BUILDING AN IMPROVED ROAD SURFACE FOR LOW VOLUME ROADS SERVING ECOTOURISM SITES, ECONOMIC GENERATORS OR AS A PRECURSOR TO FUTURE PAVING (NOT FOR SUBDIVISION ROADS OR NEW ROADS INTENDED TO BE PUBLIC).
2. 4" STABILIZED AGGREGATE BASE (AB) OR 4" AB OVER 6" COMPACTED NATIVE MATERIAL (SUBGRADE). ACTUAL ROADWAY STRUCTURAL SECTION TO BE DETERMINED BY GEOTECHNICAL EVALUATION, CONSISTENT WITH DETAILS CC208-1 AND CC208-2. SEE ROADWAY STRUCTURAL SECTIONS.
3. AGGREGATE BASE SHALL BE COMPACTED TO 100% OF MAXIMUM DRY DENSITY.
4. SUBGRADE PREPARATION SHALL BE A MINIMUM 6" DEPTH OF SCARIFICATION AND RE-COMPCTION OF NATIVE MATERIAL TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY REQUIRED.
5. ROADWAY EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY.
6. DRAINAGE DITCH AS REQUIRED.
7. MINIMUM R/W REQUIREMENTS 60' TO 80', TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
8. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROADWAY IS BETWEEN 250 AND 400 VEHICLES PER DAY.
9. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
10. SOIL CEMENT, BINDERS, POLYMERS, EMULSIFIERS OR OTHER SOIL ADDITIVES TO PROVIDE ENHANCED STABILIZATION AND DUST CONTROL OF ROADWAY SURFACE APPLIED WHEN FEASIBLE.



**ROADWAY STRUCTURAL SECTION**  
TOTAL THICKNESS = 4"



**STABILIZED ROADWAY STRUCTURAL SECTION**  
TOTAL THICKNESS = 4"

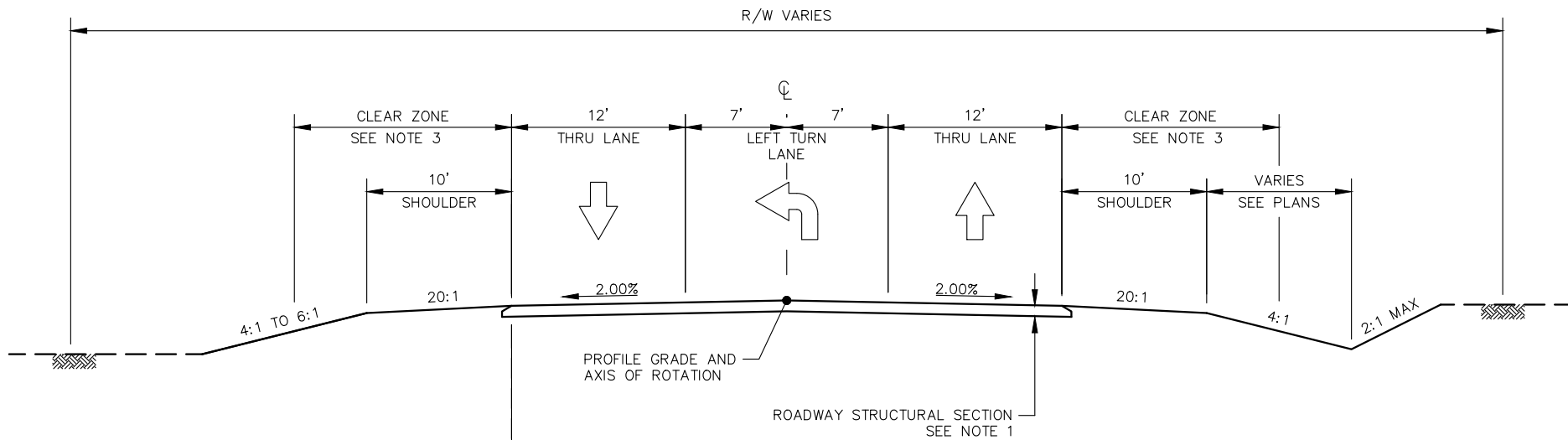


\* CROSS SLOPE: 3.00% MINIMUM, 4.00% MAXIMUM

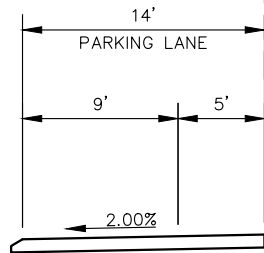
**NOTES:**

1. INTENDED FOR VERY LOW VOLUME ROADS WITH UNIQUE ENVIRONMENTAL, ECOLOGICAL, OR CULTURALLY SENSITIVE AREA CONSTRAINTS (NOT FOR SUBDIVISION ROAD OR NEW ROADS INTENDED TO BE PUBLIC).
2. TO USE THIS STANDARD, THE ROADWAY MUST BE DESIGNATED AS A CONTEXT SENSITIVE ROADWAY BY THE COUNTY ENGINEER.
3. LANE WIDTH DETERMINED BY TOPOGRAPHY AND SITE CONDITIONS. LANE WIDTH MAY FOLLOW LAND CONTOURS AND VARY THROUGHOUT ITS LENGTH.
4. DRAINAGE DITCH AND/OR SWALES PLACED WHERE FEASIBLE.
5. MINIMUM R/W REQUIREMENTS 25' TO 50'; TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
6. TYPICAL DESIGN ADT FOR THIS CLASSIFICATION OF ROADWAY IS LESS THAN 250 VEHICLES PER DAY.
7. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).





**LEFT TURN LANE SECTION**

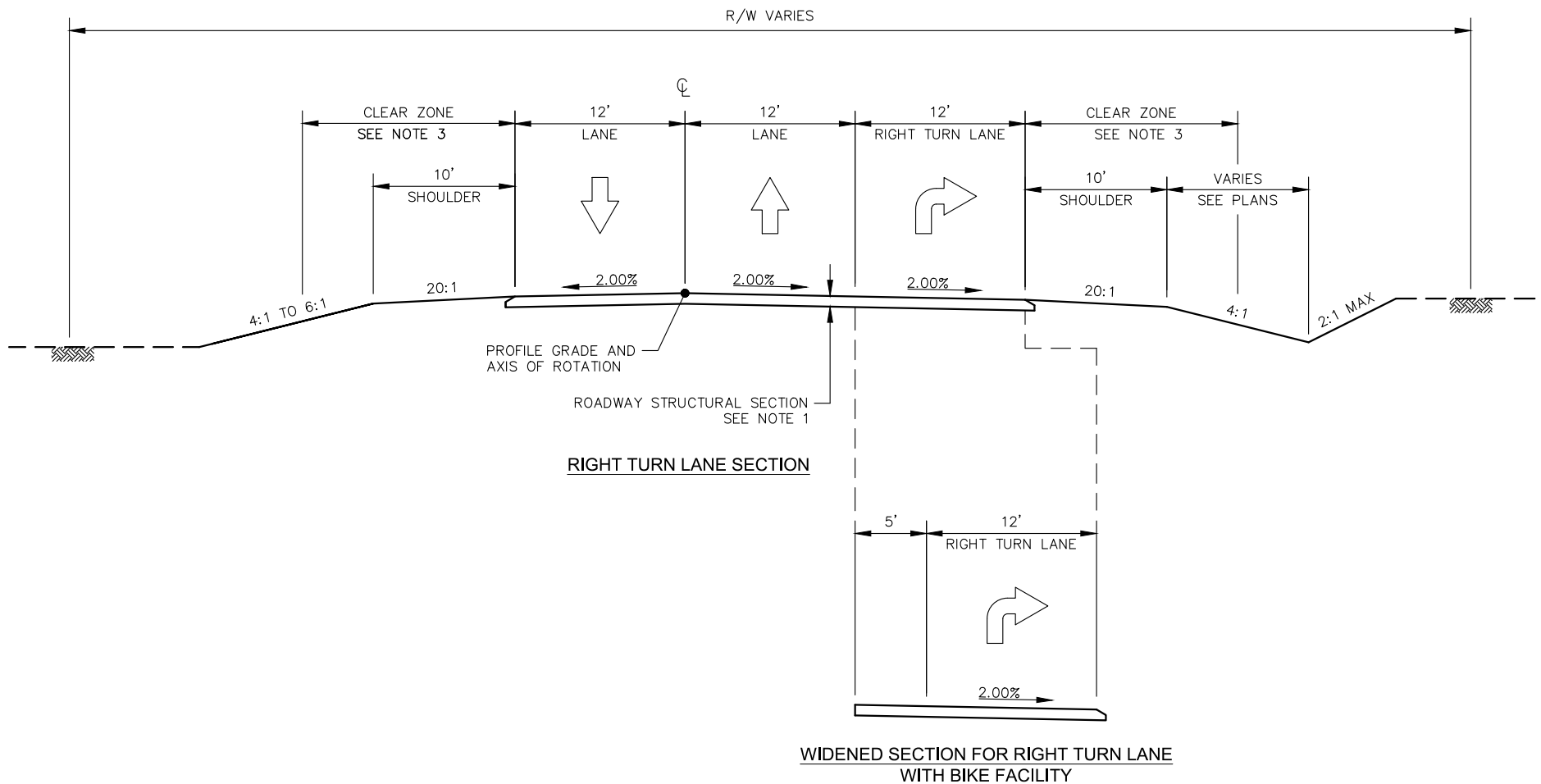


**WIDENED SECTION FOR PARKING**

**NOTES:**

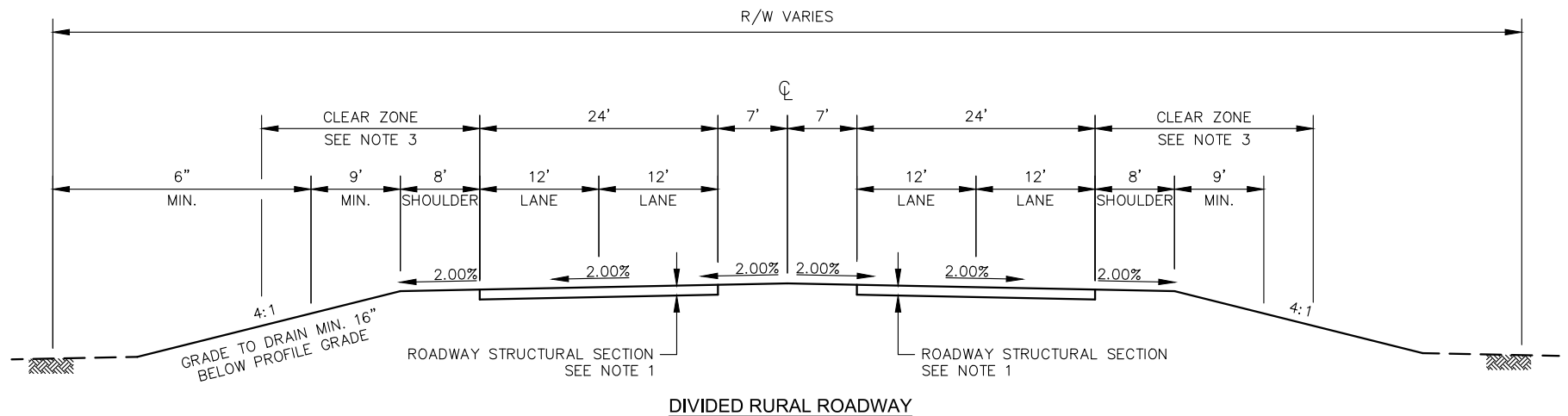
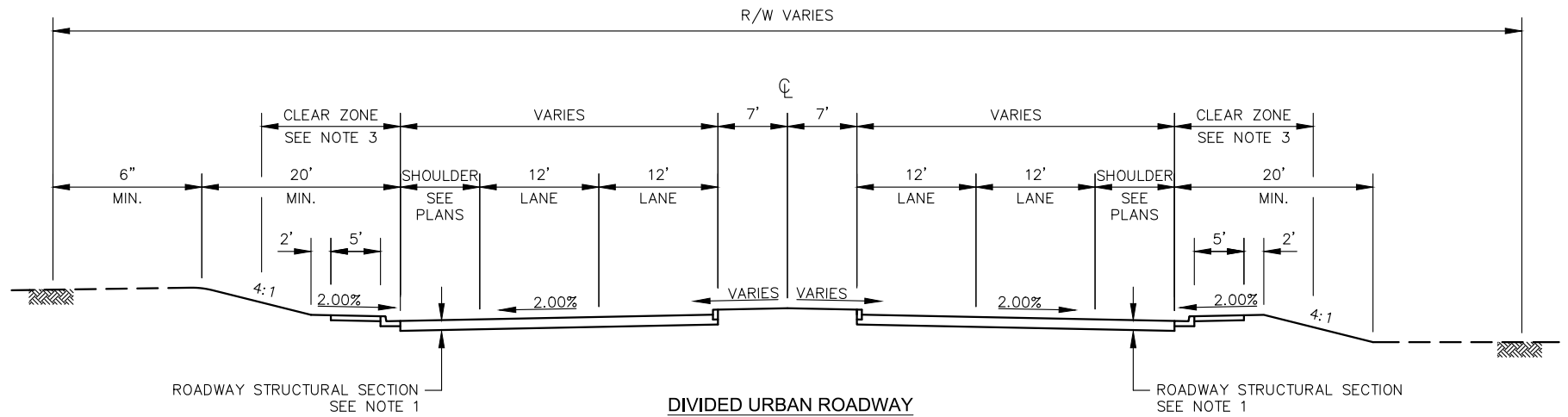
1. PAVEMENT SECTION TO BE DETERMINED BY FUNCTIONAL CLASSIFICATION AND ADT AND SHALL BE CONSISTENT WITH DETAILS CC010-CC016, CC208-1 AND CC208-2.
2. MINIMUM R/W REQUIREMENTS VARY, TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
3. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
4. IDENTIFYING TURN LANES, PARKING, AND BICYCLE LANES WITH APPROPRIATE STRIPING AND SIGNING SHOULD BE CONSIDERED, WHERE FEASIBLE.





**NOTES:**

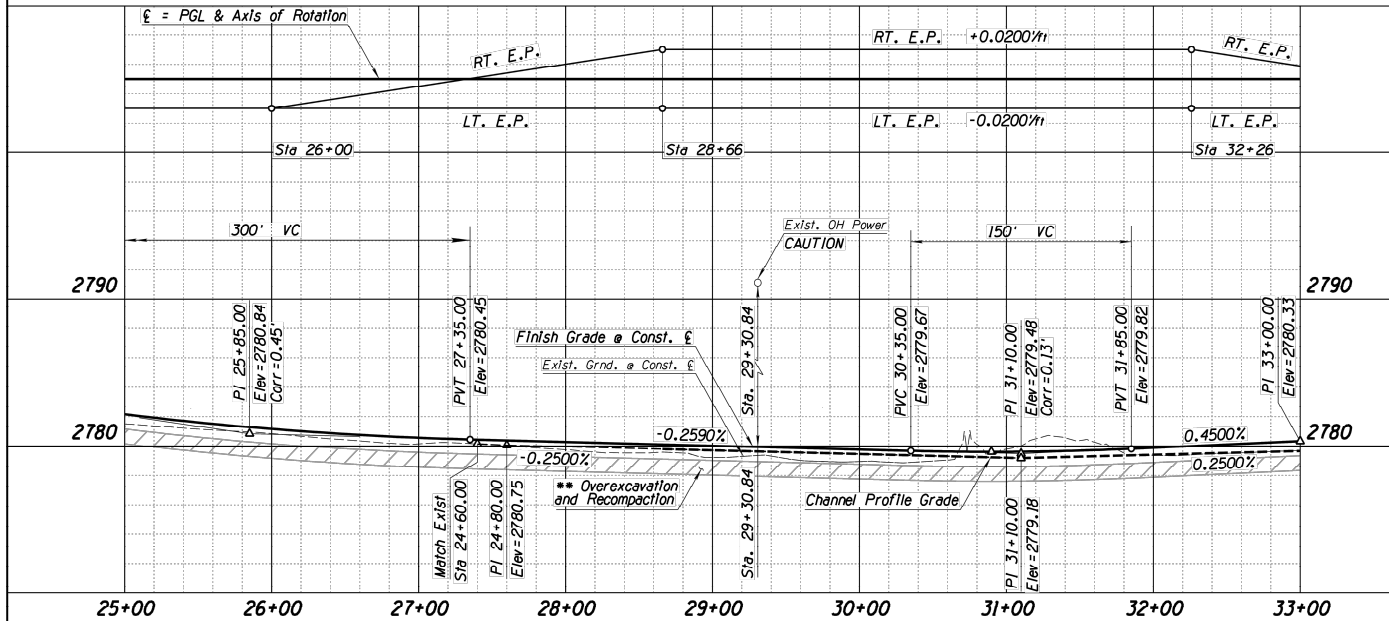
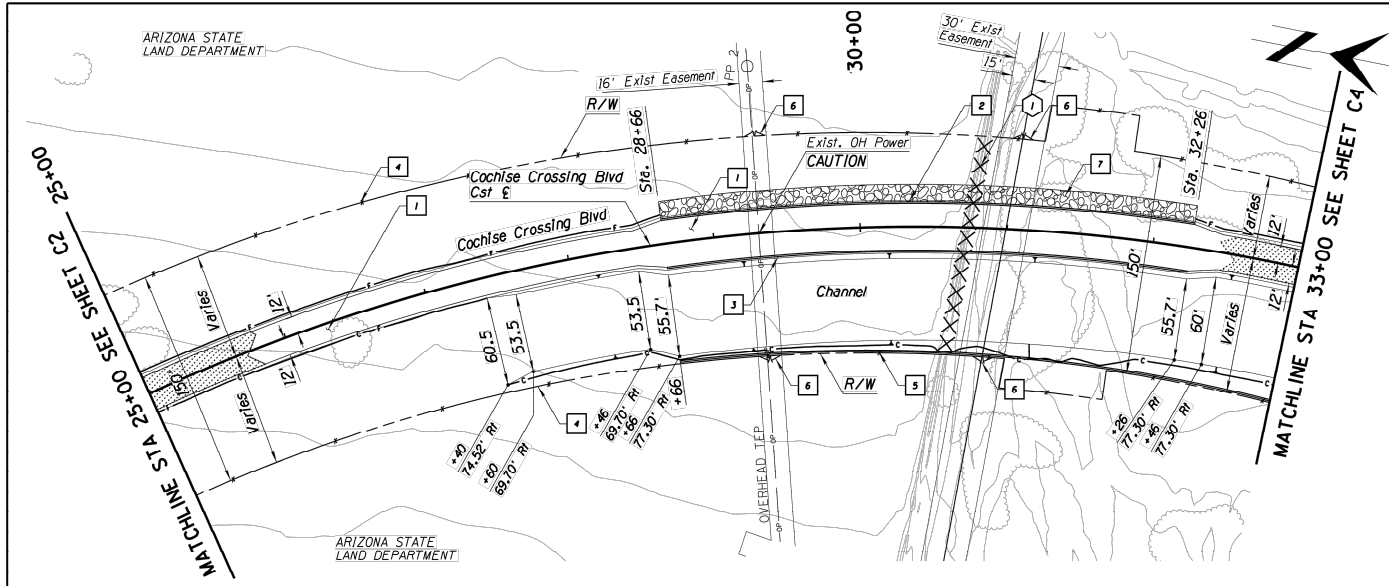
1. PAVEMENT SECTION TO BE DETERMINED BY FUNCTIONAL CLASSIFICATION AND ADT AND SHALL BE CONSISTENT WITH DETAILS CC010-CC016, CC208-1 AND CC208-2.
2. MINIMUM R/W REQUIREMENTS VARY, TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
3. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
4. IDENTIFYING TURN LANES AND BICYCLE LANES WITH APPROPRIATE STRIPING AND SIGNING SHOULD BE CONSIDERED, WHERE FEASIBLE.



**NOTES:**

1. PAVEMENT SECTION TO BE DETERMINED BY FUNCTIONAL CLASSIFICATION AND ADT. CONSISTENT WITH DETAILS CC010-CC016, CC208-1 AND CC208-2.
2. MINIMUM R/W REQUIREMENTS VARY, TOTAL WIDTH DETERMINED BY DRAINAGE/TOPOGRAPHY.
3. FOR CLEAR ZONE REQUIREMENTS, REFER TO THE LATEST EDITION OF THE AASHTO ROADSIDE DESIGN GUIDE (CHAPTER 3).
4. IDENTIFYING TURN LANES AND BICYCLE LANES WITH APPROPRIATE STRIPING AND SIGNING SHOULD BE CONSIDERED, WHERE FEASIBLE.





7:40:24 AM 6/28/2017 K:\TUC.ROADWAY\9162\900002.COCHI SE - STANDARD SUPDATE\CADD\EXAMPLE SHEET\H081 805PP03.DGN

CONSTRUCTION NOTES			
No.	DESCRIPTION	UNIT	QTY
1	AC Pavement & AB Per Struc. Sec. No. 2	SY	2471
2	Concrete Cutoff Wall (1' x 4')	LF	365
3	Concrete Cutoff Wall (1' x 2')	LF	355
4	New Right-of-Way Fencing, ADOT C-12.10 Type 1	LF	1680
5	New Concrete Header (1' x 2')	LF	404
6	New Fence Gate 14' ADOT C-12.10, Type 2	EACH	4
7	Riprap (Dumped)	CY	163

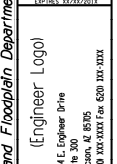
REMOVAL & RELOCATION NOTES			
NO	DESCRIPTION	UNIT	QTY
1	Remove Concrete Irrigation Ditch*	LF	151
2	Remove Barb Wire Fence*	LF	0
3	Remove Curb*	LF	0
4	Remove Pavement*	SY	0

\* Paid Under Item #202001  
 \*\* See Construction Note 23, 24, 25

Scales Horiz. 1"=40' Vert. 1"=4' Sheet C3 of C6 Page 11 of 25

Designated	G. Brown	06/20/17
Drawn	J. Smith	06/20/17
Checked	D. Pugh	06/20/17
Proj. Engr.	G. Serrano	06/20/17

No.	Revision Description	Date



Cochise County Highway and Floodplain Department  
 (Engineer Logo)  
 KEM E. Engineer (Pine)  
 Suite 300  
 Tucson, AZ 85705  
 520-745-2424 ext. 530 100-1033

**DETAILS**  
**for**  
**CONSTRUCTION**  
**within**

**COCHISE COUNTY**



Draft FINAL August 2017

**HIGHWAY AND FLOODPLAIN**  
**DEPARTMENT**

SUPPLEMENT TO THE 2017 REVISION  
OF THE 2015 EDITION OF THE MAG DETAILS

1. THESE DETAILS HAVE BEEN PREPARED IN EFFORT TO STANDARDIZE THE CONSTRUCTION DETAILS USED BY VARIOUS CONTRACTING AGENCIES IN COCHISE COUNTY. THEY ARE TO BE USED IN CONJUNCTION WITH THE CURRENT EDITION OF THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" SPONSORED AND DISTRIBUTED BY THE MARICOPA ASSOCIATION OF GOVERNMENTS, AND THE COCHISE COUNTY SUPPLEMENT TO THOSE SPECIFICATIONS.
2. MANY NOTES WITHIN THESE DETAILS REFER TO VARIOUS SECTIONS OF THE COCHISE COUNTY SUPPLEMENT TO MAG UNIFORM STANDARD SPECIFICATIONS. WHERE THIS REFERENCE IS MADE, ONLY THE ABBREVIATION "SECT." IS USED. WHEN NOTES WITHIN THESE DETAILS REFER TO VARIOUS SECTIONS OF THE MAG UNIFORM STANDARD SPECIFICATIONS. THE ABBREVIATION "MAG SECT." IS USED. AN EXAMPLE OF THIS REFERENCE WOULD BE: "CLASS 'A' CONCRETE PER MAG SECT. 725".
3. MANY NOTES WITHIN THESE DETAILS REFER TO OTHER DETAILS WITHIN THIS BOOK. WHERE THIS REFERENCE IS MADE, THE ABBREVIATION "DETAIL" IS USED. AN EXAMPLE OF THIS WOULD BE: "SEE DETAIL CC232 FOR TYPICAL SHARED USE PATH". WHEN DETAILS ARE REFERENCED FROM THE MAG STANDARDS, THE ABBREVIATION "MAG DETAIL" IS USED.
4. SOME DETAILS COVER MORE THAN ONE SHEET. THESE SHEETS HAVE BEEN GIVEN THE SAME NUMBER WITH A SUFFIX NUMBER, EXAMPLE: 391-1 AND 391-2.
5. AN EFFORT HAS BEEN MADE TO INCLUDE THE MOST COMMONLY USED CONSTRUCTION DETAILS IN THIS BOOK. ITEMS WHICH REQUIRE DESIGN CONSIDERATION BY THE DESIGN ENGINEER HAVE NOT BEEN INCLUDED.
6. SOME OF THESE DETAILS PRINTED HEREIN MAY BE USED BY SOME OF THE AGENCIES WITHIN COCHISE COUNTY BUT NOT OTHERS. THE DESIGN ENGINEER SHOULD THEREFORE CONTACT THE AGENCY WITHIN WHOSE JURISDICTION HE IS WORKING FOR DIRECTION AS TO WHICH DETAIL OR PORTIONS OF DETAILS SHOULD BE USED.
7. DETAIL DRAWINGS ARE NOT TO SCALE.
8. THE COCHISE COUNTY STANDARD DETAILS ARE SUPPLEMENT TO THE MARICOPA ASSOCIATION OF GOVERNMENT (MAG) STANDARD DETAILS. IN THE EVENT COCHISE COUNTY AND MAG DETAILS CONTAIN SIMILAR INFORMATION OR APPLICATION, THE COCHISE COUNTY DETAILS ARE INTENDED TO SUPERCEDE INFORMATION IN THE MAG DETAILS.

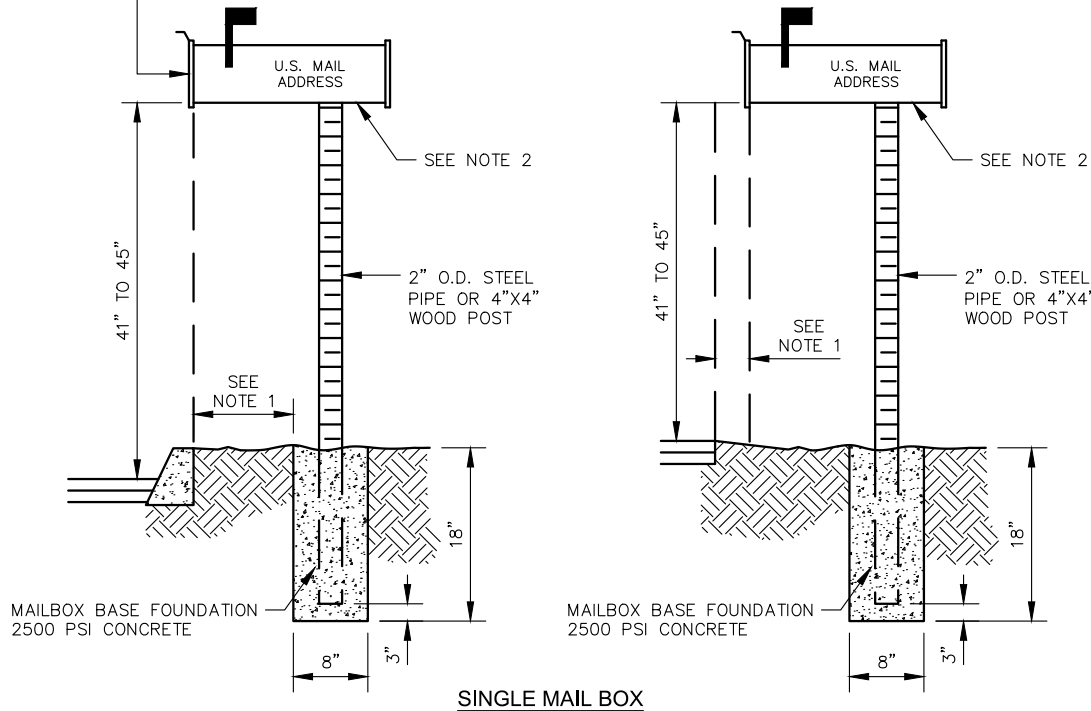


TRADITIONAL AND CONTEMPORARY BOX STYLES			
SIZE	INCHES (APPROXIMATE)		
	LENGTH	WIDTH	HEIGHT
1	19	6-½	8-½
1-A	21	8	10-½
2	23-½	11-½	13-½
OPTIONAL LETTER SLOT			

A LIST OF SUGGESTED MANUFACTURERS MAY BE OBTAINED FROM THE UNITED STATES POSTAL SERVICE.

**NOTES:**

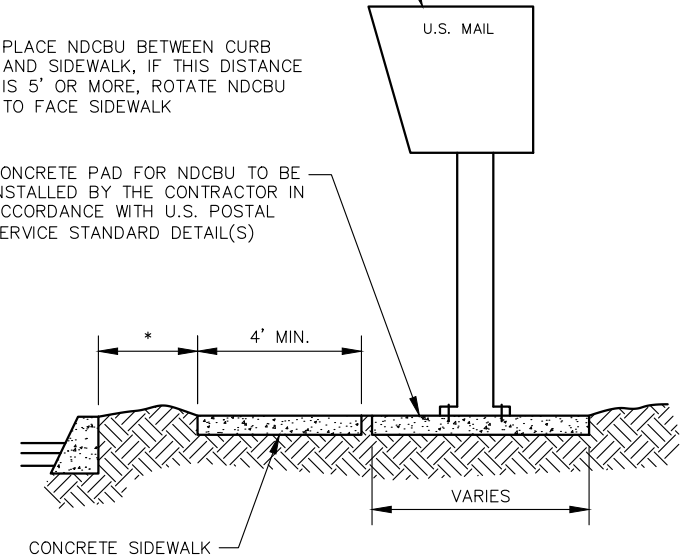
1. WHERE CURB DOES NOT EXIST, FACE OF MAILBOX SHALL BE OFFSET 10' MIN. FROM EDGE OF PAVEMENT OR OR TRAVEL WAY. WHERE CURB EXISTS, FACE OF MAILBOX SHALL BE OFFSET BETWEEN 0" TO 6" FROM REAR OF CURB, WHEN FEASIBLE.
2. ADDRESS ON MAILBOX MUST FACE THE DELIVERY SIDE (ONCOMING TRAFFIC).
3. IF MAILBOX IS ON A CURVE OR IN A CUL-DE-SAC, PREFERRED PLACEMENT IS BEFORE AND AS CLOSE TO THE EDGE OF THE DRIVEWAY AS PRACTICAL.
4. APPROACH TO MAILBOX SHOULD BE CLEAR 10 FEET IN EACH DIRECTION, INCLUDING LANDSCAPING, VEHICLES, TRASH RECEPTACLES, HOLIDAY DECORATIONS, ETC.
5. NDCBU'S SHALL BE LOCATED AND INSTALLED OUTSIDE OF SIGHT DISTANCE TRIANGLES (SEE DETAIL CC300). ON UNCURBED DRIVEWAYS, LOCATION OF NDCBU SHALL BE AS NOTED IN THE PLANS OR AS DIRECTED BY THE COUNTY ENGINEER.



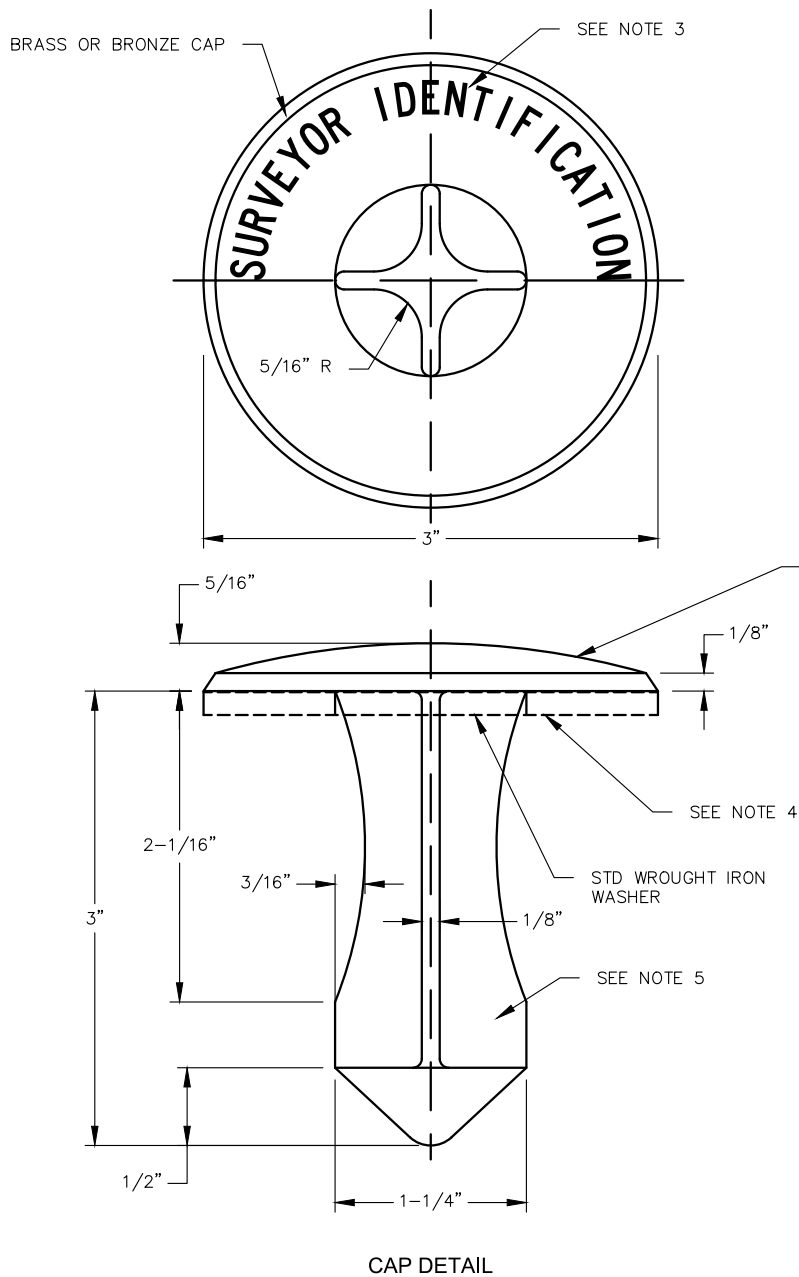
NEIGHBORHOOD DELIVERY AND COLLECTION BOX UNITS, (NDCBU) SUPPLIED AND INSTALLED BY THE POSTAL SERVICE

- \* PLACE NDCBU BETWEEN CURB AND SIDEWALK, IF THIS DISTANCE IS 5' OR MORE, ROTATE NDCBU TO FACE SIDEWALK

CONCRETE PAD FOR NDCBU TO BE INSTALLED BY THE CONTRACTOR IN ACCORDANCE WITH U.S. POSTAL SERVICE STANDARD DETAIL(S)



**NEIGHBORHOOD DELIVERY AND COLLECTION BOX**

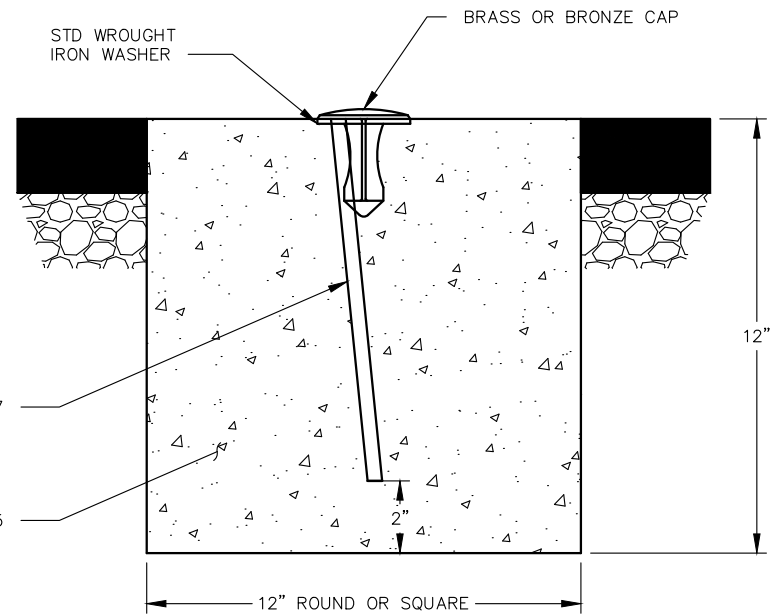


CAP DETAIL

**NOTES:**

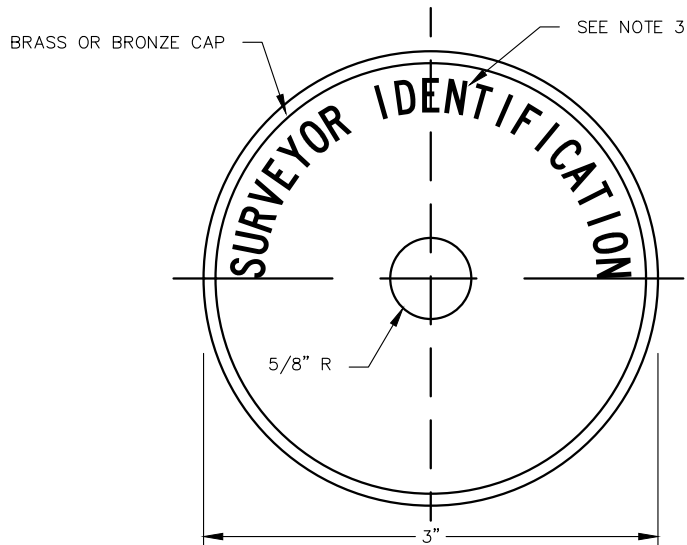
1. SURVEY MARKER WITH FRAME SHALL BE USED AT INTERSECTIONS OF MAJOR STREETS & COLLECTOR STREETS, AND AT OTHER SPECIAL POINTS AS SHOWN ON PLANS. SEE MAG DETAIL 120, TYPE "A".
2. SURVEY MARKER WITHOUT FRAME SHALL BE USED AT INTERSECTION OF LOCAL STREET CENTERLINES (EXCEPT WHERE TYPE "A" IS SPECIFIED), AT P.C.'s AND P.T.'s OF CURVES, AND AT OTHER POINTS AS SHOWN ON PLANS. SEE TYPE "B" BELOW, OR TYPE "D", DETAIL CC121-2..
3. LETTERS TO BE APPROX.  $\frac{1}{32}$ " WIDE &  $\frac{1}{32}$ " DEEP.
4. USE STANDARD WROUGHT IRON WASHER 3" O.D. X  $\frac{1}{64}$ " THICK WITH 1- $\frac{3}{8}$ " HOLE.
5. CAP TO BE CONSTRUCTED OF RED BRASS OR BRONZE.

REMOVE BURRS AND SAND FROM TOP



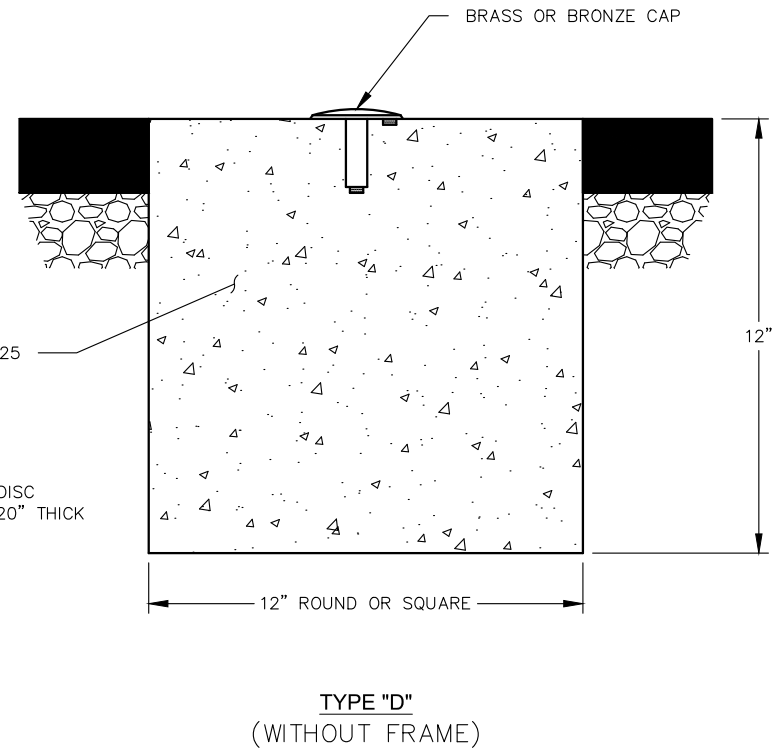
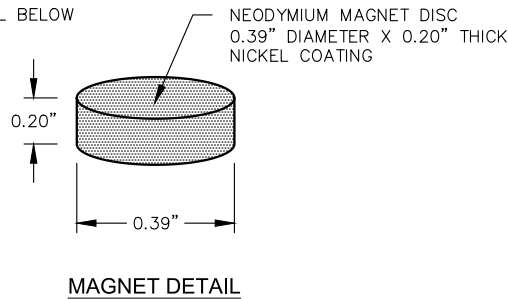
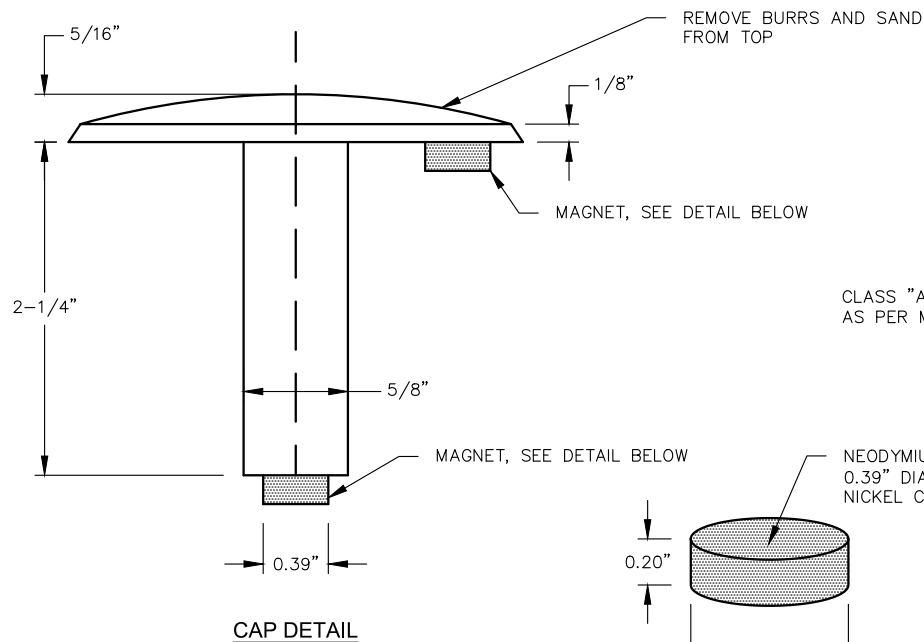
TYPE "B"  
(WITHOUT FRAME)





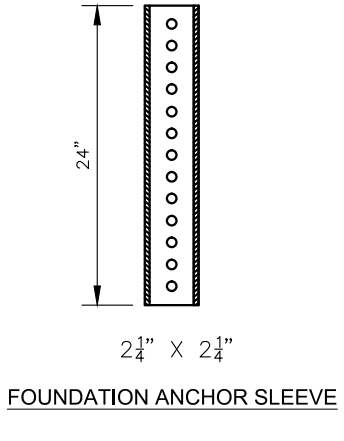
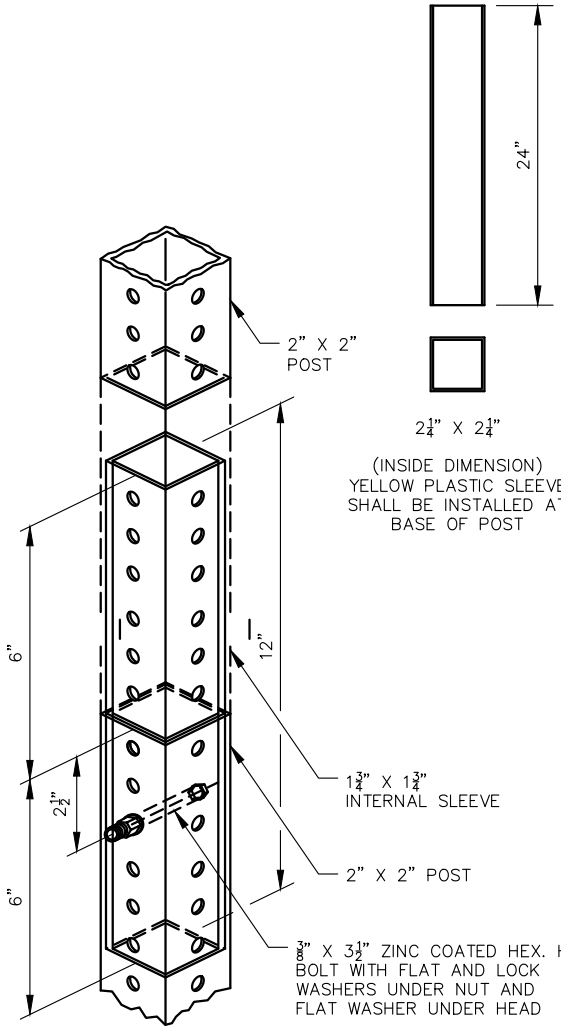
**NOTES:**

1. SURVEY MARKER WITH FRAME SHALL BE USED AT INTERSECTIONS OF MAJOR STREETS & COLLECTOR STREETS, AND AT OTHER SPECIAL POINTS AS SHOWN ON PLANS. SEE MAG DETAIL 120, TYPE "A".
2. SURVEY MARKER WITHOUT FRAME SHALL BE USED AT INTERSECTION OF LOCAL STREET CENTERLINES (EXCEPT WHERE TYPE "A" IS SPECIFIED), AT P.C.'s AND P.T.'s OF CURVES, AND AT OTHER POINTS AS SHOWN ON PLANS. SEE TYPE "B" BELOW, OR TYPE "D", DETAIL CC121-2..
3. LETTERS TO BE APPROX. 1/32" WIDE & 1/32" DEEP.
4. CAP TO BE CONSTRUCTED OF RED BRASS OR BRONZE.
5. SURVEY MARKER PLACEMENT SHALL PROVIDE MAGNETIC DETECTION LOCATORS.

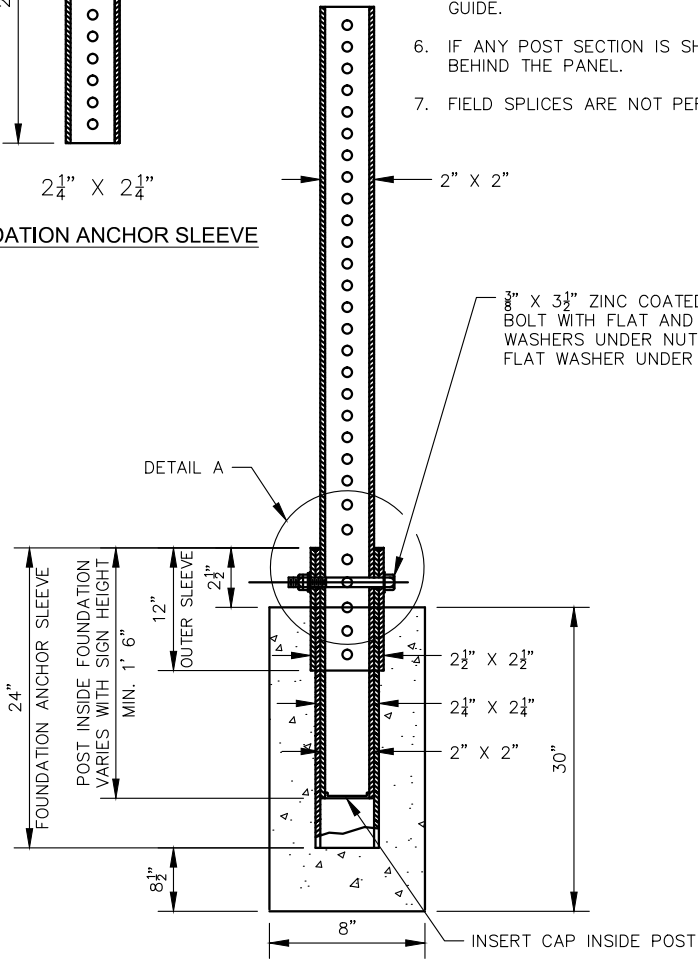


**NOTES:**

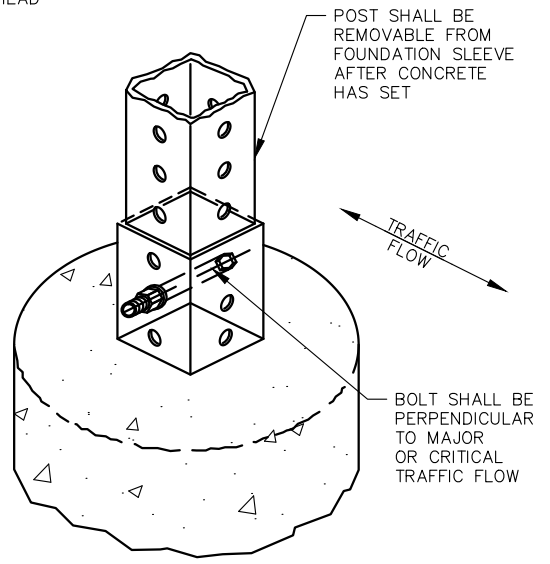
1. ALL DIMENSIONS ARE IN INCHES, EXCEPT AS NOTED.
2. SQUARE PERFORATED POST SIZE SHALL BE 2" X 2" OR AS APPROPRIATE FOR THE SIGN SIZE PER THE CURRENT ADOT SIGNING AND MARKING GUIDE.
3. FOR ESTIMATING PURPOSES, CONCRETE QUANTITY PER POST IS 1.0 CU/FT.
4. A YELLOW PLASTIC SLEEVE SHALL BE INSTALLED AT THE BASE OF ALL SIGN POSTS.
5. USE OF TELESCOPING AND/OR SLIP BASE SHALL BE DESIGNATED BY THE DESIGN ENGINEER AS NEEDED FOR THE SIGN SIZE AND LOCATION AS PER THE CURRENT ADOT SIGNING AND MARKING GUIDE.
6. IF ANY POST SECTION IS SHORTER THAN THE PANEL HEIGHT, THE FIELD SPLICE SHALL BE BEHIND THE PANEL.
7. FIELD SPLICES ARE NOT PERMITTED ON TELESCOPING POSTS.



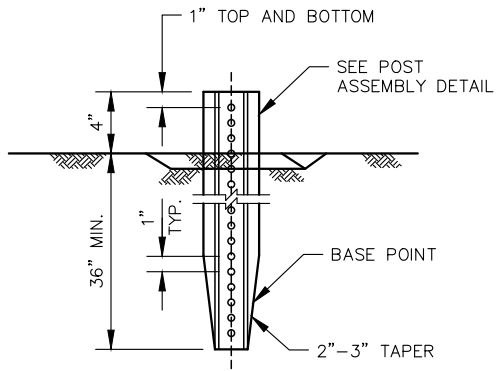
**SINGLE POST PERMISSIBLE  
FIELD SPLICE**



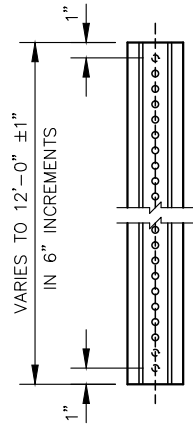
**SIGN POST FOUNDATION DETAIL**



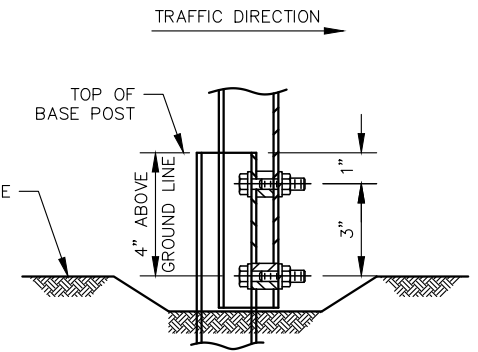
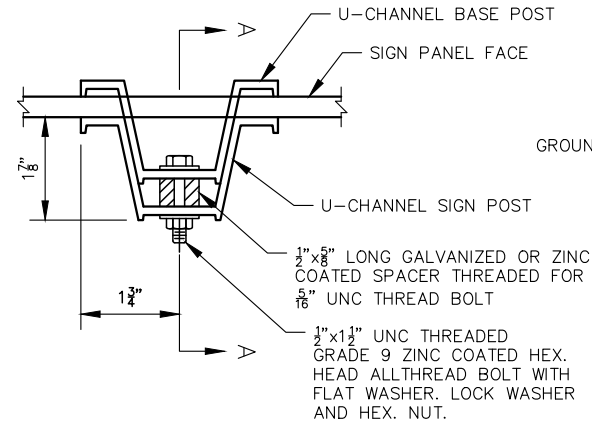
**DETAIL A**



**BASE POST AND INSTALLATION**



**SIGN POST**



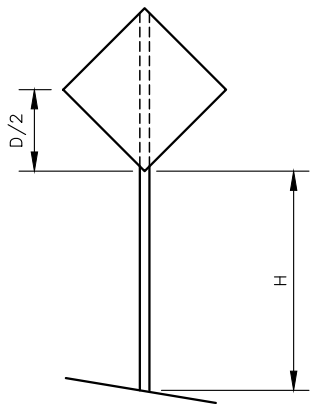
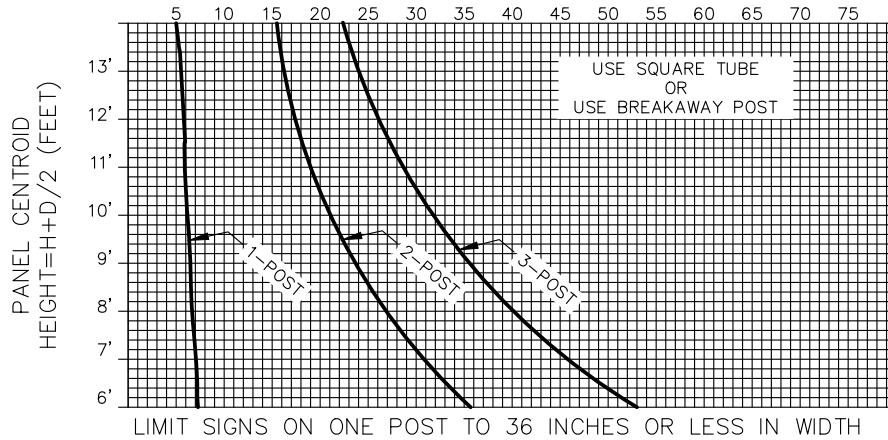
**POST ASSEMBLY SECTION A-A**

**U-CHANNEL SELECTION**

WIND SPEED = 70MPH

(3 LBS. PER FT. POST)

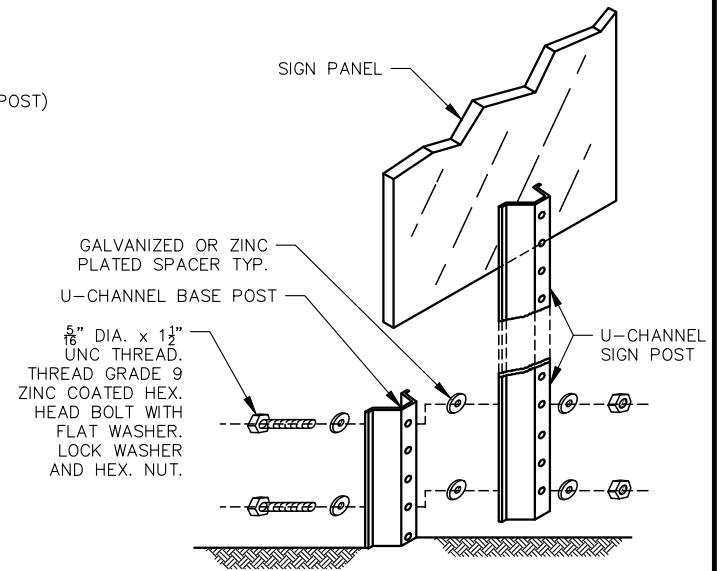
PANEL AREA (SQUARE FEET)



PANEL CENTROID HEIGHT =  $H + D/2$  (FEET)

**NOTE:**

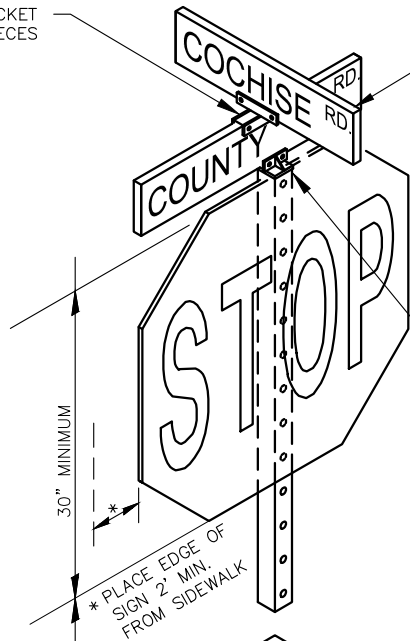
1. ALL DIMENSIONS ARE IN INCHES, EXCEPT AS NOTED.



**INSTALLATION PICTORIAL**



SIGN BRACKET  
CROSS PIECES



30" MINIMUM

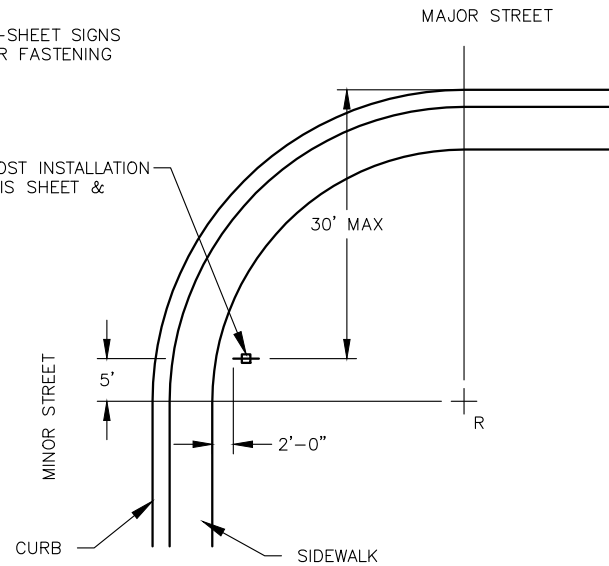
7'-0" MINIMUM

\* PLACE EDGE OF  
SIGN 2' MIN.  
FROM SIDEWALK

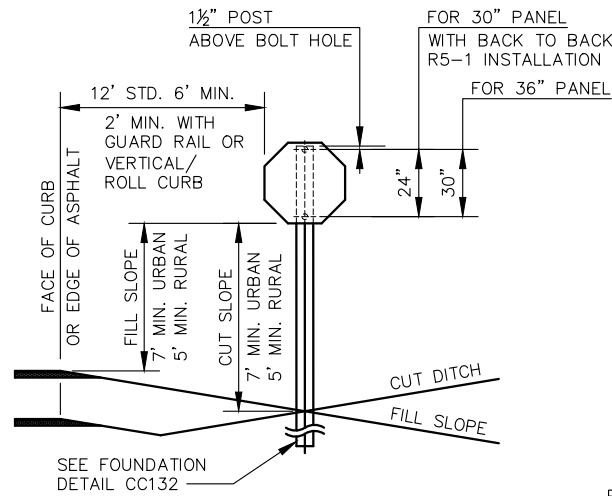
SQUARE POST  
MOUNT/CAPS FOR  
EXTRUDED SIGNS

AT STREET INTERSECTIONS INSTALL DOUBLE FACED FLAT-SHEET SIGNS FOR EACH STREET NAME. VANDAL-PROOF HARDWARE FOR FASTENING AS APPROVED BY COCHISE COUNTY.

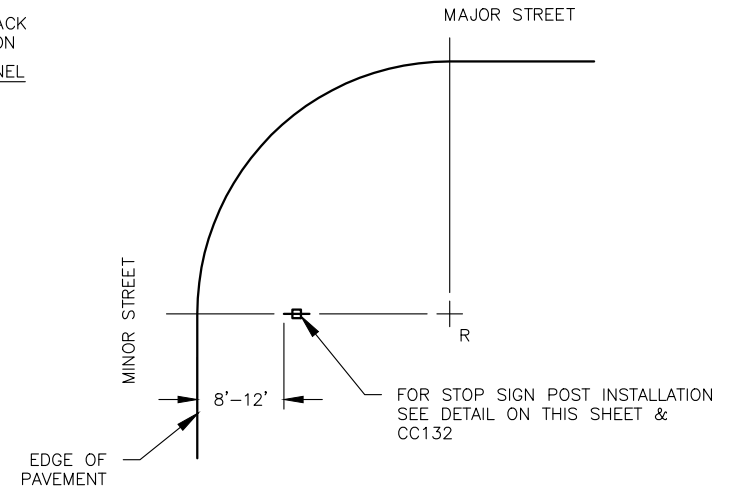
FOR STOP SIGN POST INSTALLATION  
SEE DETAIL ON THIS SHEET &  
CC132



TYPICAL SUBDIVISION PLACEMENT DETAIL



STOP SIGN PLACEMENT DETAIL



TYPICAL RURAL PLACEMENT DETAIL

SEE CC132 FOR  
FOUNDATION DETAILS

**COCHISE COUNTY**



HIGHWAY & FLOODPLAIN  
STANDARD DETAIL

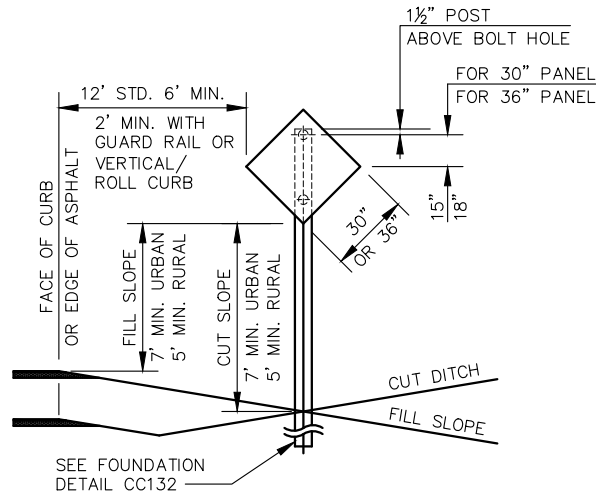
OFFSETS, CLEARANCES AND MOUNTING  
DETAILS FOR SIGNS ON COUNTY ROADWAYS

DRAFT  
08-22-2017

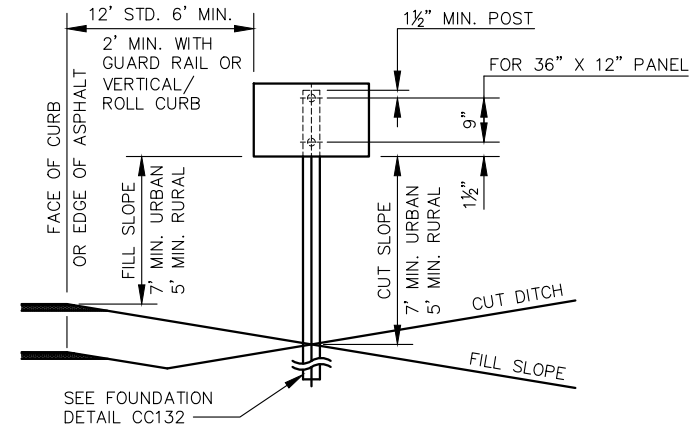
DETAIL NO.  
CC134-1

**NOTES:**

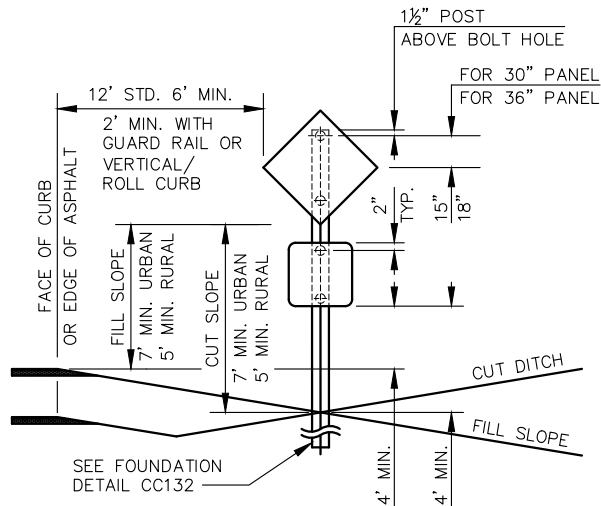
1. SEE FHWA STANDARD HIGHWAY SIGNS BOOKLET FOR PANEL BOLT HOLE. SPACING NOT SHOWN.
2. ALL DIMENSIONS IN INCHES EXCEPT AS NOTED.
3. USE GRADE #2, ZINC COATED, 18 NC THREAD, 3" X 5/16" BOLT WITH FLAT WASHER UNDER NUT AND FLAT WASHER UNDER HEAD TO ATTACH SIGN TO BRACKET.



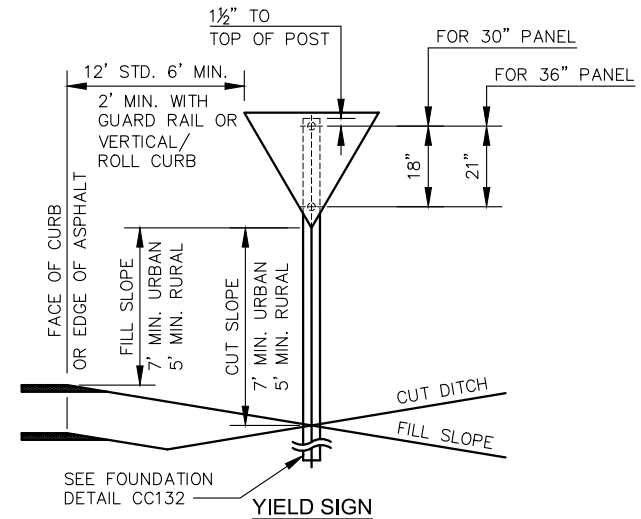
**WARNING SIGN**



**REGULATORY SIGN  
SINGLE POST**

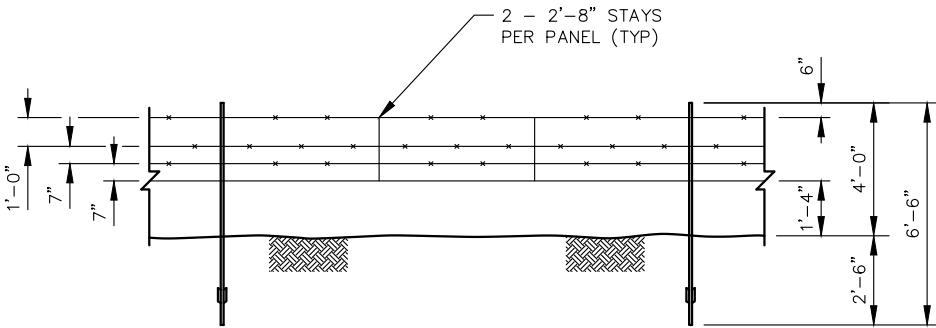


**WARNING SIGN  
WITH ADVISORY PLATE**

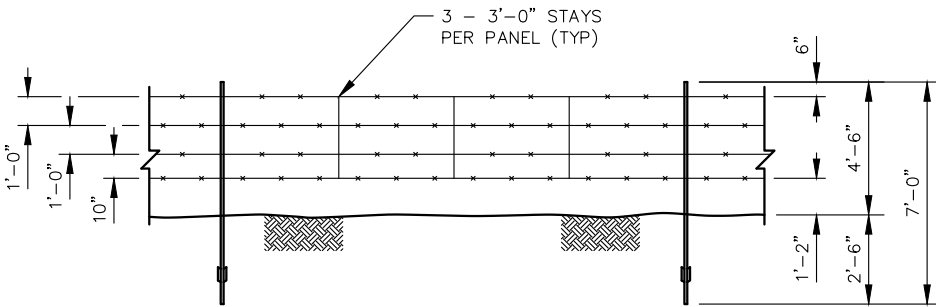


**YIELD SIGN**

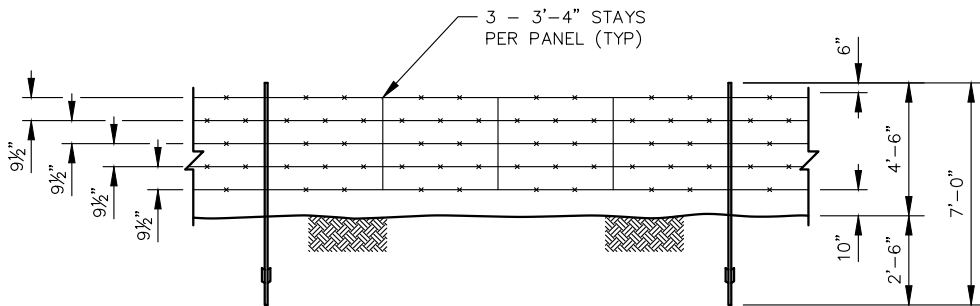




GAME FENCE (GF)



BARBED WIRE (BW) (4 WIRE)

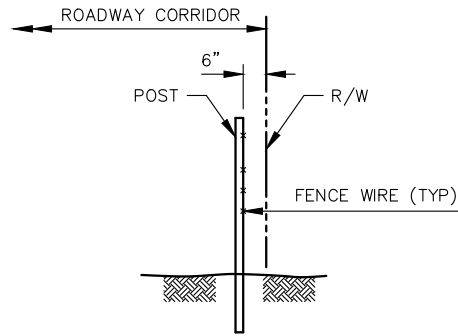


BARBED WIRE FENCE (BW) (5 WIRE)

**NOTES:**

1. FOR GAME FENCE THE BOTTOM WIRE SHALL BE BARBLESS.
2. STAYS SHALL BE EVENLY SPACED BETWEEN POSTS WITH SPACING NOT TO EXCEED 5 FEET - 4 INCHES FOR GAME FENCE OR 4 FEET FOR BARBED WIRE FENCE.
3. WIRE STAYS ON GAME FENCE (GF) SHALL HAVE THEIR ENDS TURNED UP TO PREVENT INJURIES TO GAME.
4. IN AREAS WITH HIGH CONCENTRATIONS OF UNGULATES (DEER, PRONGHORN, JAVALINA) CONSIDER USE OF THE BARBLESS BOTTOM WIRE PLACED NO LESS THAN 16" OFF THE GROUND, GAME FENCE HEIGHT SHOULD NOT EXCEED 42" AND BOTTOM SMOOTH WIRE PLACEMENT SHOULD NOT EXCEED 18".

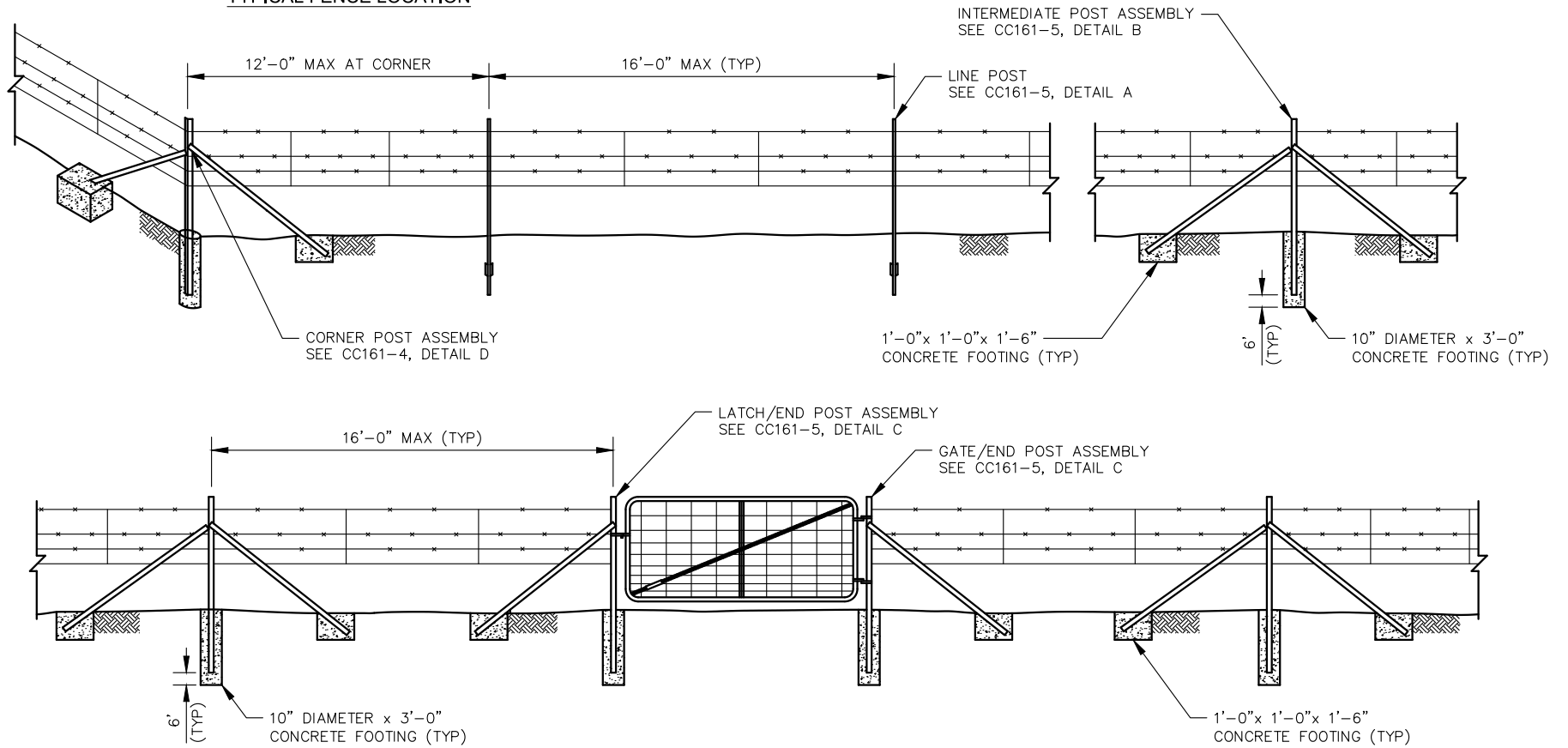




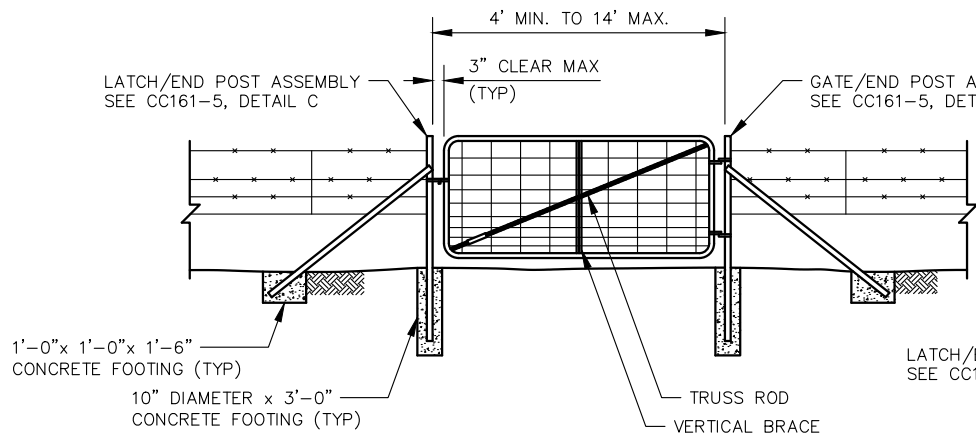
TYPICAL FENCE LOCATION

**NOTES:**

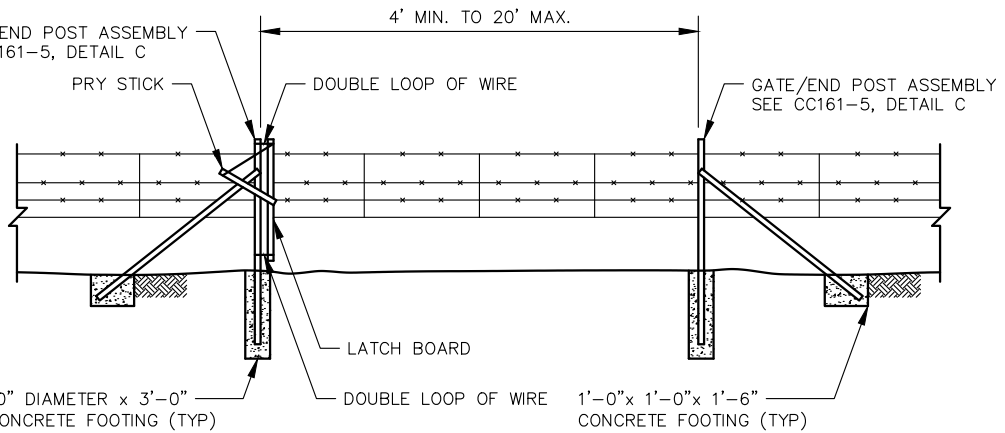
1. INTERMEDIATE POST ASSEMBLIES SHALL BE LOCATED AS SHOWN AND AT INTERVALS NOT TO EXCEED 650', OR MIDWAY BETWEEN ALL BRACED POSTS.
2. FENCE WIRE SHALL BE PLACED ON THE SIDE OF THE LINE POSTS AWAY FROM THE MAIN ROADWAY EXCEPT IN SHARPER CURVE AREAS WHERE IT SHOULD BE MOVED TO THE SIDE WITH TENSION AGAINST THE POSTS.



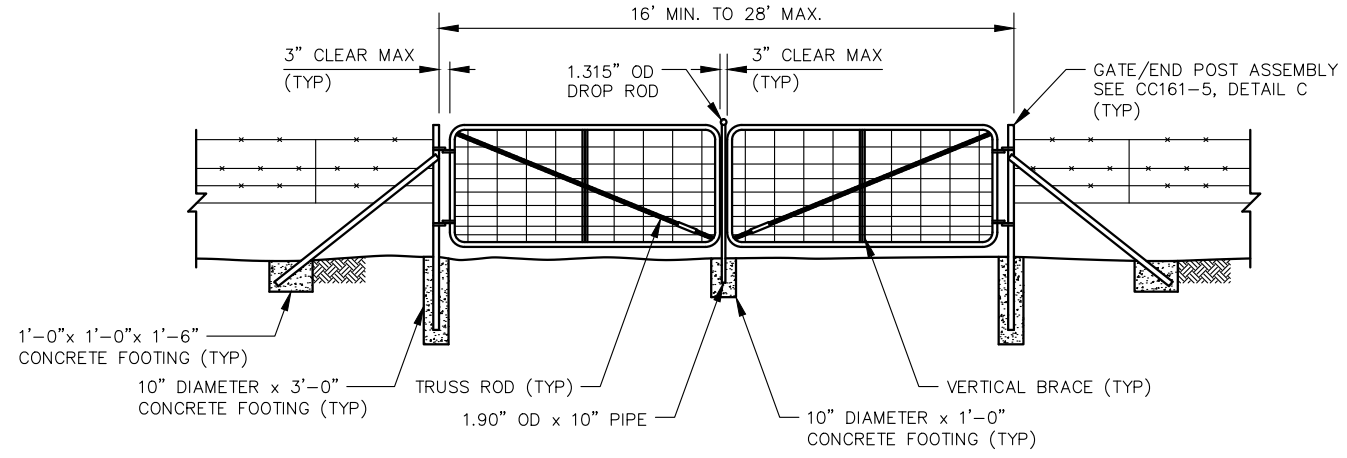
TYPICAL BARBED WIRE FENCE INSTALLATION



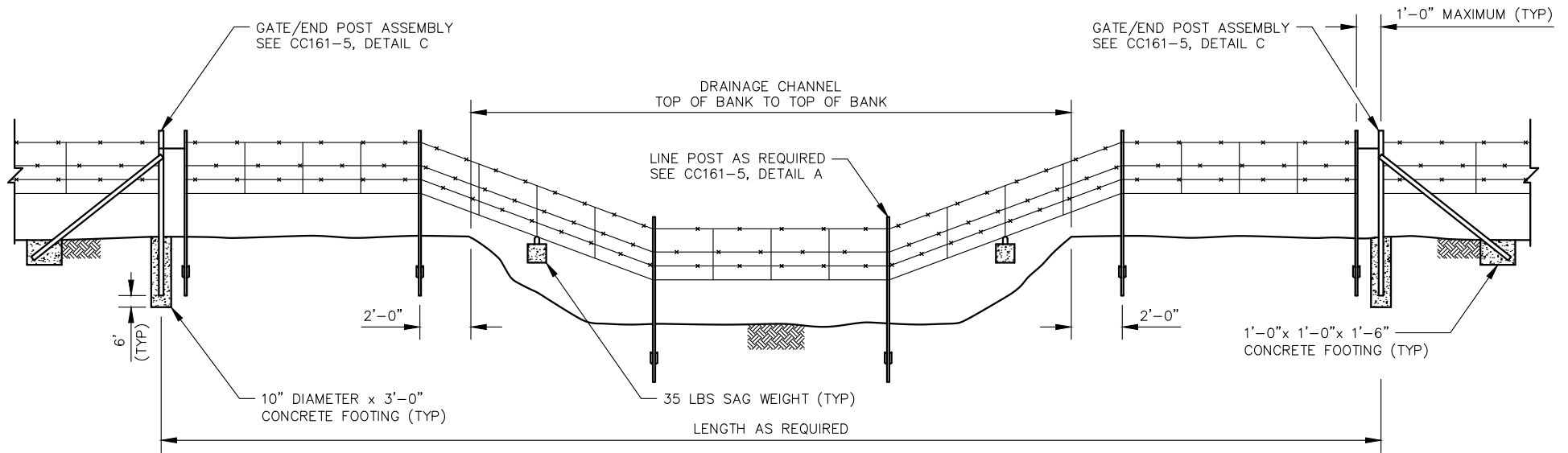
**TYPE 1 SINGLE GATE**



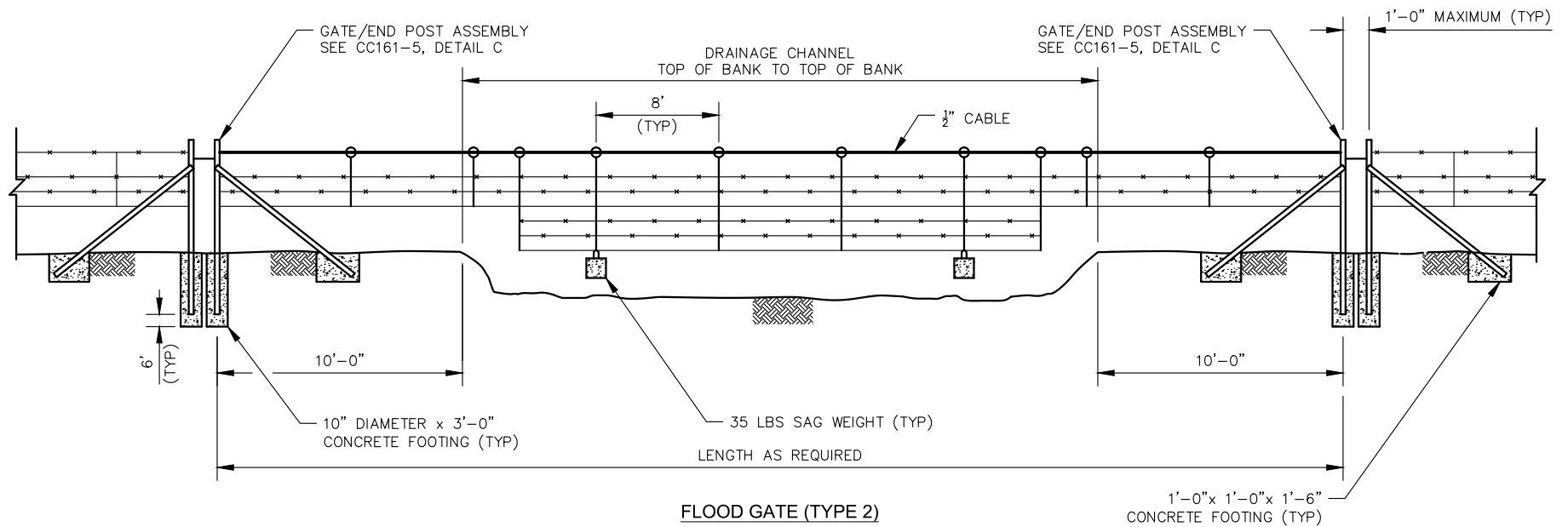
**TYPE 2 GATE**



**TYPE 1 DOUBLE GATE**



FLOOD GATE (TYPE 1)

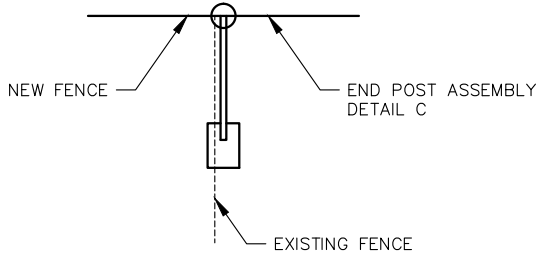


FLOOD GATE (TYPE 2)

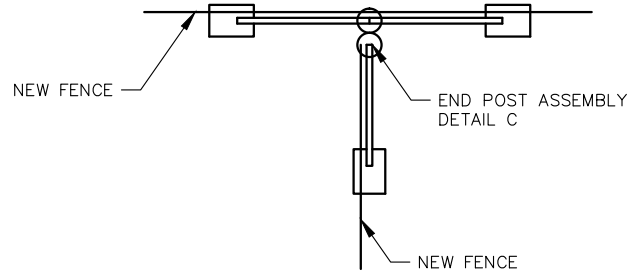


**NOTES:**

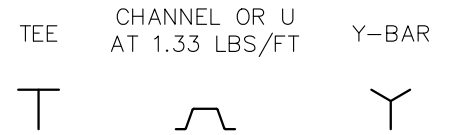
1. POST ASSEMBLIES SHALL CONSIST OF AN UPRIGHT ANGLE  $2\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{1}{4}''$  AT 4.10 LBS/FT, AND BRACE ANGLES  $2'' \times 2'' \times \frac{1}{4}''$  AT 3.19 LBS/FT.



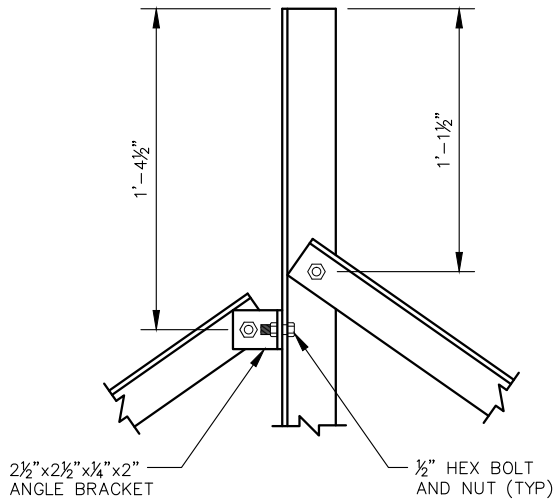
**ABUTTING FENCE**



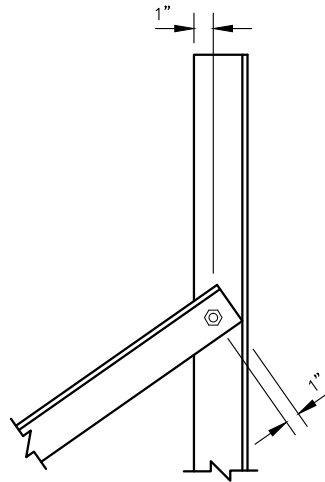
**ABUTTING FENCE AT POST**



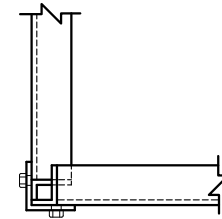
**DETAIL A  
TYPICAL CROSS SECTIONS  
OF LINE POST SHAPES**



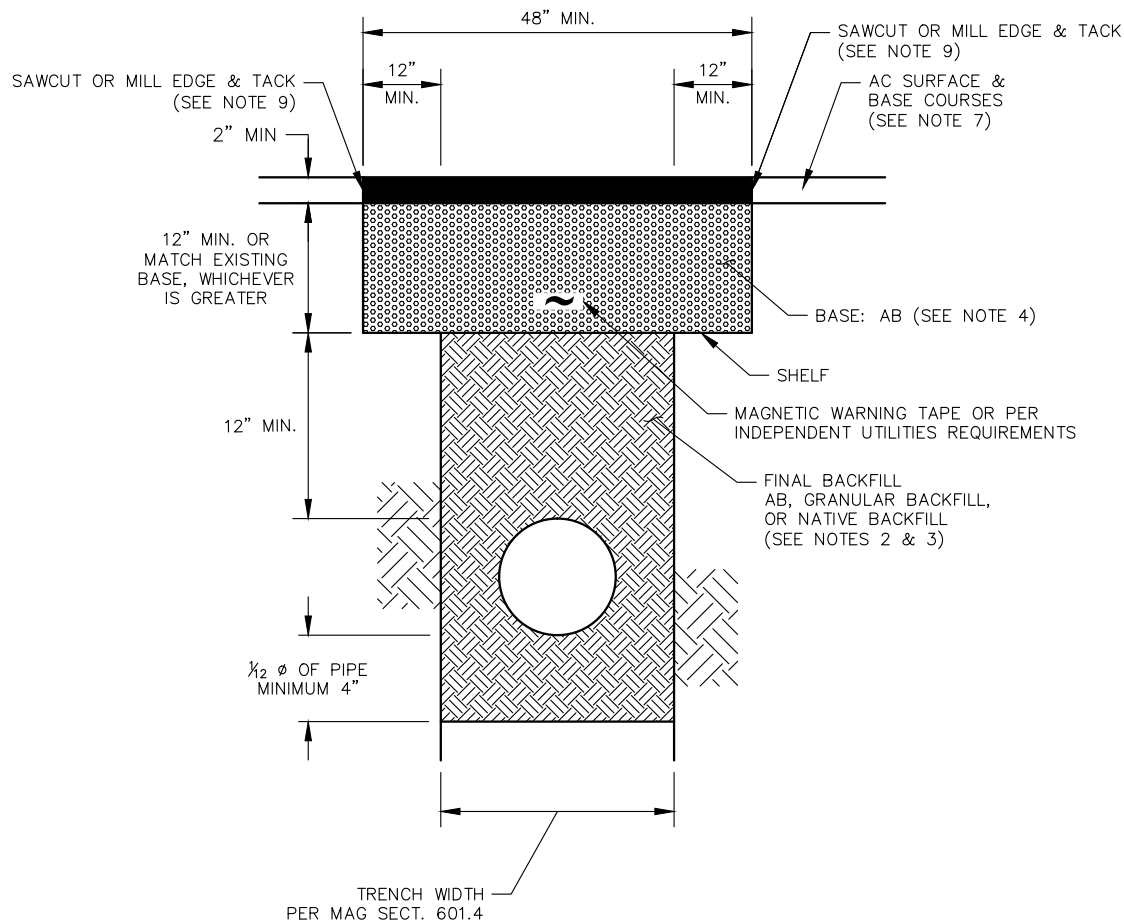
**DETAIL B  
INTERMEDIATE POST ASSEMBLY**



**DETAIL C  
END POST ASSEMBLY**



**DETAIL D  
CORNER POST ASSEMBLY**



"T TOP" TRENCH REPAIR

**NOTES:**

1. ALL TRENCHING ACROSS EXISTING PAVED STREETS OR IMPROVED DRIVEWAYS SHALL BE BORED, UNLESS OTHERWISE APPROVED BY THE COUNTY.
2. MATERIAL FOR FINAL BACKFILL SHALL BE AB, GRANULAR BACKFILL, OR NATIVE BACKFILL UNLESS OTHERWISE SPECIFIED IN APPROVED DESIGN PLANS, PERMITS, OR CONTRACT DOCUMENTS. CONTROLLED LOW STRENGTH MATERIAL (CLSM) SHALL BE 2-SACK PER MAG SECT. 604 AND 728.
3. FINAL BACKFILL SHALL BE AB, GRANULAR BACKFILL, OR NATIVE BACKFILL PER MAG SECT. 702 & 601 OR A 2-SACK CLSM PER MAG SECT. 604 AND 728 FOR TRENCH DEPTHS GREATER THAN 4'.
4. MATERIAL FOR FINAL BASE SHALL BE AB OR 2-SACK CLSM PER MAG SECT. 604 AND 728.
5. NATIVE MATERIAL MAY BE USED WHEN SUITABLE AND WITH APPROVAL OF COUNTY ENGINEER.
6. BASE, FINAL BACKFILL, AND PIPE EMBEDMENT ZONE COMPACTION SHALL BE IN ACCORDANCE WITH MAG SECT. 601.
7. ASPHALT CONCRETE SURFACE AND BASE COURSES SHALL COMPLY WITH MAG SECT. 336.2.4.1 UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS.
8. PROVIDE MINIMUM 12" WIDE SHELF AS SHOWN EXCEPT WHERE EDGE ABUTS EXISTING CONCRETE.
9. THE JOINT LOCATION OR JOINT CONFIGURATION MAY VARY FROM THAT SHOWN TO ELIMINATE REMNANTS, TO ELIMINATE FULL DEPTH SAWCUT JOINTS FROM BEING LOCATED WITHIN A WHEEL PATH AS REQUIRED BY MAG SECT. 336, OR WHEN AN OFFSET JOINT IS CONSTRUCTED.
10. WHEN MECHANICAL COMPACTION IS USED, BACKFILL SHALL BE PLACED IN LIFTS NO GREATER THAN 2', TO WITHIN 4' OF FINISHED GRADE. FROM A DEPTH OF 4' TO FINISHED GRADE, THE LIFTS SHALL NOT EXCEED 1'.
11. MATERIAL SPECIFICATIONS AND TESTING SHALL BE REQUIRED TO DEMONSTRATE CONFORMANCE WITH THIS DETAIL, UNLESS OTHERWISE DIRECTED BY THE COUNTY ENGINEER.



**TRENCH REQUIREMENTS:**

1. A WIDER TRENCH SHALL BE ALLOWED IF A PULLBOX IS USED AS MEANS FOR TRENCH SHORING.
2. FOR ALL EXCAVATION AND TRENCHES, THE CONTRACTOR SHALL ADHERE STRICTLY WITH OSHA CFR PART 1926 SUBPART P.
3. TRENCH EXCAVATIONS OVER 20' IN DEPTH SHALL HAVE AN APPROVED SHORING PLAN, STAMPED BY AN AZ REGISTERED PROFESSIONAL ENGINEER, TO BE SUBMITTED BY THE CONTRACTOR FOR REVIEW BY COCHISE COUNTY.

**AGGREGATE BASE**

- AGGREGATE BASE PER DETAIL CC200-3
- RECLAIMED CONCRETE MATERIAL (RCM) IN ACCORDANCE WITH MAG SECT. 701.4 MAY BE SUBSTITUTED FOR AGGREGATE BASE

**NON SHRINK SLURRY**

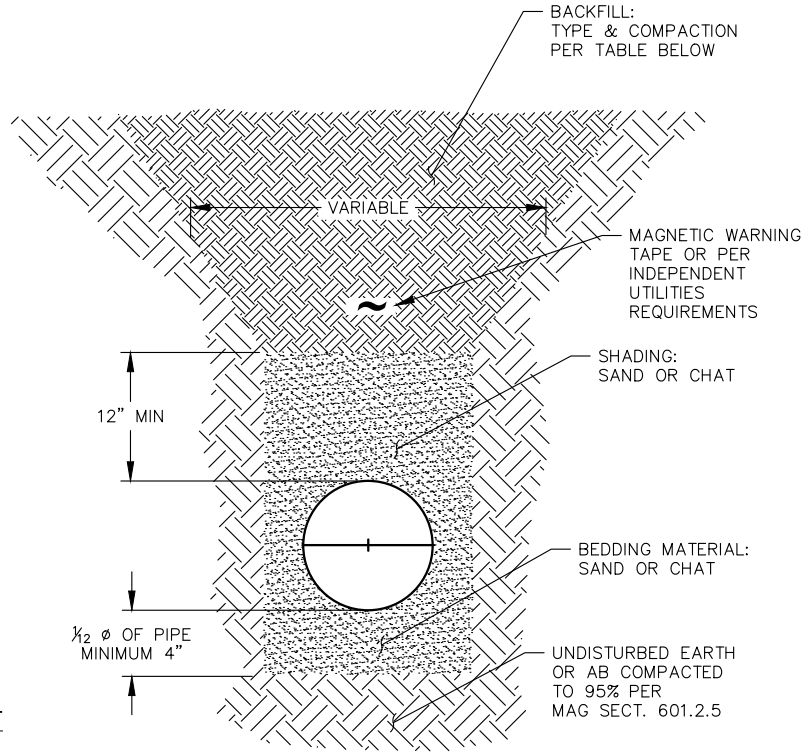
- TWO SACK TYPE II PORTLAND CONCRETE CEMENT PER CUBIC YARD.
- TYPE B SELECT AGGREGATE PER MAG 702, OR AGGREGATE BASE COURSE, OR RECLAIMED CONCRETE MATERIAL PER DETAIL CC200-3.

**ALLOWABLE BEDDING & SHADING SAND OR CHAT**

- 100% PASSING 1/2" SIEVE.
- SUM OF PI PLUS 200 SIEVE SHALL BE LESS THAN 23.

**TRENCH BACKFILL MATERIALS**

- NATIVE MATERIAL:
4. NATIVE MATERIAL MAY BE USED WHEN SUITABLE AND WITH APPROVAL OF COUNTY ENGINEER.
  5. MATERIAL SPECIFICATIONS AND TESTING SHALL CONFORM TO MAG SECT. 601.4.
  6. AT A MINIMUM, THE MATERIAL SHALL MEET THE FOLLOWING REQUIREMENTS:
    - A. MATERIAL IS FREE OF BROKEN CONCRETE, BROKEN PAVEMENT, RUBBISH, CHUNKS OF CLAY, WOOD, ORGANIC MATERIAL, OR OTHER DELETERIOUS MATERIAL.
    - B. MATERIAL DOES NOT CONTAIN ROCK OR STONES LARGER THAN 3".
  7. WHEN MECHANICAL COMPACTION IS USED, BACKFILL SHALL BE PLACED IN LIFTS NO GREATER THAN 2', TO WITHIN 4' OF FINISHED GRADE. FROM A DEPTH OF 4' TO FINISHED GRADE, THE LIFTS SHALL NOT EXCEED 1'.
  8. FOR PAVED TRENCH BACKFILL, SEE DETAIL CC200-1.



\* 200 SIEVE TO BE DETERMINED BY ASTM. D4318, DRY PREP, OR AASHTO T-90.

SIZE OF PIPE (I.D.)	MAXIMUM WIDTH AT TOP OF PIPE GREATER THAN O.D. OF BARREL	MINIMUM WIDTH AT SPRINGLINE EA. SIDE OF PIPE
LESS THAN 18"	20"	8"
18" TO 24"	23"	9.5"
27" TO 39"	28"	12"
42" TO 60"	34"	14"
OVER 60"	PER MAG. TABLE 601-1, FLEX PIPES	

	TRENCHING IN RIGHT OF WAY OUTSIDE ROADWAY PRISM OR IN UNPAVED ALLEY		TRENCHING IN EXISTING ROADWAY PRISM		TRENCHING IN PROPOSED ROADWAY PRISM	
	ALLOWABLE BACKFILL MATERIALS	COMPACTION REQUIREMENT	ALLOWABLE BACKFILL MATERIALS	COMPACTION REQUIREMENT	ALLOWABLE BACKFILL MATERIALS	COMPACTION REQUIREMENT
NATIVE MATERIAL WITHOUT FINES REQUIREMENT	X	95%				
NATIVE MATERIAL WITH FINES REQUIREMENT	X	95%			X	100%
AGGREGATE BASE	X	95%	X	100%	X	100%
NON SHRINK SLURRY	X	NA	X	NA	X	NA



AGGREGATE BASE COURSE

702.2.1 REPLACE TABLE 702-1 OF THE MAG STANDARD CONSTRUCTION SPECIFICATIONS WITH THE FOLLOWING:

REVISED TABLE 702-1			
Sieve Analysis Test Methods AASHTO T-27, T-11			
Sieve Size	Accumulative Percentage Passing Sieve, by Weight		
	Select Material		Aggregate Base Course
	Type A	Type B	
3 IN.	100	-	-
1-1/2 IN.	-	100	100
1 IN.	-	-	90-100
NO. 4	30-75	30-70	32-65
NO. 8	20-60	20-60	20-60
NO. 30	10-40	10-40	10-40
NO. 200	0-12	0-12	3-12
Plasticity Index Test Methods AASHTO T-89 Method A, T-90, T146 Method A			
MAXIMUM ALLOWABLE VALUE	5	5	5
Fractured Face, One Face Test Method ARIZ 212, Percent by Weight of the Material Retained on a #4 Sieve			
MINIMUM REQUIRED VALUE	50	50	50
Resistance to Degradation and Abrasion by the Los Angeles Abrasion Machine Test Method AASHTO T-96, Percent Loss by Weight			
MAXIMUM ALLOWABLE VALUE AT 100 REVOLUTIONS	10	10	10
MAXIMUM ALLOWABLE VALUE AT 500 REVOLUTIONS	45	45	45



HIGHWAY & FLOODPLAIN  
STANDARD DETAIL

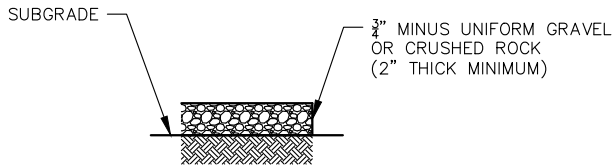
STORM DRAIN / SEWER / UTILITY / TRENCH  
BACKFILL & BEDDING TABLE

DRAFT  
08-22-2017

DETAIL NO.  
CC200-3

**NOTES:**

1. DRIVEWAY DETAILS SHALL BE NOTED ON PLANS AS FOLLOWS:  
DRIVEWAY TYPE, LENGTH, WIDTH, AND RADII.
2. RESIDENTIAL DRIVEWAYS TYPICALLY PROVIDE ACCESS TO ONE SINGLE FAMILY RESIDENCE: ACCESS TO TWO OR MORE RESIDENTIAL PARCELS IS CONSIDERED A ROADWAY ACCESS APRON (SEE CC205-3).
3. DRIVEWAYS TO BE PERPENDICULAR TO THE ROADWAY UNLESS OTHERWISE NOTED ON PLANS.
4. DRIVEWAY RADII OR CHAMFERS MUST REMAIN WITHIN THE PROJECTION OF THE SUBJECT PARCEL'S PROPERTY LINES AND SHALL NOT ENCROACH UPON ANY PART OF ADJACENT PROPERTIES' ROADWAY FRONTAGE.



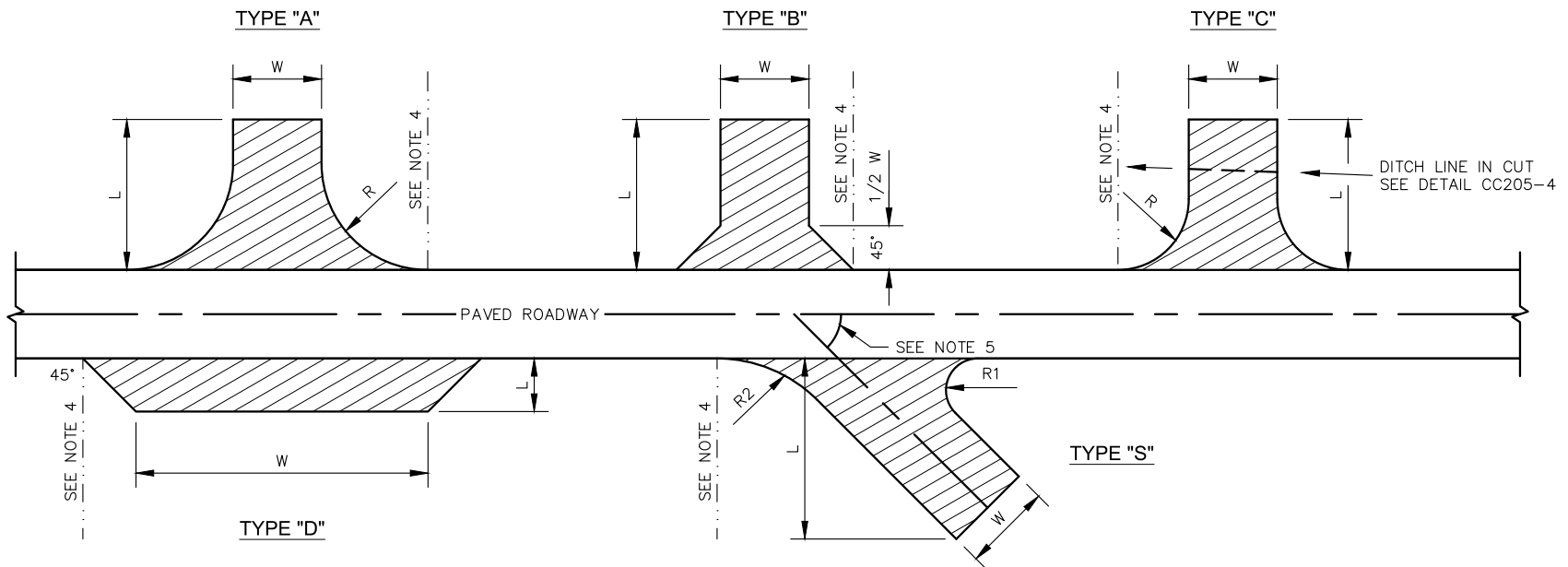
**GRAVEL STRUCTURAL SECTION**  
TOTAL THICKNESS = 2"

**NOTES (CONTINUED):**

5. TYPE "S" DRIVEWAY SHALL BE AS CLOSE TO 90° AS POSSIBLE AND SHALL BE NO LESS THAN 60° WITHOUT APPROVAL BY THE COUNTY ENGINEER OR THEIR DESIGNATED REPRESENTATIVE.
6. DRIVEWAY STRUCTURAL SECTION MAY BE NATIVE-SURFACED OR AN IMPROVED SURFACE (GRAVEL, CONCRETE, DBST, ASPHALT).
7. DRAINAGE STRUCTURES SHALL BE PROVIDED UNDER DRIVEWAYS, WHERE NECESSARY.
8. CONSTRUCTION OF CURB, GUTTER, SIDEWALK OR PATHWAY MAY BE REQUIRED AS A CONDITION OF PERMIT APPROVAL.
9. DESIRABLE SIDESLOPES FOR DRIVEWAYS IS 6:1.

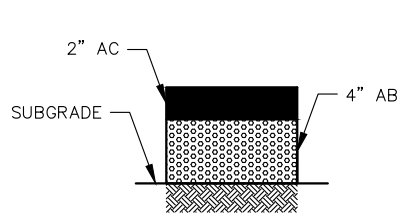
RESIDENTIAL		
POSTED SPEED (MPH)	RADIUS (R)	WIDTH (W)*
≤ 35	4'-10'	12'-30'
> 35	25'	12'-30'

\* THE PREFERRED DRIVEWAY WIDTH (W) IS 16'.

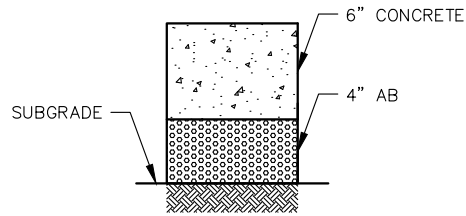


**NOTES:**

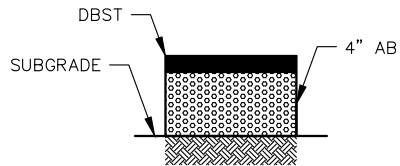
1. DRIVEWAY DETAILS SHALL BE NOTED ON PLANS AS FOLLOWS:  
DRIVEWAY TYPE, LENGTH, WIDTH, AND RADII.



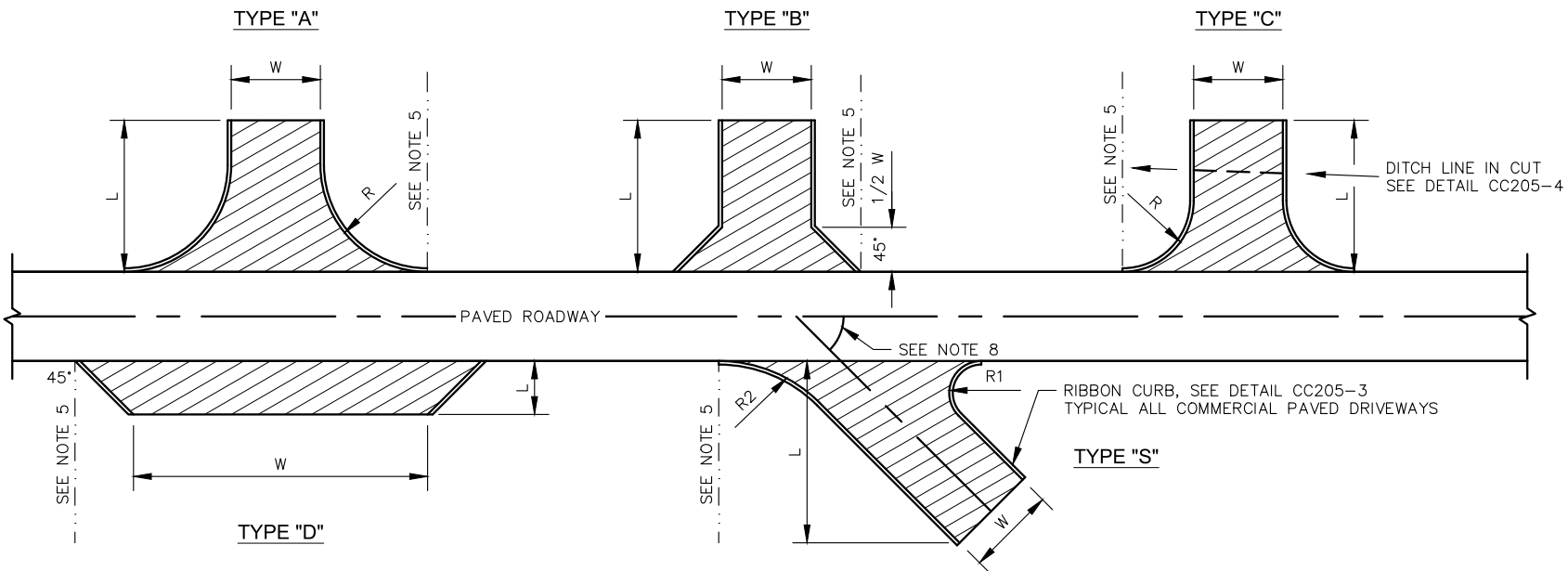
**ASPHALT STRUCTURAL SECTION**  
TOTAL THICKNESS = 6"



**CONCRETE STRUCTURAL SECTION**  
TOTAL THICKNESS = 10"



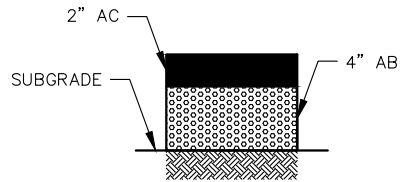
**DBST STRUCTURAL SECTION**  
TOTAL THICKNESS = 5" (APPROX.)



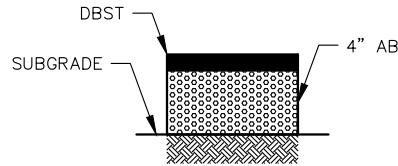
**NOTES (CONTINUED):**

2. COMMERCIAL DRIVEWAYS PROVIDE ACCESS TO AN OFFICE, RETAIL OR INSTITUTIONAL BUILDING OR TO AN APARTMENT BUILDING HAVING MORE THAN FIVE DWELLING UNITS.
3. DRIVEWAYS FOR HIGH VOLUME TRAFFIC GENERATORS SHALL BE APPROVED INDIVIDUALLY BY THE COUNTY ENGINEER OR THEIR REPRESENTATIVE.
4. DRIVEWAYS TO BE PERPENDICULAR TO THE ROADWAY UNLESS OTHERWISE NOTED ON PLANS.
5. DRIVEWAY RADII OR CHAMFERS MUST REMAIN WITHIN THE PROJECTION OF THE SUBJECT PARCEL'S PROPERTY LINES AND SHALL NOT ENCROACH UPON ANY PART OF ADJACENT PROPERTIES' ROADWAY FRONTAGE.
6. FOR COMMERCIAL PAVED DRIVEWAYS THE SURFACE COURSE MUST MATCH, OR BE MORE DURABLE THAN, THE CONNECTING PAVED ROADWAY.
7. COMMERCIAL PAVED DRIVEWAYS SHALL HAVE A MINIMUM WIDTH OF 16', 24' MINIMUM FOR 2-WAY DRIVEWAYS, AND A MAXIMUM WIDTH OF 40'. THE MINIMUM RADIUS TO BE USED IS 35' AND MAXIMUM 50'.
8. TYPE "S" DRIVEWAY SHALL BE AS CLOSE TO 90° AS POSSIBLE AND SHALL BE NO LESS THAN 60° WITHOUT APPROVAL BY THE COUNTY ENGINEER OR THEIR DESIGNATED REPRESENTATIVE.
9. DRAINAGE STRUCTURES SHALL BE PROVIDED UNDER DRIVEWAYS, WHERE NECESSARY.
10. CONSTRUCTION OF CURB, GUTTER, SIDEWALK OR PATHWAY MAY BE REQUIRED AS A CONDITION OF PERMIT APPROVAL. RIBBON CURB IS TYPICALLY DESIRED FOR COMMERCIAL DRIVEWAYS TAKING ACCESS FROM MAJOR OR MINOR COLLECTOR ROADWAYS. SEE RIBBON CURB DETAIL CC205-3.
11. DESIRABLE SIDESLOPES FOR DRIVEWAYS IS 6:1.

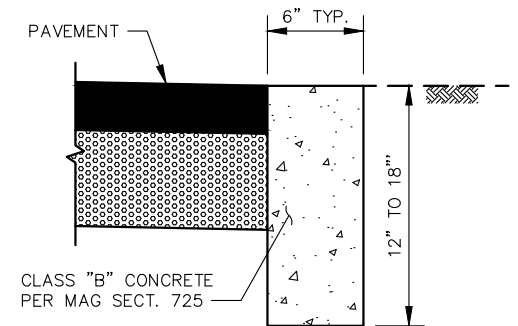
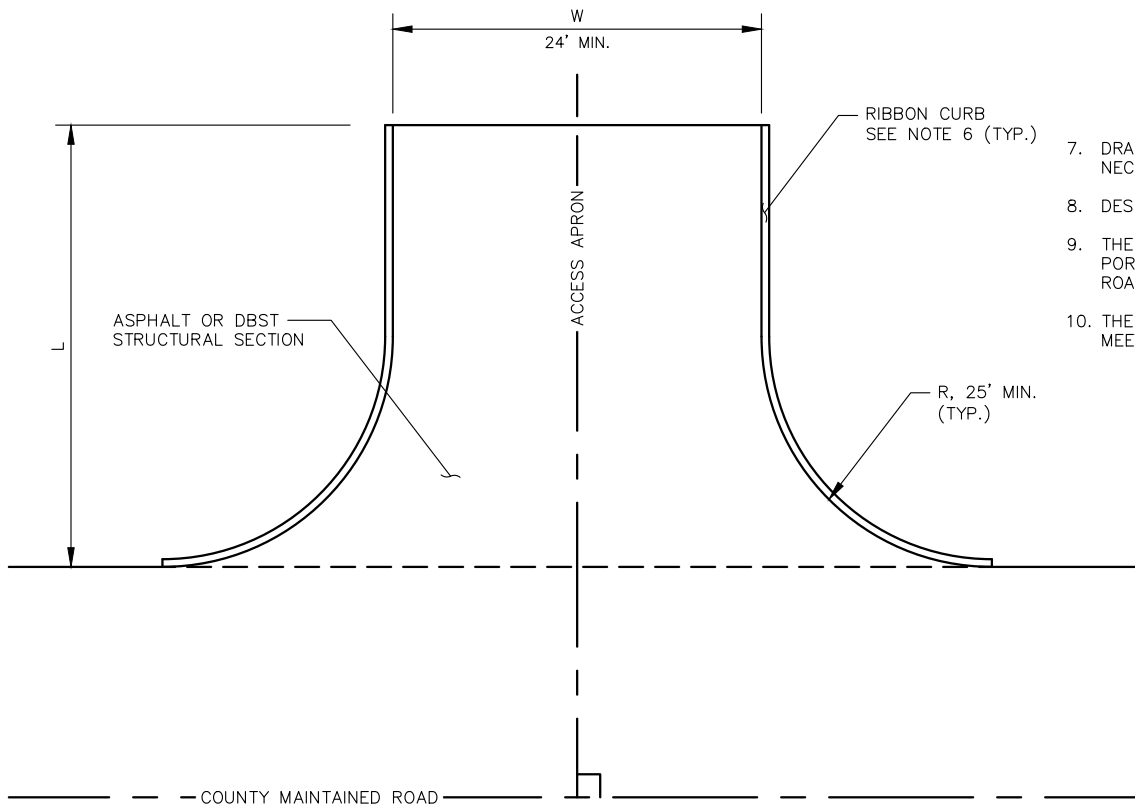




**ASPHALT STRUCTURAL SECTION**  
TOTAL THICKNESS = 6"



**DBST STRUCTURAL SECTION**  
TOTAL THICKNESS = 5" (APPROX.)



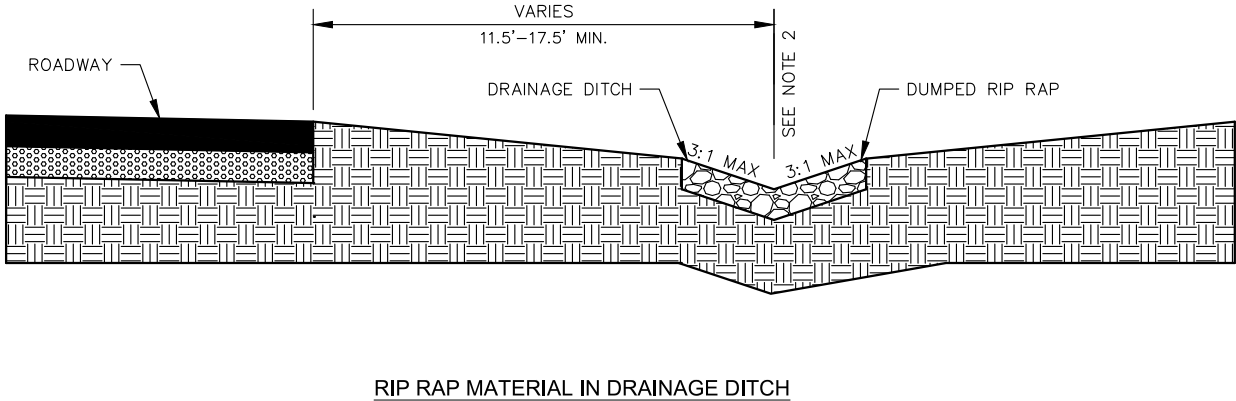
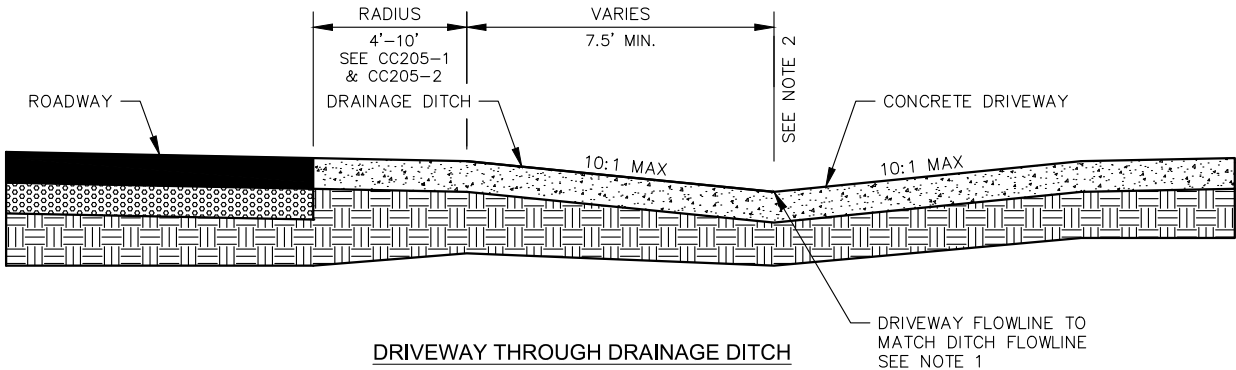
**RIBBON CURB**  
AS SHOWN ON PLANS

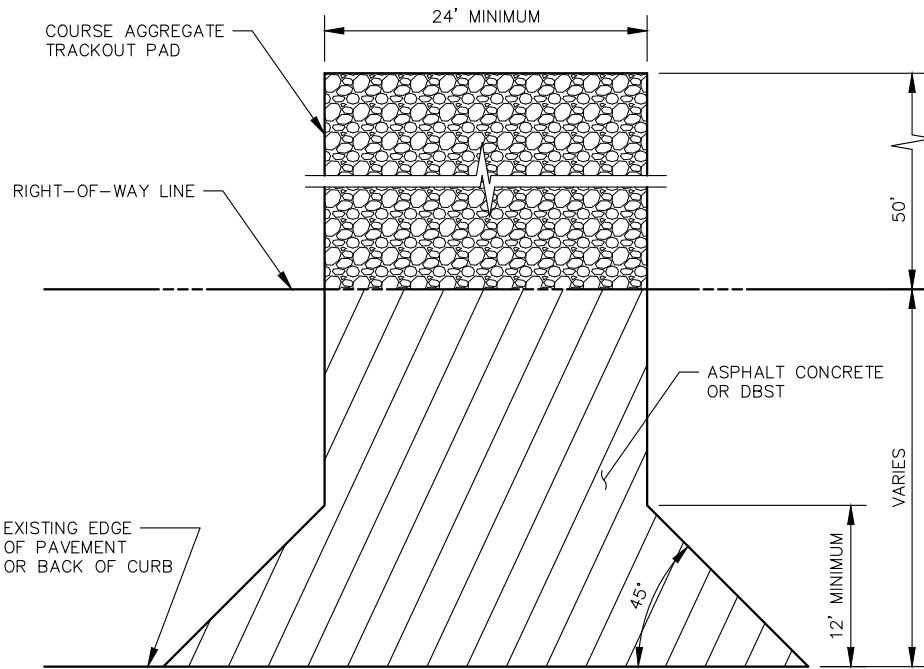
**NOTES:**

1. ACCESS APRON DETAILS SHALL BE NOTED ON THE PLANS AS FOLLOWS:  
DRIVEWAY TYPE, LENGTH, WIDTH AND RADII.
2. PRIVATE, LOCAL ROADWAYS CONNECT TWO OR MORE PARCELS TO THE ROADWAY NETWORK.
3. PRIVATE, LOCAL ROADS SHOULD BE ALIGNED WITH ROADWAYS OR DRIVEWAYS TAKING ACCESS FROM THE OTHER SIDE OF THE MAINTAINED ROADWAY, WHEN POSSIBLE.
4. PRIVATE, LOCAL ROADS SHOULD HAVE A PERPENDICULAR CONNECTION, UNLESS OTHERWISE APPROVED BY THE COUNTY ENGINEER.
5. THE PRIVATE ROADWAY ACCESS APRON MUST MATCH, OR BE MORE DURABLE THAN, THE SURFACE OF THE MAINTAINED ROADWAY.
6. RIBBON CURB, PER DETAIL BELOW, SHALL BE PROVIDED FOR CONNECTIONS TO PAVED COUNTY-MAINTAINED ROADWAYS.
  - A. VERTICAL SURFACES DOWN FROM 2" BELOW UNDISTURBED SOIL MAY BE PLACED AGAINST NEAT CUT IF APPROVED BY THE ENGINEER AND CONCRETE WILL NOT EXTEND MORE THAN 1" BEYOND THEORETICAL FACE.
  - B. ALL EXPOSED SURFACES TO BE STRIPPED GREEN AND TROWEL FINISHED.
  - C. CONCRETE CURBS CONFORM TO MAG SECT. 340
  - D. MAXIMUM SPACING OF CONTRACTION JOINTS IS 10'
  - E. WHEN PAVEMENT AND BASE COURSE EQUALS OR EXCEEDS 10" IN DEPTH, THE ENTIRE ROADWAY SIDE OF THE CURB SHALL BE FORMED. THE TOTAL RIBBON CURB HEIGHT REMAINS 12 TO 18" UNLESS NOTED OTHERWISE.
7. DRAINAGE STRUCTURES, OR AN AT GRADE WATER CROSSING, SHALL BE PROVIDED, WHERE NECESSARY, AND WHEN REQUIRED BY THE COUNTY ENGINEER.
8. DESIRED SIDESLOPES FOR ROADWAY ACCESS APRON IS 6:1.
9. THERE MAY BE A REQUIREMENT TO DEDICATE PUBLIC EASEMENTS OR RIGHT-OF-WAY FOR THOSE PORTIONS OF THE NEW ROADWAY ACCESS APRON CONNECTING TO A COUNTY-MAINTAINED ROADWAY.
10. THERE MAY BE A REQUIREMENT FOR REGULATORY SIGNS OR STREET NAMES SIGNS: THESE MUST MEET THE REQUIREMENTS OF CC134-1 AND 2.

**NOTES:**

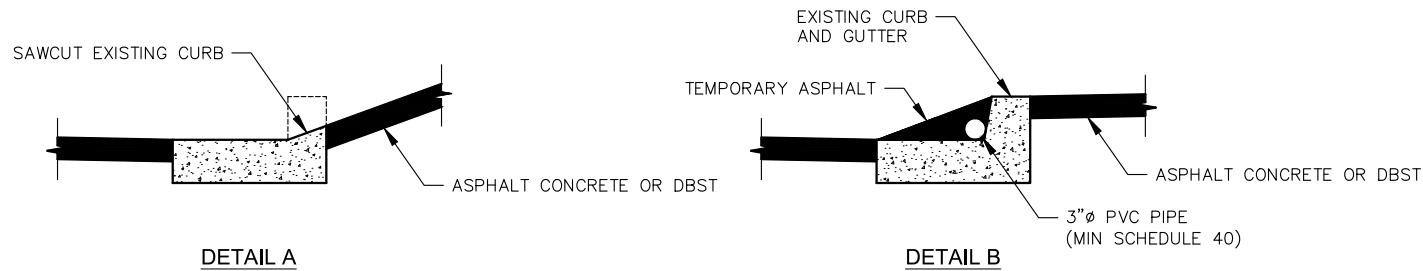
1. TOP OF DRIVEWAY PAVED OR CONCRETE SLAB AND ANY LANDSCAPE MATERIAL SHOULD BE AT GRADE WITH THE DRAINAGE DITCH.
2. DEPTH OF ROADSIDE SWALE AND DITCH SHALL MATCH EXISTING CONDITIONS OF DRAINAGE DITCH WITHOUT ADVERSELY IMPACTING STORMWATER FLOWS.
3. TRANSITION 3:1 RIP RAP SLOPE TO 10:1 PLACED A MINIMUM OF 10' ON EACH SIDE OF THE DRIVEWAY.
4. DEPTH OF DRIVEWAY FLOWLINE IS INTENDED FOR ROADWAY DRAINAGE FOR SHORT DISTANCES. IF OFFSITE FLOWS AND FLOWS FROM PARCELS CONTRIBUTE TO THIS DITCH, THE DESIGN ENGINEER SHALL VERIFY DEPTH NEEDED TO KEEP FLOWS OFF THE ROADWAY.
5. LANDSCAPING (VEGETATION, DECORATIVE ROCK ETC.) SHALL NOT INTERFERE WITH OR IMPEDE DRAINAGE FLOW OR DECREASE THE CROSS-SECTIONAL AREA OF THE CHANNEL OR BE PLACED IN SUCH A MANNER AS TO OBSTRUCT VISIBILITY WITHIN THE CLEAR ZONE, AS DEFINED BY THE SIGHT DISTANCE TRIANGLE, SEE DETAIL CC300.





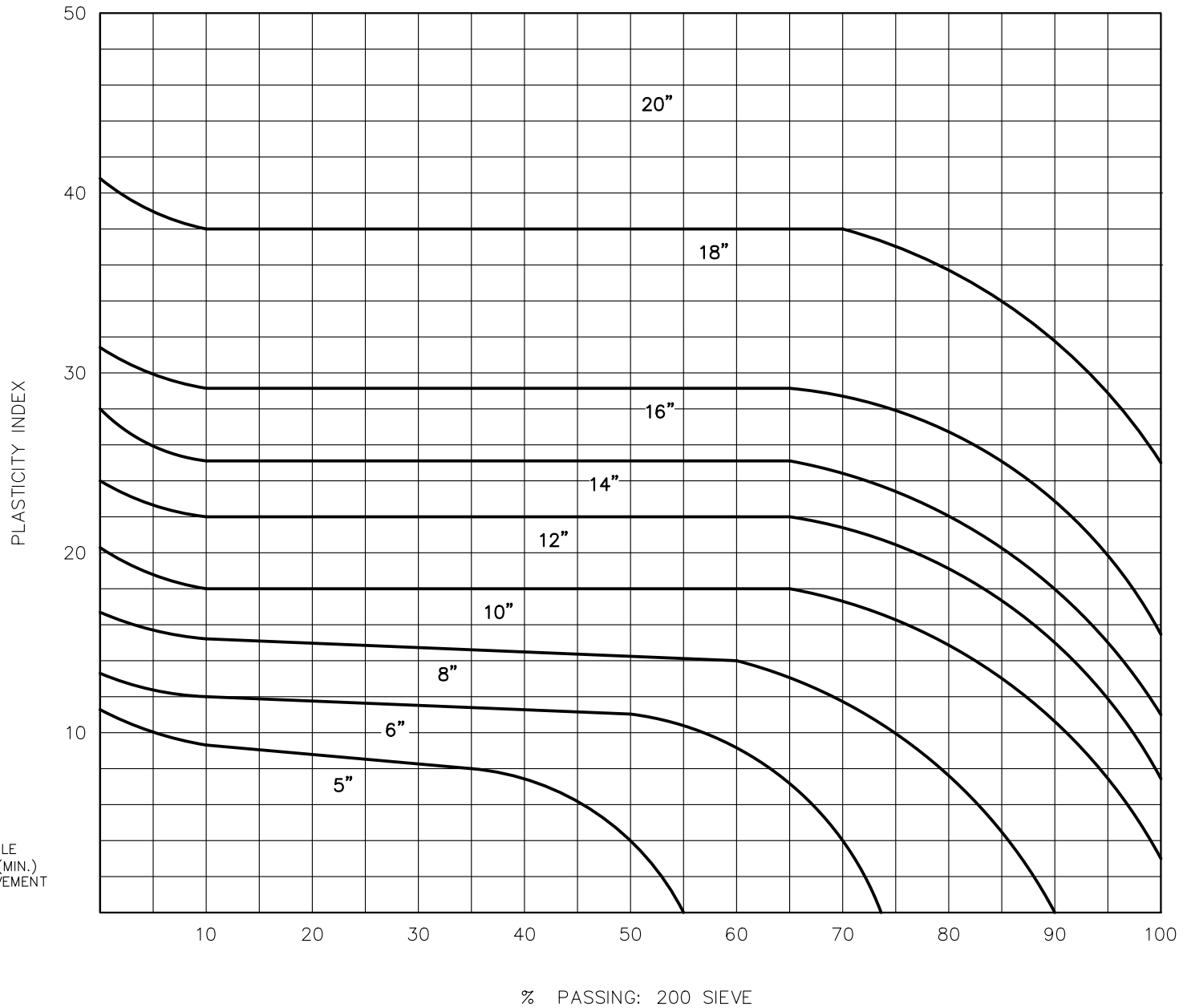
**NOTES:**

1. TEMPORARY SITE ACCESS WITHIN RIGHT-OF-WAY SHALL BE PAVED, MINIMUM STRUCTURAL SECTION SHALL MATCH OR BE MORE DURABLE THAN THE SURFACE OF THE CONNECTING ROADWAY.
2. SIDEWALKS, PATHWAYS AND TRAILS THAT CROSS THE TEMPORARY ACCESS ALIGNMENT SHALL BE MAINTAINED BY THE CONTRACTOR. RELOCATION OF THE FACILITIES REQUIRES COUNTY APPROVAL.
3. TEMPORARY SITE ACCESS SHALL NOT ALTER OR IMPEDE EXISTING DRAINAGE.
4. THE MINIMUM REQUIRED CLEAR DISTANCE FROM AN INTERSECTION IS 50 FEET.
5. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING TRACKOUT AND DUST CONTROL.
6. CONTRACTOR SHALL SWEEP ROADWAY AS NECESSARY.
7. CONTRACTOR IS RESPONSIBLE FOR RESTORING RIGHT-OF-WAY TO ORIGINAL CONDITION. THIS INCLUDES ROADWAY, SIDEWALK, PATHWAYS, TRAILS, AND LANDSCAPING.
8. CONTRACTOR IS RESPONSIBLE FOR OBTAINING AN APPROVED TRAFFIC CONTROL PLAN.
9. TEMPORARY SITE ACCESS SHALL BE REMOVED WHEN NO LONGER REQUIRED.



ALTERNATIVE SECTIONS FOR LOCATIONS WITH CURB & GUTTER





MINIMUM DEPTH OF FLEXIBLE  
BASE COURSE UNDER 3" (MIN.)  
ASPHALTIC CONCRETE PAVEMENT

**COCHISE COUNTY**

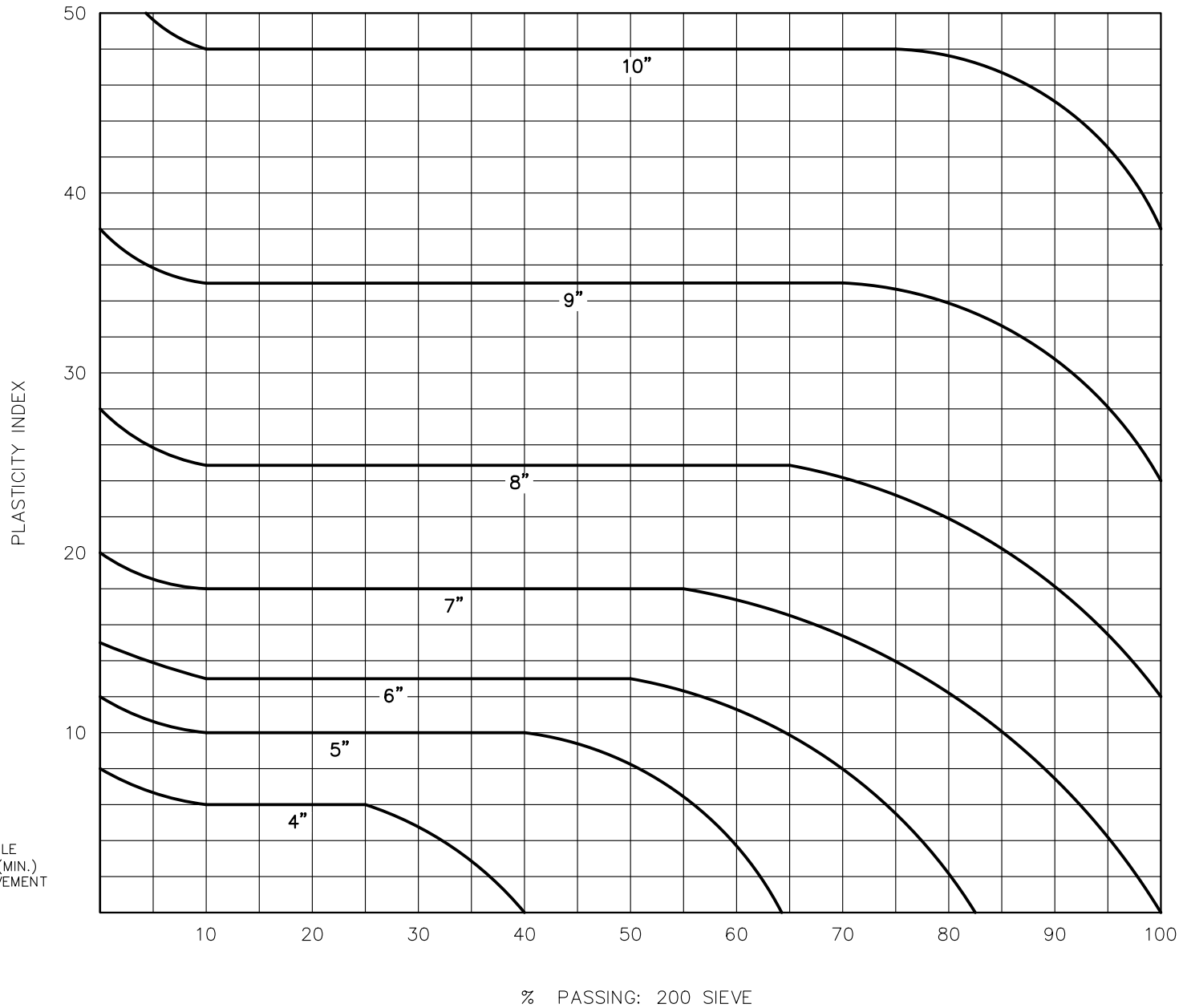


HIGHWAY & FLOODPLAIN  
STANDARD DETAIL

DEPTH OF BASE COURSE  
ARTERIAL & COLLECTOR ROADS

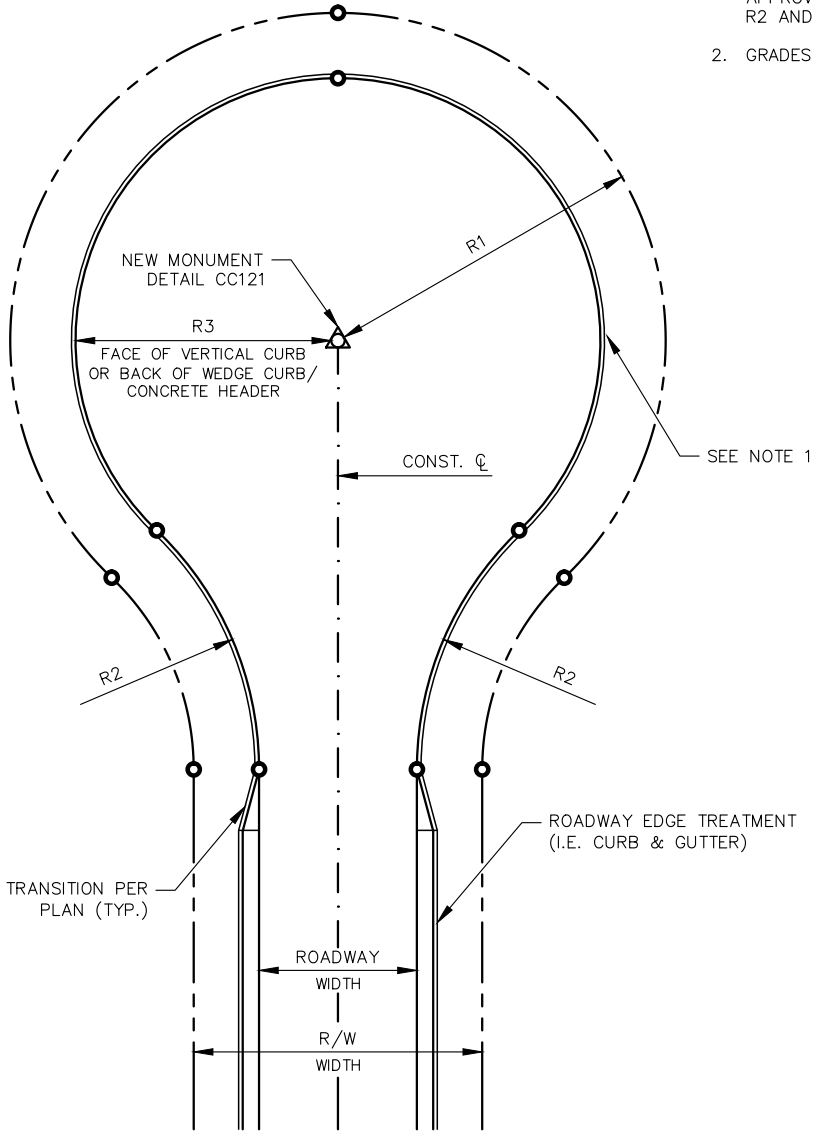
DRAFT  
08-22-2017

DETAIL NO.  
CC208-1



**NOTES:**

1. CUL-DE-SAC EDGE TREATMENT SHALL BE CONSTRUCTED PER APPROVED DESIGN PLANS OR AS CONCRETE RIBBON CURB ON R2 AND R3, SEE DETAIL CC205-3.
2. GRADES REQUIRED AT ●

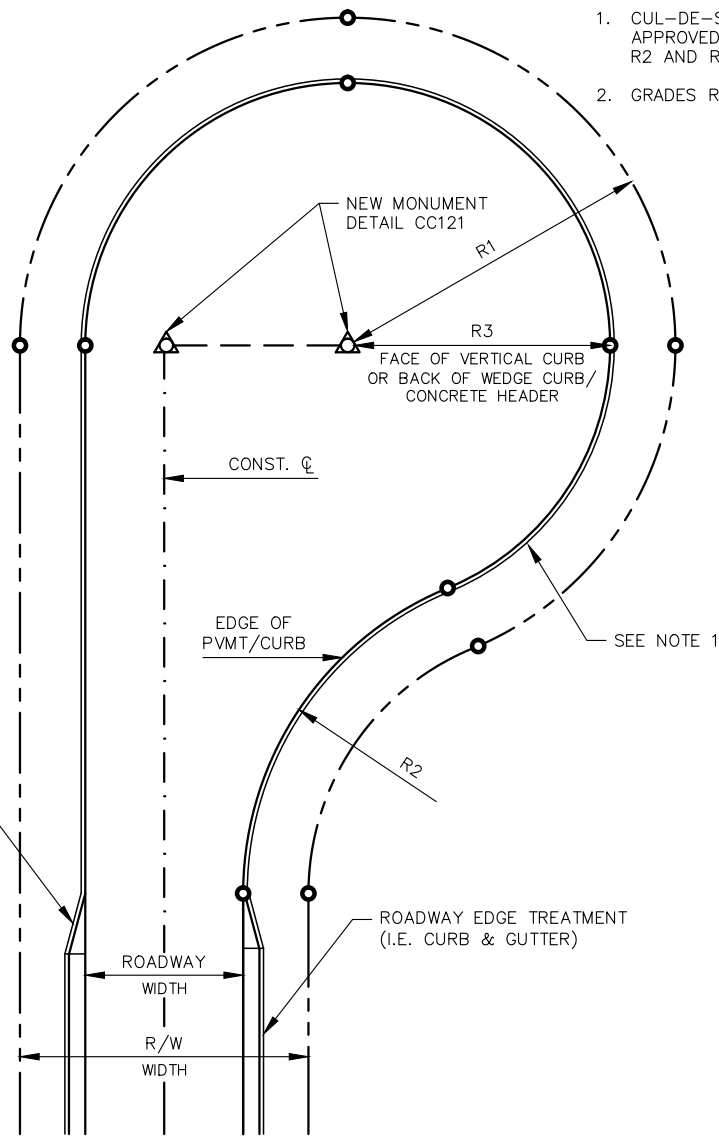


MINIMUM RADII IN FEET		
	RESIDENTIAL	INDUSTRIAL/ COMMERCIAL
R1	50'	60'
R2	50'	60'
R3	42'	52'



**NOTES:**

1. CUL-DE-SAC EDGE TREATMENT SHALL BE CONSTRUCTED PER APPROVED DESIGN PLANS OR AS CONCRETE RIBBON CURB ON R2 AND R3, SEE DETAIL CC205-3.
2. GRADES REQUIRED AT ●

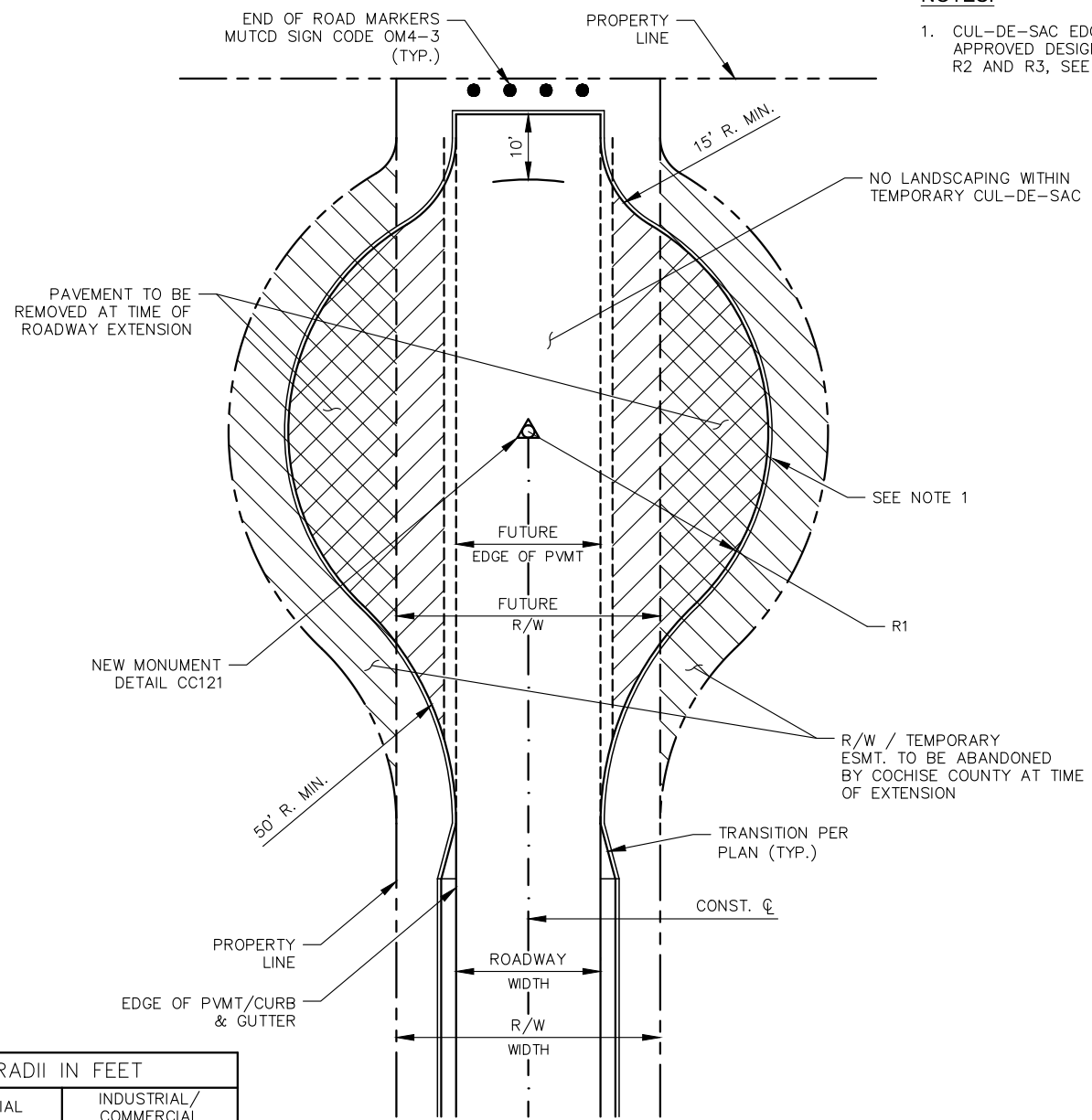


TRANSITION PER PLAN (TYP.)

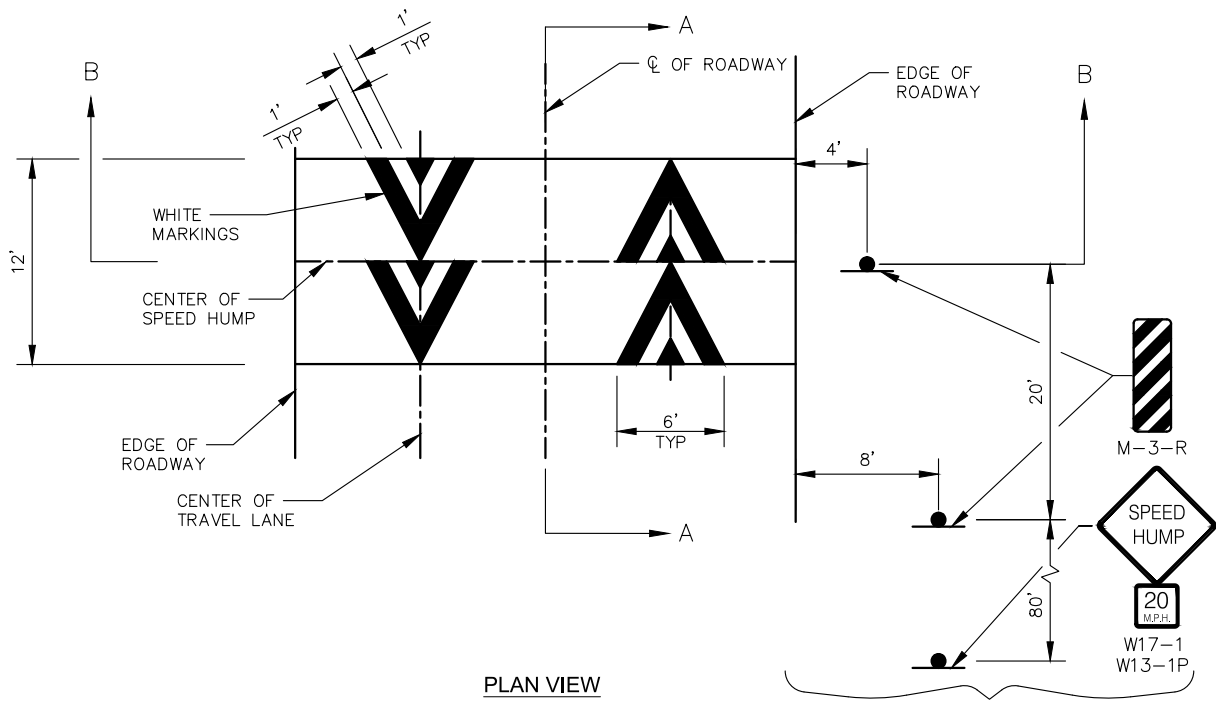
MINIMUM RADII IN FEET		
	RESIDENTIAL	INDUSTRIAL/ COMMERCIAL
R1	50'	60'
R2	50'	60'
R3	42'	52'

**NOTES:**

1. CUL-DE-SAC EDGE TREATMENT SHALL BE CONSTRUCTED PER APPROVED DESIGN PLANS OR AS CONCRETE RIBBON CURB ON R2 AND R3, SEE DETAIL CC205-3.



MINIMUM RADII IN FEET		
	RESIDENTIAL	INDUSTRIAL/ COMMERCIAL
R1	42'	52'

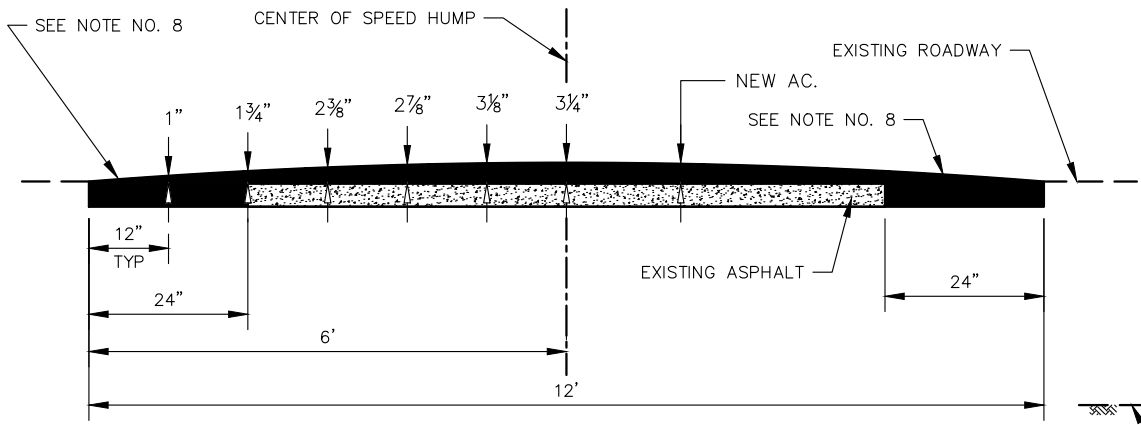


PLAN VIEW  
NOT TO SCALE

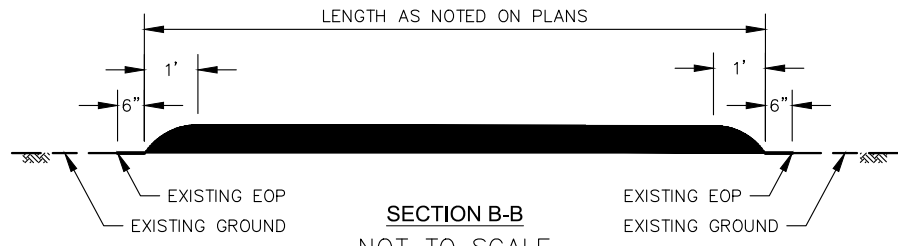
SIGNING TYPICAL AT EACH  
APPROACH OR AS DIRECTED

**NOTES:**

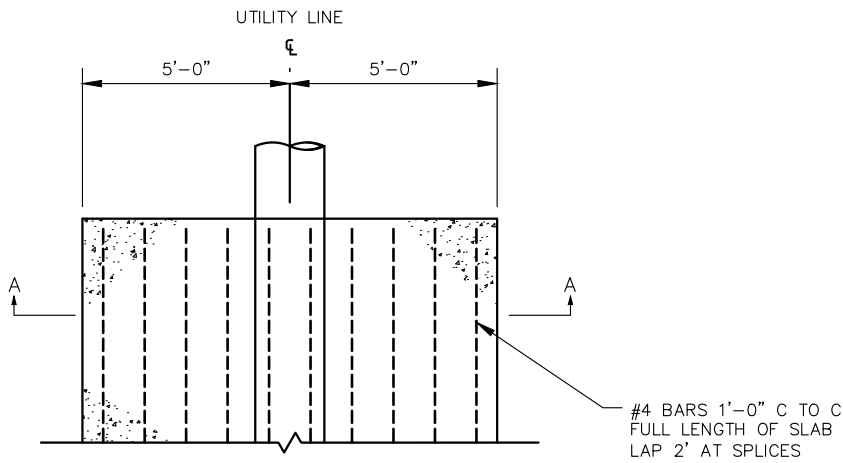
1. SECTION A-A FINISHED SURFACE DIMENSIONS ARE DISTANCES FROM THE SURFACE OF THE EXISTING ROADWAY. THE CONSTRUCTION TOLERANCE FOR THESE CROSS SECTION DIMENSIONS IS ± 0.25 INCHES.
2. SPEED HUMP THAT DO NOT COMPLY WITH CONSTRUCTION TOLERANCES SHALL BE REMOVED AND REPLACED AT CONTRACTOR'S EXPENSE.
3. SPEED HUMP SHALL NOT BE INSTALLED IN A LOCATION SUCH THAT DRAINAGE IS COMPROMISED.
4. SPEED HUMP SHALL NOT BE PLACED OVER MANHOLES, VALVE BOXES, SURVEY MONUMENTS, ETC. OR AT DRIVEWAYS.
5. SPEED HUMP SHALL ONLY BE PLACED AT LOCATIONS APPROVED BY COCHISE COUNTY.
6. SPEED HUMP SHALL BE CONSTRUCTED WITH ASPHALT MIX APPROVED BY THE AGENCY. COMPACTION SHALL BE PER SECTION 321. TACK COAT PER SECTION 713 SHALL BE APPLIED PRIOR TO PAVING.
7. STRIPING WILL BE (2) COATS OF WHITE PAINT WITH GLASS BEADS.
8. TRANSVERSE EDGE JOINTS (ACROSS ROADWAY)
  - A. FOR EXISTING ASPHALT PAVEMENTS EQUAL TO OR GREATER THAN 2 INCHES IN THICKNESS: SAWCUT AND REMOVE A 24 INCH WIDTH AT THE MATCHING SPEED HUMP EDGE. REPLACE THE FULL DEPTH OF REMOVED ASPHALT WITH SPEED HUMP ASPHALT AS A SINGLE OPERATION DURING CONSTRUCTION OF THE SPEED HUMP.
  - B. FOR EXISTING ASPHALT PAVEMENTS LESS THAN 2 INCHES IN THICKNESS: REMOVE PAVEMENT AND SUBGRADE TO A MINIMUM DEPTH OF 2 INCHES. INSTALL A NEW ASPHALT BASE PAD FOR THE SPEED HUMP.
9. IF A SERIES OF SPEED HUMPS EXIST IN CLOSE PROXIMITY, AN ADVISORY SPEED PLAQUE AND SPEED HUMP SIGN MAY BE ELIMINATED ON ALL BUT THE FIRST SPEED HUMP IN THE SERIES.
10. SPEED LIMIT AT SPEED HUMP(S) WILL BE SIGNED FOR 15 MPH IN SCHOOL ZONES AND 20 MPH ON RESIDENTIAL STREETS.
11. THE STREET IS NOT A TRUCK ROUTE, OR PRILIMINARY/ROUTINE ACCESS FOR EMERGENCY VEHICLES.



SECTION A-A  
NOT TO SCALE



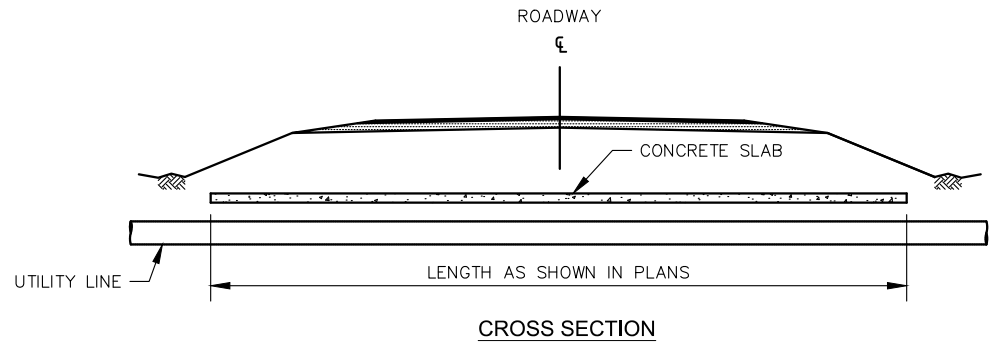
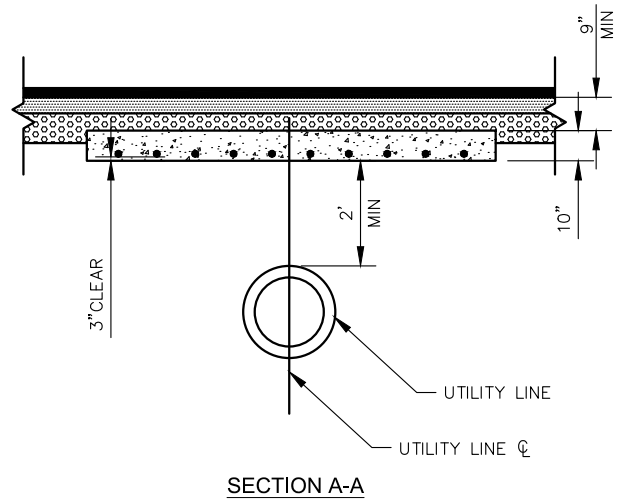
SECTION B-B  
NOT TO SCALE




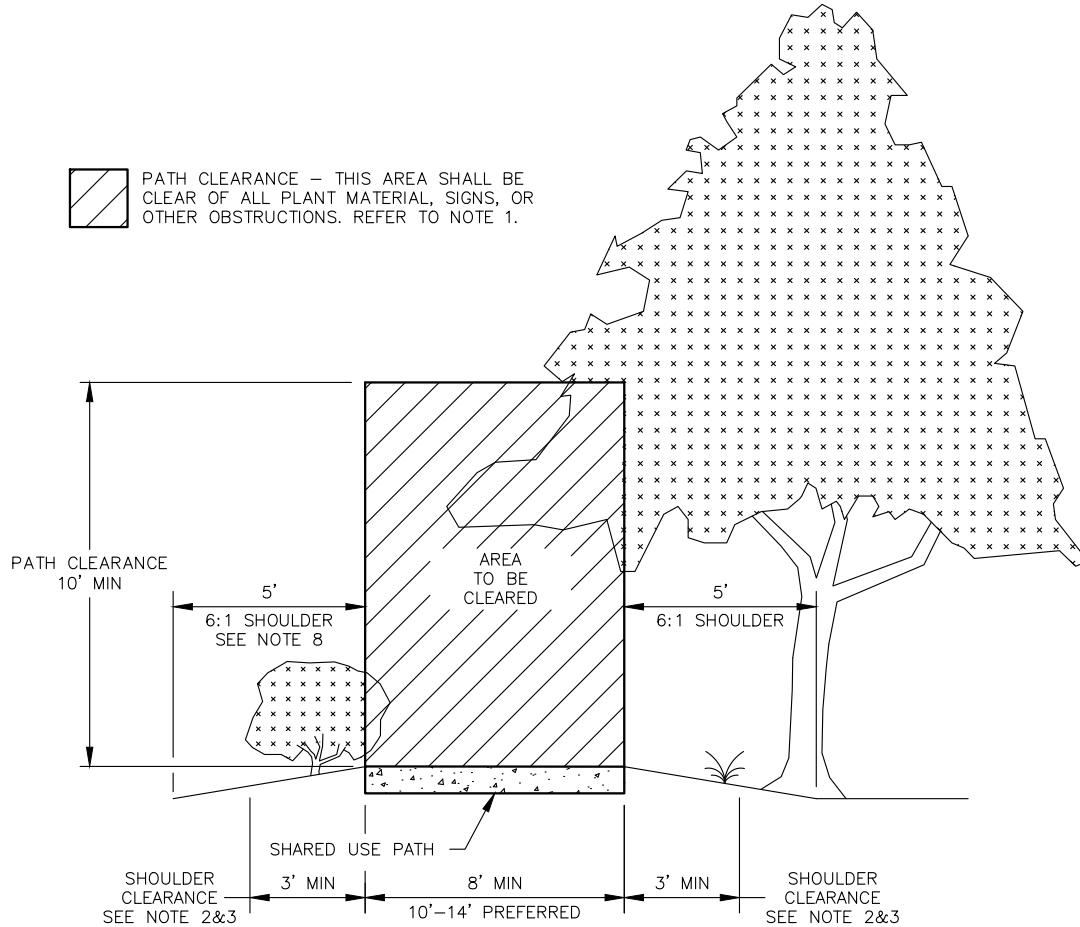
**NOTES:**

1. ALL CONCRETE SHALL BE CLASS 'B' AS PER MAG SECT. 505 AND 725.

FOR SINGLE INSTALLATION	
QUANTITIES PER FT OF SLAB LENGTH	
CONCRETE	REINFORCING STEEL
0.31 CY	6.68 LBS

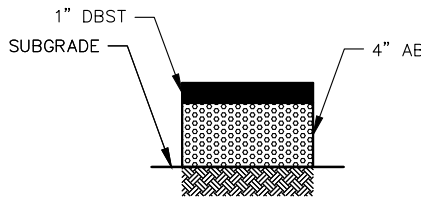


 PATH CLEARANCE – THIS AREA SHALL BE CLEAR OF ALL PLANT MATERIAL, SIGNS, OR OTHER OBSTRUCTIONS. REFER TO NOTE 1.

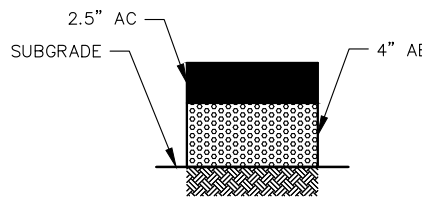


**NOTES:**

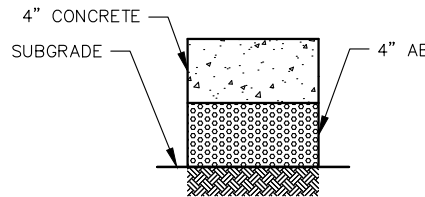
1. TREE/SHRUBS/PLANTS SHALL BE TRIMMED TO NEAREST INTERSECTING BRANCH.
2. NO TREES OR SHRUBS WITH A TRUNK DIAMETER 4 INCHES OR GREATER SHALL REMAIN WITHIN THE 3 FOOT MINIMUM SHOULDER CLEARANCE AREA.
3. ALL ORGANIC MATERIAL SHALL BE REMOVED WITHIN THE SHOULDER CLEARING LIMITS FOR NECESSARY GRADING TO A DEPTH OF SIX INCHES AND HAULED FROM THE SITE PRIOR TO GRADING.
4. COMPACTION OF ALL AREAS SHALL BE TO THE PERCENT SHOWN ON THE PLANS OF THE MAXIMUM DENSITY AS DETERMINED B A.S.T.M. D698. NATIVE SUBGRADE IS TO BE SCARIFIED TO A DEPTH OF SIX INCHES, BROUGHT TO THE PROPER MOISTURE CONTENT AND COMPACTED TO THE REQUIRED 95% DENSITY. THE SOURCE OF FILL MATERIAL SHALL BE APPROVED BY THE COUNTY ENGINEER PRIOR TO COMMENCEMENT OF WORK.
5. AGGREGATE BASE COURSE SHALL CONFORM TO MAG 310, AS AMENDED BY COCHISE COUNTY:  
310.1 DESCRIPTION:  
AGGREGATE BASE SHALL CONFORM TO MAG UNIFORM SPECIFICATION SECTION 702 WITH THE EXCEPTION THAT THE GRADATION OF SIEVE SIZE NO. 200 SHALL BE FROM 5% TO 15% WITH A PLASTICITY INDEX FROM 3% TO 6%.
6. DOUBLE CHIP SEAL SHALL CONFORM TO MAG SECTION 330, AS AMENDED BY COCHISE COUNTY:  
330.2.1 ASPHALT:  
THE TYPE OF BITUMINOUS MATERIAL SHALL BE CRS-2, CRS-2P, OR PASS. APPLICATION SHALL BE AT THE RATE OF 0.40 TO 0.45 GALLONS PER SQUARE YARD UNLESS OTHERWISE SPECIFIED BY THE COUNTY ENGINEER.  
330.2.2 AGGREGATE  
THE STONE CHIPS SHALL FULLY COMPLY WITH SECTION 716 EXCEPT PRE-COATING IS NOT REQUIRED. THE FIRST LAYER OF CHIPS SHALL COMPLY WITH TABLE 716-2 AND THE SECOND LAYER OF CHIPS SHALL COMPLY WITH TABLE 716-1. THE CHIPS SHALL BE CLEAN. APPLICATION SHALL BE AT THE RATE OF APPROXIMATELY 20 POUNDS PER SQUARE YARD FOR FIRST LAYER AND 26 POUNDS PER SQUARE YARD FOR THE SECOND LAYER.  
  
IF MOIST CHIPS ARE USED, THE TOTAL MOISTURE CONTENT SHALL NOT EXCEED 1.5%.
7. FOR PATHWAY SIGNAGE REFER TO THE CURRENT VERSION OF THE MANUAL FOR UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) PART 9: TRAFFIC CONTROL FOR BICYCLE FACILITIES.
8. THE MINIMUM RECOMMENDED DISTANCE BETWEEN A PATH AND THE ROADWAY FACE OF CURB OR EDGE OF TRAVELED WAY (WHERE THERE IS NO CURB) IS 5 FEET (1.5 M). WHERE A SHOULDER IS PRESENT, THE SEPARATION DISTANCE BEGINS AT THE OUTSIDE EDGE OF THE SHOULDER.
9. PATHWAY DESIGN SHALL COMPLY WITH ADA ACCESSIBILITY REQUIREMENTS OF A MAXIMUM 2% CROSS-SLOPE AND CURB RAMPS PER ADA ACCESSIBILITY GUIDELINES. REFER TO CURRENT ADA STANDARDS AT WWW.ADA.GOV AND WWW.ACCESS-BOARD.GOV.



**PATH STRUCTURAL SECTION #1**  
TOTAL THICKNESS = 5"

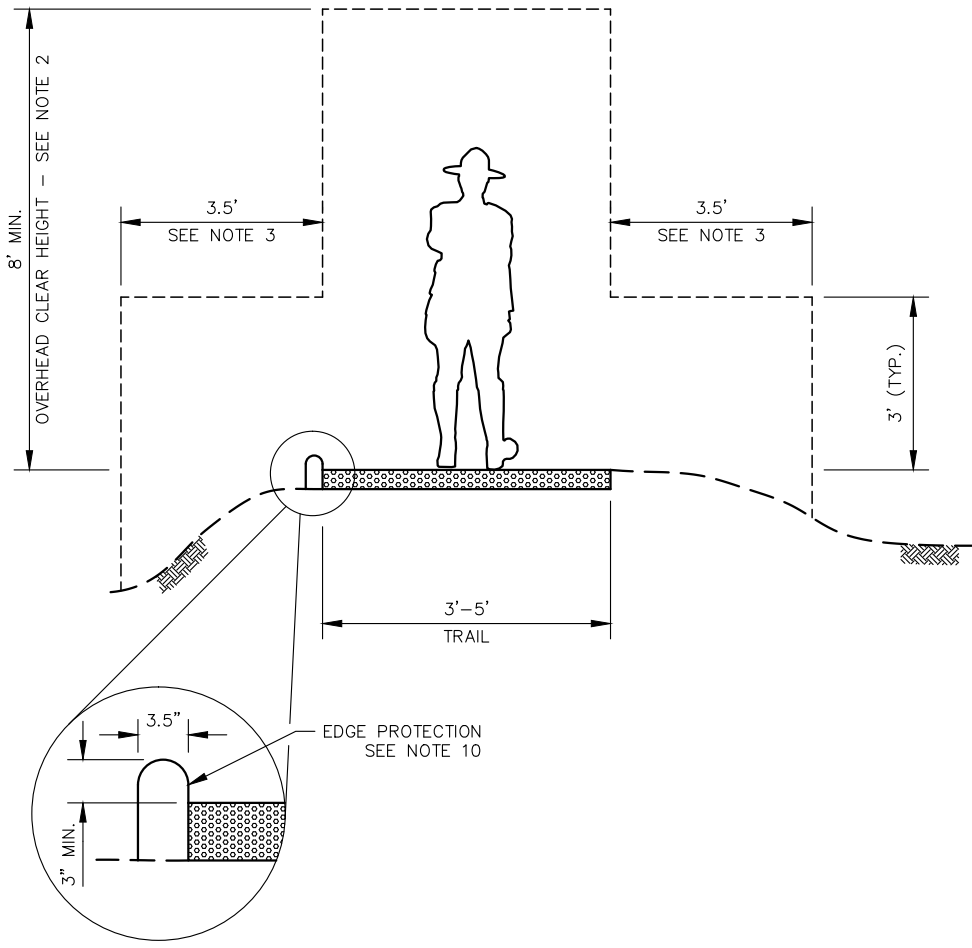


**PATH STRUCTURAL SECTION #2**  
TOTAL THICKNESS = 6.5"



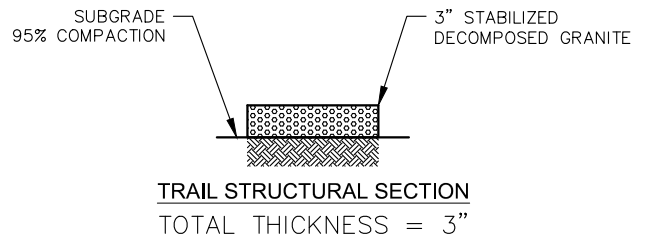
**PATH STRUCTURAL SECTION #3**  
TOTAL THICKNESS = 8"

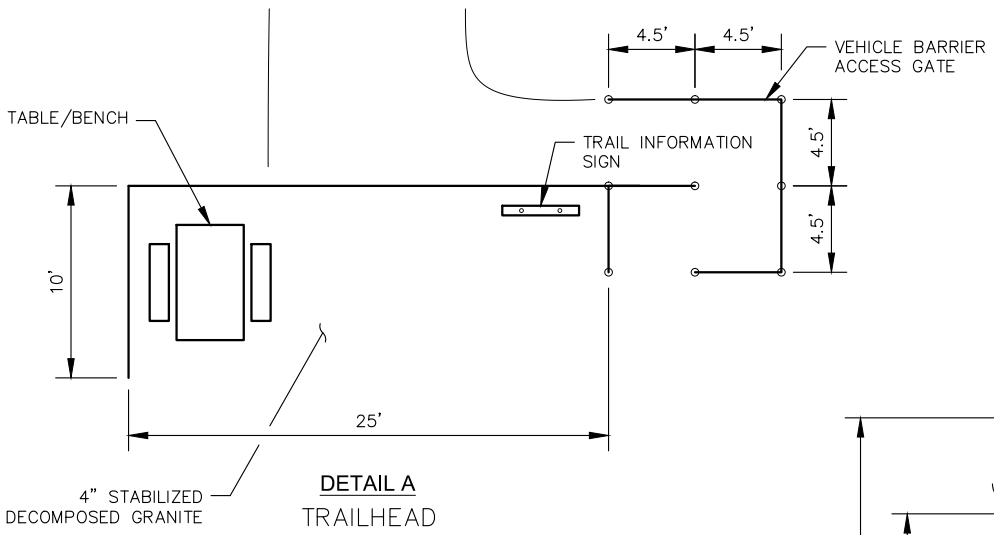




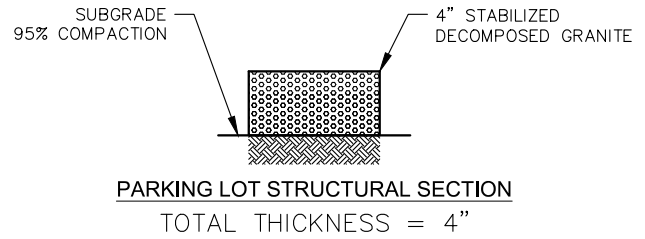
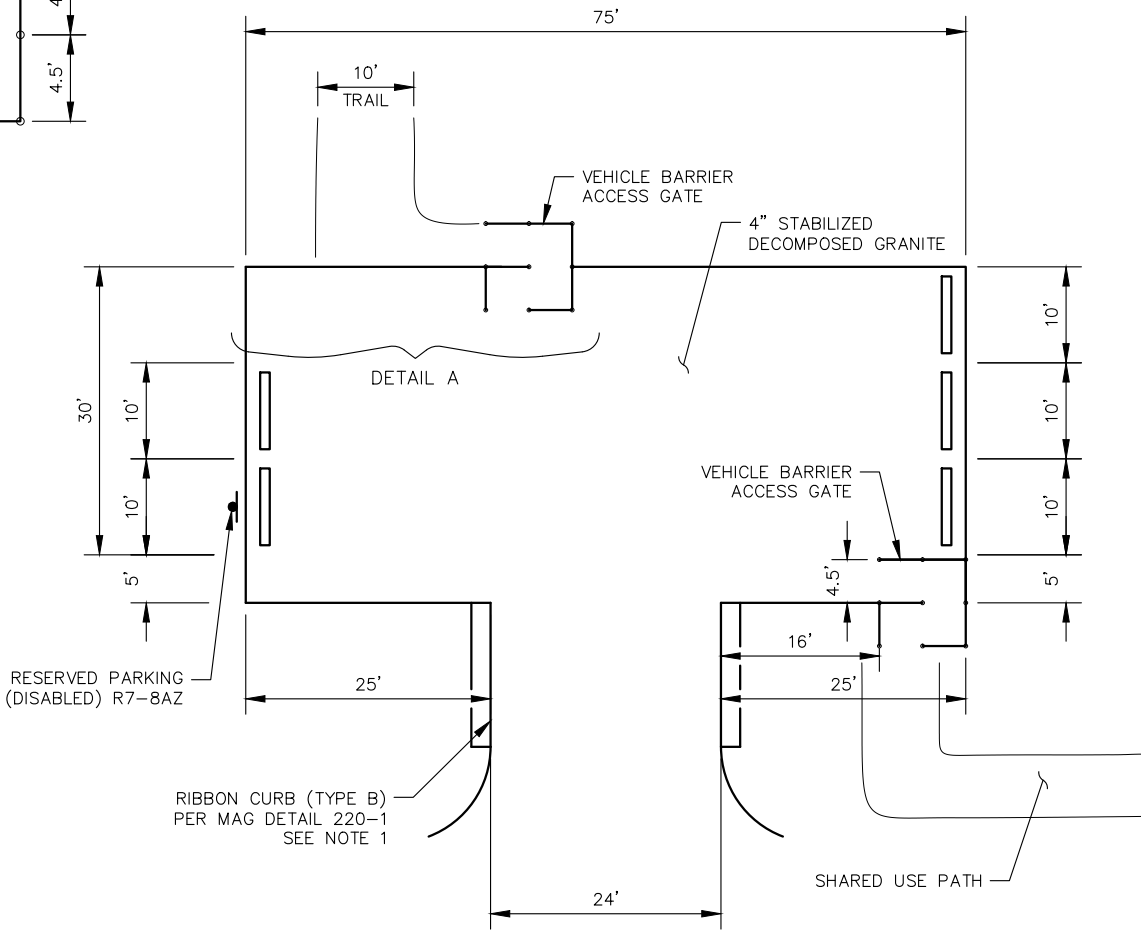
**NOTES:**

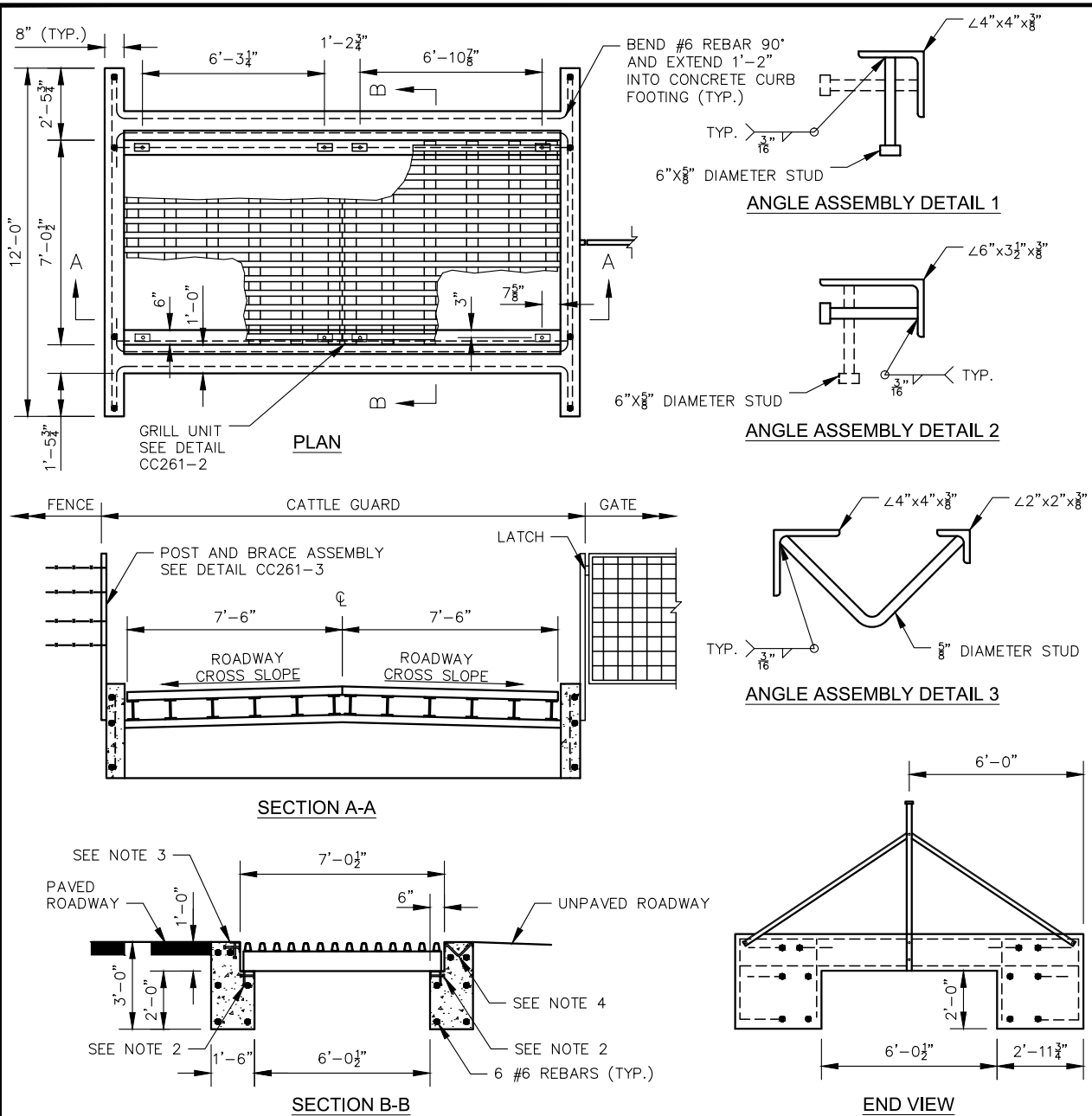
1. PATHWAY WIDTH IS 3' MINIMUM, 5' PREFERRED, AND 8' MAXIMUM.
2. AN OVERHEAD CLEAR HEIGHT SHOULD BE PROVIDED OF A MINIMUM OF 8', 10' PREFERRED. FOR RECREATIONAL TRAILS WITH EQUESTRIAN ACTIVITY OVERHEAD CLEAR HEIGHT SHOULD BE INCREASED TO 10' MINIMUM, 12' PREFERRED.
3. NO VEGETATION OR OBSTACLES WITHIN A 3' HIGH BY 3.5' WIDE SPACE EACH SIDE. OFFSET SHOULD BE 3' MINIMUM TO SIGNS, BENCHES OR ANY OTHER VERTICAL ELEMENT.
4. MINIMUM 10' CLEARANCE BETWEEN TRAIL EDGE AND NEWLY PLANTED THORNY PLANTS. ALIGN TRAIL TO AVOID EXISTING THORNY PLANTS WHEREVER POSSIBLE TO MINIMIZE THEIR REMOVAL.
5. CARE SHOULD BE GIVEN DURING TRAIL CONSTRUCTION TO PRESERVE EXISTING VEGETATION IN PLACE.
6. PASSING SPACES OF AN ADDITIONAL 5' WIDE BY 5' LONG IN NATURAL OPENINGS IN THE LANDSCAPE SHOULD BE PROVIDED AT A MINIMUM EVERY 1,000 FEET, AS ALLOWED BY TERRAIN.
7. STRIVE TO MAINTAIN 6' BETWEEN TRAIL EDGE AND TREE TRUNK. CUT TREES AND SHRUBS BACK TO THE TRUNK. TO CREATE MORE VISUAL INTEREST, AVOID CUTTING ALL VEGETATION BACK THE SAME OFFSET DISTANCE ALONG THE CORRIDOR.
8. RECREATIONAL TRAILS DESIGNED PRIMARILY FOR PEDESTRIAN ACTIVITY SHOULD MEET THE SLOPE AND SLIP RESISTANT CRITERIA OF THE ACCESSIBILITY GUIDELINES FOR OUTDOOR DEVELOPED AREAS (U.S. ACCESS BOARD).
9. FOR RECREATIONAL TRAIL SIGNAGE REFER TO THE CURRENT VERSION OF THE MANUAL FOR UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND FHWA RECREATION TRAIL MANUAL, CHAPTER 15.
10. EDGE PROTECTION SHOULD BE INSTALLED AT LOCATIONS WITH DROP OFFS OR HAZARDOUS SITUATIONS, MINIMUM 3" HIGH. IF BICYCLISTS WILL BE USERS OF THE TRAIL, THE EDGE PROTECTION SHOULD BE A MINIMUM OF 42" HIGH. ROCKS, SHRUBS AND/OR MAN MADE BARRIERS CAN BE USED AS EDGE PROTECTION.





**NOTE:**  
 1. RIBBON CURB IS REQUIRED IF CONNECTION ROADWAY IS ASPHALT OR DBST.

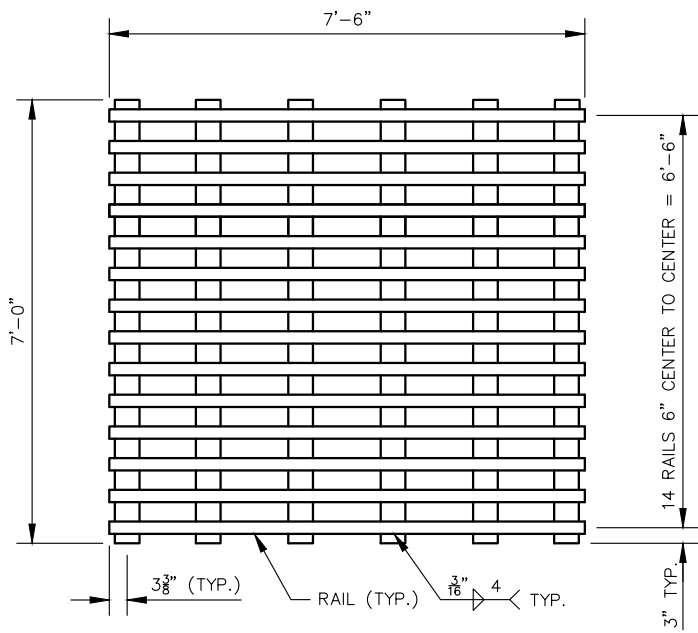




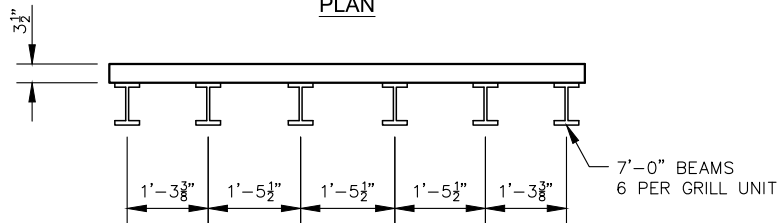
**NOTES:**

1. CATTLE GUARD SHALL INCLUDE TWO (2) CLAMPS PER DETAIL CC261-4 AT EACH GAP BETWEEN TWO (2) GRILL UNITS, ONE AT EACH END. CLAMPS SHALL BE ADJUSTED TO PROVIDE A 1/4-INCH, PLUS OR MINUS 1/16-INCH GAP BETWEEN ADJACENT GRILL UNITS.
2. GRILL UNITS SHALL BE SET ON AN ANGLE IRON ASSEMBLY CONSISTING OF ONE PIECE OF 6"x3 1/2"x3/8" ANGLE IRON AND STUDS WITH A HEAD. THE STUDS SHALL BE PLACED ON 1'-0" ALTERNATE CENTERS. SEE ANGLE ASSEMBLY DETAIL 2.
3. CATTLE GUARD SHALL BE SLOPED TO CONFORM TO THE ROADWAY GRADE AND CROSS-SECTION, EXCEPT THAT WHERE AN ODD NUMBER OF GRILL UNITS IS SPECIFIED IN A CROWNED ROADWAY, THE CENTER GRILL UNIT SHALL HAVE A LEVEL CROSS SLOPE.
4. WHERE THE ADJACENT ROADWAY IS PAVED, AN ANGLE IRON ASSEMBLY SHALL CONSIST OF ONE PIECE OF 4"x4"x3/8" ANGLE IRON AND STUDS WITH A HEAD. THE STUDS SHALL BE PLACED ON 1'-0" ALTERNATE CENTERS. SEE ANGLE ASSEMBLY DETAIL 1.
5. WHERE THE ADJACENT ROADWAY IS UNPAVED, AN ANGLE IRON ASSEMBLY SHALL CONSIST OF ONE 4"x4"x3/8" ANGLE IRON, ONE 2"x2"x3/8" ANGLE IRON, AND CONNECTED WITH STUDS. THE ASSEMBLY SHALL BE CROWNED AT THE CENTERLINE AND CONSTRUCTED WITH A BEVEL CUT AND WELDED. THE STUDS SHALL BE BENT 90° AND PLACED ON 1'-0" CENTERS. SEE ANGLE ASSEMBLY DETAIL 3.
6. EACH ANGLE IRON AND ANGLE IRON ASSEMBLY SHALL BE FABRICATED TO FORM A SINGLE PIECE FOR THE FULL LENGTH OF THE CATTLE GUARD.
7. QUANTITIES SHOWN FOR CONCRETE AND REBAR ARE APPROXIMATIONS FOR INFORMATIONAL PURPOSES ONLY.
8. WHEN A GATE IS TO BE INSTALLED, IT SHALL BE CALLED OUT ON THE PLANS.
9. ALL REBAR SHALL HAVE A MINIMUM COVER OF 3", OR AS SHOWN ON THE PLANS.
10. CATTLE GUARD BEAMS SHALL BE HS-20 LOADING UNLESS OTHERWISE SHOWN ON THE PLANS.

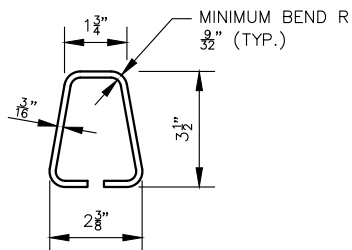
UNIT TABLE			
ROADWAY WIDTH (FT)	GRILL UNITS REQUIRED	CONCRETE (CU YD)	REBAR (LBS)
12	2	5.8	175
16	3	8.0	240
20	4	10.3	310
28	5	12.5	375
34	6	14.7	445
36	6	14.7	445
38	7	16.9	510
40	7	16.9	510



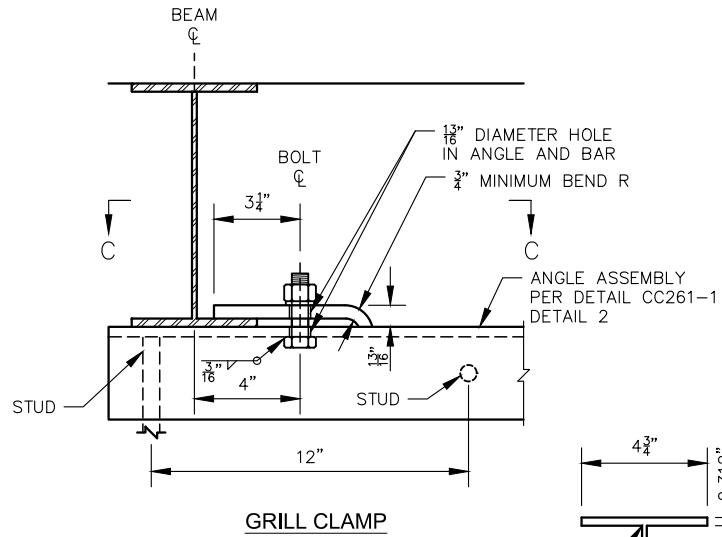
PLAN



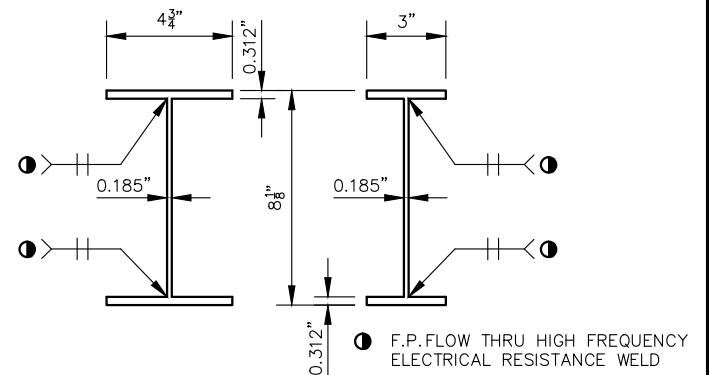
ELEVATION



RAIL GRILL UNIT

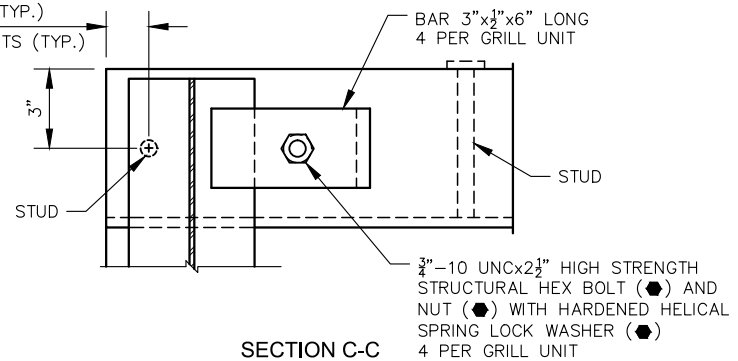


● - INDICATES AASHTO, AGC & ARTBA TASK FORCE 13 DESIGNATION



BEAMS

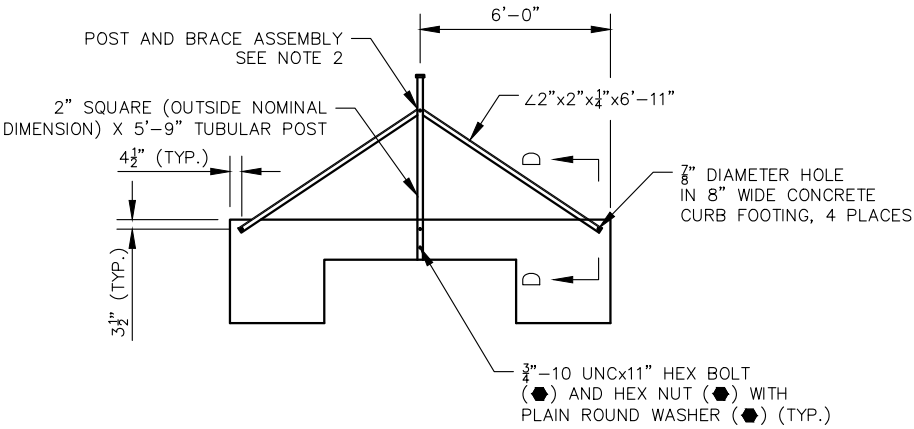
3" FOR ODD NUMBER GRILL UNITS (TYP.)  
6" FOR EVEN NUMBER OF GRILL UNITS (TYP.)



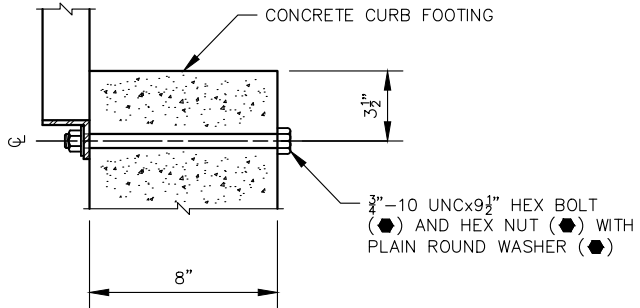
**NOTES:**

1. MATERIAL FOR SHOULDER TRANSITION SHALL BE PLACED TO THE FINISHED ROADWAY ELEVATION FOR THE ENTIRE LENGTH OF THE TRANSITION. WHEN THE ROADWAY IS PAVED, AGGREGATE SUBBASE OR AB SHALL BE USED. WHEN THE ROADWAY IS UNPAVED, A MATERIAL EQUIVALENT TO THE EXISTING ROADWAY SHALL BE USED.
2. ON STEEPER GRADES, THE POST SHALL BE INSTALLED PLUMB TO ALIGN WITH ADJACENT FENCING. THE BRACE ASSEMBLY MAY BE MODIFIED AS NECESSARY TO SUPPORT THE POST.

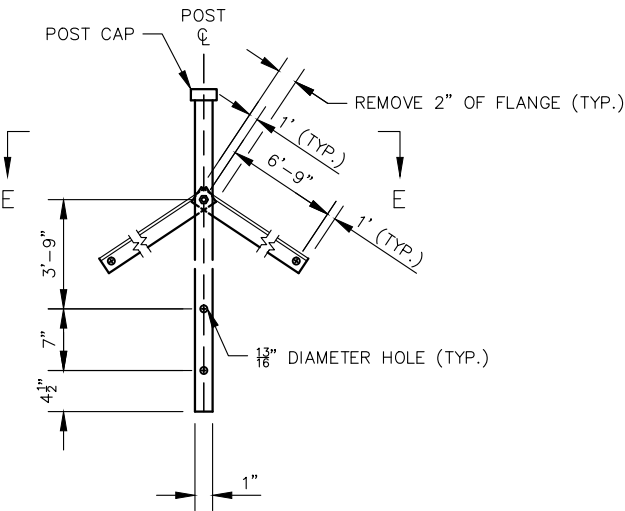
● - INDICATES AASHTO, AGC & ARTBA TASK FORCE 13 DESIGNATION



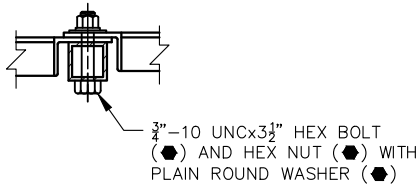
**END VIEW**



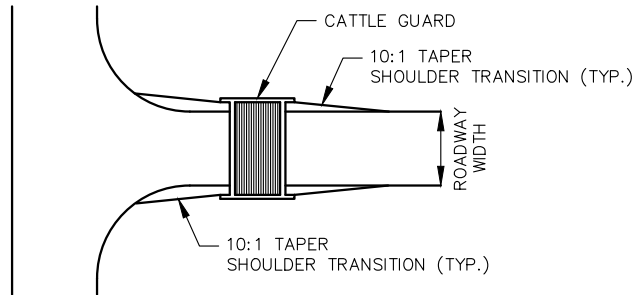
**SECTION D-D**



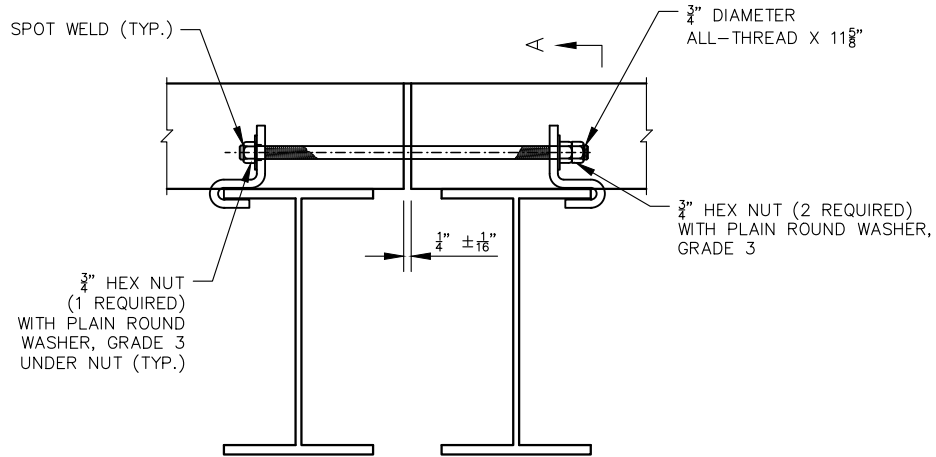
**POST AND BRACE ASSEMBLY**



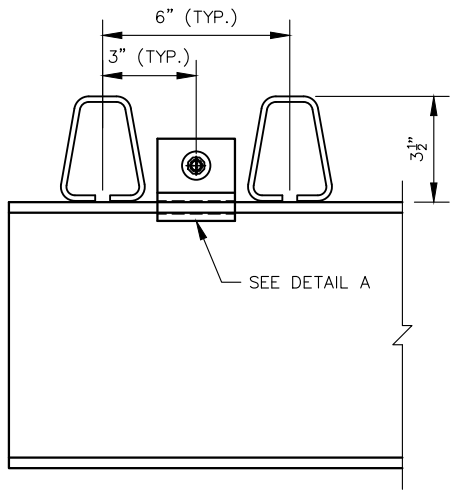
**SECTION E-E**



**SHOULDER TRANSITION AT CATTLE GUARDS**



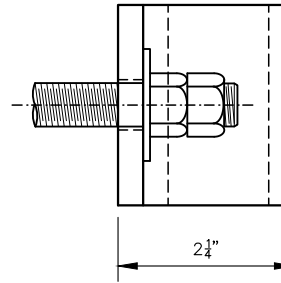
ELEVATION



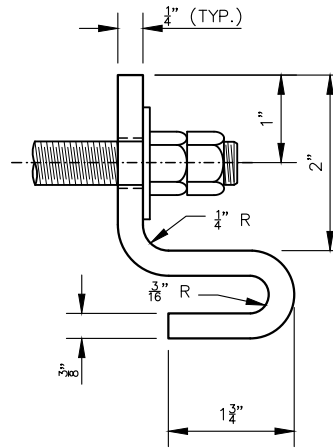
SECTION A-A

**NOTE:**

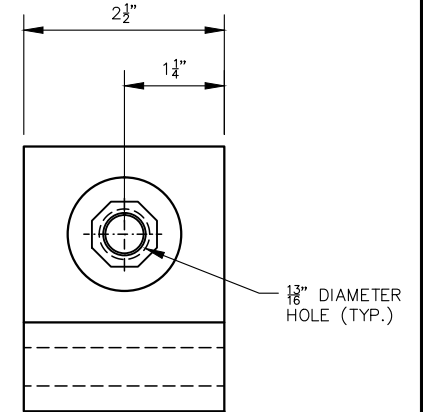
1. APPLY A HEAVY DUTY, HIGH-STRENGTH ANAEROBIC THREAD-LOCKING COMPOUND TO THE THREADS BEFORE INSTALLING THE DOUBLE NUTS.



PLAN



ELEVATION

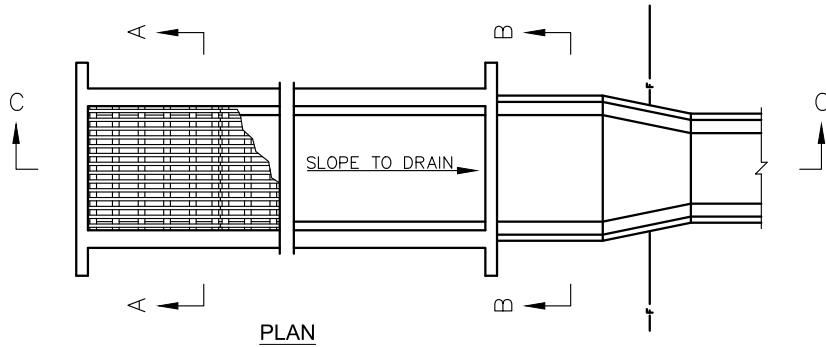


DETAIL A

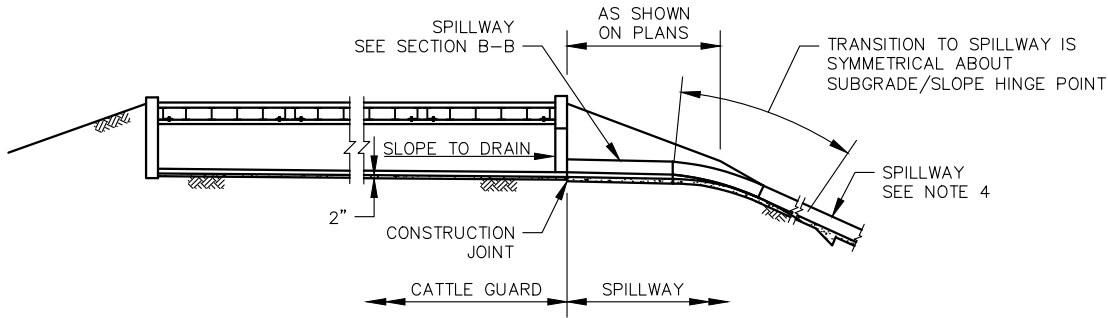


**NOTES:**

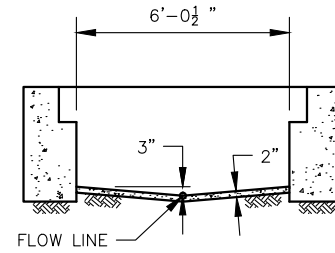
1. SEE DETAILS CC261-1 THROUGH CC261-4 FOR ALL OTHER CATTLE GUARD DETAILS.
2. THIS STANDARD SHALL BE USED IN EMBANKMENT OR WHERE HIGHLY ERODABLE SOIL IS FOUND.
3. ALL CONCRETE SHALL BE CLASS B.
4. SPILLWAY SHALL BE PER PLANS, AS DETAILED BY THE DESIGN ENGINEER.



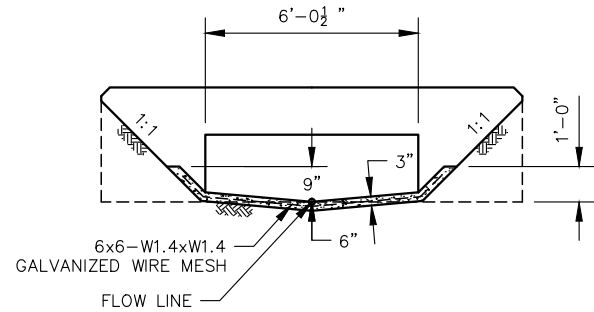
**PLAN**



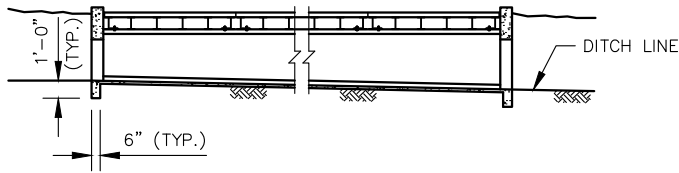
**SECTION C-C  
IN EMBANKMENT**



**SECTION A-A**

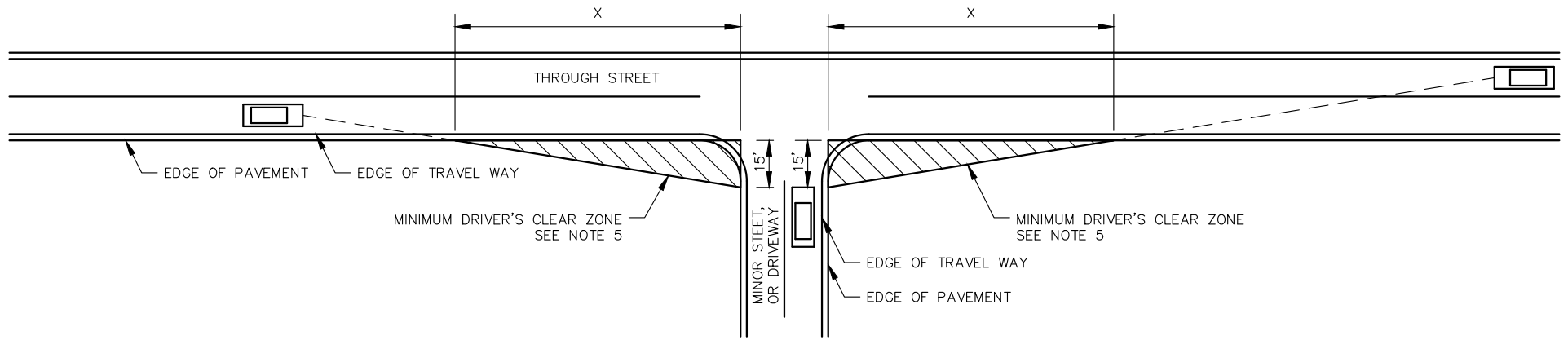


**SECTION B-B**



**SECTION C-C  
WHERE USED FOR THROUGH DRAINAGE  
CATTLE GUARD OPEN BOTH ENDS**

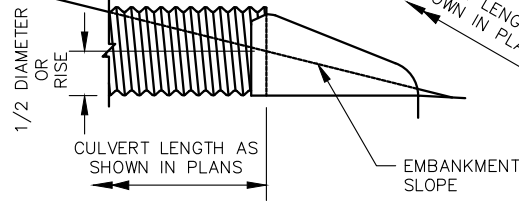
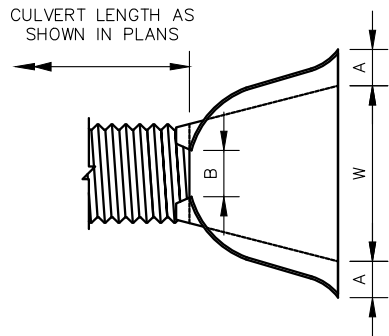




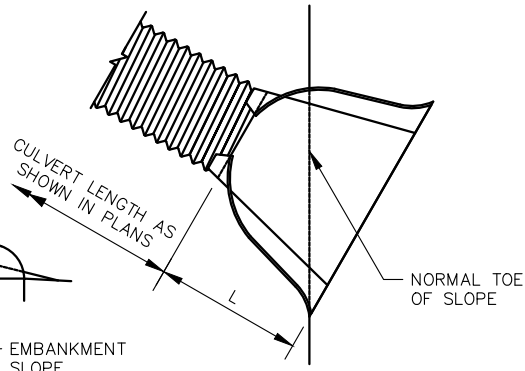
POSTED THROUGH SPEED	X DISTANCE
25 MPH	280 FEET
35 MPH	390 FEET
45 MPH	500 FEET
55 MPH	550 FEET
65 MPH	650 FEET

**NOTE:**

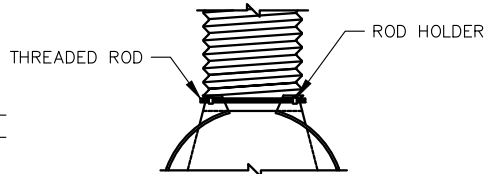
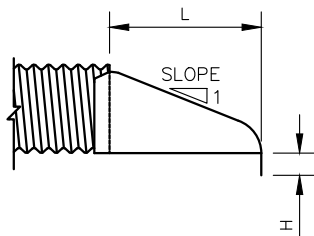
1. A SIGHT DISTANCE TRIANGLE SHALL BE DETERMINED FOR EACH CONTROLLED STREET OR DRIVEWAY THAT INTERSECTS A THROUGH OR UNCONTROLLED STREET.
2. THE SIGHT DISTANCE TRIANGLE IS MEASURED FROM EDGE OF PAVEMENT TO EDGE OF PAVEMENT OR, IF AN UNPAVED ROADWAY, FROM THE EDGE OF TRAVELWAY.
3. DETERMINATION OF SIGHT DISTANCE TRIANGLES MAY BE CALCULATED BY A TRAFFIC OR CIVIL ENGINEER, CONSISTENT WITH AASHTO GREEN BOOK, TO PROVIDE AN UNOBSTRUCTED VIEW OF THE ROADWAY VISIBLE TO THE DRIVER.
4. IF FREQUENT OR HIGH LEVELS OF LARGE TRUCK TRAFFIC IS ANTICIPATED AT THE APPROACH, INCREASED INTERSECTION SIGHT DISTANCE MAY BE WARRANTED AND SHOULD BE CALCULATED CONSISTENT WITH AASHTO GREEN BOOK.
5. NO SCREENING, LANDSCAPING, VEGETATION, STRUCTURES, PARKING AREAS OR OTHER OBSTRUCTION TO VISIBILITY BETWEEN THE HEIGHTS OF 3 AND 10 FEET ABOVE THE TOP OF CURB OR CENTERLINE GRADE OF THE STREET SHALL BE PERMITTED WITHIN THE CLEAR ZONE, AS DEFINED BY THE SIGHT DISTANCE TRIANGULAR AREA. DEVELOPMENT SHALL BE SET BACK OR RESTRICTED IN ORDER TO PROVIDE A CLEAR SIGHT DISTANCE.



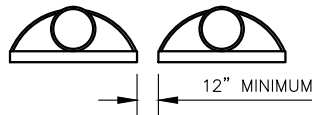
**RIGHT ANGLE CULVERT**



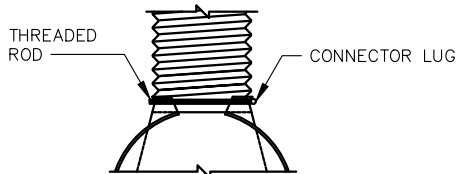
**SKewed CULVERT**



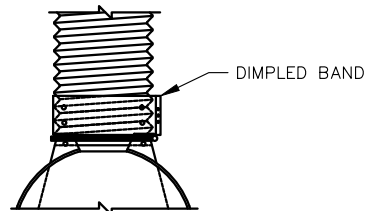
**TYPE 2  
THREADED ROD  
CONNECTIONS**



**SPACING FOR MULTIPLE  
INSTALLATION**



**TYPE 4  
THREADED ROD  
CONNECTIONS**



**TYPE 4  
DIMPLED BAND  
CONNECTIONS**

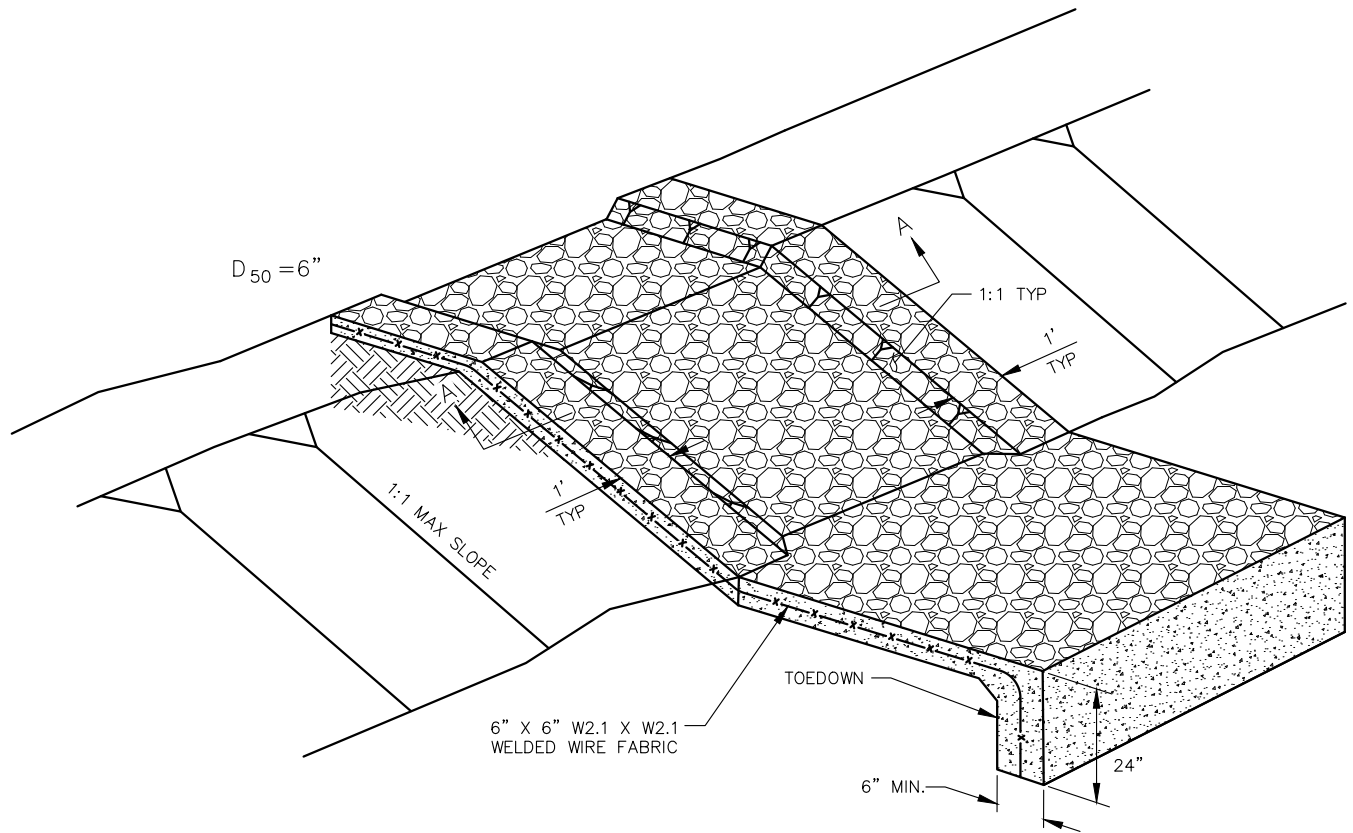
**NOTES:**

1. THE END SECTION MAY BE JOINED TO THE PIPE OR CONNECTOR SECTION BY BOLTS, RIVETS, DIMPLED BANDS, SLIP-SEAM BANDS OR THREADED ROD TYPE FASTENERS. FOR ALLOWABLE CONNECTOR TYPES, SEE TABLE.
2. THE TYPE 1 CONNECTOR IS BOLTED OR RIVETED. MAXIMUM CIRCUMFERENTIAL FASTENER SPACING SHALL BE 12" AND WITH A MINIMUM OF 8 FASTENERS PER JOINT. THE TYPE 1 JOINT MAY BE USED WITH EITHER ANNULAR OR HELICAL CORRUGATIONS.
3. TYPE 2 AND 3 CONNECTORS SHALL ONLY BE USED WITH ANNULAR HELICAL PIPE WITH A REQUISITE NUMBER OF ANNULAR CORRUGATIONS.
4. TYPE 4 CONNECTOR SHALL ONLY BE USED WITH HELICAL PIPE.
5. ALL STEEL END SECTION COMPONENTS SHALL BE GALVANIZED.
6. TOE OF EMBANKMENT SHALL BE WARPED TO MATCH TOE OF SKEWED END SECTION.
7. A BERM SHALL BE ADDED TO ABNORMAL PROJECTIONS PER STD DWG C-13.10.
8. THE FOREGOING APPLIES TO ALL CROSS-SECTION CONFIGURATIONS.

CIRCULAR PIPE		DIMENSIONS (IN)					APPROXIMATE SLOPE	CONNECTION TYPE
DIAMETER (IN)	GAUGE	A±1	B MAX	H±1	L±1½	W±2		
18	16	8	8	6	31	36	2 ½	2, 3, 4
24	16	10	13	6	41	48	2 ½	2, 3, 4
30	14	12 ½	12 ½	8	51	57	2 ½	2, 4
36	14	14 ½	12	9	60	72	2 ½	2, 4
42	12	17	11	10 ½	69	84	2 ½	3

PIPE ARCH			DIMENSIONS (IN)					APPROXIMATE SLOPE	CONNECTION TYPE
SPAN (IN)	RISE (IN)	GAUGE	A±1	B MAX	H±1	L±1½	W±2		
21	15	16	7 ½	11	6	24	36	2 ½	2, 3, 4
28	20	16	8	16	6	32	48	2 ½	2, 3, 4
35	24	14	10	16	6	39	60	2 ½	2, 4
42	29	14	12	12	7 ½	46	75	2 ½	2, 4
49	33	12	13 ½	20	9	53	84	2 ½	3

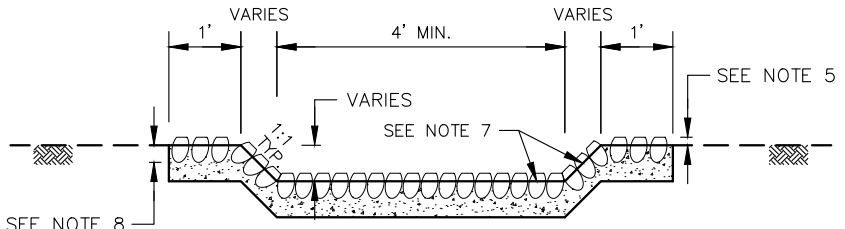




**NOTES:**

1. PREPARE THE BED FOR THE RIP RAP BY EXCAVATING AND SHAPING THE SLOPES AS WELL AS CONSTRUCTING THE TOE FOR RIP RAP INSTALLATION.
2. ALL STONES SHALL BE ANGULAR WITH ROUGH FLAT SURFACE TEXTURE. STONES SHALL BE APPROVED BY THE COUNTY ENGINEER.
3. STONE SIZE ( $D_{50}$ ) SHALL BE 6" OR IN ACCORDANCE TO WHAT IS SHOWN ON THE PLANS.
4. THICKNESS OF ANY RIP RAP LAYER SHALL BE AT LEAST 12" OR TWICE THE  $D_{50}$  SHOWN ON THE PLANS.
5. STONE TOLERANCE SHALL NOT EXCEED 1 INCH IN HEIGHT.
6. GAP TOLERANCE BETWEEN STONES SHALL NOT EXCEED 1 INCH.
7. LAY THE MAJORITY PLANE OR FACE OF STONE PERPENDICULAR TO THE SLOPE.
8. EMBED RIP RAP MINIMUM 3" INTO CONCRETE.

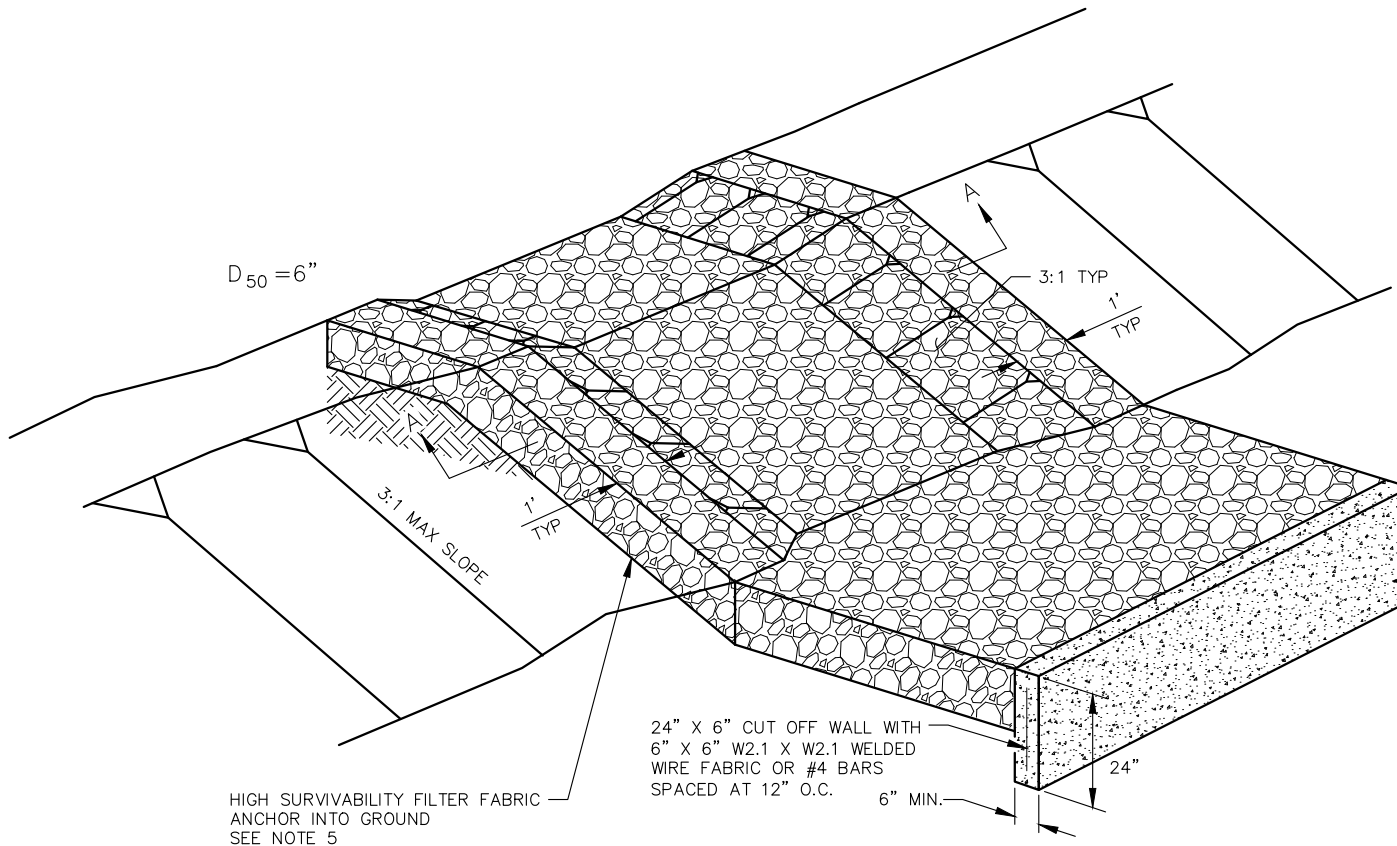
DESIGN GRADATION FOR RIP RAP $D_{50}=6"$	
% PASSING	SIZE (INCHES)
100	10
85	8
50	6
15	3



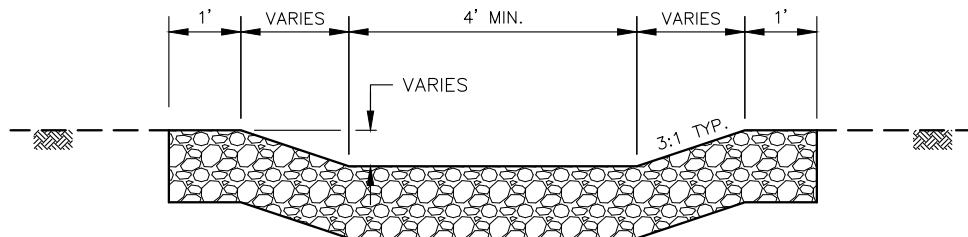
SECTION A-A

**NOTES:**

1. PREPARE THE BED FOR THE RIP RAP BY EXCAVATING AND SHAPING THE SLOPES AS WELL AS CONSTRUCTING THE TOE FOR RIP RAP INSTALLATION.
2. ALL STONES SHALL BE ANGULAR WITH ROUGH FLAT SURFACE TEXTURE. STONES SHALL BE APPROVED BY THE COUNTY ENGINEER.
3. STONE SIZE ( $D_{50}$ ) SHALL BE IN ACCORDANCE TO WHAT IS SHOWN ON THE PLANS.
4. THICKNESS OF ANY RIP RAP LAYER SHALL BE AT LEAST TWICE THE  $D_{50}$  SHOWN ON THE PLANS.
5. FILTER FABRIC SHALL CONFORM TO SECT. 224.3.1.



DESIGN GRADATION FOR RIP RAP $D_{50} = 6''$	
% PASSING	SIZE (INCHES)
100	10
85	8
50	6
15	3



SECTION A-A





# COCHISE COUNTY

HIGHWAY AND FLOODPLAIN DEPARTMENT

SUPPLEMENT TO THE  
MARICOPA ASSOCIATION OF GOVERNMENTS'  
UNIFORM STANDARD SPECIFICATIONS  
FOR PUBLIC WORKS CONSTRUCTION

August 2017

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COCHISE COUNTY  
HIGHWAY AND FLOODPLAIN DEPARTMENT

SUPPLEMENT TO THE  
MARICOPA ASSOCIATION OF GOVERNMENTS'  
UNIFORM STANDARD SPECIFICATIONS  
FOR PUBLIC WORKS CONSTRUCTION

The Cochise County Standard Specifications for Public Improvement consists of the Uniform Standard Specifications and Details for Public Works Construction, current edition, as sponsored by the Maricopa Association of Governments (MAG) and all revisions – except as provided in this Cochise County supplement to those MAG standards. Specifications for work not contained within this standard or MAG standard shall comply with applicable section of the Arizona Department of Transportation, Standards Specifications for Road and Bridge Construction.

Work performed within Cochise County right-of-way shall comply with these standards. The method of measurement and/or basis of payment for work performed under a County right-of-way permit is at the discretion of the applicant and/or developer and their selected contractor. However, the method of measurement and basis of payment, as stated in these supplemental specifications, will be used for all County contract work.

The requirements contained herein supersede, and take precedence, over any conflicting requirements in the MAG Uniform Standard Specifications. Identification is by corresponding Uniform Standard Specification paragraph, section, or part number.

This supplement is available to contractors in a standard Word format on-line at [www.cochise.az.gov](http://www.cochise.az.gov)

SECTION 101  
ABBREVIATIONS AND DEFINITIONS

101.2 DEFINITIONS AND TERMS:

The following definition is revised:

Board of Supervisors: The Cochise County Board of Supervisors acting under the authority of the laws of the State of Arizona. Any reference to Maricopa County shall be construed to mean Cochise County.

Add the following:

Certified Laboratory: An AASHTO accredited laboratory, certified in the relevant engineering materials and testing specialty areas(s) referenced in the Contract Documents.

County: The Cochise County Highway & Floodplain Department, acting through its legally constituted officials, officers, or designated employees.

Mailbox: The mail receptacle and its supporting post or structure.

Maximum Density: The maximum dry density of soil obtained from the procedures defined in MAG Section 301.3.

Portland Cement Concrete Pavement: Concrete pavement that complies with MAG specification section 324

Professional Geologist: A person who has a current registration as a geologist granted by the Arizona State Board of Technical Registration.

Force Account Work: Work performed in accordance with MAG Section 109.

SECTION 102  
BIDDING REQUIREMENTS AND CONDITIONS

102.2 CONTENTS OF PROPOSAL PAMPHLET, add the following:

Each pay item in the bid schedule contains an item number. The integer portion of the item number references the specification section related to the pay item. The decimal portion of the item number is established by the agency and is for agency use.

#### 102.5 PREPARATION OF PROPOSAL:

Add the following to Section 102.5:

It shall be the responsibility of the prospective bidder to determine, prior to the submittal of its bid, if any addenda to the project have been issued by Cochise County. All addenda issued, if not already bound in the Special Provisions, shall be submitted by bidder with its bid and noted in the proposal section. All quantity adjustments, when required as the result of the addendum, shall be reflected on the bidding schedule in pen and ink.

Bids which do not reflect the appropriate changes on the bidding schedule or do not have all issued addenda attached and noted in the proposal section of the Contract will be rejected by the County.

Prospective bidders may call Cochise County to ascertain if addenda have been issued for this project.

#### 102.6 SUBCONTRACTORS' LIST, add the following:

The Contractor shall submit to the County with the Bid documents a listing of all major Subcontractors and Material Suppliers the Contractor intends to use in the performance of the work specified in this contract. In determining the amount of work assigned to each Subcontractor, the Contractor shall adhere to the mandates set forth in Section 108.2, Subsection E, of the MAG Uniform Standard Specifications.

#### 102.12, add the following:

(C) Submission of any unit prices in the bid proposal which are unbalance, either above or below the amount of a reasonable bid price as determined by the County Engineer, to the potential detriment of the contracting County.

### SECTION 104 SCOPE OF WORK

#### 104.1 WORK TO BE DONE:

##### 104.1.4 Cleanup and Dust Control, replace the 3<sup>rd</sup> paragraph with the following:

The Contractor shall take whatever steps, procedures or means required preventing any dust nuisance due to his construction operations. The dust control measures shall be maintained at all times to the satisfaction of the Engineer and in accordance with the requirements of the Arizona Department of Environmental Quality (ADEQ) of Air Pollution Control Rules and Regulations.

##### 104.1.4 Cleanup and Dust Control, add the following:

Contractor shall dispose of excess material or construction debris on an as-needed basis to keep the site safe to Contractor's personnel and the general public. Construction debris shall be disposed of only in a manner or in a location approved by the Engineer. The Contractor shall upon request file with the Engineer the written consent of the owner of any off-site location designated to receive excess material or debris.

Contractor shall be responsible for the safe and clean condition of the site during the entire period the site is under Contractor's care, custody and control.

#### 104.3 VALUE ENGINEERING

Section 104, add the following:

##### 104.3.1 Purpose:

This clause defines a Construction Incentive Change Order Proposal ("CICOP") and establishes the policy and procedure for the application of CICOP's in the Cochise County construction process.

##### 104.3.2 Definition:

A CICOP is a defined, written proposal for a change order during construction and shall be initiated, developed and identified by Contractor. The CICOP shall result in gross capital savings and a net capital

improvement cost reduction, shall not increase the total maintenance cost of the project and shall meet the following requirements:

104.3.2.1 All Time Extensions for the project shall be agreed upon by both parties at the time the CICOP is approved. The County's determination shall be binding upon the Contractor and shall not be subject to challenge.

104.3.2.2 The CICOP shall not alter the initially intended function, quality and safety standards of the project.

104.3.2.3 The CICOP shall not change the overall scope of the work, which would require a re-bidding of the project.

104.3.2.4 The CICOP shall not conflict with any contract provisions regarding proprietary and restrictive specifications for bids in connection with Uniform Standard Specifications and details, or any other applicable specifications.

104.3.2.5 The CICOP shall not cause undue interruption of the contract work schedule.

104.3.2.6 The proposed changes in connection with the CICOP shall comply with all federal, state and local regulations, mandates and permits.

104.3.2.7 If the Contractor wishes to submit a CICOP, he shall submit a preliminary CICOP in writing, which shall address all components required for a final CICOP, in summary form. The County will review the preliminary CICOP and inform the Contractor in writing if the County wishes to implement the CICOP. The Contractor would then be requested to prepare a detailed final CICOP.

#### 104.3.3 Applicability:

All Cochise County construction contracts.

#### 104.3.4 Content:

The CICOP shall contain pertinent information and support documentation to allow comprehensive review by the appropriate contracting agency. At a minimum, the CICOP shall include the following information:

104.3.4.1 Name and title of individuals associated with the design and preparation of the CICOP.

104.3.4.2 Detailed scope description with sealed plans and specifications. A comparison summary of present design, proposed changes and detailed description of the advantages and disadvantages for each change proposed. The CICOP shall be sealed and signed by a Professional Engineer.

104.3.4.3 Comprehensive procedure and schedule outlining implementation of CICOP, including all required contract amendments and the absolute latest approval date for the CICOP.

104.3.4.4 Estimated cost summary which shall include but not necessarily be limited to the following:

104.3.4.4.1 Project cost with and without CICOP, which shall include the following items:

104.3.4.4.1.1 Quantities of materials and equipment.

104.3.4.4.1.2 Unit prices for materials and equipment.

104.3.4.4.1.3 Hourly rates and total labor hours required for installation.

104.3.4.4.1.4 Overhead and fee percentage of Contractor and all subcontractors of any tier involved in the performance of the work outlined in the CICOP.

104.3.4.4.2 Operations and maintenance cost prior to and after implementation of CICOP.

104.3.4.4.3 Implementation cost of the CICOP not covered in Section 104.3.4.4.1.4, above.

104.3.4.4.4 Contractor's cost of the savings, based on the formula specified below.

104.3.4.4.5 Other pertinent data, as may be required by the County to prepare and execute a change order to the Contract.

104.3.4.4.6 If Contractor fails to notify the County of all required changes for the CICOP during the initial CICOP approval stage, Contractor shall absorb all costs connected with the implementation of changes of which the County was not made aware of. If conditions occur, which could not be foreseen by any prudent Contractor, the County may enter into negotiations with Contractor and make the necessary cost adjustments to the Contract.

104.3.4.4.7 All CICOP's become public record when submitted to the County for review and approval. Propriety information may be protected by Contractor.

104.3.4.4.8 For CICOP's accepted by the County, processing procedure for change orders shall be used.

104.3.4.4.9 If a CICOP is rejected by the County, Contractor may not appeal such a rejection.

104.3.5 Sharing Provisions:

Upon acceptance and implementation of a CICOP, Contractor will share the net capital savings derived from the implementation of the CICOP, in accordance with the formula outlined below:

104.3.5.1 Initial construction cost minus revised construction cost minus CICOP development cost and CICOP implementation cost equals Net Capital Savings.

104.3.5.1.1 The CICOP implementation cost shall include Contractor's actual cost and fee for reviewing and redesigning the CICOP, documented to the satisfaction of the County.

104.3.5.1.2 CICOP development cost shall include Contractor's cost directly associated with the preparation of the CICOP package, documented to the satisfaction of the County.

104.3.5.1.3 CICOP implementation and development costs shall include COUNTY costs for review and approval of the CICOP package.

104.3.5.2 Sharing Formula: Net Capital Savings, calculated in accordance with the formula outlined in Section 104.3.5.1, above, shall be shared with Contractor on an equal 50/50 percentage basis.

## SECTION 105 CONTROL OF WORK

105.1 AUTHORITY OF THE ENGINEER, add the following:

The Engineer may adjust design grades or adjust the location of structures (especially drainage structures) prior to construction. Such adjustments are considered minor changes in the work and do not constitute extra work.

105.2 PLANS AND SHOP DRAWINGS, add the following:

Initial submittal for review – five copies, of which one copy will be returned to the Contractor within five working days. Final submittal for approval – five copies, of which two copies will be returned to the Contractor within five working days.

105.4 COORDINATION OF PLANS AND SPECIFICATIONS:

Section 105.4 is replaced with the following:

Contractor shall perform the work under this Contract in accordance with the intent of the Plans and Specifications and shall not take advantage of any error or omission in the Plans and/or specifications. In the event Contractor discovers an error or omission in the Plans and/or specifications, Contractor shall promptly advise the Engineer of such an error or omission.

The written dimensions on the Plans are presumed to be correct, but the Contractor is required to check carefully all dimension and quantities before beginning work thereon. Should any errors or omissions be discovered, the Engineer shall be so advised and the proper corrections made. Any such adjustments made by the Contractor, without prior approval, shall be at this own risk, and the settlement of any complications arising from such adjustments shall be made by the Contractor at his own expense. All notes on the Plans shall be carefully observed by the Contractor and as a part of the Contract.

105.6 COOPERATION WITH UTILITIES, add the following:

Contractor is solely responsible for any damage to existing utilities resulting from Contractor's operations at the site. The use of hand tools to expose a marked facility is required when proposed excavation is within the 2.0-foot tolerance zone of a marked facility, or if uncertainty exists as to the exact location of a facility.

An attempt has been made by the County to identify the location of all underground utilities located within the perimeter of the site and to design the location and elevation of all irrigation and drainage pipes, culverts and structures to avoid interference with existing utilities. It shall be the Contractor's

responsibility to cooperate with the appropriate utility companies in order to facilitate requested adjustments of obstructing utilities. (Please refer to the Special Provisions for specific telephone numbers and contact persons of utilities within the project area).

Contractor's installation of conduits, brackets, piping, valve adjustments or other material at the request and for the convenience of the utility shall be paid by the utility unless specifically identified otherwise in the plans or the Special Provisions. Contractor shall make all required arrangements for such construction and payment with the utility. The County will not extend the performance period of the contract to accommodate construction performed for the convenience of the utility.

#### 105.8 CONSTRUCTION STAKES, LINES AND GRADES:

Section 105.8 is replaced with the following:

The County will set or provide the information for the bench marks used for the design of County projects. The Contractor shall be responsible for all construction staking. Blue top control shall be set to assure conformance to grade longitudinally and transversely.

The minimum construction staking shall consist of the following:

- (A) Right-of-Way lines at 250 ft. intervals for clearing, fencing, and control of Contractor's operations.
- (B) Slope stakes shall be offset from the edge of the embankment at 100 ft. intervals.
- (C) Blue tops in subgrade at centerline and edge of pavement at 100 ft. intervals except on curves with all horizontal and vertical points.
- (D) Blue tops on aggregate base course at centerline, edge of pavement, and 1/4 points at 50 ft. intervals with all horizontal and vertical points.
- (E) Catch basin stakes shall be offset at 10 ft. and 15 ft. to the center of the structure with cuts or fills shown to the top of grate.
- (F) Grade and line stakes for all structures, pipe lines, culverts, and ditches.
- (G) Straddle points for permanent monuments.

#### 105.12 MAINTENANCE DURING CONSTRUCTION, add the following:

The Contractor shall be responsible to protect the construction site, construction activities, and new construction from the detrimental effects of weather, including flooding, until acceptance by the Engineer.

#### 105.15 ACCEPTANCE,

- (A) Partial Acceptance: Delete this paragraph

Add the following:

The Contractor may request an inspection to establish substantial completion when all of the following have occurred:

- All pavement, pavement markings and signing are complete and accepted and traffic can move unimpeded through the project at the posted speed;
- All pedestrian pathways are completed and accepted and pedestrians are not restricted by any construction activity;
- All guardrails, drainage devices, ditches, excavation and embankment have been accepted;
- The only work left for completion is incidental, away from vehicle and pedestrian traffic, and does not affect the safety or convenience of the traveling public.

A notice of substantial completion shall be issued when the Engineer determines after an inspection that all conditions for substantial completion have been met. The decision whether the project is substantially complete is within the sole discretion of the Engineer. The inspection date requested by the Contractor for the substantial completion inspection shall be the date of substantial completion if the Engineer determines the conditions for substantial completion have been met. Liquidated damages shall not be assessed after the substantial completion date.

## SECTION 106 CONTROL OF MATERIALS

#### 106.2 SAMPLES AND TEST OF MATERIALS, replace the first paragraphs with the following:

The County will provide quality assurance testing to verify the quality of the finished project. The testing will, in no way, relieve the Contractor of his responsibility for his own quality control, assurance, and furnishing materials and finish products that meet the project requirements.

The Engineer will coordinate the quality assurance testing required to complete the project with the Contractor, based on the Contractor's weekly construction schedule. The Contractor shall include in this weekly construction schedule the extent and type of quality assurance testing deemed necessary based on this completion of various stages of construction. Only complete stages of work will be tested.

Identification of quality assurance testing on the Contractor's weekly construction schedule shall not relieve the Contractor of the responsibility to notify the Engineer of said services not less than two (2) working days in advance of when the testing services are required in connection with the project. Any project delays or cost due to the Contractor failing to provide material testing request on the weekly schedule or lack of a weekly schedule will be the responsibility of the Contractor.

Replace the fourth paragraph with the following:

The laboratory responsible for the test shall furnish at least one copy of the test results to the Engineer and to the Contractor.

## SECTION 107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

107.1 COMPLIANCE WITH LAWS, add the following:

Contractor, in connection with any activity under this Contract, shall not discriminate against any person on the grounds of race, color, religion, sex, national origin, age, disability, political affiliation or belief. Contractor shall include a clause to this effect in all subcontracts. Contractor shall also comply with all applicable provisions of the Americans with Disabilities Act of 1990.

Contractor and its subcontractors and their respective employees, agents, and representatives, when performing the work described in the Construction Specifications, shall comply with all rules and regulations set forth by the County, pertaining to the safety, loss control and environmental regulations, and shall perform the work in compliance with governmental laws and regulations pertaining to occupational health, and environmental protection, including any local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract.

Contractor is solely responsible for jobsite ("site") conditions during all phases of construction, beginning with Contractor's mobilization of equipment and/or personnel until the work has been accepted by the Engineer and a certificate of completion has been issued by the County. Contractor's responsibility for the site during the period specified above shall not be limited to Contractor's working hours and shall include but not necessarily be limited to the following:

- Physical condition of the site;
- Safety of Contractor's personnel at the site and all
- other persons entering the site or areas adjacent to the site;
- Security of Contractor's equipment and material; and
- Reasonable aesthetic appearance of the site.

Contractor shall ensure that internal combustion equipment is operated with a muffler of a type recommended by the manufacturer.

107.2 PERMITS, add the following:

107.2.1 AZPDES (NPDES) Construction General Permit Requirements:

The Contractor shall comply with the Arizona Pollutant Discharge Elimination System (AZPDES) requirements and conditions administered by the Arizona Department of Environmental Quality (ADEQ). Compliance with AZPDES also includes compliance with the requirements of all municipal separate storm sewer systems (MS4) that are within the project limits.

107.2.1.1 Regulation Compliance: The Contractor, contractor employees, and subcontractors shall not discharge stormwater or non-stormwater from the construction site that is not in compliance with requirements and conditions of the AZPDES Construction General Permit for Arizona (AZCGP) as well as all other applicable federal, state and local laws, ordinances, statutes, rules and regulations

pertaining to stormwater discharge and air, ground water and surface water quality.

The Contractor shall be designated as the Operator, having day-to-day operational control of those activities at a project which are necessary to ensure compliance with a Stormwater Pollution Prevention Plan (SWPPP) for the site and other permit conditions. The Contractor is responsible for preparing, in a manner acceptable to the ADEQ and the EPA, all documents required by regulation, which shall include but not necessarily be limited to the following:

- Notice of Intent (NOI).
- Stormwater Pollution Prevention Plan (SWPPP).
- Notice of Termination (NOT).

107.2.1.2 NOI Submittal: The Contractor shall submit a Notice of Intent in accordance with the AZCGP. The Contractor shall identify on the NOI all non-stormwater discharges that are expected to be associated with the project's construction activities as required by the AZCGP.

Preliminary copies of the NOI and the SWPPP shall be available to the County during the pre-construction conference.

The Contractor shall ensure the completed and duly signed NOI form(s) are submitted in a timely manner to prevent a delay to project construction.

The AZPDES form shall be submitted to ADEQ's Phoenix office by certified mail or hand delivered to the address below:

Arizona Department of Environmental Quality

Surface Water Section - Stormwater and General Permits Unit 1110 West Washington Street, 5415A-1

Phoenix, AZ 85007

The form may also be faxed to ADEQ at 602-771-4528 or submitted via "smart NOI" accessible from the ADEQ's website:

<http://www.azdeq.gov/environ/water/permits/stormwater.html>

If the construction is near an impaired or unique water (a.k.a. an Outstanding Arizona Water), the SWPPP shall be submitted with the NOI. Permit activation may require 32 business days or more for construction sites near impaired or unique waters, as well as for construction sites with special concerns, therefore documentation is to be submitted to ADEQ as early as possible.

If the construction site is located in an urbanized area of Cochise County, the Contractor shall send a copy of the ADEQ certificate authorizing permit coverage to the local MS4 authority(s).

107.2.1.3 Time Extension: Failure by the Contractor or subcontractor of any tier to submit a NOI within the mandated time frame shall result in delay of the construction start date and no claims for extension of time will be granted for such a delay.

107.2.1.4 SWPPP: The Contractor shall develop, sign and certify, implement, update, amend, and revise the SWPPP, as necessary, to assure compliance with permit requirements. The Contractor shall address in the SWPPP, all non-stormwater discharges that are expected to be associated with the project's construction activities as required by the AZCGP.

The Contractor shall ensure that:

- The SWPPP indicates the areas of the project where the County or other entity has operational control over the project specifications, including the ability to make modifications in specifications.
- All other operators implementing portions of the SWPPP impacted by changes made to the SWPPP are notified of such modifications in a timely manner.
- The SWPPP indicates the parties with day-to-day operational control and parties responsible for implementation of the BMPs identified in the SWPPP.

The Contractor and subcontractors shall ensure that construction activities do not render another party's BMP(s) ineffective.

The Contractor shall post the SWPPP authorization number(s) in a conspicuous location near the entrance where most of the construction activity is occurring. A copy of the ADEQ authorization certificate shall be retained with the SWPPP. The SWPPP and a copy of the ADEQ authorization certificate shall be retained on the project site at all times during construction. A "Construction SWPPP Checklist" can be obtained from ADEQ for assisting in the preparation of the SWPPP.

107.2.1.5 Inspections: Contractor shall perform inspections, by qualified personnel, of all stormwater pollution control devices on the project at least once every fourteen (14) days and within twenty-four (24) hours of each 0.5-inch or greater storm event, as required under the provisions of the AZCGP. Contractor shall prepare reports, in accordance with the AZCGP, on such inspections and shall retain the reports for a period of at least three (3) years following the completion of the project. The Contractor shall maintain all stormwater pollution control devices on the project in proper working order, which shall include cleaning and/or repair during the duration of the project.

107.2.1.6 NOT Submittal: Upon project completion, acceptance and demobilization, Contractor shall submit to ADEQ a completed, duly executed Notice of Termination form for each NOI issued, with a copy of the NOT acknowledgement letter to appropriate MS4 authority(s), thereby terminating all AZPDES permit coverage for the project. Contractor shall then provide to the County copies of the SWPPP, inspection information and all other documents prepared and maintained by the Contractor in compliance with the AZPDES Construction General Permit, including records of all data used to complete the NOI to be covered by the AZCGP. Contractor shall retain the originals of such documents for a period of at least three (3) years following the completion of the project and make such documents available for inspection by representatives of the Environmental Protection Agency, the Arizona Department of Environmental Quality, the County, and any municipality having jurisdiction, upon request.

107.2.1.7 Fines and Penalties: Fines and penalties imposed by the ADEQ, MS4 authority, or the EPA for Contractor's failure to comply with any of the AZPDES permit requirements and conditions shall be borne by the Contractor. Until paid by the Contractor said fines and penalties may be withheld from monies due or becoming due the Contractor.

107.2.1.8 Payment: The lump sum price for AZPDES shall include all material, labor, and costs relating to the NOI, NOT, and the SWPPP. This includes but is not limited to the preparation, installation, maintenance, and removal of temporary SWPPP elements, assuring proper operation of the pollution control devices installed, and all maintenance, cleaning, and disposal costs associated with clean-up and repair following storm events, runoff or releases on the project. The lump sum price for AZPDES shall be inclusive of all related costs, and no additional claims shall be made by the Contractor under any other specification provision, including changed conditions. Contractor shall be compensated for this item at a rate of 25% of the total contract price paid with the first progress payment, the remaining 75% will be prorated over the entire length of the project.

107.4 ARCHAEOLOGICAL REPORTS, add the following:

If previously unidentified archaeological, historical, or paleontological features are encountered during any activity related to construction of a County project, the Contractor shall stop work immediately at that location and shall notify the Engineer.

107.5 SAFETY, HEALTH AND SANITATION PROVISIONS, add the following:

All water for Contractor's own use, drinking water, temporary electric power, heat, and telephone services shall be provided by the Contractor, at the Contractor's sole expense.

107.6 PUBLIC CONVENIENCE AND SAFETY, add the following:

107.6.3 Control of Airborne Pollutants and Sediment Tracking: Contractor shall cover dump trucks while transporting materials that may become airborne during transit. After dumping of such materials, Contractor shall either cover truck bed or take measures to remove all residues that may become airborne.

Contractor shall minimize off-site tracking of sediments by brushing or blowing off construction vehicles, or any other method deemed appropriate by Contractor, prior to exiting the construction site.

107.6.4 Protective Fencing: The Contractor shall furnish and install 6-foot high temporary chain link fencing, or approved equal, satisfactory to the Engineer, around all major structure construction areas

(i.e., bridges, pump houses, drop structures, retaining walls, etc.) and around any unattended excavations with slopes steeper than 2:1. Temporary fencing shall completely enclose the construction activity and shall be secured after normal working hours to prevent unauthorized access.

## SECTION 108 COMMENCEMENT, PROSECUTION AND PROGRESS

### 108.2 NOTICE TO PROCEED:

Add section 108.1.1 as follows:

108.2.1 Pre-Construction Conference: After execution of the Contract by both parties and prior to the commencement of the work, the Engineer will schedule a pre-construction conference at the facilities of Cochise County. Contractor shall be represented at a minimum by a company official with signature authority on behalf of its organization.

Contractor shall submit to the Engineer during the pre-construction conference the following documents:

- (A) List of all subcontractors
- (B) List of all material sources
- (C) Assumptions and calculations used to determine each of the unit prices
- (D) Preliminary work schedule
- (E) Traffic control plans
- (F) Emergency telephone numbers
- (G) Signing authority letter
- (H) Name and telephone number of the certified safety professional
- (I) Copies of all Permits required for project Construction
- (J) Preliminary SWPPP and NOI

The following items shall be submitted at the preconstruction conference when reasonably feasible. When not submitted at the preconstruction conference, the submittal(s) shall be specifically shown in the work schedule. The submittals shall be scheduled at least 45 days prior to intended use and/or material transport to the project site.

- (K) Material safety data sheets
- (L) Mix designs
- (M) (M) Manufacturer's certification for all materials
- (N) (N) Shop drawings

The pre-construction conference will cover topics such as critical elements of the work schedule, payment application and the processing of invoices. Additionally, a scheduled start date for the work will be determined.

### 108.3 SUBLETTING OF CONTRACT, add the following:

The Engineer will not consent to subletting of any portion of the contract if a copy of the subcontract or lower tier subcontract is not received. The Engineer's consent shall in no way be construed to be an endorsement of the subcontractor or its ability to complete the work in a satisfactory manner.

The subcontract, purchase order, or lease agreement shall be evidenced in writing and contain all pertinent provisions and requirements of the prime contract. The following data shall be submitted seven calendar days prior to the start of each subcontractor's work.

- (A) A complete copy of each subcontractor agreement and each second-tier subcontractor agreement.
- (B) Verification that all required Federal Provisions; i.e., Federal Form 1273, Executive Order, and Wage Determination Decisions are attached to each subcontract in any federal-aid funded contract.
- (C) Subcontracts must show the total price subcontracted. The items of work, and quantities of each item subcontracted shall be shown. Unit Prices or Extended Prices may be deleted except in the case of DBE subcontractors.
- (D) DBE subcontracts shall include full extensions of all unit prices.
- (E) Partial items shall be explained in detail and show the amount of each contract item being

subcontracted. Non-contract item work shall be fully explained.

**(F)** The contractor shall certify to the County that all of its subcontractors have all required registrations.

108.4 CONTRACTOR'S CONSTRUCTION SCHEDULE, replace with the following:

Contractor shall be solely responsible for the planning, scheduling and execution of the work to assure timely completion of the project.

108.4.1 The initial schedule shall be submitted to the County in triplicate for review at the pre-construction conference. The schedule shall be a schematic (arrow) or precedence diagram, reflecting the work stages and all activities required for the successful completion of the project. The schedule shall show enough detail to allow day to day monitoring of Contractor's operation and shall include major milestone dates for the work.

108.4.2 The schedule shall include a complete critical path schedule and shall include a detailed network diagram with the following elements:

108.4.2.1 Contractor's schedule shall be time scaled in calendar days and all activities shall be recorded from the initial start dates to their completion dates. Unless specific approval was given by the Engineer, the individual activities shall not exceed fifteen (15) calendar days in length. The plot size and scale shall be acceptable to the Engineer.

108.4.2.2 The schedule shall reflect the order and the individual categories for each activity described in section 108.4.2.7, below. Critical activities shall be highlighted by use of color or any other method acceptable to the Engineer.

108.4.2.3 The schedule shall include, in addition to all construction activities, such tasks as mobilization, demobilization, submittal and approval of material samples and shop drawings, procurement of major material and equipment items, fabrication of special items and the installation and testing of such items. The schedule shall also reflect coordination activities with other projects.

108.4.2.4 Activities shall show sufficient detail to allow the reviewer to easily follow the sequence of the work, for example, forming, reinforcing and placement of concrete on the specific calendar days such activities are scheduled.

108.4.2.5 The diagram shall show each activity, the preceding and the following activity, the activity description, the total float time, and the duration of the activity in working days.

108.4.2.6 Activity descriptions on the diagram shall be job-specific and not of a generic nature.

108.4.2.7 In addition to the diagram, Contractor shall submit a schedule report of the network outlining the following data for each activity:

- (A)** preceding and following event and activity numbers
- (B)** activity description
- (C)** activity duration
- (D)** earliest commencement date
- (E)** earliest completion date
- (F)** latest commencement date
- (G)** latest completion date
- (H)** total float times
- (I)** responsible party for specific activity

108.4.3 Contractor shall update its schedule as mandated by the following events or as requested by the Engineer.

108.4.3.1 Contractor shall submit to the County on the tenth (10th) working day of each month a construction progress report (three originals) describing all completed or in progress activities and the level of completion of all activities to date in connection with this project. Detailed information shall be given for all negative float time. If the Engineer determines that any or all parts of the network diagram requires revision, Contractor shall furnish the County with the requested revisions within ten (10) calendar days of such request.

108.4.3.2 The monthly report shall be accompanied by a brief description of the job progress, problems encountered, current and anticipated delaying factors and the potential impact on the project schedule, and a description of corrective measures taken or proposed. It shall also include any departures from

earlier schedules, including but not limited to, logical sequence or logical ties, constraints, changes in scheduled activities and the duration of such changes, addition or deletion of event numbers, activity numbers and activity descriptions. Contractor shall outline the reason for the departure from the original schedule.

108.4.3.3 All costs and expenses incurred by the Contractor for the preparation of schedules and/or reports and all revisions thereto, are considered an overhead item and therefore not reimbursable as a separate pay item.

108.4.3.4 In addition to allowances for various activities in connection with the work, Contractor shall base the schedule on normal weather conditions and shall incorporate the following factors:

- (A) procurement and shipping times for material
- (B) concrete curing time
- (C) reasonable allowances for relocation of utilities

108.4.3.5 The Engineer's review of the schedule shall not constitute an acceptance of responsibility by the County for the content of the schedule and shall not relieve Contractor of its obligations to commit all its resources to meet the schedule set forth in the specifications. Free float time within the project's stated contract time limit shall remain available for use by the project. The County or the Contractor may use as needed the available project free float time. The Engineer's review of the schedule shall not constitute a basis for additional time to complete the work specified in the scope of work nor shall it serve as basis for additional compensation.

108.4.3.6 In addition to the overall project work schedule, the Contractor shall provide a weekly schedule of his general operations, quality assurance testing, and inspections needs for the next week's operation. Said work schedule is to be submitted at the weekly construction meeting.

108.5 LIMITATION OF OPERATIONS, add the following:

Regular work hours vary depending on time of year, the Contractor shall submit proposed weekday regular work hours at the pre-construction meeting (pre-job conference) for approval. The Contractor shall be subject to additional inspection fees for overtime work when work is performed on weekends, legal holidays, or at times other than the approved regular work hours.

The Contractor shall comply with all local noise ordinances. For unincorporated areas, the Contractor shall not conduct any work during the hours 7:00 p.m. to 6:00 a.m. without the written approval of the Engineer. Special noise abatement conditions and procedures may be required if nighttime work is approved.

Part 200 add the following new Section:

SECTION 202  
REMOVAL OF STRUCTURES

202.1 DESCRIPTION:

The work under this Section shall consist of the removal, wholly or in part, and satisfactory disposal of all structures within the right-of-way which have not been designated on the project Plans or specified in the Special Provisions to remain, except for those structures which are to be removed and disposed of under other items of work in the contract. The work shall also include salvaging of designated materials and backfilling the resulting cavities.

Existing structures and other existing improvements which are to become an integral part of the planned improvements shall remain even though not specifically noted.

Materials removed and not designated to be salvaged or incorporated into the work shall become the property of the Contractor.

202.2 BLANK

202.3 CONSTRUCTION:

202.3.1 General: Bridges, culverts, retaining walls, and other structures in use by or facilitating traffic shall not be removed until satisfactory arrangements have been made to accommodate the traffic.

Blasting or other operations necessary for the removal of an existing structure, which may damage new

construction, shall be completed prior to commencing the new work.

Items designated to be salvaged shall be carefully stockpiled or stored by the Contractor at locations designated in the Special Provisions or as requested by the Engineer.

Items which are to be salvaged or reused in the new construction, that are damaged or destroyed as a result of the Contractor's operations, shall be repaired or replaced by the Contractor at no additional cost to the County.

Holes, cavities, trenches and depressions resulting from the removal of major structures, except in areas to be excavated, shall be backfilled with suitable material which shall be compacted to a density of not less than 95 percent of maximum density, as requested and approved by the Engineer.

202.3.2 Removal of Bridges: The removal of existing bridges, either wholly or in part, shall be as shown on the project plans or as described in the Special Provisions. Bridge removal operations shall be conducted in such a manner as to cause the least interference to public traffic.

At least ten days before beginning bridge removal over or adjacent to public traffic or railroad property, the Contractor shall submit to the Engineer details of the removal operations showing the methods and sequence of removal and equipment to be used.

When total bridge removal is specified, all materials designated for salvage, such as structural steel, structural steel members, timber and other reusable materials shall be carefully dismantled, removed and salvaged in accordance with the requirements of Section 202.3.1. Steel members shall be match marked as requested by the Engineer.

Piling, piers, abutments, footings and pedestals shall be removed to at least 1.0 foot below ground line or 5 feet below finished subgrade elevation unless specified otherwise in the Special Provisions or on the project Plans.

When partial bridge removal is specified or alteration of an existing bridge requires removal of portions of the existing structure, such removal shall be performed with sufficient care as to leave the remaining portion of the structure undamaged.

In case of damage to the existing bridge structure, the Contractor shall make necessary repairs at no additional cost to the County. Reinforcing steel extending from the remaining portion of the structure shall be protected, cleaned and incorporated in the new portion of the structure in accordance with the details shown on the project plans or as requested by the Engineer.

Flame cutting and saw cutting may be used for removing, widening, or modifying bridges, provided the Contractor complies with all protection, safety and damage requirements.

Explosives shall not be used in bridge removal operations unless approved by the Engineer.

Before beginning concrete removal, operations involving the removal of a portion of a monolithic concrete element, a saw cut a minimum of 1 inch deep shall be made to a true line along the limits of removal on all faces of the element which will be visible in the completed work.

Removed concrete and other debris shall be disposed of as provided in Section 104.1.4.

202.3.3 Removal of Minor Structures and Miscellaneous Structural Concrete: Minor structures and miscellaneous structural concrete shall be defined as all or portions of minor retaining walls, spillways, drainage structures, concrete box culverts, foundations, footings and all other Portland cement concrete construction, except bridges. All existing miscellaneous concrete shall be removed to a depth of at least 5 feet below finished subgrade elevation, unless otherwise specified in the Special Provisions or on the project plans.

Where new concrete is to join existing concrete, the existing concrete shall be saw cut to a true line with straight planar edges free from irregularities.

Concrete removal operations shall be performed without damage to any portion that is to remain in place. All damage to the existing concrete which is to remain in place shall be repaired to a condition equal to that existing concrete damaged by the Contractor's operations shall be at no additional cost to the County.

Existing reinforcement that is to be incorporated in new work shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete.

Removed concrete and other debris shall be disposed of as provided in Section 104.1.4.

The floors of concrete basements, pits, and structures not required to be removed, and which are located within the roadway, shall be broken in a manner that will prevent the entrapment of water.

202.4 MEASUREMENT:

Removal of structures will be measured on a lump sum basis except when the fee schedule contains specific items under this section on a unit basis, measurement will be made by the units designated in the fee schedule.

202.5 PAYMENT:

Payment for the accepted quantities of removal of structures will be made by lump sum, or by specific removal items, or by a combination of both. Payment for removal of structures and obstructions not listed in the fee schedule, but necessary to perform the construction operations designated on the project plans or specified in the Special Provisions, shall be considered as included in the prices of contract items.

The prices shall include all excavation and subsequent backfill related to the removals, and the salvaging, hauling, storing and disposing of all materials as provided herein.

SECTION 205  
ROADWAY EXCAVATION

205.1 DESCRIPTION, add the following:

Roadway excavation shall also consist of the placement and compaction of excavated material in embankments as provided under Section 211 Fill Construction.

SECTION 211  
FILL CONSTRUCTION

211.2 PLACING, add the following:

Fill material placed within 2 feet of pavement finished grade shall not exceed 3 inches in greatest dimension. Fill material placed within 2 feet of all other finished grades shall not exceed 6 inches in greatest dimension.

Part 200 add the following new Section:

SECTION 212  
ROADWAY OBLITERATION

212.1 DESCRIPTION:

Roadway obliteration shall consist of removing abandoned roadway elements and grading the area to blend in with the surrounding terrain. In undeveloped areas, the grading is to restore the natural contours.

212.2 CONSTRUCTION:

The Contractor shall remove existing pavement and base materials. The Contractor shall dispose of materials in fill areas or as approved by the Engineer. Grading and shaping operations shall consist of excavating prior filled areas and the placing of fill material as needed for terrain restoration. The roadway's native subgrade shall be scarified prior to placement of any fill. Fill material in excess of project construction requirements shall be placed in the area of the old roadway and shaped to blend with natural contours according to the obliteration detail or specified grades, to the satisfaction of the Engineer. Compaction of fill in the restored areas shall range between 85% and 90% when tested with methods defined in section 211.4. Care shall be taken to ensure proper drainage. The area shall be seeded in accordance with Section 430 Landscaping and Planting.

212.3 MEASUREMENT:

Measurement of Roadway Obliteration will be the square yards of pavement designated to be removed within roadway obliteration limits.

212.4 PAYMENT:

Payment for Roadway Obliteration will be at the contract unit price. Payment shall be full compensation for removal of all asphalt pavement and base materials together with the grading and shaping operations, complete in place.

Part 200 add the following new Section:

SECTION 221  
GABION CONSTRUCTION

221.1 DESCRIPTION:

The work under this section shall consist of furnishing all materials, equipment, labor, and incidentals required to construct metallic-coated steel wire gabion mattresses or baskets at the locations and to the line and grade shown on the plans.

221.2 MATERIALS:

The material used for gabion fill shall be clean, hard, well-graded rock. The rock size for 12" thick gabion mattresses shall be from 4" to 8" with  $D_{50} = 6"$ . Placement of stone filling shall not exceed a 12" vertical drop above the gabion mattress.

Rock shall be sound and durable, free from clay or shale seams, cracks or other structural defects. The bulk specific gravity (SSD) shall be determined in accordance with the requirements of AASHTO T-85 and shall be a minimum of 2.4. Rock may be rounded stones. Rock shall have a least dimension not less than one-third of its greatest dimension and a gradation in reasonable conformity with that shown herein. Control of the gradation will be by visual inspection.

The source and acceptability of the stone shall be submitted to the Engineer for approval. If testing is required, suitable sample of stone shall be taken in the presence of the Engineer at least 25 days in advance of the time when its use is expected to begin. The approval of a sample from a particular pit or quarry site shall not be construed as constituting the approval of all material taken from that site.

Gabion basket units shall be of non-raveling construction and fabricated from a double twist by twisting each pair of wires through three half turns developing the appearance of a triple twist per ASTM A975. The double twist mesh shall be manufactured from zinc-5% Al coated steel wire conforming to ASTM A856 Zinc-5% Aluminum-Mishmetal Alloy-Coated Carbon Steel Wire. The nominal diameter of the wire shall be 0.0866 inches for gabion mattresses and 0.120 inches for gabion baskets. The metallic-coated steel wire shall have a zinc-5% Al coating with at least 275 g/m<sup>2</sup> per DIN 1548, as manufactured by Maccaferri Gabions, Inc. (GalMac® wire) or approved equal. All gabion diaphragms and frame wires shall equal or exceed the requirements for Style 3 in ASTM A975. The mesh opening shall be hexagonal in shape and uniform in size measuring not more than 60 mm (2-½ inches) by 80 mm (3-¼ inches) for gabion mattresses. Selvedge or perimeter basket frame wire shall be of a heavier gauge than the mesh wire with a diameter of 0.015 inches after the zinc-5% Al coating. Lacing and connecting wire shall meet the same specifications as wire used in the gabion body except that its diameter shall be 0.091 inches (US gauge 13) after zinc-5% Al coating. The use of alternate wire fasteners shall be permitted in lieu of tie wire providing the alternate fastener produces a four (4) wire selvedge joint with a strength of 1,400 lbs per linear foot while remaining in a locked and closed condition. Properly formed interlocking fasteners shall be spaced from 4 inches to 6 inches and have a minimum 1 square inch inside area to properly confine the required selvedge wires. The interlocking wire fastener shall meet material specification ASTM A-764, Finish 2, Class 1, Type 3. All of the above wire diameters are subject to tolerance limit of 0.004 inches in accordance with ASTM A641.

Bedding material shall be used under and behind the gabion baskets. Bedding material shall be clean and durable, and free from clay, shale, or organic material. Two layers of bedding material shall be used, Type I and Type II, conforming to the following gradations:

GRADATION FOR GRAVEL BEDDING

<u>Standard Sieve Size</u>	<u>Percent Passing by Weight</u>	
	<u>Type I</u>	<u>Type II</u>
3 inches	-	90 to 100
1-1/2 inches	-	-

3/4 inch	-	20 to 90
3/8 inch	100	-
#4	95 to 100	0 to 20
#6	45 to 80	-
#50	10 to 30	-
#100	2 to 10	-
#200	0 to 2	0 to 3

A sample of each type of bedding material shall be provided to the Engineer for approval along with a sieve analysis of a representative sample of each type of bedding material.

The thickness of the gravel bedding shall be 4 inches for both Type I and Type II. Type II bedding shall be placed on top of Type I bedding.

Geotextile filter fabric shall be used behind and under the bedding material and shall be a non-woven fabric consisting only of long-chain polymeric filaments such as polypropylene or polyester formed into a stable network such that the filaments retain their relative position with each other. The fabric shall be inert to commonly encountered chemicals that adversely affect or alter its physical properties. The physical requirements for the geotextile fabric shall meet the following minimum average roll values:

<u>PROPERTY</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>
Grab tensile strength, lbs	200	ASTM D 4632
Grab elongation at break, %	45 min., 115 max	ASTM D 4632
Puncture strength, psi	80	ASTM D 3787
Burst strength, lbs	475	ASTM D 3786
Trapezoidal tear strength, lbs	50	ASTM D 4533
Permittivity, cm/sec <sup>-1</sup>	0.48 maximum	ASTM D 4491
Apparent opening, US Std. sieve size	150-200	ASTM D 4751
UV stability, %	70	ASTM D 4355

Minimum average roll values represent the average test results for a lot in the weaker direction when sampled according to ASTM D 4354 and tested according to the test method specified above.

The identification, packaging, handling, and storage of the geotextile fabric shall be in accordance with ASTM D 4873. Fabric rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement. Each roll shall be labeled or tagged to provide product identification sufficient to determine the product type, manufacturer, quantity, lot number, roll number, date of manufacture, shipping date, and the project number and name to which it is assigned. Rolls will be stored on the site or at another identified storage location in a manner that protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof, light-colored, opaque cover. At no time shall the fabric be exposed to sunlight for a period exceeding 14 days.

### 221.3 ASSEMBLING AND PLACING:

The gabion bed subgrade shall be excavated to the width, line, and grade shown on the plans. The gabions shall be founded on this bed and laid to the lines and dimensions required.

Excavation for toe or cut-off walls shall be made to the neat lines of the wall.

Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into rectangular units of the specified sizes. Gabions are to be of single unit construction. The base, ends, and sides shall either be woven into a single unit or one edge, or shall be connected to the base section of the unit in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

Gabion mattress dimensions shall conform to sizes as follows:

<u>DIMENSIONS (ft)</u>	<u>NO. CELLS</u>	<u>CAPACITY (ft<sup>3</sup>)</u>
6 x 3 x 1	2	18
9 x 3 x 1	3	27
12 x 3 x 1	4	36
3 x 3 x 3	multiple lengths	27 each

Tolerances: All gabion dimensions shall be within a tolerance limit of  $\pm 5\%$  of the manufacturer's stated sizes.

The Contractor shall submit for review by the Engineer, shop drawings prepared by a Professional Engineer registered in the state of Arizona for the gabion layout at the locations shown in the plans. Said shop drawings will be based on the layout shown on the plans and shall include, but not be limited to plan and sections, basket sizes, and locations.

Where the length of gabion exceeds its horizontal width, the gabion is to be equally divided into cells by diaphragms of the same mesh and gauge as the body of the gabions. The length of the cells shall not exceed the horizontal width of the gabion. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base section in such a manner that no additional tying at this juncture will be necessary.

All perimeter edges of gabions are to be securely selvedged or bound so that the joints formed by tying the selvedges have at least the same strength as the body of the mesh.

Gabions shall be placed to conform with the project plan details. Stone shall be placed in close contact in the unit so that maximum fill is obtained. The units may be filled by machine with sufficient handwork to accomplish requirements of this specification; however, the stone filling shall not exceed a 12-inch vertical drop above the gabion basket. The exposed face or faces shall be hand-placed using stones to prevent bulging of the gabion cell and to improve appearance. Each gabion basket cell shall be filled in three lifts.

Two connecting tie wires shall be placed between each lift in each cell. Care shall be taken to protect the vertical panels and diaphragms from being bent during filling operations.

The last lift of stone in each cell shall be level with the top of the gabion to properly close the lid and provide an even surface for the next course.

All gabion units shall be tied together; each to its neighbor along all contacting edges to form a continuous connecting structure.

Empty gabions staked on filled gabions shall be laced to the filled gabion at the front, side, and back.

Filter fabric shall be placed in the manner and at the locations shown on the project plans. The surface to receive the fabric shall be free of obstructions, depressions, and debris. The filter fabric shall be loosely laid and not placed in a stretched condition.

The strips shall be placed to provide a minimum 24-inch overlap for each joint. On horizontal joints, the uphill strip shall overlap the downhill strip. On vertical joints, the upstream strip shall overlap the downstream strip.

The bedding material shall be carefully placed on the filter fabric in such a manner as not to damage the fabric. If, in the opinion, of the Engineer, the fabric is damaged or displaced to the extent that it cannot function as intended, the Contractor shall remove the bedding material, regrade the area if necessary, and replace the filter fabric.

#### 221.4 MEASUREMENT:

Gabion riprap shall be measured by the cubic yard by computing the volume of the rock-filled wire baskets used.

#### 221.5 PAYMENT:

The accepted quantities of gabion riprap, measured as provided above, will be paid for at the contract unit price, which price shall be full compensation for the work, complete in place, including excavation, preparing the ground area and furnishing and installing the rock, bedding, fabric, and metal items, complete in place.

## SECTION 222 CEMENT STABILIZED ALLUVIUM BANK PROTECTION

#### 222.1 DESCRIPTION:

The work under this section consists of constructing cement stabilized alluvium (CSA) bank protection at the locations shown on the plans and in accordance with these specifications, including

excavating, backfilling and grading the river bed and banks to the lines, grades and cross sections shown on the plans or established by the Engineer; furnishing, processing and mixing aggregate, cement, fly ash and water; spreading and compacting the mixture; and placement of curing seal.

## 222.2 MATERIALS:

222.2.1 Aggregate shall be clean, sound, durable, uniform in quality and free of any soft, friable material, organic matter, oil, alkali or other deleterious substances. Aggregate shall conform to the following requirements.

Aggregate Size	Percent Passing
3 inch	100
No. 4	30-65
No. 200	0-8

Sampling and sieve analysis shall be performed in accordance with ASTM D75 and ASTM C136.

The plasticity index shall be no greater than 10 in accordance with the requirements of AASHTO T-90. Clay lumps larger than one inch shall be screened out of the raw soil prior to mixing.

Before placing aggregates upon the stockpile site, the site shall be cleared of vegetation, trees, stumps, brush, rocks and other debris, and the ground leveled to a smooth, firm, uniform surface.

Stockpiles shall be constructed upon prepared sites. The piles when completed shall be neat and regular in shape. The stockpile height shall be limited to a maximum of 13 feet.

Stockpiles in excess of 200 cubic yards shall be built up in layers not more than 4 feet in depth. Stockpile layers shall be constructed by trucks, "clamshells", or other methods approved by the Engineer. Pushing aggregates into a pile by a bulldozer will not be permitted. Each layer shall be completed over the entire layer of the pile before depositing aggregates in the next layer.

The aggregate shall not be dumped so that any part of it runs down and over the lower layers in the stockpile. The method of dropping from a bucket or spout in one location so as to form a cone shaped pile will not be permitted. Any method of placing aggregates in stockpiles, which, in the opinion of the Engineer, segregates, breaks, degrades or otherwise damages the aggregates will not be permitted.

Only pneumatic tired equipment shall be used on the processed or manufactured aggregates in constructing the stockpiles. When removing materials from the face of the stockpile, the equipment shall be operated in such a manner as to face-load from the floor to the top of the stockpile to obtain maximum homogeneity of materials.

Stockpiles shall not be constructed where traffic, vehicles or Contractor's equipment will either run over or through the stockpile, or cause foreign matter to be mixed with the aggregates.

222.2.2 Cement shall conform to the requirements for low alkali, Type II Portland Cement of Section 725.2.

222.2.3 Fly ash shall conform to the requirements of Section 725.2.1 for pozzolonic materials.

222.2.4 Water used for mixing shall be potable and free from oil, vegetable matter and any other deleterious matter; and shall conform to Section 725.4.

222.2.5 CSA shall have a minimum compressive strength of 0.75 ksi at seven days, determined in accordance with the requirements of Arizona Test Method 241

(Modification of AASHTO T-134). At least one test (two cylinders) shall be made for each 1,300 cubic yards of CSA placed.

222.2.6 Bedding Mortar shall consist of broomable, high portland cement/fly ash content, heavily sanded mortar, with a compressive strength of 2.9 ksi at 28 days, and shall have a slump of approximately 8.0 to 9.0 inches. The sand (fine aggregate) shall satisfy Sections 701.3, 776.3 and the following gradation:

<u>Aggregate Size</u>	Percent Passing
3/8 inch	100
No. 4	95-100
No. 16	45-80
No. 50	0-30
No. 140	0-10
No. 200	0-4

222.2.7 Exterior Concrete shall be Class B, conforming to Section 725.1.

222.2.8 Forms shall be mortar tight and designed, constructed, braced and maintained so that the finished concrete will be true to line and elevation; and will conform to the required dimensions and contours. They shall be designed to withstand the pressure of concrete, use of set-retarding admixtures or pozzolonic materials in the concrete, effects of vibration as the concrete is being placed and all loads related to the construction operations, without distortion or displacement.

All forms shall be treated with an approved release agent before concrete is placed. Any material that will adhere to or discolor the concrete shall not be used.

### 222.3 CONSTRUCTION:

222.3.1 Mix Design: Contractor shall determine the mix proportions of the aggregate, cement, fly ash and water; and shall furnish CSA conforming to the requirements specified herein. The job-mix design with supporting test results shall be submitted to the Engineer for review. The Engineer's approval shall be obtained prior to incorporating any material into the work.

The mix design objective is to provide the minimum cement plus fly ash content (C+P), W/C ratio and mix proportions to meet the specified strength, plus 2% additional cementitious materials (same C+P content) for durability and material variations. At the same time, the mix shall be dry (stiff) enough to support heavy placement and compaction equipment, yet wet enough to permit effective consolidation by adequate distribution of the paste binder throughout the CSA mass, during the mixing and placing process. The C+P content during CSA production shall not be decreased nor increased from that of the approved job-mix design unless approved by the Engineer. Actual mix designs, used on this project, shall be determined from the Contractor's laboratory tests from material stockpiled after construction of the stockpiles is completed.

The mix design shall be performed in accordance with Arizona Test Method 220 (Determination of Cement Content Required for Cement Treated Mixtures, a modification of AASHTO T-144) to determine the cementitious (C+P) content necessary for the strength required for CSA.

Determination of the optimum moisture content for compaction of the CSA mixture, including the additional 2% cementitious material for durability, shall be in accordance with AASHTO T-134, Method B. The additional 2% cementitious materials shall be a mixture of cement and fly ash in the same proportions as used in the mix design to meet the strength requirement. The total weight of cement replaced by fly ash shall not exceed 15%.

The Contractor shall follow the general provisions in accordance with Arizona Test Method 220 and AASHTO T-99, Method D, with the following exceptions:

The AASHTO T-99, Method D, shall be used in determining maximum dry density, modified to the extent that a rock correction will be calculated to correct for aggregate passing the 3.0-inch and retained on the 5/8 inch sieves. No correction will be used in determining the optimum moisture content.

Included in the job-mix design data shall be the grade of cement, brand of fly ash, and source of aggregate. A new mix design shall be submitted for approval at least two weeks prior to use, any time the Contractor requests a change in materials or proportioning of the materials from that given in the approved mix design.

222.3.2 Preparation of Subgrade: CSA shall be placed on a prepared subgrade shaped to the lines and grades shown on the plans, or be placed on existing CSA. The subgrade shall be compacted to a minimum of 95% of the maximum density in accordance with Section 301.3. When the embankment material is composed predominately of rock such that these compaction procedures will not achieve the required density, the Engineer will determine the amount of compaction required and the adequacy of equipment used to obtain the required compaction.

Immediately prior to placement of the CSA, the subgrade shall be uniformly moistened and maintained in an acceptable condition throughout the placement operation. Soft or yielding subgrade shall be corrected and made stable before construction proceeds. Saturated or submerged subgrade shall remain dewatered a minimum of 48 hours after placement of the CSA.

When CSA is to rest on rock, the rock shall be fully uncovered. The surface of the rock shall be removed to a depth sufficient to expose sound rock. Bedrock shall be roughly leveled or cut to approximate horizontal and vertical steps. Seams in the rock shall be grouted where determined by the Engineer.

When placed on existing CSA, the surface receiving the new CSA shall be cleaned to the satisfaction of the Engineer in the following manner:

After exposing the CSA structure, the surface shall be thoroughly cleaned of all loose materials foreign to the CSA. The surface shall be cleaned by sand-blast or hydro-blast (2.0 ksi maximum) to remove all foreign or loosened particles and hand scaled, if necessary, to provide a clean rough surface, free of loose materials, satisfactory to the Engineer.

The old CSA surface shall be moist at the time of placement and a ¼ inch layer of broomable bedding mortar (2.9 ksi) shall be used between the old and new CSA. A set retarding admixture shall be used in the mortar during hot weather placement.

222.3.3 Mixing, General Requirements: Aggregate, fly ash and cement shall be proportioned and mixed in a central mixing plant, unless otherwise permitted by the Engineer. The plant shall be either the batch mixing type (using revolving blade or rotary drum), or the continuous mixing type. The aggregate fly ash and cement shall be proportioned by weight. Certification for each shipment of cement or fly ash shall be provided to the Engineer.

The fly ash and cement shall be added in such a manner so that they are uniformly distributed throughout the mixing operation.

There shall be safe, convenient facilities for sampling the cement and fly ash in the supply line to the weight hopper or pugmill. The charge in the batch mixer or continuous mixer shall not exceed that which will permit complete mixing of the materials.

The water shall be proportioned by weight or volume and there shall be some means to enable the Engineer to verify the amount of water in each batch or the rate of water flow for continuous mixing. The time of the addition of water or the points where it is introduced into the mixer shall be as approved by the Engineer.

Control of water content in the field shall be accomplished in two ways:

- (1) The moisture-density relationship for the CSA shall be determined in accordance with AASHTO T-134, Method B, on a routine basis, or when any significant shift in the gradation or rock content occurs.
- (2) The actual moisture content of the mixture at the time of compaction, or shortly thereafter, shall be determined in accordance with ASTM D2216 (oven dry) or AASHTO T 310 (nuclear method), to determine if the optimum moisture content as determined by AASHTO T 134, Method B, is being maintained. Water content in the aggregates is to be continuously monitored and the mixing water shall be adjusted as necessary to maintain proper moisture.

222.3.4 Batch Mixing: The mixer shall be equipped with a sufficient number of paddles of a type and arrangement to produce a uniformly mixed batch. The mixer shall be equipped with a timing device which will indicate, by a definite audible or visual signal, the expiration of the mixing period. The device shall be accurate to within two seconds. The time of mixing shall begin after all the ingredients are in the mixer and shall end when the mixer is half emptied. The allowable tolerance for weight batching of aggregates and cementitious material will be 2.0% and 0.5%, respectively, for each batch.

The batch mixing plant shall provide sampling facilities that are satisfactory to the Engineer and which will allow representative samples of the CSA to be obtained easily and safely.

222.3.5 Continuous Mixing: A control system shall be provided that will automatically close down the plant when the material in any storage facility approaches the strike-off capacity of the feed gate. The plant will not be permitted to operate unless this automatic control system is in good working condition.

The feeder for the aggregate shall be mechanically or electrically driven.

Aggregate shall be drawn from the stockpile by a feeder or feeders that will continuously supply the correct amount of aggregate.

The cement/fly ash and aggregate feeders shall be equipped with devices that can accurately determine the rate of feed while the plant is in full operation.

Continuous mix plants shall provide sampling facilities which are satisfactory to the Engineer, and that allow representative samples of the aggregate and CSA mixture to be obtained easily and safely.

222.3.6 Transporting/Spreading: Mixed materials shall be transported from the plant to the construction site in vehicles and spread on the prepared subgrade or previously completed CSA. Spreading shall be accomplished by the use of approved motor graders or crawler type equipment. The compacted lifts of CSA shall not exceed 8.0 inch or be less than 4.0 inch in thickness.

Aggregate shall not be mixed or placed when the air temperature is below 45° F in the shade, unless the air temperature is at least 45° F in the next 24 hours. CSA shall not be mixed or placed when the air temperature is greater than 109° F in the shade.

222.3.7 Compacting/Finishing: All completed CSA surfaces that will be covered with succeeding layers of CSA shall be kept continuously moist by fog spraying until placement of next lift.

CSA shall be uniformly compacted to a minimum of 98%, with an average of 100%, of maximum density as monitored by nuclear density tests in accordance with AASHTO T 238 and T 310. Maximum density shall be determined in the lab in accordance with the requirements of AASHTO T 99, Method D, for minus 0.75-inch material only, with rock correction at each density test location according to AASHTO T 224, Section 2.2.2. At least one density test shall be taken for each 460 cubic yards of CSA.

At the start of compaction of each lift, the mixture shall be in uniform, loose condition throughout its full depth. The moisture content shall be as previously specified herein. No section shall be left undisturbed for longer than thirty minutes during compaction operations. Compaction of each lift shall be accomplished in such a manner as to produce a dense surface, free of compaction planes, and shall be completed within one (1) hour from the time water is added to the mixture. After compaction, CSA shall be shaped to the required grades, cross sections and rolled to a reasonably smooth surface. Whenever the Contractor's operation is interrupted for more than two hours, the top surface of the completed layer, if smooth, shall be scarified to a depth of at least 1 inch with a spike-tooth instrument prior to placement of the next lift. The surface, after scarifying, shall be swept using a power broom or other method approved by the Engineer, to completely free the surface of all loose material prior to the placement of the next lift.

At the time of compaction, the moisture content shall not be more than one percent (1%) below optimum and shall not be more than one percent (1%) above optimum when the mean air temperature during construction hours does not exceed 90° F.

When the mean air temperature does exceed 90° F, or there is a breeze or wind which promotes rapid drying of the CSA mixture, the moisture content shall be increased as needed, at the direction of the Engineer, but shall be less than the amount that will cause the CSA to become unstable during compaction and finishing operations.

Backfill shall not be placed within 40 inches of the top of the CSA surface. Construction joints shall be provided at the end of each day's work or when work is halted for two hours or more. The joints shall be trimmed to a straight line and vertical to the full depth of the lift. Before resuming placement of new material, the joints shall be roughened and loose material removed by power broom or compressed air.

Compaction equipment shall be capable of obtaining specified requirements without detrimentally affecting the compacted material. The equipment shall be modern, efficient compacting units approved by the Engineer. The units shall be of a type that is capable of compacting each lift of material as specified, and meet the minimum requirements as contained herein:

Self-propelled drum drive vibratory roller shall be of a type that will transmit dynamic impact to the surface to be compacted through a steel drum by means of revolving weights, eccentric shaft or other methods. The compactor shall have a gross mass of not less than 23,000 lbs. and shall produce a dynamic force of at least 13 lbs. per inch of drum width when operated at 2,400 cycles per minute (cpm). The dynamic force is defined as the force developed by revolving the eccentric weight at 2,400

cpm. The roller shall have a smooth drum or drums and the drum diameter shall be between 48 inches and 70 inches, and the width shall be between 28 inches and 100 inches. The frequency of vibration during operation shall be 2,400 cpm. The roller shall be operated at speeds not to exceed 15 mph in the forward direction. The engine driving the eccentric mass shall have a rating of not less than 90 kilowatts. Variation in speed, frequency and method of operation will be determined when found necessary to secure maximum compaction of materials.

Heavier compacting units may be required to achieve the required density.

222.3.8 Bedding Mortar: Bedding Mortar shall be used between CSA that has been in place more than seven (7) days and the new CSA after the existing CSA has been properly cleaned. The bedding mortar is to be used for achieving bond between the old and new CSA layers and to eliminate and prevent segregation or voids along the margins of CSA placements. Adjustment to the mix design may be required by the Engineer.

222.3.9 Control Strips: A control strip shall be constructed at the beginning of work on the CSA to be compacted. The control strip construction will be required to establish procedures necessary to obtain densities for the specific course plus use of portable nuclear moisture/density testing equipment to determine in-place densities.

Each control strip, constructed to acceptable density and surface tolerances shall remain in place and become a section of the completed CSA. Unacceptable control strips shall be corrected or removed and replaced at the Contractor's expense. A control strip shall cover an area of approximately 420 square yards and be of the same dimensions specified for the CSA course.

The materials used in construction of the control strip shall conform to the specification requirements. They shall be furnished from the same source and be of the same type as used in the CSA. The underlying surface for the control strip shall have prior approval of the Engineer.

The equipment used in the control strip shall be of the same type and weight as used for the CSA.

Compaction of control strips shall start immediately after the course has been placed to the specified thickness, and shall be continuous and uniform over the entire surface. Compaction of the strip shall continue until no discernible increase in density can be obtained by additional effort.

Upon completion of compaction, the mean density of the control strip will be determined by averaging the results of ten density tests taken at random sites within the strip. If the mean density of the control strip is less than 98% of the laboratory compacted specimens as determined by testing procedures appropriate for the material being placed, the Engineer may order the construction of another control strip.

A new control strip may be ordered by the Engineer, or requested by the Contractor when:

- (1) A change in material or mix design.
- (2) There is reason to believe that the control strip density is not representative for the material being placed.
- (3) Ten days of production have passed without a new control strip.

222.3.10 Power Tampers and Small Vibratory Rollers: Small vibratory rollers that are capable of operating within a few millimeters of a vertical face shall be used for compaction adjacent to guide banks, next to utilities and drainage conduit, at transitions to previously constructed levee protection and at other areas where larger vibratory rollers cannot maneuver. The dynamic force produced by the small vibratory rollers shall be at least 140 lbs. per inch of drum width.

Tampers shall be a type capable of developing a force per blow of at least 1390 lbs. The amount of rolling and tamping required shall be whatever is necessary for the particular equipment to provide the same degree of compaction as would be obtained by four passes of the large self-propelled vibratory roller. Standby replacement equipment shall be available within one hour if needed.

222.3.11 Curing: Temporarily exposed surfaces shall be kept continuously moist. Care must be exercised to ensure that no curing material other than water is applied to the surface that will be in contact with succeeding layers.

Permanently exposed surfaces shall be kept in a moist condition for seven days, or they may be

covered with bituminous or other suitable curing material, subject to the Engineer's approval. Any damage to the protective covering within the seven days shall be repaired to the satisfaction of the Engineer.

Regardless of the curing material used, any permanently exposed surface shall be kept moist until the protective cover is applied. This protective cover is to be applied as soon as practical, with a maximum time limit of twenty-four hours between the finishing of the surface and the application of the protective cover.

222.3.12 Maintenance: The Contractor will be required, within the limits of the contract, to maintain the CSA and curing seal in good condition until the work is completed and accepted. Maintenance shall include repairs to any defects that may occur. This work will be done at the Contractor's expense and repeated as often as necessary. Faulty work shall be replaced for the full depth of the layer.

222.4 MEASUREMENT:

The work will be measured by the cubic yard of completed CSA bank protection constructed to the lines, grades and cross-sections shown on the plans.

The maximum limit for the placement of CSA due to over excavation or sloughing of existing soils shall be 4 inches. Any placement beyond these limits will not be included in the pay quantity.

222.5 PAYMENT:

The accepted quantities of CSA will be paid for at the contract price per cubic yard for CSA Bank Protection, subject to the following penalties for failure to achieve the required strength requirements:

<u>Percent of Specified Strength</u>	<u>Percent of Contract Unit Price</u>
100	100
97-99	92
94-96	85
90-94	77
85-89	68
80-84	60
75-79	50
<75	See Note

Note: Material represented by lots attaining seven day compressive strengths with a mean value less than 75% of the specified compressive strength will be evaluated as to acceptance. The Engineer will determine if the material can be left in place or removed and replaced at the Contractor's expense.

Part 300 add the following new Section:

SECTION 308  
STABILIZATION USING LIME SLURRY WITH FLY ASH

308.1 DESCRIPTION:

This section shall consist of constructing a mixture of soil, lime slurry, fly ash and water for the stabilization of soils or base materials. The work shall be performed in conformity with the lines, grades, thickness, and typical cross sections shown on the plans.

308.2 MATERIALS:

308.2.1 Soil or Subgrade: The soil or subgrade material used for this work shall consist of materials on the site or imported and shall be free of roots, sod, weeds, and stones larger than 3 inches.

308.2.2 Quicklime and Hydrated Lime: Lime used to manufacture the Commercial Lime Slurry specified herein, shall be either Quicklime or Hydrated lime and shall conform to the requirements of ASTM C977. Lime may only be used in the production of lime slurry. The direct use of dry hydrated lime

or quicklime to the soil material is strictly prohibited. All lime shall come from a single source. If a source change is requested, a new mix design shall be submitted using lime from the proposed new source. The new design must be approved by the Engineer prior to use.

308.2.3 Commercial Lime Slurry: Commercial lime slurry shall be a pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material in sufficient quantity naturally injurious or objectionable for the purpose intended. The solids portion of the mixture, when considered on the basis of solids content, shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following requirements as to chemical composition and residue.

**(A)** Chemical Composition: The solids content of the lime slurry shall consist of a minimum of 90 percent by weight, of calcium and magnesium oxides (CaO and MgO), as determined by ASTM C25.

**(B)** Residue: The percent by weight of residue retained in the solids content of lime slurry shall conform to the following requirements:

Residue retained on a No. 6 sieve Max. 0.2%

Residue retained on a No. 30 sieve Max. 4.0%

**(C)** Grade: Commercial lime slurry shall conform to a dry solids content as approved by the Engineer.

A certificate of compliance and a field summary of lime slurry produced shall be provided to the Engineer for each load of slurry.

308.2.4 Water: Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product. The pH (hydrogen ion concentration) of water to be used during construction for mixing or curing shall be within the range of 6.0 to 8.5. The procedure for determining pH values shall be based on the test apparatus used, the test apparatus may use either an electrometric or colorimetric method. The testing procedure shall be in accordance with the methods and instructions furnished by the manufacturer of the test apparatus. Water known to be of potable quality may be used without testing.

308.2.5 Fly Ash: Fly ash shall meet the requirements of AASHTO M-295, Class C.

### 308.3 MIX DESIGN:

Before commencing lime / fly ash treatment work, the Contractor shall submit for approval by the Engineer, a proposed mix design. A testing laboratory under the direction and control of an Arizona registered Professional Engineer shall prepare the proposed mix design. The mix design shall be determined using the soils or subgrade material to be stabilized, water from the source to be used during construction, and lime and fly ash from the proposed suppliers. The mix design shall identify the water source to be used during construction and, if not from a potable source, the water's pH value.

The mix design shall determine the following:

- Percent of fly ash and rate of application.
- Percent of lime and rate of application of lime slurry in the treated soil or subgrade material.
- Optimum water content during mixing, curing and compaction.  
Gradation of in-situ mixture after treatment.
- Additional mixing or equipment requirements.  
Mellowing time requirements, if needed.

The mix design shall comply with the following requirements:

- Plasticity Index: Less than 3, per AASHTO T-89 & 90.
- Swell Potential: One (1) percent or less vertical expansion of an air-dried soil when inundated with water and allowed to swell at a confined pressure of 60 psi.
- Unconfined Compressive Strength: Minimum 300 psi in five days curing at 100 degrees F when tested in accordance with ASTM D1633 Method A.

### 308.4 CONSTRUCTION:

308.4.1 General: The completed subgrade shall consist of a uniform lime / fly ash mixture, free from loose segregated areas, have a uniform density and moisture content, and be well bound for its full depth. A smooth surface suitable for placing subsequent courses is required if pavement is to be placed directly on the treated subgrade.

Prior to beginning stabilization, the subgrade shall be constructed and brought to grade and shall be shaped to conform to the typical sections, lines, and grades as shown on the plans.

When the design requires treatment to a depth greater than 12 inches, the subgrade soil shall be treated in equal layers. The top layer(s) of soil shall be removed and stockpiled. The lower layer of soil to be treated shall then be treated and allowed to cure in place. After final mixing, the lower layer shall be compacted in maximum 12 inch compacted lifts. The stockpiled soil shall then be placed, treated, mixed and compacted in successive maximum 12 inch compacted lifts.

308.4.2 Weather Limitation: Lime slurry / fly ash treated subgrade shall not be constructed if the atmospheric temperature is below 40° F or when conditions indicate that temperatures may fall below 40° F within 24 hours.

308.4.3 Equipment: Contractor shall provide all equipment necessary to complete the work, including grading and scarifying equipment, lime slurry spreader (gravity feed spreaders will not be permitted), fly ash spreader, mixing and pulverizing equipment, sheepsfoot and pneumatic rollers, sprinkling equipment, and trucks. When using dry hydrate to make slurry, agitators are mandatory in spreader. All equipment used for this work shall be subject to approval by the Engineer.

308.4.4 Application: Lime slurry and fly ash slurry shall be spread only on that area where the mixing operations can be completed during the same working day. The application and mixing of lime and fly ash with the soil shall be accomplished by the methods hereinafter described as Slurry Placing.

Slurry Placing: Fly ash shall be spread with trucks equipped with an approved distribution system on the prepared subgrade at the rate specified by the job mix design in a single pass, just prior to the application of the lime slurry. The fly ash may be added to the lime slurry and placed together, if approved by the Engineer. Lime slurry / Lime slurry fly ash, shall be mixed in a portable mixing unit and spread with trucks equipped with an approved distribution system as a slurry. Commercial lime slurry shall be applied with a lime percentage not less than specified herein. The distribution of lime slurry shall be attained by successive passes over a measured section of subgrade until the proper amount of lime has been spread, as determined in the job mix design. The rate of application shall be verified using ASTM D3155 methods.

Thickness: The thickness of the lime slurry treated subgrade shall be determined by visual inspection and/or by depth tests taken at intervals so that each test shall represent no more than 1000 square yards per layer, if more than one layer. The method used to remove material to determine depth of lime treatment may be by shovel and/or pick, coring or other method approved by the Engineer. Phenolphthalein solution shall be used to detect the presence of lime. When the grade deficiency is more than 1 inch, the Contractor shall correct such areas in a manner satisfactory to the Engineer. Contractor shall replace, at no cost to the Agency, the material where depth tests are taken.

No traffic other than the mixing equipment will be allowed to pass over the spread of lime slurry until after completion of mixing.

308.4.5 Mixing: The full depth of the treated subgrade shall be mixed with an approved mixing machine. The use of disc plows or blades are prohibited except in areas specified by the engineer. To ensure a complete chemical reaction of the lime, fly ash and soil or subgrade, water shall be used as required to maintain a moisture content at or above the optimum prior to beginning compaction and held above optimum during compaction. During the interval of time between application and mixing, lime that has been applied, unmixed and exposed to the open air for 10 hours or more will not be accepted.

After mixing and prior to compaction, clay lumps shall meet the following criteria:

	Percent
Minimum of clay lumps passing 1½ inch sieve	100
Minimum of clay lumps passing No. 4 sieve	60

308.4.6 **Compaction:** Compaction of the mixture shall begin after final mixing. Sheepsfoot or segmented steel rollers shall be used during initial compaction. Steel wheel or pneumatic tired rollers shall be used only during final compaction, if pavement is to be placed directly on the treated subgrade. Areas inaccessible to rollers shall be compacted to the required density by methods approved by the Engineer.

The material shall be aerated or watered as necessary to provide and maintain required moisture content. The field density of the compacted mixture shall be a least 95 percent of the maximum density at 0-4 percent above optimum moisture. A composite of treated soil or subgrade materials from a minimum of five (5) random locations, per soil type, within the area to be stabilized shall be used to determine the maximum density and optimum moisture content in accordance with ASTM D558. The in-place field density shall be determined in accordance with ASTM D1556, ASTM D2167 or ASTM D2922.

After each section is completed, tests will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked to meet requirements.

If pumping subgrade should become evident at any time prior to paving, the Engineer may require proof rolling with a pneumatic-tire roller or other approved equipment in order to identify the limits of the unacceptable area. The proof rolling will be performed at no additional cost to the Contracting Agency.

All irregularities, depressions, or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and compacting. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts. Compaction and finishing shall be done in such a manner as to produce a smooth dense surface free of compaction planes, cracks, ridges, or loose materials.

Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion, shall be smooth and shall conform with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished at no cost to the County.

308.4.6.1 **Tolerances:** At final compaction, the lime, fly ash and water content for each course of subgrade treatment shall conform to the approved mix design with the following tolerances.

<u>Material</u>	<u>Tolerance</u>
Lime	+0.5% of design, (ASTM C114)
Fly Ash	±1.0% of design, (ASTM C114)
Water	+4%, -0% of optimum, (ASTM D698)

308.4.7 **Finishing and Curing:** After the final layer or course of lime slurry / fly ash treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the plans. The completed section shall then be finished by rolling with a pneumatic or other suitable roller.

The final layer of lime slurry / fly ash treated subgrade shall be maintained in a moist condition until the next layer of pavement structure is placed. If required, a fog seal for curing, in compliance with Section 333, shall be furnished and applied to the surface of the final layer of the lime stabilized material as soon as possible after the completion of final rolling and before the temperature falls below 40° F. Curing seal shall be applied at a rate between 0.10 and 0.20 gallons per square yard of surface. The exact rate will be determined by the Engineer.

After curing begins, all traffic, except necessary construction equipment shall be kept off the lime slurry / fly ash stabilized subgrade for a minimum of 7 days or until the final pavement structure layer(s) are placed.

308.4.8 **Maintenance:** The Contractor shall maintain, at his / her own expense, the entire lime slurry treated subgrade in good condition from the start of work until all the work has been completed, cured, and accepted by the Engineer.

308.5 MEASUREMENT:

The quantity of lime slurry / fly ash treated soils shall be measured by the square yard, measured in place, treated, compacted, to the proper depth, and accepted.

The quantity of curing seal shall be measured by the ton, diluted.

308.6 PAYMENT:

The lime slurry / fly ash treated soils measured as provided above will be paid for at the contract price per square yard, which price shall be full compensation for the item complete in place, as herein described and specified.

Payment for curing seal will be made at the contract price per ton for Fog Seal (Contingent Item) based on the rate of application as requested by the Engineer.

SECTION 310  
PLACEMENT AND CONSTRUCTION OF AGGREGATE BASE COURSE

310.5 PAYMENT, replace with the following:

Payment for aggregate base course will be paid at the contract unit price per cubic yard for the type involved, complete in place.

SECTION 317  
ASPHALT MILLING

317.2 CONSTRUCTION REQUIREMENTS, add the following:

Asphalt milling adjacent to valley gutters or curb and gutter shall include removal and disposal of built-up asphalt concrete, slurry seal, microsurfacing and similar materials from adjacent concrete valley gutters or concrete gutter pans.

317.3 MEASUREMENT AND PAYMENT, add the following:

Removal and disposal of built-up materials from adjacent portland cement concrete surfaces shall not be measured; the associated cost shall be included in the contract unit price for Asphalt Milling.

SECTION 321  
PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

321.8.2 Joints, add the following:

Longitudinal joints shall be located to maintain a minimum 6-inch clear distance from the edge of any proposed longitudinal pavement stripe.

321.8.6 Asphalt Concrete Overlay, replace paragraphs (a) and (b) with the following:

(a) Areas designated for pavement repair or surface replacement by the contract documents (which may include localized pavement failures, severely raveled areas, severely cracked areas, over-asphalted areas, and other defects) shall be cut out and replaced. Pavement repairs and surface replacements shall be completed and approved before placing asphalt concrete overlay.

(b) Before placing asphalt concrete overlay, thermoplastic pavement markings and raised pavement markers shall be removed and milling shall be completed. Milling shall be as shown on the plans or specified in the special provisions in accordance with Section 317.

321.10.1 Acceptance Criteria, replace the third sentence with the following:

When the quantity of asphalt concrete placed in a day exceeds 1000 tons but is less than 2000 tons, the day's production will be divided into two (2) approximately equal sublots. Where the quantity of asphalt concrete placed in a day exceeds 2000 tons, the day's production will be divided into three (3) approximately equal sublots. A minimum of one sample will be obtained from each lot.

321.13 PAYMENT, add the following:

Payment for removal of thermoplastic markings and raised pavement markers prior to roadway overlay operations will be as specified in Section 460.

Payment for asphalt pavement replacement and asphalt pavement repair required prior to roadway overlay operations will be as specified in Section 336.

SECTION 325  
PLACEMENT AND CONSTRUCTION OF ASPHALT-RUBBER ASPHALT CONCRETE

325.7 PLACEMENT:

325.7.2 Placing and Construction Methods, add the following:

Longitudinal joints shall be located to maintain a minimum 6-inch clear distance from the edge of any proposed longitudinal pavement stripe.

325.7.3 Compaction:

Delete the phrase "any desired" from the first sentence.

325.7.5 Adjustments, add the following:

When the Engineer determines an insufficient amount of material is available for shoulder adjustment, the Engineer may require the Contractor to provide additional material.

325.8 QUALITY CONTROL, add the following:

Requests for an Engineering Analysis or Referee Testing as described in 325.9.4 and 325.10 will not be considered unless based on quality control test results by an AMRL and CCRL accredited laboratory using properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

325.9 ACCEPTANCE:

325.9.1 Acceptance Criteria, replace the third sentence with the following:

When the quantity of ARAC placed in a day does not exceed 1000 tons, the day's total production shall be considered as a single subplot. When the quantity of ARAC placed in a day exceeds 1000 tons but is less than 2000 tons, the day's production shall be divided into two (2) approximately equal sublots. Where the quantity of ARAC placed in a day exceeds 2000 tons, the day's production shall be divided into three (3) approximately equal sublots.

325.9.2 Gradation and Binder Content, replace the first paragraph with the following:

Acceptance testing for gradation and binder content will be performed in accordance with section 325.9.2.2 End Product Sampling and Testing.

325.9.2.2.1 Mineral Aggregate Gradation and Binder Content, add the following:

The Engineer may run tests to determine the correction factor to be used with AASHTO test procedure T 308. When requested by the Engineer, the contractor shall provide calibration materials to the Engineer.

325.9.6 Engineering Analysis (EA), replace Table 325-4 with the following:

TABLE 325-4		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	Acceptance Limits	Penalty When Contracting Agency is the Owner (\$/Ton)
Asphalt-Rubber Binder Content	Over 0.2% points from that Permitted	\$9.00
Laboratory Air Voids (Measured at 75 blows)	Deviation from Target Greater Than $\pm$ 4.0%	\$7.50

325.12 PAYMENT, add the following

Payment for removal of thermoplastic markings and raised pavement markers will be as specified in Section 460.

Payment for asphalt pavement replacement and asphalt pavement repair will be as specified in Section 336.

#### SECTION 329 TACK COAT

329.1 DESCRIPTION, add the following:

Emulsified asphalt for tack coat shall be grade SS-1h.

#### SECTION 330 ASPHALT CHIP SEAL

Section 330 is supplemented with the following:

330.2.1 ASPHALT:

The type of bituminous material shall be CRS-2. Application shall be at the rate of 0.40 – 0.45 gallons per square yard unless otherwise specified by the County Engineer.

330.2.2 AGGREGATE:

The stone chips shall fully comply with Section 716 except precoating is not required. The first layer of chips shall comply with Table 716-2 and the second layer of chips shall comply with Table 716-1. The chips shall be clean. Application shall be at the rate of approximately 20 pounds per square yard for first layer and 26 pounds per square yard for the second layer unless otherwise specified by the County Engineer.

If moist chips are used, the total moisture content shall not exceed 1.5%. It is the responsibility of the Contractor to determine that the asphalt binder is compatible with the aggregate. Certified weigh tickets for aggregate are required.

330.3 TIME OF APPLICATION AND WEATHER CONDITIONS:

Chip seals shall not be placed between the dates of October 1 and April 1 unless cold weather bituminous material is used and prior approval obtained from the County Engineer. The chip seal shall not be applied unless the pavement temperature or ground surface temperature of the area to be chipped, measured in the shaded area, is at least 65° F and rising.

The roadside drainage ditches and shoulders shall be constructed, and compaction tested prior to placement of chip seal course(s).

330.4. PREPARATION OF SURFACES:

A Tack Coat is not required prior to chip sealing on base course.

The surface shall be uniformly smooth, firm, true to grade and cross section, free from ruts or irregularities, tightly bound, and free from any loose stone or debris and shall be so maintained throughout the placing of the bituminous treatment. In no event shall chip sealing be placed on a soft, uneven base. Any holes, depressions or irregularities shall be repaired. All loose and unsuitable material shall be removed and replaced by suitable material, which shall be compacted to produce a dense surface conforming to the adjacent area. Uniformity of surface texture is of the utmost importance. The base course may not vary by more than ¼ inch above or below required grade and cross-section. Any divots deeper than ¼ inch and greater than 4 square inches shall be filled in, leveled and recompacted prior to chip sealing.

Contractor should lightly blade, water and compact the base with an 84-inch smooth drum steel wheel roller immediately prior to chip sealing. In dry areas, additional light applications of water may be required prior to the application of the bituminous material to facilitate penetration of the bituminous material.

330.4.2 APPLICATION OF BITUMINOUS MATERIAL:

The quantity of asphalt shall be between 0.40 and 0.45 gals. /sq. yd. or as specified by the County Engineer based on temperature variables at the time of application.

#### 330.4.3 APPLICATION OF COVER MATERIAL:

The application rate shall be 20 lbs/sq.yd. for the first layer and 26 lbs/sq. yd. for the second layer.

#### 330.4.4 ROLLING:

In residential areas, rollers shall be skirted so that any cover material that should stick to the tires during rolling will be thrown back down to the pavement instead of outward into neighboring property.

Sufficient operational self-propelled pneumatic-tired rollers, with operators, shall be provided to accomplish the required embedment of the cover material. If Contractor is working at more than one location, there shall be a minimum of three rollers, with operators, at each location.

Sufficient rollers shall be used for the initial rolling to cover the width of the aggregate spread with one pass. The first pass shall be made immediately behind the cover material spreader. Four complete passes with rollers shall be made and all rolling completed within one hour after the application of the cover material. If the spreading is stopped for an extended period, the cover material spreader shall be moved ahead or off to the side so that all cover material can be immediately rolled.

#### 330.4.5 JOINTS:

Paper shall be used at the beginning and end of the chip seal section to make a smooth, straight, clean transition. Paper shall also be used at concrete crossings.

#### 330.4.6 SURPLUS AGGREGATE REMOVAL:

Contractor is responsible for locating and acquiring areas to stockpile materials and equipment needed for construction. Contractor shall obtain a letter of release from the property owner prior to stockpiling/equipment storage. The cost of material stockpiling, equipment storage and cleanup is incidental to the project. Contractor shall conduct all sweeping operations in the same direction of traffic flow.

For double chip seal construction modest amounts of excess chips that have been evenly placed on the first layer do not need to be removed from the first layer before application of the second layer.

Before final acceptance by the County, all private or public property and grounds occupied by the Contractor in connection with the work shall be cleaned of all rubbish, excess materials, temporary structures and equipment. All parts of the work area shall be left in a condition equal to, or better than, it was prior to the start of the project.

Cleanup shall also include the daily removal of chip seal materials from manhole covers, valve covers, fire hydrant markers, gutters, curbs, sidewalks, etc. in the project area.

Contractor shall keep driveways and sidewalks clean of any loose chips, in residential areas, daily during construction.

#### 330.4.7 PERFORMANCE:

The completed chip seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a skid resistant surface texture. Areas of the chip seal mat where the old road surface is exposed, or areas where asphalt binder lies uncovered by chips, shall be filled in by the Contractor with asphalt binder and cover material and rolled.

#### 330.6 MEASUREMENT:

Chips will be measured by the square yard of area to be chipped per plan dimensions.

#### 330.7 PAYMENT: is revised with;

(B) Chips:

Single Chip Seal - Square yard

Double Chip Seal - Square yard

### SECTION 333 FOG SEAL COATS

#### 333.1 DESCRIPTION, add the following:

Fog seal coats for curing seal purposes as specified in Section 308 or Section 309 shall consist of the application of emulsified asphalt.

333.6 APPLICATION OF ASPHALT EMULSION, add the following:

For curing seal applications over Lime Slurry Stabilization or Lime Slurry with Fly Ash Stabilization the application rate shall be between 0.10 to 0.20 gallons per squareyard.

#### SECTION 336 PAVEMENT MATCHING AND SURFACE REPLACEMENT

336.2 MATERIALS AND CONSTRUCTION METHODS

336.2.3 Temporary Pavement Replacement, add the following:

Temporary pavement replacement that uses cold-mix asphalt concrete shall be replaced no later than seven (7) calendar days after initial placement.

336.2.4 Permanent Pavement Replacement and Adjustments, add the following:

336.2.4.3 Pavement Repair: Areas designated for pavement repair are suspected subgrade failure areas within asphalt pavement. Pavement repair consist of removal of the existing pavement structural section (asphalt pavement and the underlying aggregate base), exposing and then removal of subgrade material to a depth of eight inches (8"), backfill and compact subgrade and aggregate base materials to depths as directed by the Engineer, and replacement of the asphalt pavement. The Engineer may revise the removal boundary limits at any time during this work. The Engineer shall be notified and given the opportunity to inspect the soil conditions when the subgrade is exposed prior to excavating subgrade material and again at the completion of subgrade excavation.

After approval of the excavation by the Engineer, the Contractor shall proceed with placement of subgrade and aggregate base materials to elevations directed by the Engineer. Compaction of subgrade and aggregate base shall comply with requirements of Table 601-2. The aggregate base material placed shall be compliant with section 702 requirements; the removed aggregate base may or may not be compliant. After placement of the aggregate base course to the bottom of the adjacent pavement, sawcut and remove asphalt pavement to one foot back of the newly placed aggregate base and then construct new asphalt pavement matching the adjacent existing grades and slopes. Asphalt pavement shall be constructed in accordance with the Section 336.2.4.1 Permanent Asphalt Pavement Replacement, except application of a seal coat is not required.

336.3 TYPES AND LOCATIONS OF TRENCH SURFACE REPLACEMENT, add the following:

Type B trench repair is not approved for use within County right of way.

336.5 PAYMENT, add the following:

Payment for asphalt pavement repair shall be full compensation for all labor, equipment, and materials required for the complete in place repair including but not limited to pavement removal, excavation, aggregate base coarse placement, and asphalt pavement replacement.

#### SECTION 337 CRACK SEALING

Replace SECTION 337 CRACK SEALING with the following:

SECTION 337 CRACK SEALING AND FILLING

337.1 DESCRIPTION:

This work consists of furnishing and placing sealant or filler material in Contractor prepared cracks and joints of asphalt concrete or portland cement concrete pavements. All cracks and joints, including the space between asphalt concrete pavement and concrete curb and gutter, which have a clear opening of one-quarter inch (¼") or greater, shall be sealed for the length of the crack that equals or exceeds one-eighth inch (⅛") in width.

337.2 MATERIALS:

337.2.1 Material for Category 1 Cracks: Cracks and joints which have a clear opening ranging from one-quarter inch (¼") to one and one-half inches (1½") shall be classified as category 1 cracks. Sealant materials for category 1 cracks shall be a premixed, single component mixture of asphalt cement, aromatic extender oils, polymers, and granulated rubber in a closely controlled manufacturing process. Materials shall conform to the following specifications when heated in accordance with ASTM D5078 and the manufacturer's maximum safe heating temperature.

TEST	REQUIREMENT
Cone Penetration (ASTM D5329)	20-40
Resilience (ASTM D5329)	30% Minimum
Softening Point (ASTM D113)	210°F (99°C) Minimum
Ductility, 77°F (25°C) (ASTM D113)	30 cm Minimum
Flexibility (ASTM D3111 *Modified)	Pass at 30°F (-1°C)
Flow 140°F (60°C) (ASTM D5329)	3 mm Maximum
Brookfield Viscosity 380°F (193°C) (ASTM D2669)	90 Poise Maximum
Asphalt Compatibility (ASTM D5329)	Pass
Bitumen Content (ASTM D4)	60% Minimum
Tensile Adhesion (ASTM D5329)	400% Minimum
Maximum Heating Temperature	400°F (204°C)
Minimum Heating Temperature	380°F (193°C)
Flash Point (ASTM D92)	450°F Minimum

\*Specimen bent 90° over a 1-inch mandrel within 10 seconds.

337.2.2 Material for Category 2 Cracks: Cracks and joints which have a clear opening ranging from one and one-half inches (1½") to three inches (3") shall be classified as category 2 cracks. Filler material for category 2 cracks shall be hot applied, pourable, high bonding mastic for application in unconfined areas and for vertical-side recessed configurations. Upon curing the material shall provide a flexible waterproof seal. The material shall be traffic ready in thirty minutes or less when installed in accordance with the manufacturer's instructions. Material for sealing category 2 cracks shall be Deery brand Level & Go Repair Mastic or approved equal.

337.2.3 Material for Category 3 Cracks: Cracks and joints which have a clear opening greater than three inches (>3") shall be classified as category 3 cracks. Material for filling category 3 cracks shall be asphalt concrete 3/8" marshal mix compliant with Section 710 and have 100% of the aggregate passing the 3/8" sieve.

337.2.4 Product Submittals: Prior to application of category 1 crack sealant and category 2 crack filler material, the Contractor shall submit the material manufacturer's product specifications together with installation recommendations which shall include surface preparation, product installation, and curing requirements. Certification of compliance for sealant material shall be submitted. Asphalt mix design for category 3 crack filler material shall be submitted to the Engineer for approval.

The Engineer may request material samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

### 337.3 CLEANING AND PREPARING CRACKS OR JOINTS:

Immediately prior to application of sealant, all cracks and joints shall be cleaned of debris and dust. Cracks and joints shall be vacuumed during final cleaning.

337.3.1 Routing: When specified, narrow cracks shall be routed to create a sealant reservoir. Cutting shall remove at least 1/8" from each side and produce vertical, intact surfaces with no loosely bonded aggregate. Routing of joints and cracks shall produce a reservoir having a nominal size of 3/4" wide by 3/4" deep. Variations from the nominal size are subject to acceptance or rejection at the engineer's discretion

337.3.2 Vacuuming: Final cleaning shall thoroughly clean cracks and joints to a minimum depth of 1" for cracks that are 3/4" or narrower and to the full asphalt depth for cracks that are wider than 3/4". Surfaces are to be inspected to assure adequate cleanliness and dryness.

High pressure 90 psi minimum, dry oil free compressed air shall be used for final cleaning and dust removal from cracks. The high-pressure tool shall be integral with a vacuum unit to collect the dust and residue. Both sides of the crack or joint shall be cleaned.

#### 337.4 APPLICATION OF CATEGORY 1 CRACK SEALANTS:

337.4.1 Weather: In no case shall sealant be placed during damp roadway conditions such as wet roadway surfaces or damp material inside the cracks. Operations stopped by the Engineer, due to weather, shall be at no additional cost to the contracting Agency. If installing at night, ensure that dew is not forming on the pavement surface.

Sealant material shall only be applied when pavement temperature exceeds 40°F (4°C). If pavement temperature is lower than 40°F (4°C), it may be warmed using a heat lance that puts no direct flame on the pavement.

337.4.2 Temperature: Sealant temperatures are to be maintained at the maximum heating temperature recommended by the manufacture.

337.4.3 Equipment: The melter applicator unit shall be a self-contained double boiler device with the transmittal of heat through heat transfer oil. It shall be equipped with an on board automatic heat controlling device to permit the attainment of a predetermined temperature, and then maintain that temperature as long as required. The unit shall also have a means to vigorously and continuously agitate the sealant to meet the requirements of Appendix X1.1 of ASTM D6690. The sealant shall be applied to the pavement under pressure supplied by a gear pump with a hose and wand and direct connecting applicator tip. The pump shall have sufficient pressure to apply designated sealant at a rate of at least three (3) gallons (11.4 L) per minute. Melter applicators shall be approved for use by the sealant manufacturer.

337.4.4 Placement of Sealant: The sealant shall be applied in cracks, joints, and sealant reservoirs uniformly from bottom to top and shall be filled without formation of entrapped air or voids.

Cracks and joints shall be slightly overfilled then leveled with a 3" sealing disk or v-shaped squeegee to create a neat band extending approximately 1" on each side of the crack or joint for surface waterproofing. The band shall be as thin as possible and shall not extend more than 1/8 inch above the pavement surface.

If the pavement is to be overlaid with Hot Mix Asphalt within six months of sealant application, cracks shall be routed, and sealant placement shall be recessed 1/4" in the crack or joint reservoir with no over band. If routing is not used, the sealant over band thickness and width shall be kept as narrow and thin as possible.

During and after placement of the sealant, the Contractor shall protect against harm to persons or animals that may be exposed to the hot material.

337.4.5 Opening to Traffic: Sealant material shall not be exposed to traffic until fully cured. If the sealed area must be opened to traffic, blotter material shall be applied to the surface of all uncured sealant material.

All sealed cracks that have a clear opening of 1 1/2 inches or greater shall have blotter material applied prior to opening to traffic.

On two lane roads or where traffic may come in contact with the hot sealant before it cures, a blotter or specialized bond breaking material shall be used to prevent asphalt bleeding and/or pickup of sealant by vehicular traffic. Blotter material shall be compatible with the crack sealant and any surface treatment being used.

#### 337.5 APPLICATION OF FILLER MATERIAL FOR CATEGORY 2 CRACKS:

The Contractor shall comply with the material manufacturer's installation recommendations including but not limited to surface preparation, application equipment, and application procedures. No filler material shall be installed until all cracks to be filled have been inspected and approved by the Engineer. Filler material shall not be opened to traffic until fully cured.

#### 337.6 APPLICATION OF FILLER MATERIAL FOR CATEGORY 3 CRACKS:

No filler material shall be installed until all cracks to be filled have been inspected and approved by

the Engineer.

All machines, tools, and equipment used to install filler material will be subject to the Engineer's approval.

Hand tamp, vibratory plate compactor and rollers are acceptable for final compaction of filler material. Depending on depth of crack, lower lifts shall be compacted using a steel rod with a 1½" diameter head.

#### 337.7 UNACCEPTABLE WORK:

The Contractor, at no additional cost to the contracting Agency, shall correct unacceptable work.

Unacceptable work shall include, but not be limited to, unsealed or unfilled cracks, material wastage on the sides of the roadway, and excess quantities of material on the roadway that adversely affects driving.

The Contractor shall not progress to a new area until the unacceptable work is corrected to the satisfaction of the Engineer. Correction of unacceptable work shall be accomplished within five working days after notification from the Engineer of the unacceptable work.

#### 337.8 MEASUREMENT:

The Contractor shall meet with the Engineer or the Engineer's designated representative on a daily basis and supply a signed daily report indicating the date and identifying for each road segment:

- The amount of category 1 crack sealant material applied in total pounds and the total square yards of pavement sealed.
- The amount in pounds of category 2 crack filler material installed.
- The linear feet of category 3 cracks filled.

Payment for crack sealing and crack filling shall be based on accepted quantities of Category 1 Crack Sealing, Category 2 Crack Filling, and Category 3 Crack Filling.

Accepted Category 1 Crack Sealing shall be measured by the square yards of pavement surface area sealed.

Accepted Category 2 Crack Filling shall be measured by the pounds of filler material placed.

Accepted Category 3 Crack Filling shall be the measured linear feet of cracks filled.

#### 337.8 PAYMENT:

Payment for pavement crack sealing and crack filling will be at the contracted unit prices. Payment shall be full compensation for furnishing all labor, materials, equipment, tools, and incidentals used for surface preparation, placement of materials, and cleanup.

### SECTION 340

#### CONCRETE CURB, GUTTER, SIDEWALK, CURB RAMPS, DRIVEWAYS AND ALLEY ENTRANCES

340.3.9 Tolerances, add the following:

Vertical displacement across joints shall not exceed 1/8 inch.

340.3.10 Deficiencies, add immediately after the first paragraph:

- (A) Misalignment, heaving or settlement that results in a discontinuity in excess of 1/8-inch over 5 feet.
- (B) Visible cracks, not contained within control joints that have opened to 1/32-inch or more.
- (C) Cracking, spalling or scaling of the concrete surface.
- (D) Gouges that expose aggregate.
- (E) Graffiti

- (F) Imprints and/or depressions causing ponding or inconsistency in the specified finish of the concrete.
- (G) Broken or chipped edges.
- (H) Structural cracking, durability racking, or alkali-silica reaction (ASR) cracking
- (I) Visible cracking in concrete used for architectural finishes and that negatively impacts the aesthetics, as determined by the Engineer.

Replace the second paragraph with the following:

Concrete work that does not comply with tolerance requirements of this section and Section 340.3.9 shall be removed and replaced to the nearest joint. Remove and replace gutters that exceed the ponding tolerance. Concrete work that exhibits these deficiencies (except graffiti) within the one (1) year warranty period shall also be subject to removal and replacement, to the nearest joint, at no cost to the owner. Grinding is not allowed in lieu of replacement. Any use of grinding to correct minor deficiencies shall be submitted and approved by the Engineer prior to use.

## SECTION 350 REMOVAL OF EXISTING IMPROVEMENTS

350.1 DESCRIPTION, add the following:

The work under this Section shall consist of the disposal of any obstacle to construction, unless specifically noted on the Plans for removal or relocation by other entities.

Arrangements for disposal of all waste material shall be the responsibility of Contractor. All usable pipe culvert, as determined by the Engineer, shall be stockpiled within the right-of-way for salvage by the County. Removal and storage of traffic signs and other traffic control devices shall comply with section 401.2.5. Delivery of salvaged traffic signal and lighting equipment shall comply with section 470.6.

Removal of existing improvements shall be performed in a safe manner avoiding damage to improvements not designated for removal.

350.2 CONSTRUCTION METHODS

350.2.2 Others, add the following:

Removal of traffic signal pole foundations unless otherwise indicated shall be to a depth of at least 18 inches below finished grade.

Remove and Salvage Traffic Sign Assembly shall consist of salvaging existing sign panels and posts, removing and disposing of the existing foundations, backfilling and compacting all voids, and restoring the existing surface to match previous existing conditions. The sign panels and posts shall be dismantled in a manner that will prevent damage. Concrete sign foundations shall be disposed of by the contractor. Contractor shall pre-arrange delivery of sign panels and posts by calling (602) 506-8662. The sign panels and posts shall be transported to and unloaded at 2909 W. Durango Street by the contractor in a manner that will prevent damage. The quantity measured for Remove and Salvage Traffic Sign Assembly includes all sign panels and posts that are a part of the assembly.

Part 300 add the following new Section:

## SECTION 351 RELOCATION AND ADJUSTMENT OF EXISTING IMPROVEMENTS

351.1 DESCRIPTION:

This work shall consist of the movement of existing improvements and specialty items to accommodate project construction. Relocation is the horizontal movement or change in location of an existing improvement or item, as shown or described on the Project Plans. Adjustment is a change in the vertical position of an existing improvement or item, typically required to accommodate a change in grade at the location of the existing improvement.

351.2 MATERIALS:

All relocations and adjustments requiring reseating, replacement, or the use of additional materials shall be accomplished using materials of the same or better quality than found in the existing improvements, as approved by the Engineer.

For mailbox relocations, the Contractor shall supply a replacement support post for any mailbox installation deemed hazardous by the Engineer. Hazardous mailbox installations may include but are not limited to support posts that act as fixed objects (i.e. rigid or non-deflecting posts that exceed the stiffness or breakaway characteristics of a nominal 4"x4" wood post buried 36 inches into the ground) and installations of multiple mailbox receptacles mounted on a horizontal beam.

### 351.3 CONSTRUCTION:

The work shall include the removal of posts, foundations, and other associated items directly related to the relocation or adjustment of the existing improvement; filling and compacting all holes left by such removals; and installing, adjusting, or reconstructing moved items in their new location.

Improvements shall be moved in such a manner that the moved elements and all remaining unmoved portions of previously attached improvements are not damaged. All portions of moved and remaining unmoved improvements that are damaged during the relocation or adjustment shall be repaired, or shall be replaced in kind by the Contractor, as approved by the Engineer, at the Contractor's expense.

All relocated or adjusted improvements shall exhibit the same quality, integrity, function, and appearance as the improvements exhibited prior to relocation or adjustment. The unmoved portion of the moved improvement shall be repaired or restored to the same type, quality, appearance, and strength as existed prior to relocation or adjustment.

If for any reason the improvement cannot be removed, relocated, and adjusted within the same working day, the disturbed/removed portion shall be secured from theft and damage until such time that it can be permanently installed in its final location. Also, where the move cannot be accomplished within the same working day, a temporary substitute facility shall be provided to accomplish the required function, as approved by the Engineer. Example: security fencing is to be relocated and the relocation is incomplete at the end of a work day, the contractor is to provide appropriate temporary fencing or approved alternative measures to secure the fenced area.

When the materials of the existing facility are insufficient in quantity to meet the relocation or adjustment requirement, then the Contractor shall provide additional new materials of like kind as needed to complete the relocation or adjustment.

When materials in the existing facility cannot be moved without deterioration in quality, appearance, strength, or function then the Contractor shall provide new replacement materials of like kind as needed for the relocation or adjustment.

Relocate Traffic Sign consists of salvaging the existing sign panel and post, removing the existing foundations, backfilling and compacting all voids, restoring the existing surface to match previous existing conditions and installing the traffic sign panel on a post or posts of appropriate length mounted on new post foundations. New post foundations shall be measured separately and not included as part of the Relocate Traffic Sign pay item.

### 351.4 MEASUREMENT:

Relocated or adjusted items will be measured by the number of improvements and/or the number of linear feet as designated in the fee proposal.

For linear items, such as relocated fencing, the length measured shall be the installed length; no measurement of the removal length shall be made.

The measurement of relocated mailboxes will be the number of mailboxes relocated to a new permanent location as indicated by the project plans or directed by the Engineer and shall include replacement posts to correct conditions deemed hazardous, as required for an acceptable complete in place installation. No measurement will be made for temporary relocations made to maintain mail delivery during construction.

### 351.5 PAYMENT:

Payment will be made at the contract unit price for each relocated or adjusted improvement. Payment shall be full compensation for all tools, equipment, labor, materials, services, transportation, and

incidentals necessary for relocation or adjustment of the improvement including additional new materials or replacement material and repairs or adjustments to the unmoved remainder of fences and other facilities.

## SECTION 401 TRAFFIC CONTROL

401.2 TRAFFIC CONTROL DEVICES, add the following:

All traffic control devices and their application shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD - United States Department of Transportation, Federal Highway Administration) as modified by the Arizona Department of Transportation's Supplement, the Arizona Department of Transportation Traffic Control Design Guidelines, current edition, the special provisions, and any field modifications made by the Engineer.

All traffic control devices shall meet the guidelines of NCHRP 350 or the AASHTO 2009 Manual for Assessing Safety Hardware.

If at any time the Engineer is unable to contact the Traffic Control Technician, the Engineer reserves the right to make contact with the traffic control subcontractor to request any materials or services deemed appropriate by a demonstrated or apparent need in accordance with the standards and guidelines established by the MUTCD as supplemented by the Arizona Department of Transportation and the Cochise County Department of Transportation's Traffic Control Manual for the safety of the public or workers. The cost of these materials or services shall be part of the cost of Traffic Control.

401.2.1 Installation of Temporary Traffic Control Devices: It shall be the responsibility of the Contractor to provide, erect, maintain, remove and/or relocate all temporary and existing traffic control devices and signal indications necessary to properly mark and control the construction area(s) for the safe and efficient movement of all roadway users.

The contractor shall maintain all traffic control devices 24 hours a day, 7 days a week (including weekend and holidays) for the entire duration of the construction or maintenance project. It shall be the contractor's or permittee's responsibility to have all traffic control devices inspected at least once during each workday, once per week during nighttime hours and immediately after a wind or rain storm. Any traffic control device not properly located shall be immediately adjusted or reinstalled.

The Contractor shall install temporary traffic control warning signs and devices prior to the start of any work in accordance with the approved Traffic Control Plan (TCP). All existing signs in conflict with the construction signs shall be covered, removed, or relocated.

The Contractor shall provide additional devices as determined by the Engineer, to safely control traffic.

All advanced warning construction signs shall be mounted on channels driven into the ground or be mounted on temporary spring stands. Each approach at one mile and at one half-mile point prior to the project shall be signed with "Road Work Ahead" and with speed limit signs, mounted on channels driven into the ground or mounted on temporary spring stands and placed at locations where the need for relocation during construction is minimized.

All temporary traffic control devices shall be ballasted with sandbags or other approved ballast. The amount of sandbags used shall be enough to provide adequate safety for the traveling public.

Ground mounted temporary traffic control signs for rural areas shall be mounted with the bottom of the sign at least five feet and not more than six feet above the near edge of the pavement and for urban areas shall be mounted with the bottom of the sign at least seven feet and not more than eight feet above the near edge of the pavement.

The Contractor shall mount signs on wind resistant, spring-type bases when conditions warrant or as requested by the Engineer.

The Contractor shall place flags above all signs.

The Contractor shall use warning lights to mark traffic control devices at night.

The Contractor shall mount Type B high-intensity flashing warning lights on all stop signs within the work zone.

All construction warning signs (black on orange) shall use retroreflective sheeting with fluorescent orange Type VIII, IX or XI and all regulatory signs (black on white) shall use retroreflective sheeting with a minimum of Type IV retroreflective sheeting.

The Contractor shall use an arrow board for all stationary or moving lane closures.

The Contractor is responsible for all costs incurred in replacing lost or damaged traffic control devices and traffic control warning signs.

401.2.2 Traffic Cones: Are effective for daytime channelization of traffic and to delineate minor maintenance areas. Traffic cones are versatile because they are portable and if struck, they will minimize damage to vehicles. They can be set up and removed quickly. When traffic cones are approved by the Engineer for use, it is necessary to check them often because vehicles frequently move them. The minimum height for cones is 28" high and minimum weight is 10 pounds on arterials/collectors and 7 pounds on local roadways. When used at night, cones must have retroreflective bands as called for in the MUTCD.

401.2.3 Temporary Longitudinal Traffic Barriers: Temporary longitudinal traffic barrier installations shall be portable concrete barrier (PCB) or other segmented longitudinal barrier. The barrier and installation shall be in accordance with Chapter 9 of the AASHTO Roadside Design Guide. PCB shall use F-shape faces. Each barrier section shall be properly connected to the adjacent section to provide barrier continuity to resist movement, snagging, and/or instability of impacting vehicles. Panels and connections shall meet NCHRP 350 Test Level 3 or an approved test level of the AASHTO 2009 Manual for Assessing Safety Hardware.

401.2.4 Pavement Markings: Pavement markings used as an integral part of the traffic control plan shall be kept distinct and visible during their use. Temporary pavement markings shall match and meet the markings in place at both ends of their usage.

401.2.5 Removal of Permanent Traffic Control Devices: The Contractor shall notify the Engineer and obtain the Engineer's approval prior to the removal of any permanent traffic control device.

The Contractor shall remove (without damage) all permanent signs including sign posts that are no longer applicable. The sign panels and posts shall be dismantled and transported to the Cochise County Sign Shop in a manner that will prevent damage. Concrete sign foundations shall be removed and disposed of by the Contractor. The Contractor shall coordinate with the Cochise County Sign Shop (520) 432-9300 to establish an acceptable delivery time during normal working hours. The sign panels and posts shall be delivered to: 1229 Hereford Road, Bld B, Bisbee, Arizona 86503

401.4 TRAFFIC CONTROL MEASURES, add the following:

401.4.1 Traffic Control Plan: Construction shall not commence without an approved Traffic Control Plan (TCP). At the time of the pre-construction meeting, the Contractor shall submit preliminary traffic control plans for each phase of the work for review. Plans shall be of an appropriate size and legible, plans found to be deficient by the Engineer shall be returned. The Contractor shall design the traffic control plan using the posted speed limit existing prior to commencement of work as the design speed. The TCP shall show all striping, signing, barricading and distances for all devices for all movements of roadway users during each phase of construction. The TCP shall show existing traffic control signs and temporary construction signs; shall identify conflicting signs to be covered/removed or relocated; and shall identify other features that may conflict with the placement of temporary signage. The TCP shall also show the duration with the start and end date of each phase. When requested by Cochise County, the Contractor shall supply a copy of the manufacturer's certification of compliance with NCHRP 350 test requirements (or compliance with a designated approved test level of the AASHTO Manual for Assessing Safety Hardware) for any of the Contractor proposed traffic control devices. The manufacturer's certification shall identify the NCHRP 350 or AASHTO test number. The County will within 10 working days review the plan and notify the Contractor of approval or note items to be revised.

401.4.2 Traffic Control Technician: The Contractor shall appoint a Traffic Control Technician (other than the superintendent/foreman), who has been properly trained and certified in the application of work zone traffic control, to maintain all necessary traffic control devices. At the beginning and end of each workday and at a minimum of once during nighttime hours during the work week, and periodically throughout the day, the Traffic Control Technician shall inspect the construction work site. The Traffic Control Technician shall ensure that all construction signs and barricades are standing upright in

accordance with the approved traffic control plan, free of dirt and debris and visible to intended traffic. At the end of the workday all non-essential traffic control devices will be removed. The Traffic Control Technician shall also inspect the construction work site at least once during weekends. The Contractor shall immediately correct deficiencies noted by the Engineer. The Contractor shall provide an after-hours pager and telephone number for the Traffic Control Technician at the pre-construction meeting.

401.4.3 Intersection Restriction: Off-duty uniformed police officers are required at all signalized intersections when restrictions are present, and may be required at other locations as requested by the Engineer. Any work performed in the right of way within 300 feet of signalized intersections and intersections formed by two multilane roadways shall require an off-duty uniformed police officer.

401.4.4 Traffic Control Devices: The Contractor shall provide and maintain all necessary traffic control devices until acceptance of the project by the County.

Pavement markings used as an integral part of the traffic control plan shall be kept distinct and visible during their use. Temporary pavement markings shall match and meet the markings in place at both ends of their usage.

401.4.5 Flaggers: All flaggers shall be properly trained and certified by a recognized source, such as the American Traffic Safety Services Association (ATSSA) or the International Municipal Signal Association (IMSA) and shall carry with them at all times a current certification as proof that all training requirements have been completed.

401.4.6 Failure to Provide Adequate Traffic Control Measures: If the Contractor fails to provide adequate traffic control measures, the Engineer may have the work accomplished by other sources. The cost of having this work accomplished by other sources will be computed in accordance with Section 109.5. The total cost will be deducted from monies due or to become due to the Contractor.

401.5 GENERAL TRAFFIC REGULATIONS, add the following:

The Sheriff's Department shall be provided with the name and phone number of the person responsible for 24-hour maintenance of all traffic control devices.

The Contractor shall notify all affected emergency services such as fire departments, police stations, and emergency management system by handbill a maximum of 48 hours and minimum of 24 hours in advance of any street restrictions.

401.5.1 Road Closure and Road Restrictions: A road closure for the convenience of the Contractor is not authorized. Traffic restrictions are not permitted on arterial or collector streets during peak traffic hours of 6:00 a.m. to 8:30 a.m. and 4:00 p.m. to 7:00 p.m. unless authorized by the County Engineer.

401.5.2 Minimum Lane Requirements: At signalized intersections, during peak hours, two lanes shall be open on roads with four or more lanes. During off-peak traffic hours, the minimum number of lanes shall be two lanes (one in each direction).

401.5.3 Temporary Lane Diversions: For construction or trenching that requires movement of traffic from the normal travel lanes, temporary lane diversions may be used only during daylight hours and the normal traffic lanes shall be restored prior to the end of daylight hours. Traffic plates and temporary pavement shall be used to restore traffic lanes.

401.5.4 Regulatory Speed Limit Signs: An appropriate regulatory speed limit sign shall be used where traffic is maintained on temporary detour roads, diversions, or on traffic lanes that are severely restricted.

401.5.5 Access to Adjacent Property: Access to all adjacent properties shall be maintained whenever possible. When access cannot be maintained, Contractor shall notify the adjacent residents at least two working days in advance of the access closure. In no case shall the access be closed for more than four hours. Access to fire stations, hospitals, sheriff stations and schools shall be maintained at all times.

401.5.6 Signal Equipment Repair: If existing signal equipment is damaged the Contractor shall notify the owner of the signal in order to facilitate the prompt restoration of the traffic signal operation. All costs associated with the repair of damaged traffic signals, caused by Contractor construction activity, shall be borne by the Contractor.

401.5.7 Temporary Longitudinal Traffic Barriers / Steel Plating: Open excavations and trenches within 10

feet of an active traffic lane shall be protected at night and during non-working hours from vehicle traffic by steel plating or the use of temporary longitudinal traffic barriers complying with requirements of section 401.2.3. Open excavations as may occur with reinforced concrete box culvert construction and other work shall require temporary longitudinal traffic barriers to separate vehicle traffic from the work site. The Contractor shall use temporary longitudinal traffic barriers when construction hazards warrant, or as requested by the Engineer. Impact attenuation devices shall be provided by the Contractor commensurate with barrier end treatment requirements.

#### 401.5.8 Changeable Message Boards for Public Information:

Changeable Message Boards for Public Notification are for informing the motoring public of project information, traffic restrictions, road closure, or other public awareness items deemed necessary for the project. Changeable message boards shall comply with the requirements of section 701-3.08 of the Arizona Department of Transportation 2008 Standard Specifications for Road and Bridge Construction. The Contractor shall furnish, install, and operate the changeable message boards as requested by the Engineer. Message board locations shall be shown on the Traffic Control Plans.

#### 401.6 MEASUREMENT, Section 401.6 is replaced with the following:

Measurement for Traffic Control shall be made on a Lump Sum basis. This lump sum measurement shall include all materials, equipment and labor necessary to facilitate traffic control per the contract documents. Traffic Control includes but is not limited to the application and removal of temporary pavement markings including related modification of existing pavement markings, pilot cars, flagmen, barricades, sign panels, sign stands, warning lights, and related temporary pavements.

No direct measurement of individual traffic control elements or devices will be made. All traffic control devices, unless otherwise noted, shall be considered as included in the lump sum measurement for the Traffic Control pay item.

No direct measurement for the installation or removal of temporary pavements will be made. All sawcutting, grading, aggregate base course materials, asphaltic concrete pavement, labor, and equipment shall be considered as included in the lump sum measurement for the Traffic Control pay item.

Uniformed Off-duty Law Enforcement Officers including vehicle and equipment will be measured by the hour for each hour required to perform traffic control duties. When an officer is used less than the agency's minimum number of hours and the Contractor is charged for the agency's minimum number of hours, the minimum hours charged will be approved for payment. Time over the agency's minimum number of hours will be measured by the hour.

Changeable Message Boards for Public Notification shall be measured by the day for each calendar day for each sign authorized and operating as directed by the Engineer. Measurement will only be made for actual days-in-use.

When included as a separate pay item within the fee schedule, Portable Concrete Barrier (PCB) shall be measured by the foot. Otherwise, portable concrete barrier shall not be measured and shall be considered a traffic control device.

#### 401.7 PAYMENT, Section 401.7 is replaced with the following:

Payment for Traffic Control other than Uniformed Off-duty Law Enforcement Officers shall be made at the lump sum contract price in equal payments distributed over the entire duration of the project. Payment for Traffic Control shall be full compensation for all labor, pilot cars, flagmen, materials, traffic control devices, and miscellaneous items necessary to complete the work.

Payment for Uniformed Off-Duty Officer will be based on approved time sheets or invoices for all actual hours Contractor provided a Uniformed Off-Duty Law Enforcement Officer for traffic control purposes at the request and with the approval of the County. Expenses, eligible for reimbursement, are labor costs, supported by approved time sheets or invoices and directly related documented expenses such as taxes, bond cost charges to Contractor in connection with the Uniformed Off-Duty Law Enforcement Officer assignment, and special jurisdictional requirements. No additional mark-up for profit and/or fee for Contractor will be eligible for reimbursement.

Approved quantities for Changeable Message Board for Public Notification shall be paid at the contract unit price. Payment will be compensation in full for furnishing, transportation, installation,

programming, adjustment, maintenance, and removal of the changeable message boards.

Separate payment for Portable Concrete Barrier will only be made when Portable Concrete Barrier is included as a separate pay item within the fee schedule. Payment will be full compensation for the furnishing, transportation, installation, adjustment, maintenance, and removal of the temporary barrier system.

SECTION 415  
FLEXIBLE METAL GUARDRAIL

Section 415 is replaced with the following:

415.1 DESCRIPTION:

The work under this section shall consist of furnishing all materials, constructing new guardrail, and delineating guardrail sections at the location shown on the project plans in accordance with Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, current edition, SECTION 905 GUARDRAIL and any supplemental Technical Bulletins and notices.

Part 400 add the following new Section:

SECTION 421  
WIRE FENCE

421.1 Description:

The work under this section shall consist of applying and furnishing all materials at the location shown on the project plans in accordance with Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, current edition, SECTION 903 WIRE FENCE and any supplemental Technical Bulletins and notices.

Part 400 add the following new Section:

SECTION 423  
CATTLE GUARDS

423.1 Description:

The work under this section shall consist of applying and furnishing all materials at the location shown on the project plans in accordance with Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, current edition, SECTION 906 CATTLE GUARDS and any supplemental Technical Bulletins and notices.

Part 400 add the following new Section:

SECTION 461  
PAINTED PAVEMENT MARKINGS

461.1 Description:

The work under this section shall consist of applying and furnishing all materials at the location shown on the project plans in accordance with Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, current edition, SECTION 708 PERMANENT PAVEMENT MARKINGS and any supplemental Technical Bulletins and notices.

Part 400 add the following new Section:

SECTION 463  
RAISED PAVEMENT MARKERS

463.1 Description:

The work under this section shall consist of applying and furnishing all materials at the location shown on the project plans in accordance with Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, current edition, SECTION 706 RAISED PAVEMENT MARKINGS and any supplemental Technical Bulletins and notices.

Part 400 add the following new Section:

SECTION 464  
ROADSIDE SIGN SUPPORTS

464.1 DESCRIPTION:

The work under this section shall consist of furnishing and installing roadside sign supports in accordance with the details shown on the plans and the requirements of these specifications.

Sign supports shall consist of breakaway, square perforated tube, and U-channel sign posts, and foundations. The type, size, and installation location of the sign posts will be shown on the project plans.

Sign post and foundations shall conform to the requirements of Cochise County Standard Details.

464.2 MATERIALS

464.2.1 General: Certificates of Analysis shall be submitted for all square perforated tube sign posts and U-channel sign posts.

Excessive damage to the finish of the posts during shipping, handling, or installation will result in rejection of the damaged posts.

464.2.2 Breakaway Sign Post Shapes: Posts shall be fabricated from structural steel conforming to the requirements of ASTM A 572, Grade 50 or ASTM A 588 at the option of the contractor. Base plates for the breakaway connections and friction fuse plates and back plates for the post hinge assembly shall be fabricated from the same type structural steel selected for the sign posts.

Posts shall be fabricated from structural steel conforming to the requirements of ASTM A 572, Grade 50 or ASTM A 588 at the option of the contractor. Base plates for the breakaway connections and friction fuse plates and back plates for the post hinge assembly shall be fabricated from the same type structural steel selected for the sign posts.

All plate holes shall be drilled and all plate notches shall be saw cut, except that flame cutting will be permitted provided all edges are ground. Flange holes shall be drilled or sub-punched and reamed. The posts shall be saw cut for the hinge and bolted as detailed on the plans.

Bolts, nuts and washers shall conform to the requirements of ASTM A 325. Posts and plates shall be galvanized after fabrication in accordance with the requirements of ASTM A 123. Bolts, nuts and washers shall be cadmium plated in accordance with the requirements of ASTM B 766, or zinc plated in accordance with the requirements of ASTM B 633.

464.2.3 Perforated Sign Posts: Single and telescoping perforated posts shall be square tube fabricated from galvanized sheet steel 0.105 inches (12 gauge) or 0.135 inches (10 gauge) as required by the project specifications. Sheet steel shall conform to the requirements of ASTM A 653 for either SQ Grade 40 or SQ Grade 50 Class 1, and be galvanized in accordance with the requirements of Coating Designation G-90. The posts shall have a wall thickness, including coating, of 0.097 to 0.116 inches for 12 gauge and 0.127 to 0.146 inches for 10 gauge.

Posts shall be welded directly in the corner by high frequency resistance welding or equal. The outside edges of the posts shall be scarfed as necessary to produce a standard corner radii of  $5/32 \pm 1/32$  inch.

External welded surfaces and scarfed areas shall be re-galvanized after fabrication.

Holes  $7/16 \pm 1/64$  inch in diameter shall be provided on one-inch centers along all four sides over the entire length of the post. The holes shall be laterally centered on the longitudinal centerline of each face. Hole positioning and spacing shall be the same on all four faces, such that the hole centerlines for each group of four holes shall pass through a common point on the longitudinal centerline of the tube. For telescoping posts, holes shall be in proper alignment to allow 3/8-inch diameter bolts to pass through the entire post.

The finished posts shall be straight and have a smooth, uniform finish. All consecutive sizes of posts shall be freely telescoping for not less than 10 feet of their length without the necessity of matching any particular face to any other face.

Perforated sign posts shall be manufactured by an approved manufacturer. A list of approved manufacturers of perforated sign posts is shown on the Department's Approved Products List (APL).

Copies of the most current version of the APL are available on the internet from the Arizona Transportation Research Center (ATRC), through its PRIDE program.

Bolts shall conform to the requirements of SAE Specification J 429, Grade 5, or ASTM A 449, Type 1. Nuts shall conform to the requirements of ASTM A 563, Grade A. Washers shall conform to the requirements of ASTM F 844.

Bolts, nuts and washers shall be zinc coated in accordance with the requirements of ASTM B 633 or cadmium plated in accordance with the requirements of ASTM B 766.

#### 464.2.4 U-Channel Sign Posts:

U-channel posts shall be fabricated from rerolled rail steel conforming to the requirements of ASTM A499 or hot-rolled carbon steel bars.

Prior to rerolling the rail steel, the rail nominal weight shall be 91 pounds per yard and shall meet the requirements of ASTM A1 pertaining to quality assurance.

Yield Point of the steel shall be 80,000 pounds per square inch (psi) minimum.

The cast heat analysis of the steel shall conform to the following requirements:

Element	Composition (Percent)
Carbon	0.67 - 0.82
Manganese	0.70 - 1.10
Phosphorus, max.	0.04
Sulphur, max.	0.05
Silicon	0.10 - 0.25

Posts shall be a uniform, modified, flanged channel-section as shown in Cochise County Standard Detail CC133. Weight of the posts shall be 2.00 lbs. per lineal foot, plus or minus five percent. The post shall be punched with continuous 3/8-inch diameter holes on 1.0-inch centers. The first hole shall be 1.0 inches from top and bottom of post.

The post shall consist of two parts, a sign post and a base post. The sign post lengths shall be supplied in 6-inch increments up to 12.0 feet as required for the installation location. The base posts shall be 3.5 feet in length, pointed at one end, and have at least eighteen holes in the base post, starting 1.0 inch from the top and continuing at 1.0-inch increments.

Posts shall be machine straightened to have a smooth uniform finish, free from defects affecting their strength, durability, or appearance. All holes and edges shall be free from burrs. Permissible tolerance for straightness shall be within 1/16 inch in 3 feet.

Posts shall be galvanized after fabrication in accordance with the requirements of ASTM A123. Bolts, nuts, washers and spacers shall be cadmium plated in accordance with the requirements of ASTM B 766 or zinc plated in accordance with the requirements of ASTM B633.

U-channel base posts shall be driven into the ground to a minimum depth of 36 inches. Where rock is encountered, the rock shall be cored, drilled or removed to a minimum diameter of eight inches and to a depth sufficient to place Portland cement concrete two inches below the bottom of the base post and fill the hole to within one inch of the top. Solid rock coring or drilling is not required to continue beyond 2 inches in depth regardless of the depth at which the rock is encountered, the base post may be cut at the bottom prior to being set in Portland cement concrete where rock does not permit use of full length base post.

464.2.5 Concrete: Concrete for perforated sign post foundations shall be Class B in accordance with Section 725.

Concrete for breakaway sign post foundations shall be Class B, except that utility concrete may be used for foundations using stub post sizes S 3 x 5.7 and S 4 x 7.7. Class B concrete shall conform to the requirements of Section 725. Concrete for perforated sign posts foundations and U-channel sign post foundations, when required, shall conform to the requirements of Subsections 922-2 and 922-3.

Foundation stub posts shall be fabricated from the same type of steel selected for the appropriate sign posts. Breakaway stub posts shall be galvanized a minimum of 12 inches down from the top of the stub. Galvanizing shall be in accordance with the requirements of ASTM A 123.

Reinforcing steel bars for breakaway sign post foundations shall conform to the requirements of ASTM A 615, Grade 40. Reinforcing steel wire shall conform to the requirements of ASTM A 82.

#### 464.3 CONSTRUCTION:

Foundations for perforated sign posts and U-channel posts shall be constructed to the details and dimensions shown on the plans.

Perforated and U-channel sign post lengths shall be determined by the contractor at the time of construction staking. Posts shall be cut to the proper lengths in the field. Splicing will be permitted for single perforated posts; however, splices will be limited to one per each post installation and the splicing shall be accomplished in accordance with the details shown on the plans. The minimum length of any spliced piece of post shall be two feet.

Sign posts shall be erected plumb.

#### 464.4 MEASUREMENT:

Breakaway sign posts will be measured by the linear foot for each size of post furnished and erected. The length of each size of post will be measured from the bottom of the upper base plate to the top of the post, measure to the nearest 0.1 feet. The total length of all posts of the same size will be rounded to the nearest foot.

Perforated sign posts and U-channel sign posts shall be measured by the foot, to the nearest 0.1 feet for each post furnished and installed. The total length of all posts of the same type will be rounded to the nearest foot. Telescoping post members will be considered as one post after installation and will not be measured separately. The length of perforated sign post shall be measured from the top of the post to the bottom of the eighteen inches (18") located in the post foundation. The length of U-channel sign posts shall not include the U-channel base post.

Foundations for sign posts will be measured by the unit each for each type of foundation constructed, except that concrete and excavation, when required for setting U-channel base posts, will be considered as part of the post.

#### 464.5 PAYMENT:

The accepted quantities of breakaway posts, perforated sign posts, U-channel sign posts, and foundations for the sign posts, measured as provided above, will be paid for at the contract unit prices complete in place.

The contract unit prices paid shall include full compensation for furnishing all labor, excavation, materials, tools, equipment and incidentals, and for doing all the work involved in constructing foundations, furnishing and erecting the sign posts including galvanizing and furnishing all metal plates and hardware, as shown on the plans and as specified herein, complete in place.

## SECTION 465 SIGN PANELS

#### 465.1 Description:

The work under this section shall consist of furnishing and installing sign panels in accordance with the details shown on the plans and the requirements set forth herein.

The sign panels shall be of the following types:

- Extruded Aluminum Sign Panels with Demountable Characters
- Flat Sheet Aluminum Sign Panels with Direct-Applied or Silk-Screened Characters
- Warning, Marker, and Regulatory Sign Panels
- Route Shields for Installation on Sign Panels

- EXIT ONLY for Installation on Sign Panels

#### 465.2 Materials:

##### 465.2.01 General:

Certificates of Compliance, conforming to the requirements of Subsection 106.05, shall be submitted for all materials required for fabricating sign panels, including retro reflective sheeting.

Shipment, storage, and handling of sign panels shall conform to the recommendations of the manufacturers of the sign panel components. Fabricated signs and overlay sheets shall be shipped on edge. Damage to the sign panel or legend resulting from banding, crating or stacking may be cause for rejection of the signs.

##### 465.2.02 Extruded Aluminum Sign Panels with Demountable Characters:

Panels shall be fabricated from 12-inch wide aluminum extrusions formed from Aluminum Alloy 6063-T6 conforming to the requirements of ASTM B 221 and fastened together by bolt connections as shown on the plans.

Panel facing shall be covered with retroreflective sheeting of the color specified on the plans. The retroreflective sheeting shall conform to the requirements of Section 1007.

The letters, numerals, symbols, borders and other features of the sign message shall conform to the requirements of Subsection 465-2.14, Demountable Characters.

Panel surfaces to be covered with retroreflective sheeting shall be prepared in accordance with the recommendations of the sheeting manufacturer. Panel surfaces not covered with sheeting shall be etched in accordance with the recommendations of the extrusion manufacturer to reduce glare from reflected sunlight.

After all fabrication has been completed, including the cutting and punching of holes, except holes for demountable letters, numerals, symbols and borders, the aluminum extrusions shall be degreased and the retroreflective sheeting shall be applied.

Aluminum extrusions shall be flat with 1/4 inch of tolerance allowed in an eight-foot length, with proportionally greater tolerances permitted on lengths greater than eight feet. Flatness tolerance across the face of each extrusion shall be 0.5 percent of the width.

Aluminum extrusions shall be bolted together on 12-inch centers with a maximum allowable gap of 1/32 inch between extrusions.

Shop fabricated sub-assemblies shall be rigidly braced for transportation and erection. Hardware utilized to fasten panels to supports shall conform to the panel manufacturer's recommendations.

Each completed sign panel shall be provided with a side trim molding fabricated from extruded Aluminum Alloy 6063-T6 conforming to the requirements of ASTM B 221. The trim molding shall be fastened to each individual 12-inch aluminum extrusion with two 5/32-inch diameter self-plugging aluminum blind rivets, 2-1/2 inches from either edge. The exposed surface of the side trim molding shall be treated by etching as recommended by the manufacturer to reduce glare from reflected sunlight.

Each completed sign panel shall be shipped with sufficient bolt clamps placed to install the panel on the sign posts as shown in the plans. Bent bolt channels will be cause for rejection of the sign panel.

465.2.03 Blank

465.2.04 Blank

465.2.05 Blank

465.2.06 Blank

##### 465.2.07 Flat Sheet Aluminum Sign Panels with Direct-Applied or Silk-Screened Characters:

Panels shall be fabricated from 0.125-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B 209.

Panel facing shall be prepared and covered with retroreflective sheeting in accordance with the recommendations of the sheeting manufacturer. The color of the sheeting shall be as specified on the

plans or as shown in the Manual of Approved Signs.

All surfaces not covered shall be etched to reduce glare from reflected sunlight.

The retroreflective sheeting shall conform to the requirements of Section 1007. Splicing of retroreflective sheeting shall not be allowed on sign panels having a minimum dimension up to and including four feet.

Messages shall be reflectorized white or, if called for on the plans, opaque black and shall be produced by either silk screening or direct-applying lettering as specified under Subsection 465-2.15.

465.2.08 Blank

465.2.09 Warning, Marker, and Regulatory Sign Panels:

Panels shall be fabricated from flat sheet aluminum and shall be reflectorized as specified herein.

Panels shall be fabricated in one piece from 0.125-inch thick, 5052-H38 or 6061-T6 Aluminum Alloy conforming to the requirements of ASTM B 209.

All surfaces of panels to be covered with retroreflective sheeting shall be prepared in accordance with the recommendations of the sheeting manufacturer. Surfaces not covered shall be etched to reduce glare from reflected sunlight. Retroreflective sheeting shall conform to the requirements of Section 1007.

Warning signs shall be reflectorized with yellow retroreflective sheeting.

Regulatory signs shall be reflectorized with silver-white retroreflective sheeting.

Reflectorized red signs shall be reflectorized with silver-white retroreflective sheeting. The red color shall be produced by silk screening.

Regulatory signs with reflectorized red circles and slashes shall be reflectorized with silver-white retroreflective sheeting. The red color shall be produced by silk screening.

Interstate route markers shall be cut to shape. The colors and legend shall be as shown on the plans and shall be reflectorized with silver-white retroreflective sheeting. The Interstate route colors shall be silk screened. The numerals may be silk-screened or direct-applied characters.

United States, State Route, and Cardinal Direction markers shall be reflectorized with silver-white retroreflective sheeting unless otherwise shown on the plans.

Splicing of retroreflective sheeting shall not be allowed on sign panels having the minimum dimension up to and including four feet.

Sign panels shall be attached to the posts with bolts as shown in the plans. A nylon washer, conforming to ANSI Standard and having a diameter two times the bolt head diameter, shall be placed between the bolt head and panel face. Fastening nuts shall be heavy hex; however, standard nuts may be used if a flat wash is placed between the nut and sign posts.

465.2.10 Blank

465.2.11 Route Shields (For Installation on Sign Panels):

Route shields shall be cut to shape and shall consist of 0.063-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B 209. The aluminum shall be degreased and etched in accordance with the recommendations of the sheeting manufacturer. Retroreflective sheeting shall be silver-white and shall conform to the requirements of Section 1007. The size of the numerals shall be half the height of the shield.

Route shields shall be attached to the sign panel with self-plugging aluminum blind rivets with a 1/4-inch thick nylon spacer on each rivet between the route shield and the sign panel.

465.2.12 EXIT ONLY (For Installation on Sign Panels):

EXIT ONLY panels shall be fabricated from 0.063-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B 209 with yellow retroreflective sheeting adhered to the face side. The aluminum shall be degreased and etched in accordance with the recommendations of the sheeting manufacturer. Retroreflective sheeting shall conform to the requirements of Section 1007.

EXIT ONLY panels shall be attached to the sign panel with self-plugging aluminum blind rivets with a 1/4-inch thick nylon spacer on each rivet between the EXIT ONLY panel and the sign panel.

The letters, arrows, and borders shall consist of black embossed aluminum frames or flat sheet aluminum frames with no reflectors. The height of the letters shall be 12 inches unless otherwise specified in the plans. The panel shall be 36 inches in height unless otherwise specified in the plans.

#### 465.2.13 Retroreflective Sheeting, Inks and Opaque Film:

Retroreflective sheeting, sign-making inks, and opaque films shall conform to the requirements of Section 1007.

Signs shall be fabricated in accordance with the recommendations established by the manufacturer of the sign sheeting. All processes and materials used to make a sign shall in no way impact the performance, uniform appearance (day and night), or durability of the sheeting, or invalidate the sign sheeting manufacturers' warranty.

All sheeting used for letter and number text shall be of the same type and brand, and shall be installed at a zero-degree orientation.

#### 465.2.14 Demountable Characters:

##### (A) General:

Letters, numerals, symbols, route shields, borders, and other features of the sign message shall consist of cut-out, flat sheet aluminum legends, with direct-applied sign sheeting or other finishes, that are mounted to the sign panel with rivets as described herein. All characters shall be placed on the signs in a straight and true fashion.

Flat sheet aluminum substrates used for characters and borders shall be either aluminum alloy 3105-H14, 3003-H14, or 5052 as specified in ASTM B 209. Characters produced from the flat sheet aluminum alloy shall sit flat on the face of the sign panel without visible gap or deformation.

The thickness for letters and numbers shall be 0.032 inches. The thickness for symbols, route shields, and borders shall be 0.063 inches.

All aluminum shall be chemically treated with a chromate acid conversion type coating, or equivalent, to form an oxidation resistant barrier film that is suitable for long term outdoor application. The coating shall prevent the occurrence of oxidation that may cause streaking or discoloration on the sign. The coating shall be applied in accordance with the manufacturer's specifications, and shall have a minimum thickness of 0.002 inches.

All corners and edges of the characters shall be clean and well-defined with no apparent waviness, tears, delamination, deformation or flaws. Burrs and waste material generated from the cutting process shall be removed so characters have a clean, flat, and correct appearance.

Design of letters and numbers shall be in accordance with the project plans.

Splicing of aluminum panels will be acceptable for diagrammatic arrows or other large symbols and shields exceeding 48 inches in more than one direction. Splices, when required, shall include a continuous four- to six-inch wide aluminum back plate that overlaps the joint. The back plate shall ensure no gap at the splice joint when the symbol is assembled and attached to the sign.

Borders on signs with demountable characters shall also be made of aluminum substrate panels, unless otherwise specified. However, in all cases borders on signs with demountable characters shall be made of the same material as the legend.

##### (B) Sheeting and Colors:

Sheeting or film applied to demountable characters shall be a continuous monolithic piece, without splice or patch, that covers the entire front face of the character. Splicing of the sheeting for demountable borders or characters which have a dimension larger than 48 inches in more than one direction will be allowed. Only one splice shall be allowed every four feet. When a splice is necessary, the adjoining edges shall be placed so there is no visible gap between the two pieces.

The adhesive system for sheeting and opaque films shall form a durable bond which tightly adheres to the aluminum or sign background. After attachment, the sheeting and opaque films shall not discolor, crack, craze, blister, bubble or delaminate. Sheeting and film adhesives must be warranted by the manufacturer against such defects as specified in Section 1007. Only those sheeting and film products which provide the specified warranty will be acceptable.

The color for demountable letters, numbers, symbols, and route shields on green, blue, and brown background signs shall be white, and shall conform to the requirements of Section 1007. Demountable legends on white and yellow background signs shall be black, and shall be opaque and non-reflective. Acceptable finishes for black characters shall be porcelain-enameled black, powder-coated black, or laminated black opaque acrylic film.

When borders are used with demountable characters, white legend and border shall be used on green, blue, or brown sign backgrounds, and black legend and border shall be used on white or yellow sign backgrounds. Sign sheeting conforming to Section 1007 shall be used for white borders. Black borders shall be porcelain-enameled black, powder-coated black, or laminated black opaque acrylic film.

Black porcelain enameling, black powder-coatings, or laminated black opaque acrylic film to be used for characters or borders, as specified above, shall be applied in accordance with the coating manufacturer's recommendations. The contractor shall provide copies of any warranties provided by the manufacturer for such coatings to the Engineer.

On combination signs, such as a green background sign with white characters that also includes a smaller panel with yellow background and black characters, the color scheme used for the characters and border for each portion of the sign shall be as specified above, i.e. white legend and border shall be used on the green background portion of the sign and black legend and border shall be used on the yellow background portion.

(C) Attachment of Characters and Borders:

Self-plugging aluminum, protruding, regular head blind rivets shall be used to secure all demountable characters. The rivets shall conform to the applicable requirements of International Fasteners Institute (IFI) 114 standard for break mandrel blind rivets. All rivets shall be 5/32 inch in diameter with the appropriate grip range.

Rivets shall be either IFI 114 Grade 10 or 11 aluminum alloy rivets. The rivets shall have an ultimate shear and tensile strength that has been determined by IFI 135 Specification 2.1 and 2.2. The ultimate shear and tensile strength shall meet or exceed those values specified for a 5/32 inch (0.1562) nominal rivet diameter per IFI 114 Table 6 for Grades 10 or 11. A higher strength and grade aluminum rivet can be used at the option of the sign fabricator.

Rivets securing the characters to the back panel shall be of sufficient length to ensure a secure attachment and conform to the grip length specifications of the rivet manufacturer. The determination of rivet grip length shall include the total thickness of the joint. This thickness shall include the character (sheeting and aluminum sheet), spacer (if applicable) and the sign back panel (sheeting and aluminum extrusion).

The hole size used to install the rivets shall conform to the recommendation of the rivet manufacturer and Table 2 of IFI 114. Rivets shall be placed a minimum of four times the diameter of the rivet from the edge of the character being attached, e.g., 5/8-inch clearance for a 5/32-inch diameter rivet. Clearance shall be measured to the outside of the rivet head.

Minimum requirements for attaching demountable characters shall be as follows:

Straight numerals and letters such as "1" shall have three rivets, one at the top, middle and bottom. The more complex numerals and letters shall have from four to seven rivets. Letters such as "W" and "M" typically require seven rivets. Letters and numerals such as "P", "H" and "9" typically require six rivets. Letters and numerals such as "G", "S", "2", "3" and "7" typically require five rivets. A rivet shall secure each corner of the letter or numeral. For shields and symbols, rivets shall be spaced evenly around the entire perimeter. Additional rivets shall be added in the middle of the shield or symbol as necessary to eliminate bowing. Rivets for borders shall be spaced evenly around the border.

The actual number of rivets used will depend on the thickness, configuration, weight, position (with or without spacers), size of the character being attached, and the recommendations of the rivet manufacturer. The number and location of rivets shall be sufficient to secure the character to the panel so it shall not miss-align, bend or move when subjected to wind loading. Additionally, the number of rivets used shall ensure that the character does not bow or pull away from the back panel for the life of the sign. Rivets shall be placed in a defined, evenly spaced pattern which is consistent from character to character. The placement and pattern of rivets shall not interfere with the appearance of the sign from normal drive-by viewing distances. The contractor shall supply standard punch details prior to

fabrication.

The protruding head and shaft of the rivets shall closely match the color of the character on which they are being applied, e.g., black characters shall be applied with black rivets. Aluminum colored rivets are acceptable for mounting white characters.

The coating used to color the rivets shall be a factory-applied anodized type finish, or equivalent, that is suitable for long term outdoor application. The coating shall have durable colorfastness and shall be capable of preventing the occurrence of oxidation that may cause streaking or discoloration on the sign. Non-factory painting of the protruding heads of the rivets is not acceptable.

#### 465.2.15 Silk-Screened or Direct-Applied Characters:

Silk-screened letters, numerals, arrows, symbols, and borders, shall be applied on the retroreflective sheeting background of the sign by direct or reverse screen process. Messages and borders of a color darker than the background shall be applied to the retroreflective sheeting by direct process. Messages and borders of a color lighter than the sign background shall be produced by the reverse screen process.

Opaque or transparent colors, inks, and paints used in the screen process shall be of the type and quality recommended by the manufacturer of the retroreflective sheeting.

The screening shall be performed in a manner that results in a uniform color and tone, with sharply defined edges of legends and borders and without blemishes on the sign background that will affect intended use.

Signs, after screening, shall be air dried or baked in accordance with the manufacturer's recommendations to provide a smooth hard finish. Any signs on which blisters appear during the drying process will be rejected.

Direct-applied letters, numerals, symbols, borders, and other features of the sign message shall be cut from black opaque or retroreflective sheeting of the color specified and applied to the retroreflective sheeting of the sign background in accordance with the instructions of the manufacturer of the retroreflective sheeting and shall be applied by heat activation of the adhesive.

The retroreflective sheeting used for characters shall meet or exceed the minimum Specific Intensity Per Unit Area (SIA) of the background sheeting.

#### 465.3 Construction Requirements:

##### 465.3.01 Fabrication:

Fabrication of the sign panels shall be in accordance with the details shown on the plans and the requirements of these specifications. If additional details for sign panel fabrication are required, the contractor shall submit shop drawings in accordance with the requirements of Subsection 105.03.

Panels shall be cut to size and shape and shall be free of buckles, warps, dents, cockles, burrs and defects resulting from fabrication.

Fabricated signs shall be stored indoors and kept dry during storage. If packaged signs become wet, all packaging material shall be removed immediately and the signs allowed to dry. The signs may be repackaged using new dry materials. If outdoor storage is necessary, all packaging materials shall be removed. Signs shall be stored on edge, above ground, in an area where dirt and water will not contact the sign face. Materials used to support stored signs shall not contact sign faces.

##### 465.3.02 Installation of Sign Panels:

The sign panels shall be installed on overhead sign structures and roadside sign supports in accordance with the details shown on the plans and in accordance with the recommendations of the manufacturers of the sign panel components.

Minor scratches and abrasions resulting from fabrication, shipping and installation of panels may be patched; however, patching shall be limited to one patch per 50 square feet of sign area with the total patched area being less than five percent of the sign area. Panels requiring more patching than the specified limit will be rejected. Patches shall be edge sealed by a method approved by the retroreflective sheeting manufacturer.

The heads of bolts on the panel face shall be anodized or painted to match the background or legend

color in which they are placed. The nylon washers on the panel face shall be the color of, or shall be painted to match, the background or legend color in which they are placed. The sign manufacturer's name and date of installation shall be placed on the back of each sign in black, one-inch block letters. Use of felt markers for this purpose will not be permitted. Bolts shall be tightened from the back by holding the bolt head stationary on the face of the panel. Twisting of the bolt head on the panel face will not be allowed.

The contractor shall provide two copies of a detailed list of all new signs installed on the project to the Engineer. The list shall include the sign identification code, the date each sign was installed (month and year), the fabricator of the sign, and the materials used to make the sign (manufacturer, type of sheeting, ink and film). The list shall be provided in a commonly used electronic spreadsheet format, such as EXCEL, and the two copies shall be submitted on either CD-ROM disks or IBM-formatted 3.5-inch floppy diskettes. Signs shall be listed in numerical order by route, direction, and milepost and, where more than one sign is installed at the same general location, a letter subscript.

Signs shall be placed at the same orientation along the roadway so that the entire legend of the signs appear uniform under normal viewing conditions, both day and night.

Upon the installation of each finished sign, the contractor shall place information on the back of the sign showing the sign identification code, the sign fabricator, the manufacturer of the sheeting used, and the month and year of the installation. The formatting of the required information shall be as shown on the plans. The information shall be positioned to be readily visible from a vantage point outside the flow of traffic and not obstructed by sign posts, extrusions, stringers or brackets. All letters shall be made of a long-life material such as a black opaque acrylic film. Signs not marked as required will not be eligible for payment.

Construction signs are exempt from the installation information requirement unless noted otherwise on the project plans.

Bolts shall be tightened from the back of the sign by holding the bolt head stationary on the face of the panel to prevent damage to the sheeting surface.

#### 465.3.03 Miscellaneous Work (Sign Panels):

The work under this section shall also include furnishing all miscellaneous materials, tools, equipment and labor necessary to relocate exit panels to the right side of the parent sign panel; removing, cutting, and installing side trims and new or salvaged aluminum extrusions on existing sign panels; relocating large guide and exit gore signs; and cutting post tops on existing installations, as required on the plans.

#### 465.3.04 Inspection:

An inspection of the completely installed sign panels will be made by the Engineer during the daytime and at night for proper appearance, visibility, color, specular gloss and proper installation. Each sign panel face shall be cleaned thoroughly just prior to the inspection by a method recommended by the manufacturer. The cleaning solvent and cleaning material shall in no way scratch, deface or have any adverse effect on the sign panel components.

All apparent defects disclosed by the inspection shall be corrected by the contractor at no additional cost to the Department. If color variations or blemishes between sign panel increments are visible from a distance of 50 feet either during the day or at night, the panels shall be removed and replaced at no additional cost to the Department.

#### 465.4 Method of Measurement:

Sign panels will be measured by the square foot for each type or types of sign panels furnished and installed. The area of each sign panel, except for warning, regulatory and marker sign panels, will be measured per plans dimensions.

For warning, regulatory and marker sign panels, the area of each sign panel will be measured to the nearest square foot and the areas will be determined as follows:

The areas of each rectangular, square or triangular sign panel will be determined from the dimensions shown on the plans. The area of irregular shaped signs, such as stop signs and route markers, will be determined by multiplying the maximum height in feet by the maximum width in feet, using the dimensions shown on the plans.

Miscellaneous Work (Sign Panels) will be measured on a lump sum basis.

465.5 Basis of Payment:

The accepted quantities of each type of sign panel designated in the bidding schedule, measured as provided above, will be paid for at the contract unit price per square foot, complete in place.

Payment shall be made on the total area of each type of sign panel to the nearest square foot, except Route Shields and EXIT ONLY (For Installation On Sign Panels) which shall be paid for as part of the overall panel.

The contract unit price shall be full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for performing all the work involved in furnishing and installing the sign panels, complete in place, including furnishing and applying all retroreflective sheeting, all fastening hardware, all necessary sign supports, stringers and post ties, all as shown on the plans and as specified herein.

The accepted quantities of Miscellaneous Work (Sign Panels), measured as provided above will be paid for at the contract lump sum price, which price shall be full compensation for the work complete in place as shown on the plans and as described and specified herein.

Part 400 add the following new Section:

SECTION 470  
TRAFFIC SIGNAL AND INTERSECTION LIGHTING SYSTEMS

463.1 Description:

The work under this section shall consist of applying and furnishing all materials at the location shown on the project plans in accordance with applicable Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, current edition, and any supplemental Technical Bulletins and notices.

SECTION 601  
TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION, add the following:

Backfill around manholes and junction structures shall comply with requirements of Section 206.4 Structural Backfill.

The work covered by this specification includes the backfilling of utility potholes.

601.4.5 Final Backfill, add the following:

Trenches within existing paved areas, roadway shoulders, and the travelled way of unpaved roadways shall use 1-sack CLSM or 2-sack CLSM for backfill unless use of an alternative material has received prior approval. Utility potholes in existing paved areas or within two feet of pavement shall use 1-sack CLSM or 2-sack CLSM for backfill unless use of an alternative material has received prior approval.

Requests for the use of alternative materials shall include project information such as trench width, trench depth, backfill material source, properties of the proposed backfill material, proposed backfill procedures, and proposed testing.

For trenches and utility potholes within paved areas the CLSM backfill shall extend from twelve inches (12") above the top most conduit to the bottom of the aggregate base as defined for Trench Repair of MAG Detail 200. For trenches and utility potholes within unpaved areas the CLSM backfill shall extend from twelve inches (12") above the top most conduit to six (6) inches below the finished grade, material for the top six (6) inches shall match the existing surfacing.

Add the following new section:

601.4.12 Embedment Zone Material Requirements for HDPE Pipe: Controlled low strength material (CLSM) shall be used within the pipe embedment zone for HDPE pipe. The CLSM shall be 1-sack or 2-sack per Section 728. Placement of the CLSM shall be per Section 604 and extend from the trench foundation to 12 inches above the pipe crown.

Add the following new section:

601.4.13 Allowable Resistivity and pH Values for Material Placed within the Pipe Embedment Zone and Backfill: Material placed within the pipe embedment zone and final backfill area for pipes, pipe-arches, or arches made of metal shall have a value of resistivity not less than 2000 ohm-cm or of the value shown on the project Plans. When resistivity is not shown on the Plans, the material shall have a value of resistivity not less than that of the existing in-place material or 2000 ohm-cm, whichever is greater. Material for all metal pipe installations shall have a pH value between 6.0 and 9.0 inclusive. Material for all concrete or plastic pipe installations shall have a pH value between 6.0 and 12.0. Tests for pH and resistivity shall be in accordance with the requirements of Arizona Test Method 236.

## SECTION 710 ASPHALT CONCRETE

### 710.2 MATERIAL:

710.2.3 Reclaimed Asphalt Pavement (RAP), Replace the third paragraph with the following:

RAP shall not exceed 20% contribution of the aggregate or binder in the base or intermediate courses of arterial streets. RAP shall not exceed 30% contribution of the aggregate or binder in the base or intermediate courses of collector streets.

### 710.3 MIX DESIGN REQUIREMENTS:

710.3.1 General, add the following:

710.3.1.1 Verification Testing: The Engineer may conduct tests to verify the laboratory air voids using the submitted target binder content and design gradation. If the resulting air voids is outside the required range, the Contractor shall make adjustments on the binder content to gain compliance with the air voids requirement. The Contractor shall make available samples of the proposed aggregate and binder to conduct verification testing by the Engineer.

## SECTION 728 CONTROLLED LOW STRENGTH MATERIAL

728.4 MIXING, add the following:

The project identification used to obtain the Engineer's pre-approval for dry batched unmixed CLSM shall be on the batch weight records.

## SECTION 738 HIGH DENSITY POLYETHYLENE PIPE & FITTINGS FOR STORM DRAIN & SANITARY SEWER

Section 738.1 is modified as follows:

HDPE pipe size shall be limited to sizes 8-inch through 60-inch diameter. Sizes greater than 60-inch diameter shall not be used within Cochise County rights-of-way without specific written approval from Cochise County.

## SECTION 740 POLYPROPYLENE PIPE & FITTINGS FOR STORM DRAIN, IRRIGATION & SANITARY SEWER

Polypropylene pipe (PP) shall not be used within Cochise County rights-of-way without specific written approval from Cochise County.

## SECTION 771 GALVANIZING

771.4 REPAIR OF GALVANIZED SURFACES, replace with the following:

Unless otherwise specified, where galvanized surfaces are field or shop cut, broken, burned, or abraded, thus breaking the galvanizing, the locations thus damaged shall be repaired to the

satisfaction of the Engineer with zinc dust-zinc oxide coating conforming to the Repair of Damaged Coatings section of AASHTO M-36.

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