



COCHISE COUNTY

Highway & Floodplain



Road Design & Construction Standards & Specifications For Public Improvements

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COCHISE COUNTY ROAD DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS

FOR PUBLIC IMPROVEMENTS

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SECTION A

INTRODUCTION

1. PURPOSE

The purpose of this manual is to standardize roadway design elements where necessary for consistency and to assure, as far as practical, that minimum requirements for public safety, welfare, convenience, and economical maintenance are achieved. These standards are based on the experience of Cochise County highway engineers, on changes in applicable standards and publications, and on evolving policies and practices regarding County transportation infrastructure. In the event of a conflict between these standards and the scope of work or provisions of an executed County design contract, the contract shall govern.

It is recognized that each roadway project is likely to have conditions that require special treatment. Therefore, this document is not a substitute for the design engineer's experience, professional judgment, comprehensive understanding of the referenced material, or ongoing communication with reviewers. When the application of a particular standard is required, the words "must" or "shall" are used. When there is flexibility the words "may" or "should" are used. However, any deviation from these published standards must be submitted to the Cochise County Engineer and approved before the project design is finalized.

At the beginning of any project, the functional classification, future traffic volumes, and topography of the project area shall be established. These basic items shall dictate the design standards of the road.

The manual also provides report formatting so that significant design elements are properly documented and reviews are facilitated.

2. APPLICABILITY

These 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 standards do not apply to routine maintenance of existing facilities that do not meet these standards.

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 shall be used by private parties, consulting engineers, public utilities and agencies, and the 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.

For the purpose of this manual, the following definitions for maintenance/rehabilitation and construction shall be used:

Roadway maintenance/rehabilitation is defined as any work that does not change the geometric prism of the road. Such work will include any surface treatment of the same kind of surface (i.e., addition of gravel to gravel/dirt roads; crack sealing; chip sealing; slurry seal; micro-surfacing; surface recycling; cold mix or hot mix recycling; road mixes or overlays less than or equal to two inches to paved roads; and incidental drainage improvements).

Roadway construction and reconstruction is defined as any work that changes the geometric prism or surface type of the roadway. Such work will include roadway widening, penetration and chip seal on existing gravel/dirt surfaces, overlays greater than two inches, and major drainage improvements.

3. DEVELOPMENT OF PLANS AND SPECIFICATIONS

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

- A Policy on Geometric Design of Highways and Streets, as distributed by the American Association of State Highway and Transportation Officials (AASHTO).
- A Guide for Erecting Mailboxes on Highways, as distributed by AASHTO.
- An Informational Guide for Roadway Lighting, published by AASHTO, 1985
- Arizona Department of Transportation (ADOT) Traffic Control Design Guidelines.
- Arizona Supplement to the 2003 Manual on Uniform Traffic Control Devices, ADOT.
- Flexibility in Highway Design, as distributed by U.S. Department of Transportation, Federal Highway Administration.
- Floodplain Regulations for Cochise County.
- Guidelines for Geometric Design of Very Low-Volume Local Roads (Average Daily Traffic (ADT) \leq 400), as distributed by AASHTO.
- Highway Capacity Manual, as distributed by the Transportation Research Board.
- Uniform Standards Specifications and Details for Public Works Construction, sponsored and distributed by the Maricopa Associations of Governments (MAG). See Section E for Cochise County amendments to MAG Standards.
- Manual on Uniform Traffic Control Devices for Streets and Highways, as distributed by the U.S. Department of Transportation, Federal Highway Administration; and as amended and approved by the Arizona Department of Transportation.

- Materials Preliminary Engineering and Design Manual, Chapter 2, Pavement Design; prepared by ADOT.
- Pavement Marking Design Manual, published by Pima County Department of Transportation and Flood Control District and City of Tucson Department of Transportation.
- Roadside Design Guide, as distributed by AASHTO.
- Roundabouts: An Informational Guide, June 2000, as distributed by U.S. Department of Transportation, Federal Highway Administration.
- Signing and Marking Specifications, as distributed by ADOT.
- State Standard for Watercourse Bank Stabilization, Arizona Department of Water Resources Flood Mitigation Section, SSD 7-98..
- Traffic Impact Analyses, Section 240 (2002) of ADOT Traffic Engineering, Policies, Guidelines and Procedures.
- Trip Generation Manual, 7th Edition, as distributed by the Institute of Transportation Engineers.
- Trip Generation Handbook, 2nd Edition, as distributed by the Institute of Transportation Engineers.
- Traffic Control Devices Handbook, 2001, as distributed by the Institute of Transportation Engineers.
- Traffic Calming, State of the Practice, U.S. Department of Transportation, Federal Highway Administration, August 1999.
- Traffic Engineering Handbook, Institute of Transportation Engineers.
- Hydraulic Design of Highway Culverts, Hydraulic Design Series (HDS) No. 5 U.S. Department of Transportation, Federal Highway Administration.
- Hydraulic Design of Energy Dissipaters for Culverts & Channels, Hydraulic Engineering Circular 14 (HEC-14), U.S. Department of Transportation, Federal Highway Administration.

4. VARIANCE REQUESTS

Variances from these standards and procedures may be granted by the Cochise County Engineer upon evidence that such variances are in the public interest, they are based upon sound engineering judgment and that safety, function, appearance, and maintainability requirements are fully satisfied. Variances must be requested and approved in writing. All variance requests shall address the pertinent issues indicated above and be accompanied with

all necessary exhibits. A written decision will be conveyed within 30 days of the CCH&FD receiving a formal and complete submittal. The variance request(s) shall consist of:

- A. Identification of the standard provision to be waived or varied.
- B. Identification of the alternative design or construction standards to be adhered to.
- C. A through justification of the variance request including impact on capital and maintenance requirements and cost.
- D. Request shall be prepared and sealed by a professional civil engineer licensed to practice in Arizona.

Variance requests to allow an aggregate base course as a surface type rather than DBST (double bituminous surface treatment) can only be submitted for roads in a Category D Rural Area (per Cochise County Comprehensive Plan) with an ADT (average daily traffic) projection of 250 vpd or less. Such requests shall be directed to the County Engineer in writing and shall be accompanied with all necessary exhibits. The County Engineer shall make a recommendation to the Board of Supervisors, who shall make a final decision on these surface requests only.

5. TIME LIMITATION OF APPROVAL

The approval of road construction plans shall be valid for a time period of one (1) year from the date of final design approval by the County. Improvements not under construction within this time period must be resubmitted to and reapproved by the County unless a longer time period has been specifically authorized with the County's original approval. Requests for extensions must be submitted in writing with necessary justification warranting such an extension. A written decision will be conveyed within 30 days of the formal and complete submittal.

SECTION B

FUNCTIONAL CLASSIFICATION

1. SYSTEMS AND CLASSIFICATIONS

Functional classification is the system by which rural and urban roads are grouped into classes according to the character of service they are intended to provide. The basic functional systems used in this classification are arterials, collectors, and locals. Typical cross-sections are shown in Section D. Using national classification terminology, these systems are sub-classified based on the trips serviced, the areas served, and the operational characteristics of the streets or highways. The systems and standards defined herein are intended for planning and design purposes, and not for the distribution of federal transportation funds.

The design year for future traffic volumes will be 20 years from the start of design and may change the classification. The classification will also depend on if the road is shown as a major road per an adopted traffic circulation plan.

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

2. RURAL SYSTEM (typically road systems primarily serving those areas zoned or designed for minimum lot sizes greater than ½ acres)

Rural Arterial Roads

They provide high-speed travel and provide minimal interference to through movement and are to be appropriately spaced apart. They are the most heavily traveled rural roads.

The rural arterials consist of roads with the following service characteristics:

- A. Serve most of the larger communities.
- B. Traffic movements between urban areas or larger traffic generators.
- C. Traffic movements with trip length and density suitable for integrated interstate or inter-County service
- D. Traffic movements at relatively high speeds.
- E. Minimal interference to through movement.
- F. Striped for one or two lanes in each direction with auxiliary lanes at intersections as required by traffic volumes.
- G. Desired LOS C.

Example: Non-urban State Routes

Rural Major Collector Roads

Rural Major Collectors tend to connect to State or Interstate routes. Provide service to the larger communities not directly served by the higher systems. Serve the principal business area or a concentration of community facilities in rural communities. The rural major collector roads consist of roads with the following service characteristics:

- A. Traffic movements with trip length and density suitable for inter-county service.
- B. Traffic movements between traffic generators and larger cities, and between traffic generators and routes of a higher classification.
- C. Traffic movements are subject to low level of side friction.
- D. Development may front directly on the road.
- E. Signal spacing is two miles or greater.
- F. Design to the same horizontal and vertical design characteristics as arterial roads, but to specified rural collector road widths.
- G. Striped for one lane in each direction.
- H. Desired LOS C.

Example: Fort Grant Road, Davis Road, Charleston Road.

Rural Minor Collector Roads

Rural Minor Collector collects traffic from local roads. Tend to feed predominantly residential traffic from side streets into major collectors or arterials. The rural minor collector roads consist of roads with the following service characteristics:

- A. Traffic movements between local roads and major collector roads.
- B. Traffic movements between smaller communities and developed areas.
- C. Traffic movements between locally important traffic generators within their remote regions.
- D. Two-lane undivided roads with intersections at grade, and designed to take a minimum interference of traffic from driveways appropriate to a rural setting.
- E. Striped for one lane in each direction.
- F. Desired LOS B.

Example: Moson Road, Palominas Road, Hereford Road, Frontier Road.

Rural Local Roads, ADT > 400

Rural 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 get to and from residences. The rural local roads consist of roads with the following service characteristics:

- A. Two-lane undivided roads with intersections at grade.
- B. Traffic movements between collectors and adjacent lands.
- C. Traffic movements involving relatively short distances.
- D. Desired LOS A.

Example: Choctaw, Bevers.

3. **URBAN SYSTEM** (typically road systems primarily serving those areas zoned or designed for minimum lot sizes of ½ acre or less and/or roads serving areas that are zoned commercial, industrial or for planned developments of mixed uses)

Urban Arterial Roads

To collect and distribute traffic from divided highways to collector streets; to facilitate traffic movement between neighborhoods. Intended to carry high volumes of traffic, at moderate speeds, with restricted access to property. The construction of a frontage road to provide access to abutting property is permissible at the option of the developer. The urban arterial roads consist of roads with the following service characteristics:

- A. Traffic movements in urban areas consisting of major circulation movements within these urban areas with more emphasis on land access than major roads.
- B. Traffic movements do not penetrate residential neighborhoods.
- C. Traffic movements at moderate speeds with partially controlled access facilities.
- D. Undivided four-lane roads with intersections at grade.
- E. Striped for two lanes in each direction with a center left turn lane.
- F. Desired LOS C.

Example: State Routes 90 & 92

Urban Collector Roads

Collector streets connect local streets to the high-speed arterial roads to provide access to nonresidential uses and arterial streets. Collector streets form barriers between neighborhoods and are designed for higher speeds and traffic volumes than are local streets. Intended for utilization by through traffic with limited direct access from adjacent property. Collector systems may penetrate residential neighborhoods. The urban collector roads consist of roads with the following service characteristics:

- A. Traffic movements in urban areas consisting of both land access service and traffic circulation.
- B. Traffic movements are subject to high levels of side and median friction.
- C. Traffic movements penetrate local areas:
- D. Development may front directly on the road.
- E. Signal spacing is two miles or less.
- F. Has more than 10 uncontrolled access points per mile on one side.
- G. Local areas include residential neighborhoods, commercial, and industrial areas.
- H. Desired LOS B.

Example: Foothills Drive

Urban Local Roads ADT>400

To provide direct access to abutting property and connect to collector streets. Urban local streets comprise all streets not on one of the higher systems. The primary function of the urban local street system is to provide direct access to abutting land Urban local streets provide access to higher functional systems.

Typically, service to through traffic movement is deliberately discouraged via the low-posted speed limit, the use of stop signs, etc. Thus, urban local streets provide the lowest travel mobility. These streets have the lowest posted speed limits and have the following service characteristics:

- A. Two-lane undivided roads with intersections at grade with frequent driveway access.
- B. Traffic movements between adjacent lands and collectors or other roads of higher classification.
- C. Traffic movements involving relatively short distances, in most cases less than eight blocks in length.
- D. Fronting lots are less than 18,000 square feet.
- E. Desired LOS A.

Example: Streets in the Fry area of Sierra Vista

4. Low-Volume (ADT \leq 400), Road Routes

See Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT \leq 400), AASHTO for descriptions and standards.

Rural Roads

- rural major access roads
- rural minor access roads
- rural industrial/commercial access roads
- rural agricultural access roads
- rural recreational and scenic roads
- rural resource recovery roads

Urban Roads

- urban major access streets
- urban residential streets
- urban industrial/commercial access streets

5. **Context Sensitive Roads** --Provide access to areas of exceptional environmental, aesthetic, ecological or cultural value.

See Flexibility in Highway Design, as distributed by U.S. Department of Transportation, Federal Highway Administration.

Example: Westerly end of Portal Road.

SECTION C

ELEMENTS OF DESIGN

1. DESIGN STANDARDS

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

The design speed for urban local roads is 25 mph. For all roads with an anticipated posted speed limit of 30 mph or less, the design speed shall be 5 mph over the posted speed limit. For roads with an anticipated posted speed of 35 mph or greater, the design speed should be 10 mph over the posted speed limit. Design speeds may increase 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 arterials streets the WB-40.

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 none, some, or all of the city's or town's standards into the design.

This section highlights the important considerations and requirements in designing and reviewing plans for new and improved Cochise County roadways. It is recognized that the use of widely accepted industry standards reduces both design time and review time. Each part of the section presents the elements of roadway design and includes references to other documents for additional guidelines and specifications. These documents are also listed in Section A. Note that these documents are revised periodically; therefore users should use most recent version of the document specified.

2. GEOMETRIC DESIGN

A. Horizontal Alignment:

Design of horizontal alignment must consider safety, vertical alignments, access and intersection location. 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 Exhibits 3.1 and 3.2 in the Green Book The use of compound circular curves should be avoided. In special 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 feet or equal to at least 4/3 the superelevation runoff length, whichever is greatest. Special attention to drainage requirements of the roadway must be given when using reverse curves.

An angle point is acceptable for breaks in tangent alignments of less than 1°.

Local roads and two-lane residential collectors with design speeds at or less than 35 mph should generally not be superelevated at curves. The normal two-way crown section (-0.02 for asphaltic concrete or -0.03 for DBST) will be used. The minimum radius of curvature for given design speeds is shown in Table C-1 below:

TABLE C-1 MINIMUM RADII OF CURVATURE FOR SELECTED DESIGN SPEEDS

Design Speed (mph)	Max. E (%)	Min. R (ft.)	Max. E (%)	Min. R (ft.)
20	-0.02	107	-0.03	111
25	-0.02	198	-0.03	208
30	-0.02	333	-0.03	353
35	-0.02	510	-0.03	544

Source: A Policy on Geometric Design of Highways and Streets, 2004 AASHTO, p. 151

The maximum superelevation permitted is 0.04 ft/ft for urban classifications and 0.06 ft/ft for rural classification roadways.

In superelevated sections, the graded shoulder slope shall be a continuation of the pavement slope on the high side and 0.05 foot per foot downward on the low side, except when the superelevation rate exceeds 0.05 foot per foot, in which case the low side graded shoulder slope shall equal the rate of superelevation.

The design control at the crossover line between the pavement and the graded portion of the shoulder is the algebraic difference in the cross slope rates. The maximum algebraic difference at this point shall be 8.0%. For superelevated pavements greater than 3% but less than 6% the graded portion of the shoulder on the high side can vary from 5% to 2% to affect a maximum algebraic grade difference of 8%.

Superelevation must be designed to show length, transition, crown runoff, and runout, see detail 140 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 under, intersecting at angles between 60° and 90°.

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. The minimum taper lengths shall be based on the following:

On roads with a design speed less than or equal to 40 mph:

$$L = WS^2 / 60$$

Where the design speed is greater than 40 mph:

$$L = W \cdot S$$

Where: W = Offset from drivable through lane in feet
 S = Design speed
 L = Taper length

Source: Manual on Uniform Traffic Control Devices for Streets and Highways, published by the U.S. Department of Transportation, Federal Highway Administration, 2003 and as amended.

The minimum taper length shall be 100 feet in urban and 200 feet in rural locations.

B. 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. Stopping sight distance shall be provided along the entire length of 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:

$$L = K \cdot A \quad \text{where } L = \text{length of vertical curve (ft)} \\ K = \text{rate of vertical curvature (ft/\%)} \\ A = \text{algebraic difference in grades (\%)}$$

TABLE C-2 MINIMUM K FACTOR OF VERTICAL CURVES

Design Speed (mph)	25	30	35	40	45	50	55	60	65
K _{min} (Crest Curves)	12	19	29	44	61	84	114	151	193
K _{min} (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, AASHTO 2004.

To ensure proper 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 on all roads; a maximum grade of 7 percent on arterial, major collector or section-line roads; and 10 percent on minor collector or local roads; for a distance not to exceed 600 feet.

C. New Roads Accessing a County Maintained Road

A road is any vehicular travelway that serves two or more lots or parcels. All roads intersecting an arterial, major collector or section-line road shall do so at a 90 degree angle; intersections of minor collectors and local roads shall not vary from the 90 degrees by more than 15 degrees.

Intersecting street jogs with centerline offsets shall be a minimum of 200 feet on local and minor collector roads and 300 feet on all other roads.

The provision of exclusive right or left turn lanes should be considered at major intersections and at locations where safety is significantly improved by providing a deceleration area for vehicles moving from the major roadway and turning left or right into a cross road or driveway. Turn lane design shall be per ADOT Traffic Engineering Policy 430, Turn Lanes. Specific design values and marking for turn lanes and storage are given in Pima County/City of Tucson Pavement Marking Design Manual.

At road intersections, property line and road alignment shall be rounded with a minimum radius of 25 feet for local and minor collector roads and 50 feet for all other roads. When acceleration or deceleration lanes are present, curve radii may be reduced to 25 feet. The centerline tangents shall be a minimum of 50 feet for local roads and 100 feet for all other roads, measured from the right-of-way line.

The crossover crown of two adjacent intersecting pavements shall not exceed an algebraic difference of 4 percent for arterial and collector roads and 6 percent for local roads.

Functional clear visibility shall be provided 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.

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

Sight triangles provide areas at the corners of intersections of roads and driveways where views of approaching traffic are not obstructed. Sight distance easements shall be identified and shown at all road intersections and noted on the final subdivision plat and on commercial site plans, see Detail D-300. These easements will remain free of all obstructions that will obstruct vision between a height of 2.5 feet and 10 feet to include but not be limited to structures, trees, shrubbery, and signs, except utility poles, fire hydrants, and traffic control signs. Intersection sight triangles are applied to approaching vehicles and departing vehicles. Obstructions in both the horizontal plane and the vertical plane must be reviewed when designing the intersection. The sight distance triangle shall also be shown on the construction plans.

New public and private roads accessing a County maintained road shall require a right-of-way permit. The surface type of the apron shall meet or exceed the surface type of the adjacent County maintained roadway and shall be designed to adequately handle roadside drainage. Applicant shall demonstrate that additional stormwater from the new roadway shall not result in stormwater overtopping any part of the existing County maintained travelway or cause erosion or deposition within the County right-of-way. Further, applicant shall demonstrate that the new roadway shall not increase stormwater drainage onto neighboring properties.

Uncurbed intersections shall utilize concrete ribbon curb, per MAG Detail 220, Type B, along the curb return to prevent pavement raveling.

D. Driveways

A driveway is any access constructed within the public right-of-way, connecting the public roadway with one adjacent property. Some of the principles of intersections also apply directly to driveways.

The location and spacing of driveways which provide access along arterial and major collectors has an impact on both safety and capacity of the roadway. A minimum of 150 feet, measured at the right-of-way line, shall separate the nearest pavement edge of any entrance or exit driveway and 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 feet from the median opening. Driveways that access onto local streets shall be a minimum of 50 feet from the nearest intersecting road.

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. The design of a driveway should take into consideration the space necessary to store vehicles using the driveway. This applies to both vehicles making a left turn from the roadway and to vehicles stopped on the driveway waiting to enter the roadway. Joint access will be required for two adjacent developments where a proposed new access will not meet these spacing requirements.

Commercial and industrial driveways must take into consideration the needs of truck traffic and shall be checked using the appropriate turning template. Commercial

driveways shall have a minimum return radius of 35 feet. Driveways having three or more lanes shall follow the design standards for street intersections. Drainage shall also be accommodated in the design. Where necessary for the safe and efficient movement of traffic the County may require the driveway to be geometrically designed so as to provide for only limited turning movements, depending on a Traffic Impact Study.

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, horizontal or vertical roadway alignments, etc. In all cases, stopping sight distance shall be provided.

Adequate design of driveway grades should reflect consideration for the basic functions of the adjacent street and the site that the driveway serves. In order to enable safe ingress and egress maneuvers, driveway profiles should provide for sufficient clearance between the vehicle and the driveway surface.

A two-way driveway should be as close to 90° to the roadway as possible (no less than 60°).

Where a residential property has access to more than one road, access shall be restricted to the lowest volume road where the impacts of a new access will be minimized to the higher volume road. A commercial property may take access off the higher volume road if adequate geometric improvements are constructed to the higher volume road. Geometric improvements may consist of left and right turn lanes and/or deceleration/acceleration lanes.

Where necessary for the safe and efficient movement of traffic, the County may require access points to be geometrically designed so as to provide for only limited turning movements.

Exceptions may be made by the County Engineer where the application of these standards would create an undue hardship to the abutting property owners and good traffic engineering practice can be maintained which may include left and right turn lanes. This does not constitute a guarantee by the County to provide access to a property.

All non-residential driveway surface aprons shall meet or exceed the surface type of the adjacent County maintained road to which it provides access. The construction shall not alter the natural drainage.

All construction to connect or change driveways entering County roads must first be authorized by a valid CCH&FD Right-of-Way Permit.

E. 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 slopes.

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 should be relocated laterally or in a more protected location.
- Obstacles which may not be moved should be reduced in impact severity. Breakaway devices and flattened side slopes 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 inches in diameter
- Streams or permanent bodies of water more than 2 feet deep
- Shoulder drop-offs with slopes steeper than 3:1 and heights greater than 2 feet
- Signs, traffic signals, and luminary supports with a concrete base extending 6 inches or more above ground
- Bridge piers and abutments
- Retaining walls and culverts
- Trees with an expected mature size greater than 4 inches in diameter, measured 12 inches above ground
- Wood poles or posts with a cross sectional area greater than 16 square inches
- Culverts, pipes, cattle guards and headwalls. Drainage structures should extend beyond the clear zone limits.
- Embankments
- Fire hydrants
- Non-standard mailboxes

The clear zone width shall be per 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-feet over the entire roadway.

F. Traffic Calming

During street layout and design of a residential subdivision, the issue of traffic calming should be considered. Early consideration can minimize future speeding problems and improve the livability of the neighborhood.

The goal of traffic calming is to reduce vehicle speed and the volume of cut-through traffic. Traffic calming can be achieved through the utilization of operational measures, design features, and sometimes, physical barriers. Therefore, the need for physical barriers such as speed humps or chokers is not anticipated.

Subdivision streets should be designed to encourage 85th percentile speeds to be the same as the design speed. Intersection return radius may be reduced to 15 feet for local to local road. Road tangents should ideally not exceed 500 feet in length. Long tangent sections can be segmented by T intersections or conditions that require reduced speeds such as horizontal curve or knuckles. Tangent sections greater than 1000 feet, with a proposed isolated traffic calming device, shall not be considered as traffic calming. Speed humps and speed tables shall be constructed per detail 310 and 311 in Section D.

G. Context Sensitive Road

Purpose and Intent of the Context Sensitive Road Classification:

Cochise County includes a number of areas of exceptional environmental, aesthetic, ecological or cultural value. In certain circumstances, these special places could be damaged or degraded in the absence of careful stewardship. The roadway standards authorized by this classification are intended to reduce the impacts that the construction and maintenance of public roadways might otherwise have on these designated areas, while also providing a roadway that is reasonably safe for public use and reasonably amenable to public maintenance.

Context sensitive design equally addresses safety, mobility, and the preservation of scenic, aesthetic, historic, and environmental values. Sufficient flexibility is permitted by modifying design standards to particular situations for the purpose of preserving important historic and scenic resources. The U.S. Department of Transportation, Federal Highway Administration manual "Flexibility in Highway Design" should be referred to for guidance for these roads.

Eligibility for the Context Sensitive Road

Existing County maintained roads, or road segments, may be recommended for this classification if they meet the following criteria:

- The road or road segment is located in an area that possesses extraordinary environmental, ecological, aesthetic or cultural characteristics which could be damaged or degraded by the disturbances that may accompany typical roadway construction or maintenance. These effects may include, but are not limited to, adverse impacts on the topography, water courses, wildlife habitat, vegetation, cultural resources, or the integrity of the area as a whole.
- The speed limit and roadway design standards associated with this classification shall be 25 mph or less.

Approval of Roads for this Classification

Existing County maintained roads or road segments may be recommended for this designation by members of the public or by the County Engineer. All roads that have been nominated for this classification will be evaluated by the CCH&FD engineering staff in order to determine if the roadway meets the criteria listed above. If the County

Engineer recommends this designation for any nominated roadway, he shall forward this recommendation, together with any recommendations for particular requirements or conditions and the standards for a typical section of that roadway, to the Board of Supervisors for formal approval. Upon approval by the Board of Supervisors, following a public meeting, the designated road or road segment shall be given this classification and thereafter managed in a manner that is consistent with the conditions, requirements and standards adopted for that roadway. Any necessary changes in the speed limit for that road or road segment shall also be adopted by the Board of Supervisors at that time.

If the County Engineer determines that the proposed roadway does not meet the specified criteria for this designation, the County Engineer shall advise any third party applicant of the results of his review and the specific reasons for his determination.

Construction and Maintenance Standards

Roads or road segments that have been approved for inclusion in this classification shall be constructed, improved and maintained according to following standards:

- The roadway design shall be limited to the minimum geometric standards that are compatible with the "Very Low-Volume Local Road" standards, as adopted by AASHTO even though some of the candidate roads have an ADT>400. The Cochise County adopted standard for such roads is Figure D-125. The design speed and established speed limit shall be not more than 25 miles per hour.
- The maintenance of the roadway shoulders and adjacent drainage ditches shall be limited to the greatest degree possible to reduce the amount of disturbance of the adjacent areas. Typically this area of maintenance shall be limited to not more than two feet on each side of the travelway.
- This road or road segment shall be signed in a manner that is consistent with the MUTCD as a "Scenic Road," together with "Narrow Width, Limited Shoulder" and speed limit signs.
- The travel way and roadway shoulders shall be managed by the Cochise County Highway and Floodplain Department in a manner that is consistent with all of the special conditions or restrictions and typical standard sections that have been adopted for that particular area by the action of the Board of Supervisors

3. STREET ELEMENT DESIGN

A. Pavement

All roads shall be paved with asphalt concrete over aggregate base or double bituminous surface treatment (DBST or chip seal) over aggregate base per County standard cross-sections and specifications. Pavement and base course design shall be in accordance with "Materials Preliminary Engineering and Design Manual" by ADOT, 1992 and as amended.

The pavement as designated on the typical cross-section shall be considered a preliminary requirement, not approved for construction, until substantiated by acceptable test results of the actual subgrade soil. Approval 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 every 500 feet per lane (every 250 feet alternating lane) and within 0.5 feet 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.

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. Laboratory reports shall be submitted showing sieve analysis, PI and minus 200 of all subgrade samples taken and of the findings of all other material and construction test made on or for the required public improvements. Sieve analysis shall be per ASTM D422, plasticity index per ASTM D4318 and #200 wash per ASTM D1140.

B. Drainage

The drainage design report for the complete development shall be in compliance with the Floodplain Regulations for Cochise County, effective May 15, 2002, as amended and these standards.

Hydraulic calculation for pipe and box culverts should use the methodology of *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 feet per second (fps) shall be provided for all culverts and dip crossings.

The following table shows the design storm that shall pass under the road based on the road classification.

<u>Road Class</u>	<u>Q_{storm} under road</u>
Arterial, Major Collector	25 year
Minor Collector	10 year
Local	5 year

Drainage crossings and channels shall be designed to convey the above storm under the roadway with provision that the 100-year storm be contained in an overflow/dip section with the depth of flow crossing the roadway not to exceed 1 foot at any point within the paved section. The road surface shall be stabilized with AC or PCC depending on velocity. A minimum 6 inch x 18 inch cutoff wall shall be provided along the edges of the street pavement to prevent erosion and to maintain a stable roadbed under overflow conditions. Actual depth shall be verified by scour calculations. Cut-off walls shall be

placed at least 4 feet 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 Q_{100} within the right-of-way. Diversion of flow from one basin to another is prohibited.

At intersecting local roads for flows less than 10 cubic feet second (cfs) a 4 foot 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 can result in excessive erosion or scour.

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

A right-way-permit shall be obtained before installing culverts. A driveway on minor collector and above roads shall have the finished grade lower than the edge of pavement of the adjacent travel lane. This is to prevent any overflow drainage impacting the thru 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 height of box culverts shall be 4 feet above the natural streambed elevation. The minimum height of arch culvert shall be 4.5 feet. In desert wash areas the preferred minimum height of box culverts is 5 feet and their inverts shall typically be set 6 inches below the existing streambed flow. Handrails shall be installed for headwalls located in areas where pedestrians may be present.

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

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 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, 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 requirements for prefabricated pipe. All culverts shall have a minimum of one-foot cover from the top of pipe to top of base course.

C. Landscaping

Landscaping on the right-of-way may be permitted, in compliance with the Roadside Design Guide, provided the landscaping does not create sight distance problems, introduce safety hazards, and does not introduce potential damage to the road and drainage system infrastructure. If installed within a roadside drainage channel, all material shall not impede the drainage flow or decrease the cross-sectional area of the channel. See Detail 134 in Section D.

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 on the right-of-way provided that under drains are installed 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.

D. Raised Median Curb, Gutter and Sidewalk

Raised medians may be placed at subdivision entrances or can be used to create a divided roadway through a subdivision. All medians greater than 6 feet in width shall have a desert landscape in accordance with the applicable Cochise County regulations and a maintenance agreement from a homeowners association or other group. Any median less than 6 feet shall be constructed of concrete.

Curb, gutter and sidewalk shall be installed on urban roads per the cross-sections in Section D. Sidewalks and sidewalk ramps shall conform to the requirements of the Americans with Disabilities Act (ADA) of 1991 and current updates. Curb return ramp shall be per MAG Detail 231 and sidewalk ramp shall be per MAG Detail 233.

E. Guardrail

Guardrail shall be provided and installed by the developer 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 feet in front of the obstacle. In fill section, the back of the guardrail post shall be 2 feet 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, location of trees, utility poles, etc. must all be taken into consideration when determining if guardrail is warranted in a particular location.

Guardrail is typically required on sections of roadway when any of the following conditions exist within the clear zone:

- A roadside parallel embankment (fill slope) of 3:1 or steeper and a depth of 4 feet or more.
- A water hazard with a depth of 2 feet or more (as measured from the near edge of pavement).
- A ditch section with a depth of 3 feet or more (as measured from the near edge of pavement).
- 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. Guardrail shall generally not be placed within the shy line.

See the AASHTO Roadside Design Guide for discussion on all types of approved barriers and required length of need and end treatment. New roadside barriers shall meet the crash test requirements established by NCHRP Report 350 and approved for use by FHWA.

F. Pavement Markings and Signs

All required pavement markings, traffic control and road name signs for new and/or existing roads shall be shown on the improvement plans and installed by the developer, (refer to Signing and Marking Specifications, ADOT, and Pavement Marking Design Manual, Pima County Department of Transportation and Flood Control District and City of Tucson Department of Transportation).

G. Road Monuments

Permanent survey monuments shall be installed to designate road centerline at all angle points, at points of curvature and at 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.

H. Road Extension Sign

Signs indicating that a stub roadway, within a subdivision, 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”.

The sign is to be provided by the developer and fabricated using a 0.080-inch gauge aluminum sign blank and fully reflective (minimum engineering grade material) sheeting and designed per MUTCD.

I. 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 An Informational Guide for Roadway Lighting, (AASHTO, 1985); pole locations per the Roadside Design Guide, (AASHTO, 2002); and light distribution per applicable Cochise County regulations.

Equipment and material standards shall be per ADOT Standards.

J. Traffic Signals

Traffic signals shall be installed at all locations as 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 inch diameter. Wiring for traffic signals in Cochise County is based on the use of multiconductor cables rather than individual conductors. Equipment and installation procedures shall conform to ADOT Standards.

K. 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 D-200 thru D-204.

4. UTILITIES WITHIN PUBLIC RIGHT -OF-WAY

This section applies to all public and private utilities including but not limited to communication, electric power, gas, water and sewer, cable television, telephone, fiber optics, irrigation, and similar facilities that are located on and under arterial roads and major collectors within Cochise County public right-of-way.

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 feet from back of curb, one foot from back of sidewalk, or 10 feet from edge of pavement, if no curb is present. Utility poles and any other above ground streetscape shall be located within five feet of the right-of-way line or ten feet from the travel lane, whichever is most restrictive. Warning tape shall be installed a minimum one foot 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 Standard 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. DEVELOPMENT IMPROVEMENT PLANS

The developer shall be responsible for having a registered engineer, licensed in the State of Arizona, prepare a complete set of improvement plans to include plan/profile drawings, drainage structures, and specifications for all public work improvements. No construction shall commence until improvement plans are reviewed and approved by CCH&FD and a Right-of-Way permit is obtained. Such review and approval is intended to assure general compliance with County Standards. This review is not intended to assure completeness and/or accuracy of all plan details or assume any design responsibility from the designing Engineer. At the time of submittal of plans, plan check fees as per current adopted fee schedules shall be paid.

The following provides plan formatting so that significant design elements are properly shown and plan reviews are facilitated.

Plans shall be drawn on a 24 inch x 36 inch sheet at no smaller than a horizontal scale of 1 inch = 40 feet and a vertical scale of 1 inch = 4 feet. A smaller scale may be required 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, 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 downstream direction 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 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 or microfilmed. Minimum lettering height shall be 0.10 inches. Stick-on materials, other than Standard Blue-Stake stickers, shall not be allowed on plan originals.

All existing culture shall be shown including one foot contour lines. Horizontal limits shall extend a minimum of 25 feet 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 and 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 of the project a minimum 300 feet beyond the project limits. Existing edge of pavements, major driveways, traffic signals, traffic striping, and traffic signs shall be surveyed a minimum of 300 feet beyond the end of the project. Existing grades shall be shown on 50 foot intervals and new grades on 100 foot intervals.

As a minimum, curve, geometric data and drainage features shall be shown per detail 140 in Section D. 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 right-of-ways, curb return data, drainage structures, etc. Indicate finished elevations, including PVC, PI and PVT of vertical curves, intersection points, and all other points needed for good vertical control of construction. Include any additional information needed to clarify profiles or deal with special conditions.

Cross-sections: A typical cross-section is needed for each condition encountered and should be clearly identified as to where it is applicable. Cross-sections shall show both existing grade and proposed grades for the structural section and the proposed road template. Cross-sections shall show materials, thickness, compaction and application for select material, aggregate base, prime coat, AC, DBST, curb and gutter, sidewalk, and drainage structures, as applicable.

Plan and profile sheets shall show the locations and typical cross-section of street pavements including all features and structures for proper drainage. Provide adequate detail plans 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 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 shall be referred to by number and included as part of the plans.

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 Recorders Office as stipulated by A.R.S. §33-106. Such monuments shall conform to MAG Standard 120-2.

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, P.C.'s, P.I.'s, P.T.'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.

Title, name, 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 ½ size set of the construction plans to CCH&FD.

6. CONSTRUCTION AND INSPECTION

All construction within the existing or proposed County right-of-way shall be constructed 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 the Cochise County Road Construction Standards and Specifications for Public Improvements.

Existing roads that are incorporated into the subdivision circulation system and serve existing development shall be maintained to the current level of service during construction of the new subdivision roads. 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, document all field changes, and summarize 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 County 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 Title 32-142 of the Arizona Revised Statutes 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 cost of all sampling and testing necessary to substantiate the design or acceptability of construction quality of the improvements is the responsibility of the developer. 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. Sub grade and base course shall be density tested a minimum of every 500 feet, 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:

- A. Subgrade Completion – all utilities, culverts, ditches, shaping to finished subgrade, etc. complete in place.
- B. ABC complete in place.
- C. Pavement course, AC, DBST or PCC, complete in place.
- D. 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 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 developer's 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 engineers report. The responsibility for the construction of all projects shall lie with the developer. The cost for all required quality control shall be born by the developer. Any questions as to construction standards, interpretation of results, or methods of construction, shall be brought to the County Engineer's attention for his interpretation.

The developer shall have the Design Engineer submit final, stamped as-built plans, drawn on reproducible film, 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. 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 this documentation shall be submitted before a request for release of lots will be considered.

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 construction itemized costs of all dedicated public improvements.

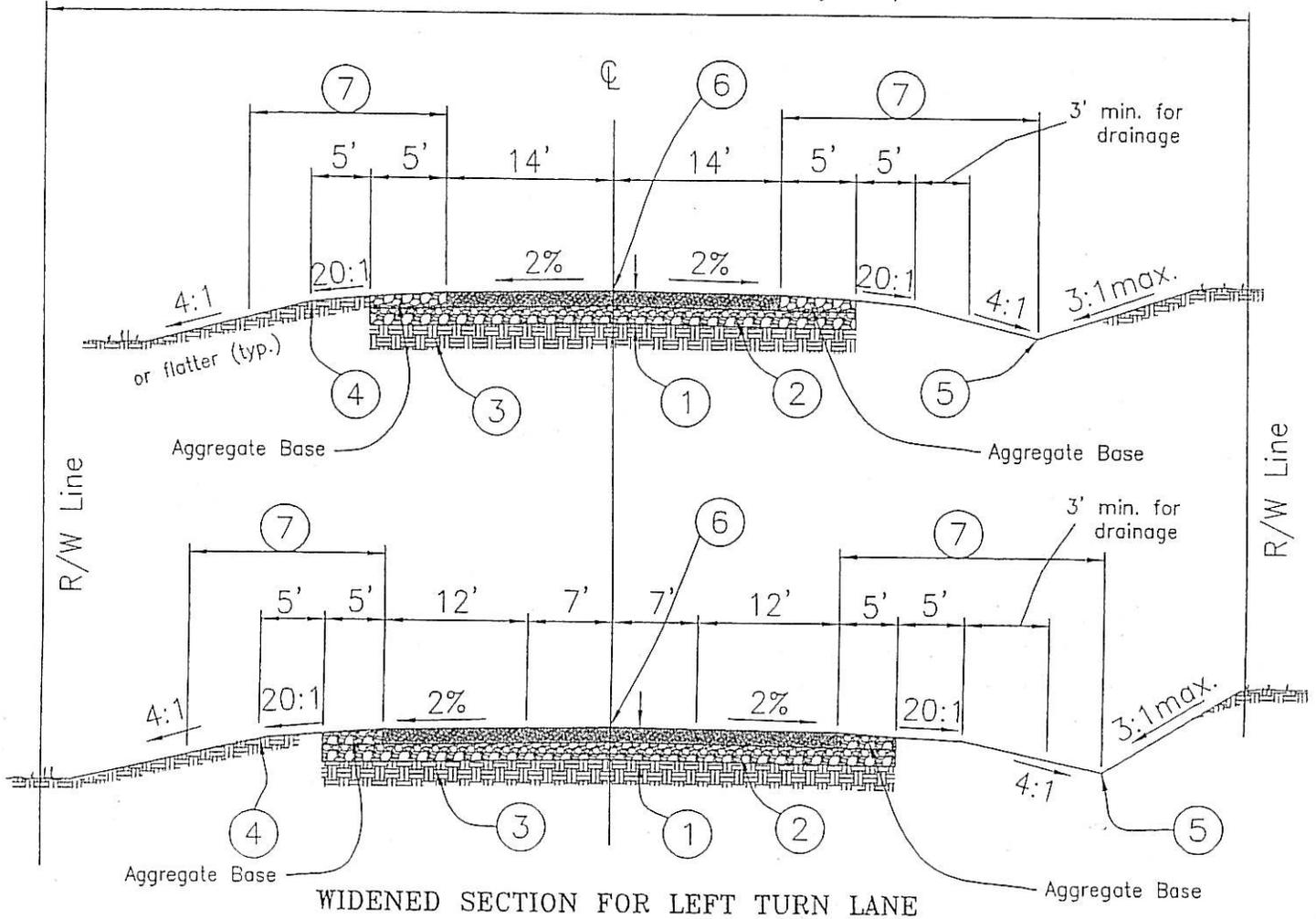
The final inspection shall be scheduled at least 5 working days in advance. It is the responsibility of the developer to have all necessary persons in attendance at the final inspection including the Design Engineer and Contractor. When the final inspection is complete, a written punch list will be sent to the developer, Design Engineer and the contractor. Once all punch list items are complete, the CCH&FD will prepare the required documentation to accept the public improvements. The one-year warranty period shall

commence once this documentation is signed by the County Engineer. The developer is responsible to maintain all Arizona Pollutant Discharge Elimination System (AZPDES) requirements during the one year warranty period.

SECTION D

ROAD CROSS-SECTION AND STANDARD DETAILS

100' minimum standard right-of-way requirements



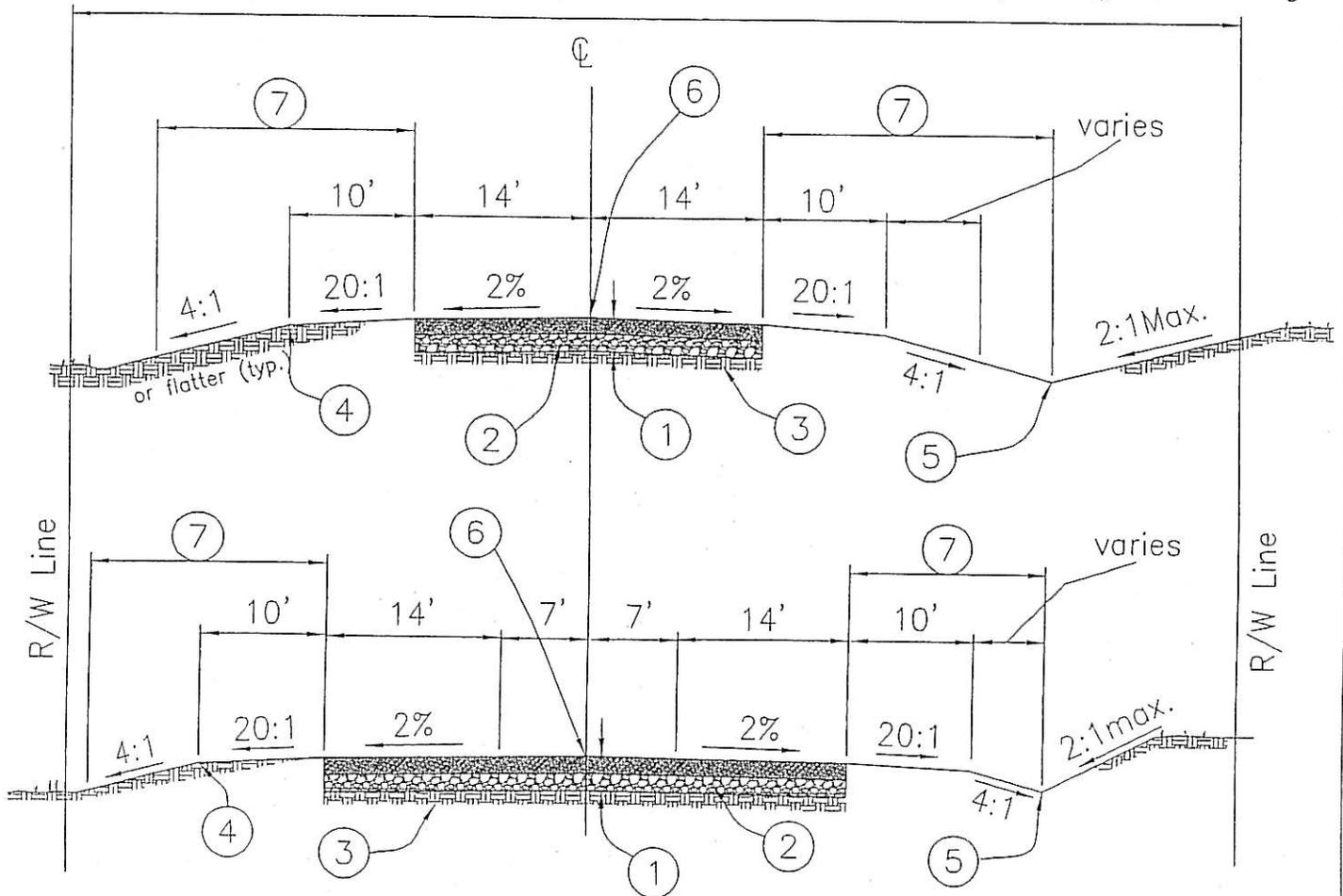
- ① 3" minimum asphaltic concrete (A.C.) over 6" minimum aggregate base (A.B.) over 6" compacted native material. Actual depth of A.B. to be determined by laboratory tests and Figure D-150 or $SN \geq 2.36$.
- ② Aggregate Base compacted to 100% of maximum dry density.
- ③ Subgrade compacted to a minimum of 95% of maximum dry density.
- ④ Compacted to a minimum of 90% of maximum dry density.
- ⑤ Drainage Ditch as required.
- ⑥ Profile grade & axis of rotation.
- ⑦ Clear Zone (for clear zone requirements refer to AASHTO "Roadside Design Guide", 2002, Chapter 3).

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
RURAL MAJOR COLLECTOR
ROADS

FIG.
D-100
Rev 3-8-05

Minimum standard right-of-way requirements: 80' to 100' depending on drainage



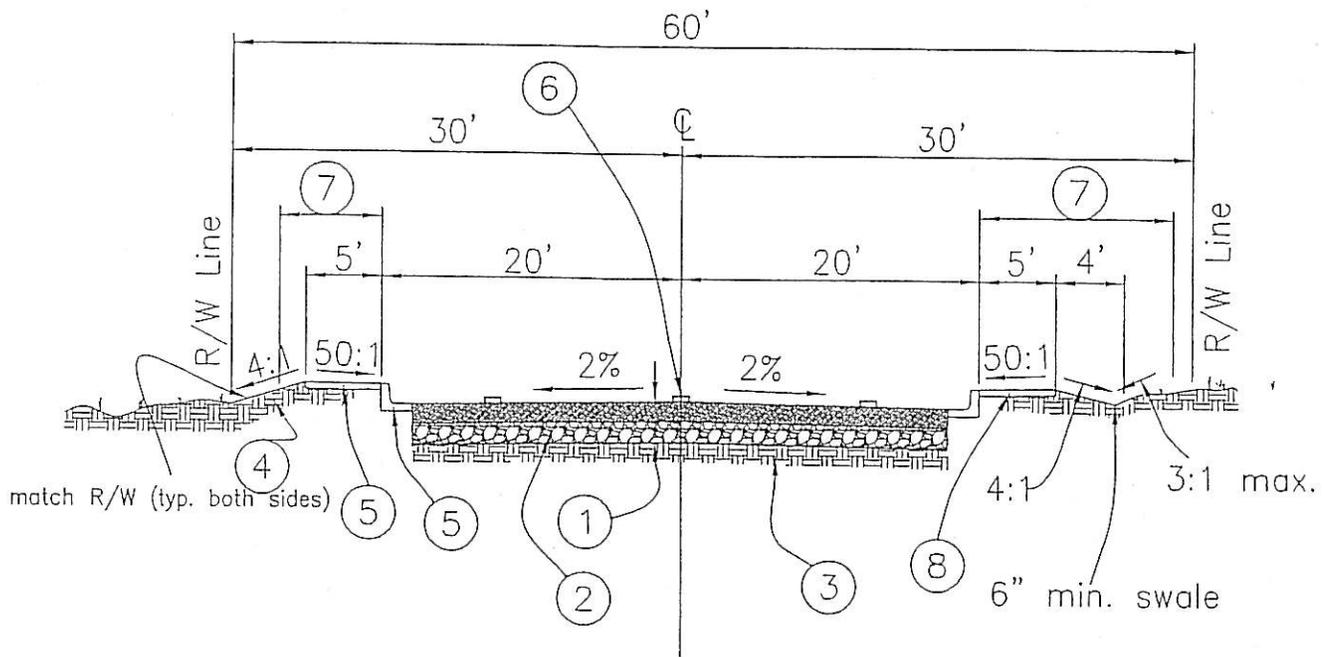
WIDENED SECTION FOR LEFT TURN LANE

- ① 2" minimum asphaltic concrete (A.C.) over 6" minimum aggregate base (A.B.) over 6" compacted native material. Actual depth of A.B. to be determined by laboratory tests and Figure D-150 or $SN \geq 1.92$.
- ② Aggregate Base compacted to 100% of maximum dry density.
- ③ Subgrade compacted to a minimum of 95% of maximum dry density.
- ④ Compacted to a minimum of 90% of maximum dry density.
- ⑤ Drainage Ditch as required.
- ⑥ Profile grade & axis of rotation.
- ⑦ Clear Zone (for clear zone requirements refer to AASHTO "Roadside Design Guide", 2002, Chapter 3).

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
RURAL MINOR COLLECTOR
ROADS (ADT>2000)

FIG.
D-101
Rev 3-8-05



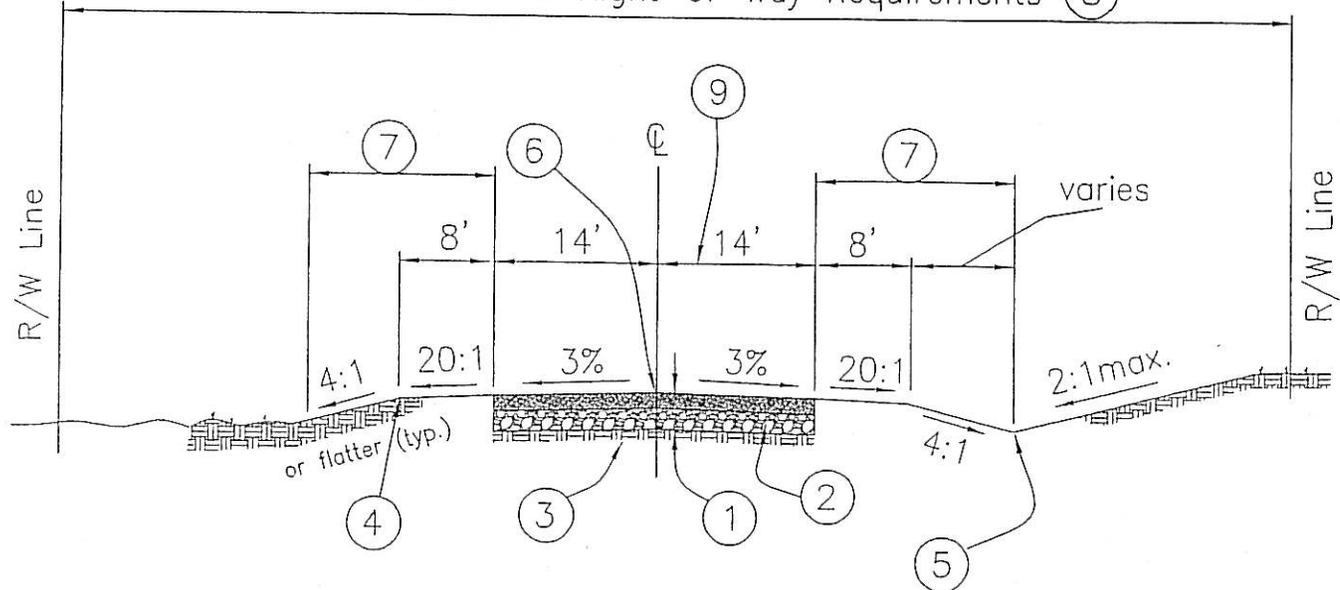
- ① 2" min. AC over 6" min. AB over 6" compacted native material. Actual depth of AB determined by soils test of subgrade and Fig. D-150 or $SN \geq 1.92$.
- ② Aggregate Base compacted to 100% of maximum dry density.
- ③ Subgrade compacted to a minimum of 95% of maximum dry density.
- ④ Compacted to a minimum of 90% of maximum dry density.
- ⑤ MAG Std. Detail 220, Type A, H=6" (typ. both sides).
- ⑥ Profile grade & axis of rotation.
- ⑦ Clear Zone (for clear zone requirements refer to AASHTO "Roadside Design Guide", 2002, Chapter 3).
- ⑧ MAG Std. Detail 230

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
URBAN (MINOR) COLLECTOR &
COMMERCIAL/INDUSTRIAL ROAD

FIG.
D-111
Rev 3-8-05

Minimum Standard Right-of-Way Requirements (8)

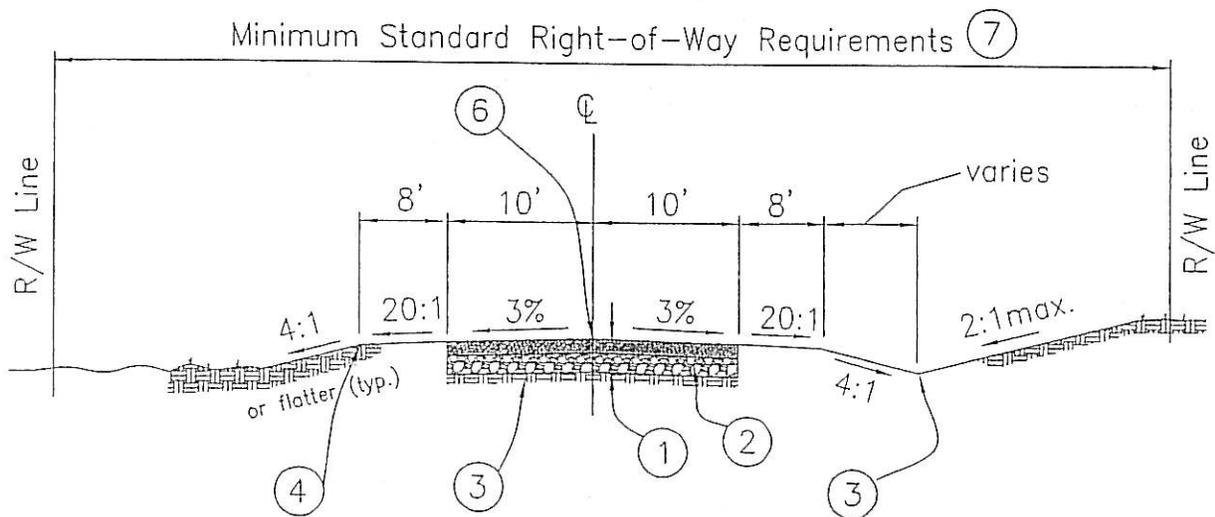


- ① Double Bituminous Surface Treatment (DBST) over 6" minimum aggregate base (A.B.) over 6" compacted native material.
If ADT \leq 400, then see Fig. D-103.
Actual depth of AB to be determined by soils test of subgrade material and Fig. D - 150.
- ② Aggregate Base compacted to 100% of maximum dry density.
- ③ Subgrade compacted to a minimum of 95% of maximum dry density.
- ④ Compacted to a minimum of 90% of maximum dry density.
- ⑤ Drainage Ditch as required.
- ⑥ Profile grade & axis of rotation.
- ⑦ Clear Zone (for clear zone requirements refer to AASHTO "Roadside Design Guide", 2002, Chapter 3).
- ⑧ Minor Collector: 80'
Local Road: 60'
- ⑨ Local Road 12' lanes.

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
RURAL MINOR COLLECTOR &
LOCAL ROADS (ADT<2000)

FIG.
D-102
Rev 3-8-05

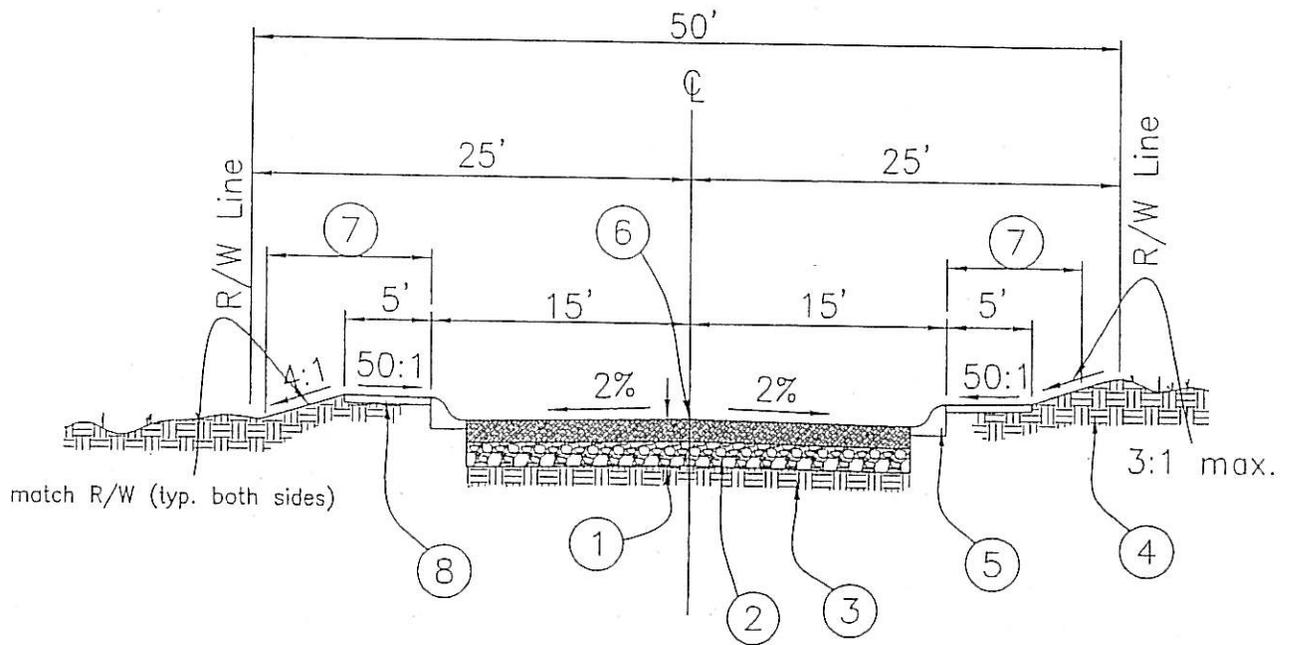


- (1) Double Bituminous Surface Treatment (DBST) over AB (minimum AB determined by Fig. D-151) over 6" compacted native material.
- (2) Aggregate Base compacted to 100% of maximum dry density.
- (3) Subgrade compacted to a minimum of 95% of maximum dry density.
- (4) Compacted to a minimum of 90% of maximum dry density.
- (5) Drainage Ditch as required.
- (6) Profile grade & axis of rotation.
- (7) Local Road: 50'
- (8) ADT of design year (20 year) not to be greater than 400 ADT.

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
RURAL MAJOR & MINOR ACCESS
LOW VOLUME \leq 400 ADT

FIG.
D-103
Rev 3-8-05

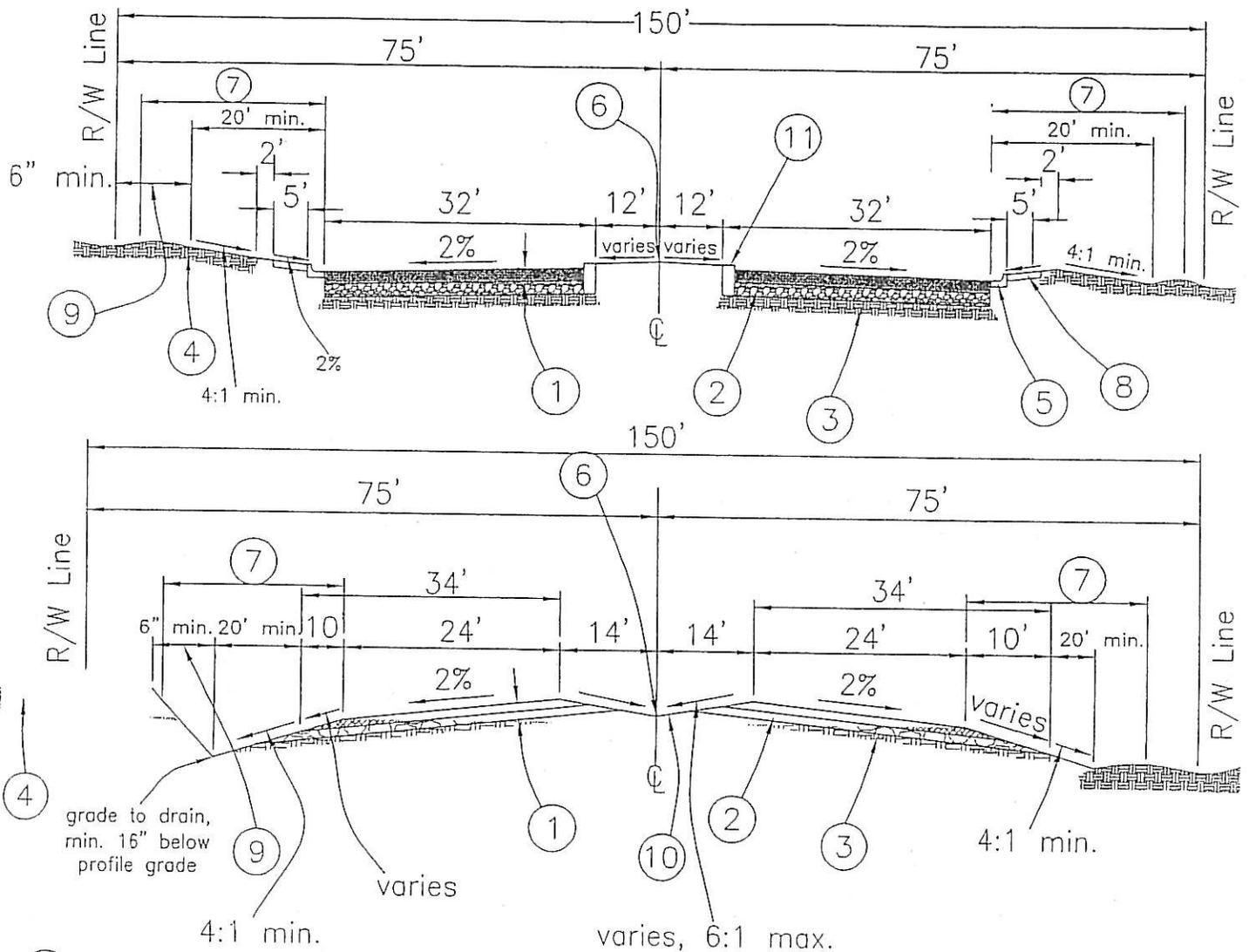


- ① 2" min. AC over 5" min. AB over 6" compacted native material. Actual depth of AB determined by soils test of subgrade and Fig. D-151 or $SN \geq 1.77$.
- ② Aggregate Base compacted to 100% of maximum dry density.
- ③ Subgrade compacted to a minimum of 95% of maximum dry density.
- ④ Compacted to a minimum of 90% of maximum dry density.
- ⑤ MAG Std. Detail 220, Type C, H=4" (rolled curb)
- ⑥ Profile grade & axis of rotation.
- ⑦ Clear Zone (for clear zone requirements refer to AASHTO "Roadside Design Guide", 2002, Chapter 3).
- ⑧ MAG Std. Detail 230

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
URBAN LOCAL ROAD
ON STREET PARKING

FIG.
D-112
Rev 3-8-05

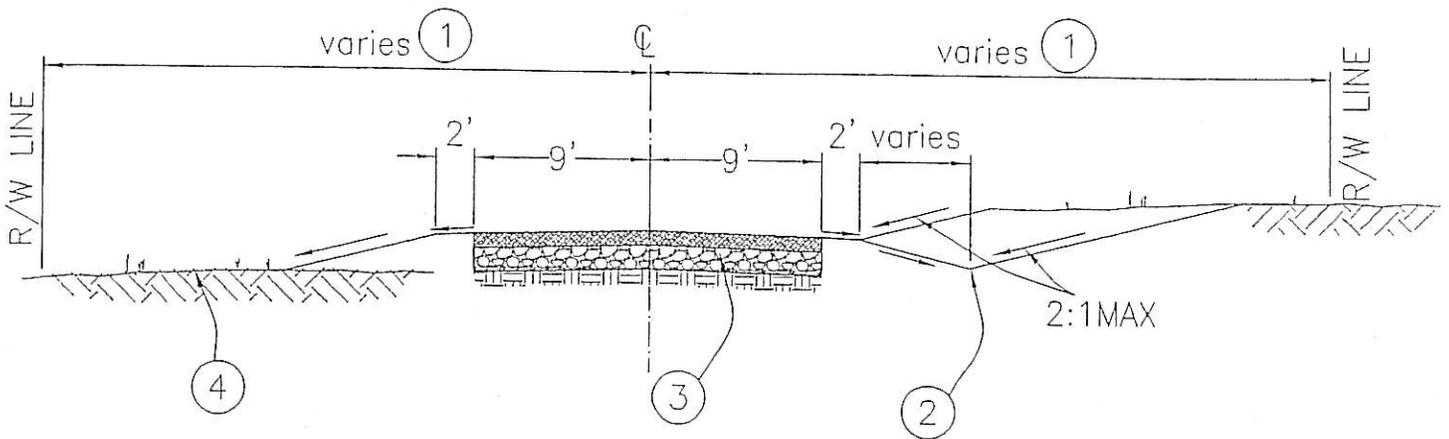


- ① Pavement section to be determined by functional classification and ADT.
- ② Aggregate Base compacted to 100% of maximum dry density.
- ③ Subgrade compacted to a minimum of 95% of maximum dry density.
- ④ Compacted to a minimum of 90% of maximum dry density.
- ⑤ MAG Std. Detail 220, Type A, H=6"
- ⑥ Profile grade & axis of rotation.
- ⑦ Clear Zone (for clear zone requirements refer to AASHTO "Roadside Design Guide", 2002, Chapter 3).
- ⑧ MAG Std. Detail 230
- ⑨ May be reduced if required by fill depth & slope limitations; or increased if resulting slope is flatter than 4:1
- ⑩ Median
- ⑪ MAG Std. Detail 222, Type A

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
DIVIDED ROADWAY

FIG.
D-113
Rev 3-8-05



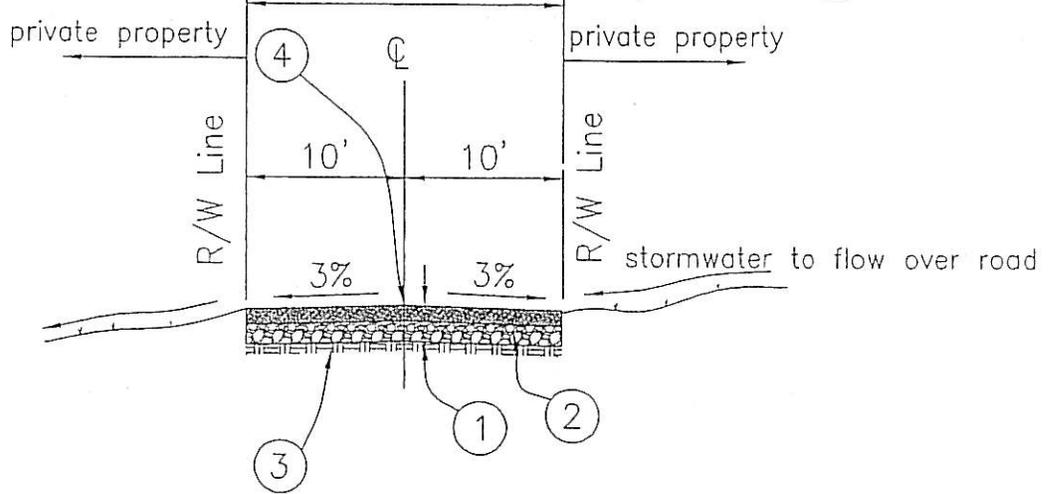
- ① Minimum standard R/W requirement is 22'.
- ② Special Drainage Ditch as required.
- ③ Retain native surface or chip seal surface over 4" minimum aggregate base (A.B.) over 6" compacted native material (compacted to 100% density).
- ④ Clear zone varies

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL X-SECTION
CONTEXT SENSITIVE ROAD

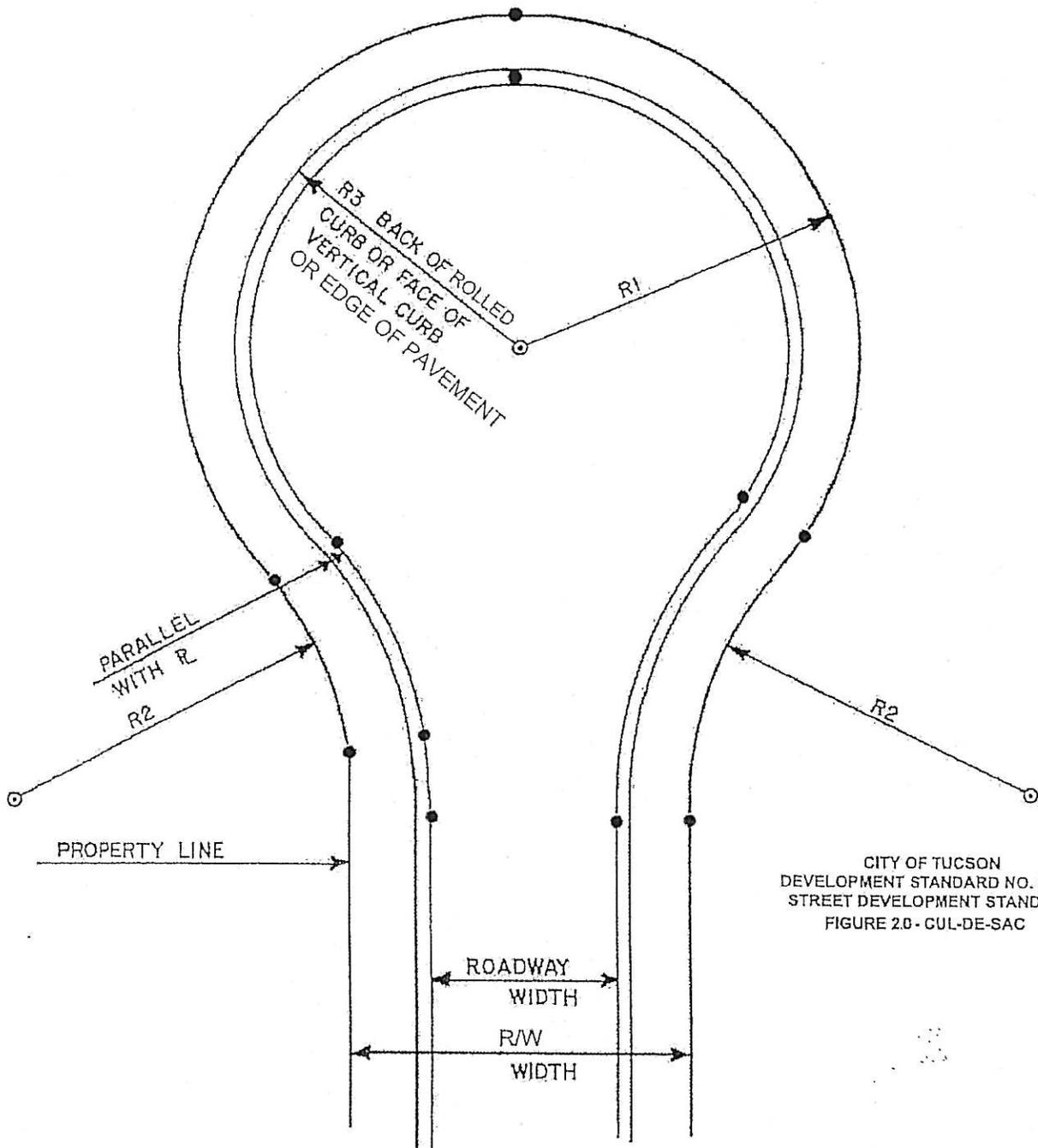
FIG.
D-120
Rev 3-8-05

Minimum Standard Right-of-Way Requirements (5)



- (1) Double Bituminous Surface Treatment (DBST) over AB (minimum AB determined by Fig. D-109) over 6" compacted native material.
- (2) Aggregate Base compacted to 100% of maximum dry density.
- (3) Subgrade compacted to a minimum of 95% of maximum dry density.
- (4) Profile grade & axis of rotation.
- (5) Local Road: 20' with no on-street parking, no utilities and no drainage ditch required.
- (6) ADT of design year (20 year) not to be greater than 250 ADT.
- (7) Intended to retrofit existing unimproved public roads. (Not for subdivision roads or new roads intended to be public.)
- (8) Posted Speed Limit will be 20 mph.

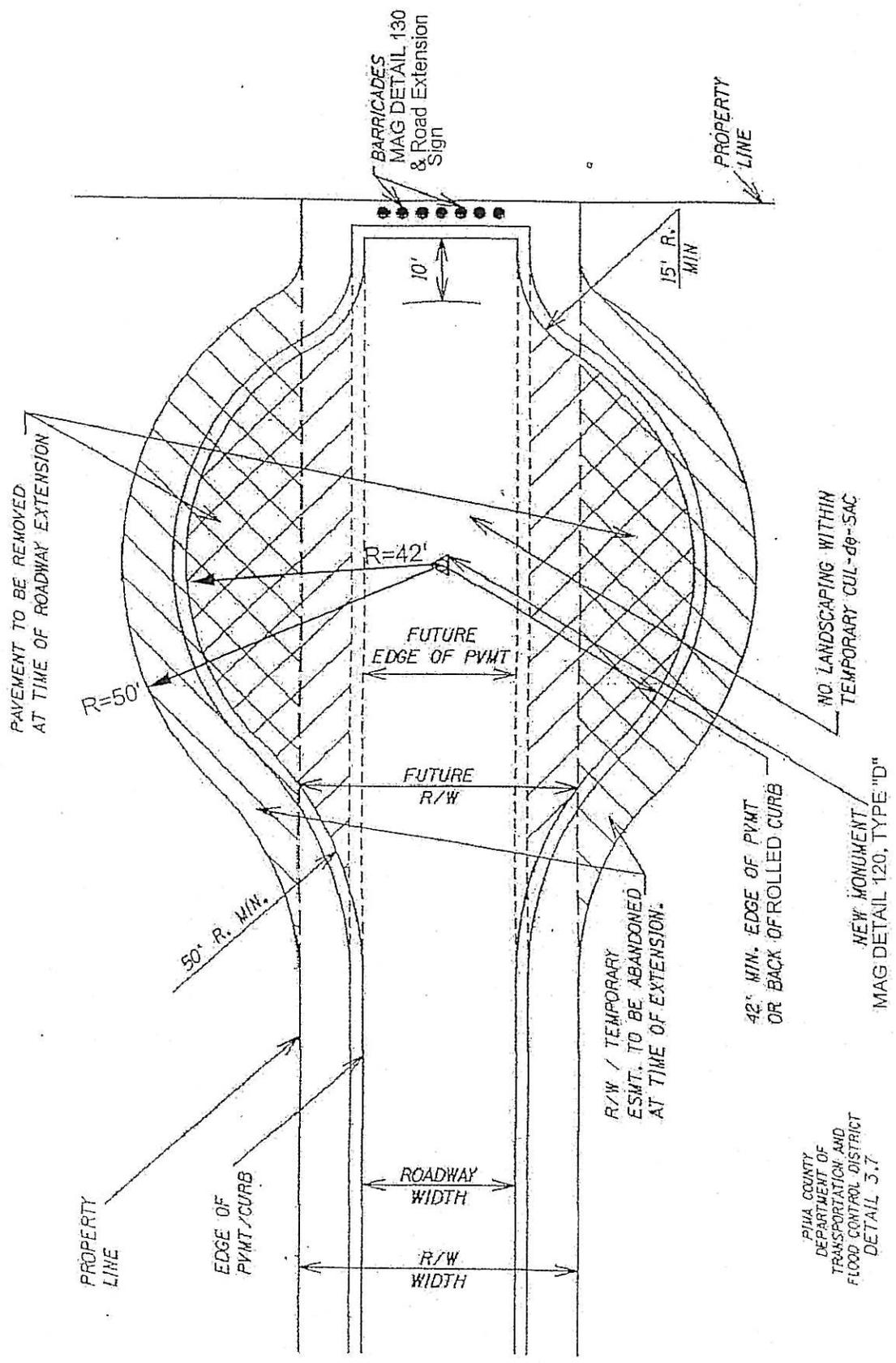
<p>COCHISE COUNTY HIGHWAY AND FLOODPLAIN DEPARTMENT</p>	<p>TYPICAL X-SECTION RURAL MINOR ACCESS VERY LOW VOLUME ≤ 250 ADT</p>	<p>FIG. D-121 Rev 3-8-05</p>
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CITY OF TUCSON
 DEVELOPMENT STANDARD NO. 3-01.0
 STREET DEVELOPMENT STANDARD
 FIGURE 2.0 - CUL-DE-SAC

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

Grades required at •

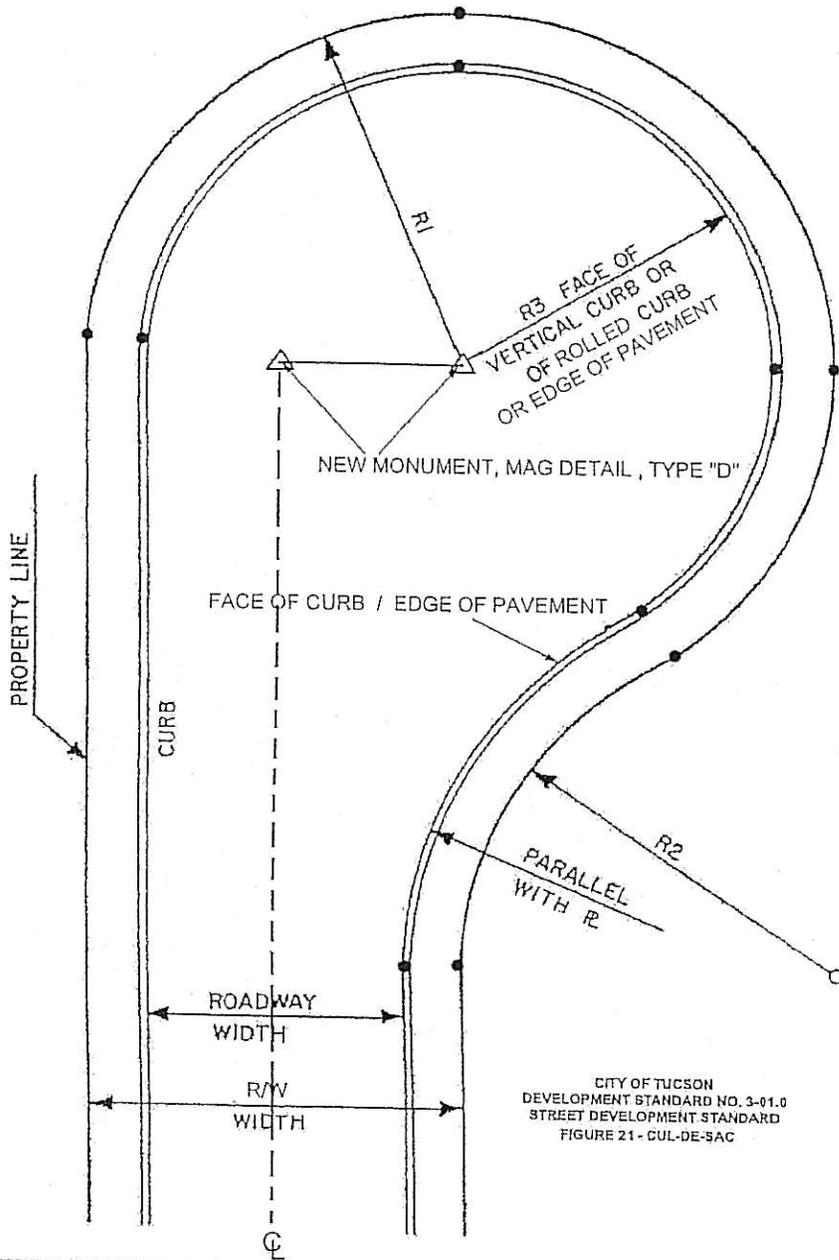


COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

TYPICAL LAYOUT
TEMPORARY CUL-DE-SAC

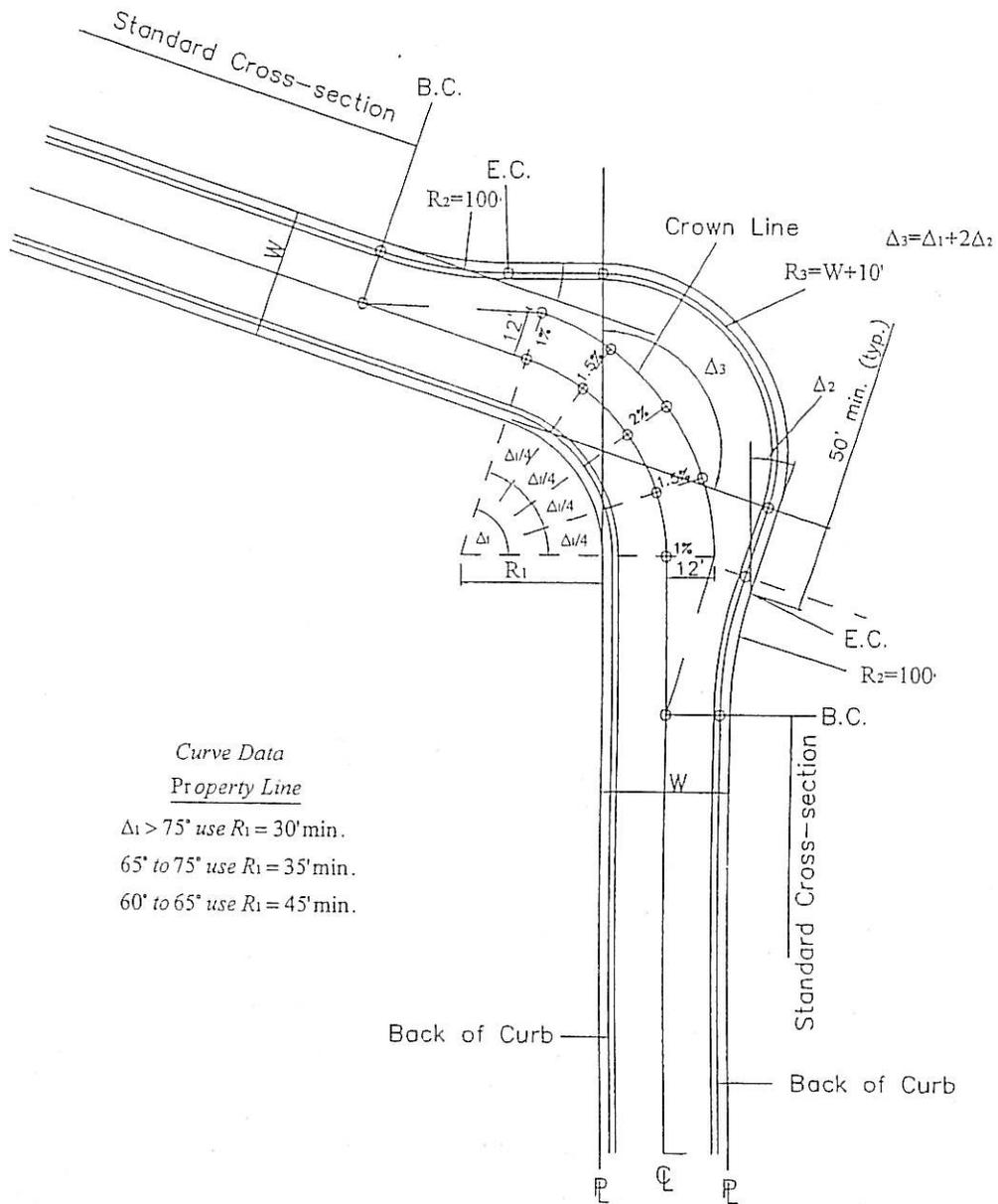
FIG.
D-131
Rev 3-8-05

PIMA COUNTY
DEPARTMENT OF
TRANSPORTATION AND
FLOOD CONTROL DISTRICT
DETAIL 3.7



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

Grades required at •

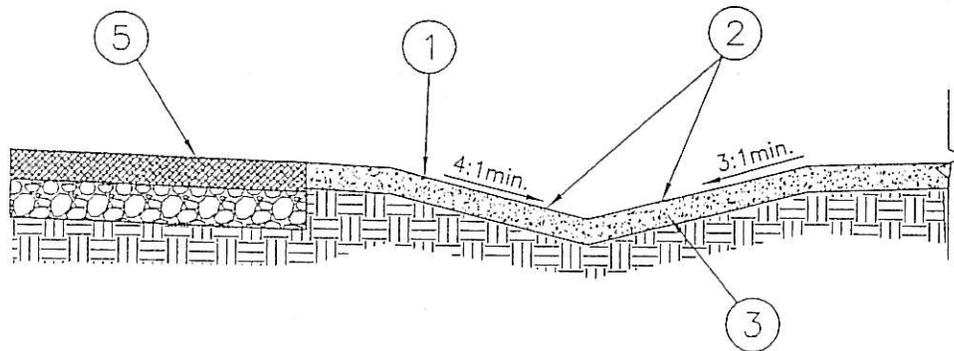


Notes:

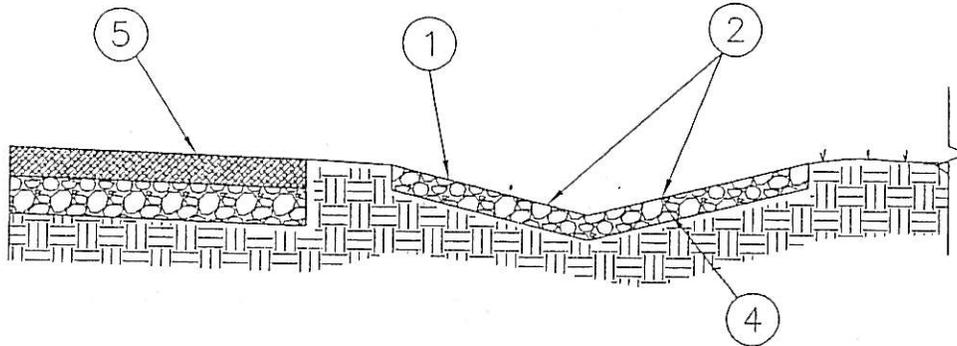
1. Use normal section from inner curb to center line
2. From crown to outer curb, the standard slope is 2% (AC) or 3% (DBST)
3. Superelevation percentages shown are a straight grade from center line to crown line
4. Elevations are required where circles are shown (o)
5. The intersection angle shall be between 60° and 90°

COCHISE COUNTY HIGHWAY AND FLOODPLAIN DEPARTMENT	TYPICAL LAYOUT <hr style="width: 50%; margin: 0 auto;"/> SUBDIVISION KNUCKLE	FIG. D-133 Rev 3-8-05
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DRIVEWAY THROUGH DRAINAGE DITCH

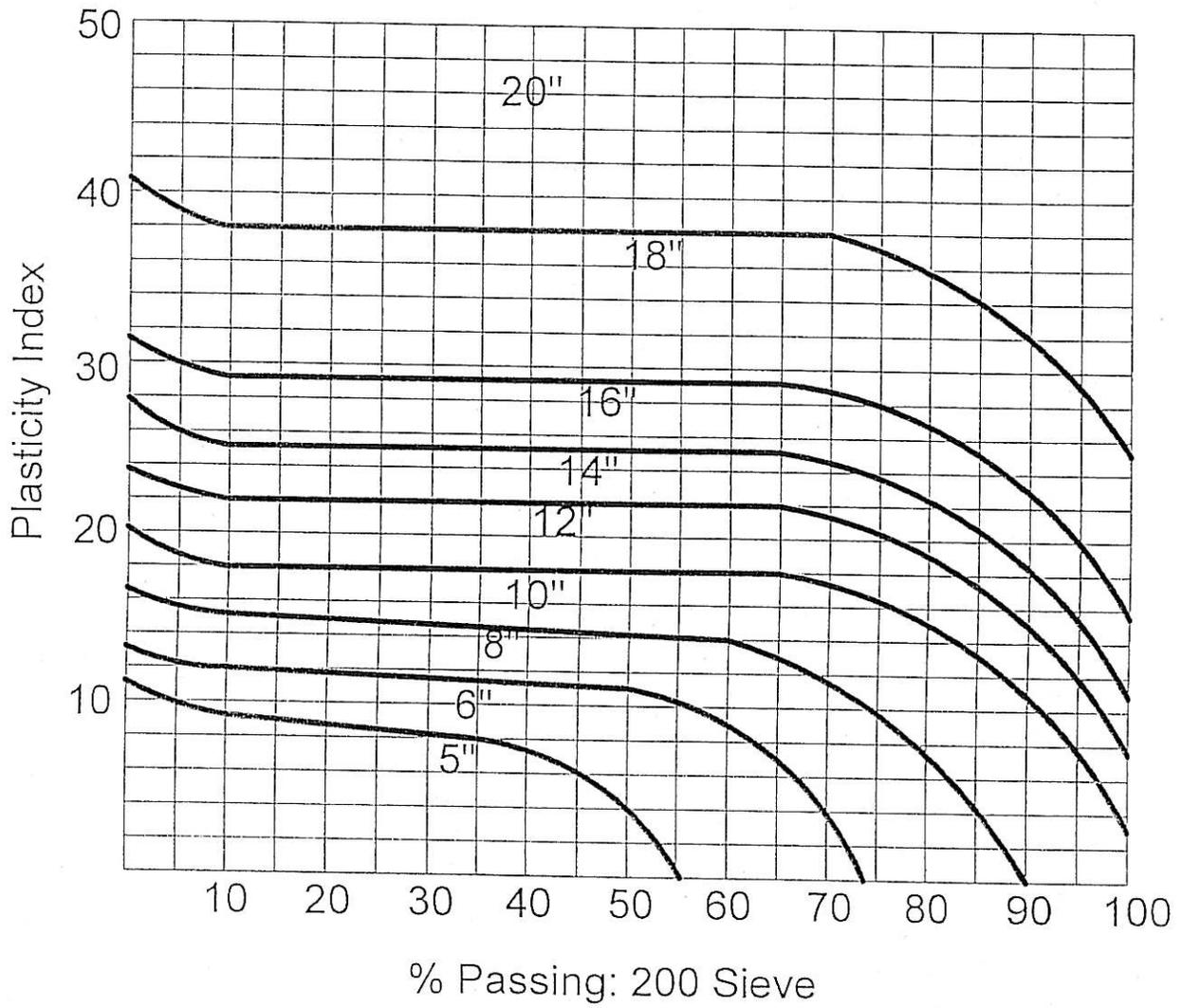


LANDSCAPE MATERIAL IN DRAINAGE DITCH

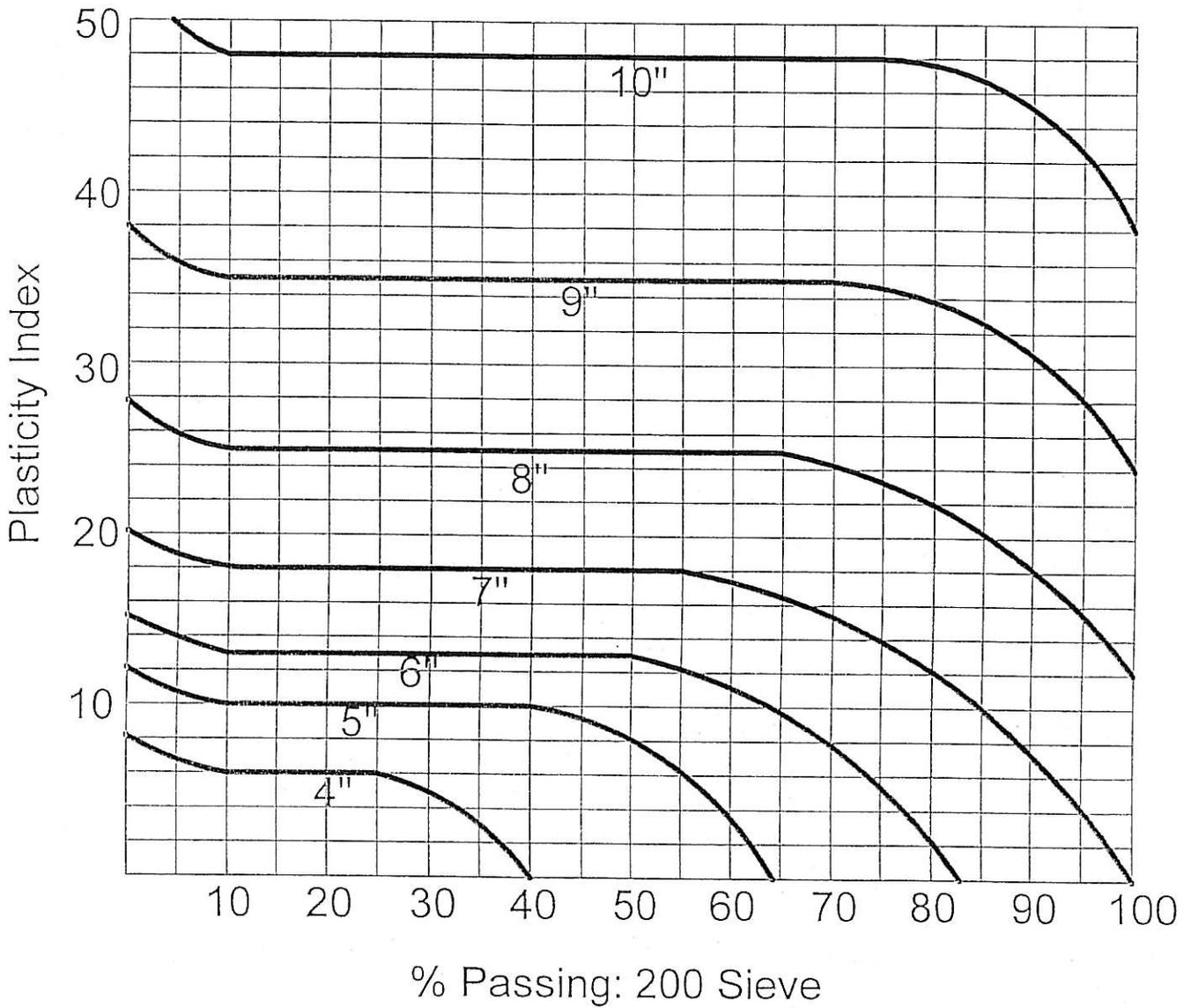


- ① Drainage Ditch, the clear depth & width
- ② Top of driveway concrete slab & landscape material have to be at grade with drainage ditch and have to match side slopes of the drainage ditch.
- ③ Driveway
- ④ Landscape material
- ⑤ Road

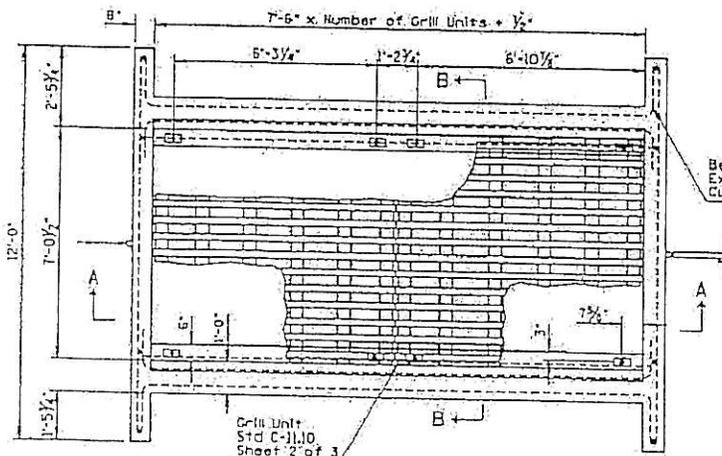
COCHISE COUNTY HIGHWAY AND FLOODPLAIN DEPARTMENT	STANDARD TYPICAL SECTION	FIG. D-134 Rev 3-8-05
	DRIVEWAY & LANDSCAPING WITHIN DRAINAGE DITCH	



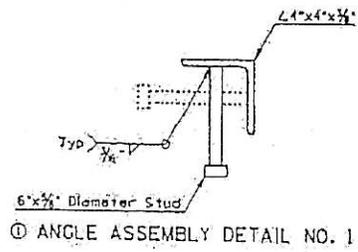
Minimum depth of flexible base course under 3" (min.) asphaltic concrete surface



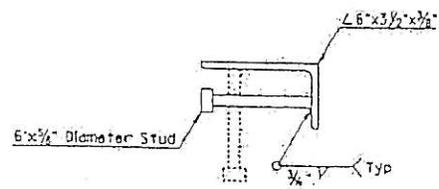
Minimum depth of flexible base course under 2" (min.) asphaltic concrete surface or double bitumious surface treatment



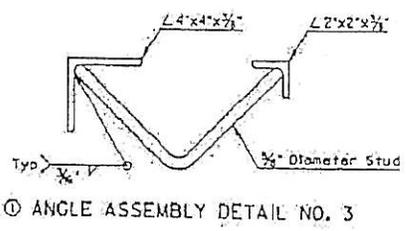
PLAN



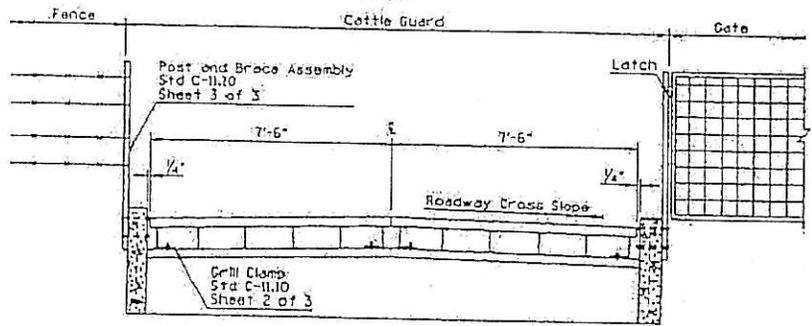
ANGLE ASSEMBLY DETAIL NO. 1



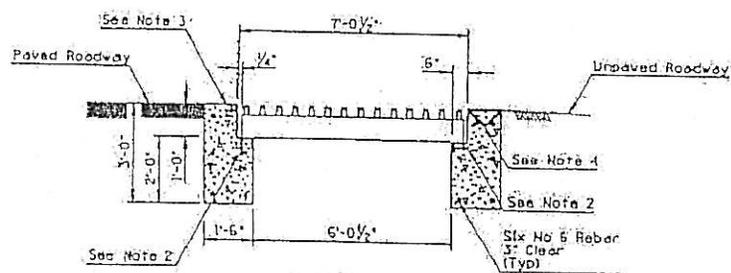
ANGLE ASSEMBLY DETAIL NO. 2



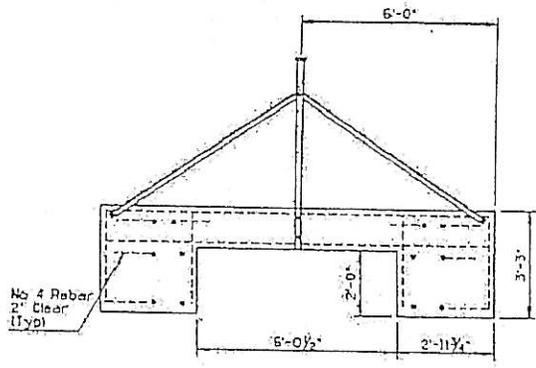
ANGLE ASSEMBLY DETAIL NO. 3



SECTION A-A



SECTION B-B



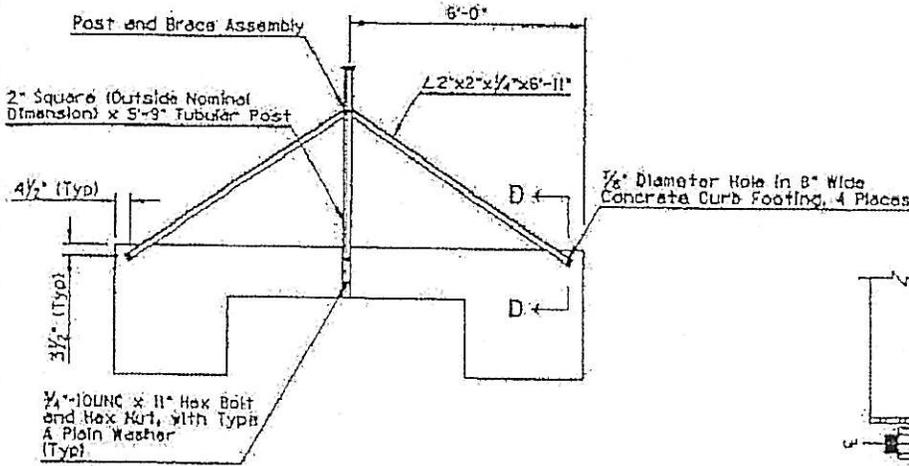
END VIEW

GENERAL NOTES

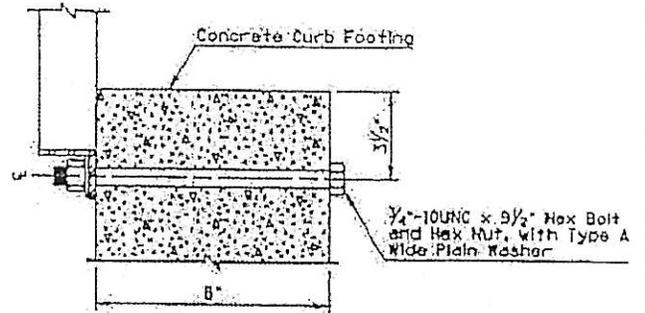
1. Cattle guard shall be sloped to conform to the roadway grade and cross section, except that where an odd number of grill units is specified in a crowned roadway, the center grill unit shall have a level cross slope.
2. Grill units shall be set on an angle assembly consisting of one 6"x3 1/2"x3/8" angle and 3/4" diameter studs with head. The studs shall be placed on 1'-0" alternate centers. See Angle Assembly Detail No. 2.
3. Where the adjacent roadway is paved, an angle assembly shall consist of one 4"x4"x3/8" angle and 3/4" diameter studs with head. The studs shall be placed on 1'-0" alternate centers. See Angle Assembly Detail No. 1.
4. Where the adjacent roadway is unpaved, an angle assembly shall consist of one 4"x4"x3/8" angle and one 2"x2"x3/8" angle and connected with 3/4" diameter 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 No. 3.
5. Each angle and angle assembly shall be fabricated to form a single piece for the full length of the cattle guard.
6. Quantities shown for concrete and reinforcing bars are to be considered approximations for informational purposes only.
7. When guard roll is to be used at the cattle guard, it may be possible to reduce the number of grill units required.

UNIT TABLE			
Roadway Width (Feet)	Grill Units Required	Concrete Cubic Yards	Rebar Lbs.
12	2	5.8	173.3
16	3	8.9	240.9
20	4	10.3	308.5
28	5	12.5	376.1
34	6	14.7	443.7
36	6	14.7	443.7
38	7	16.9	511.2
40	7	16.9	511.2

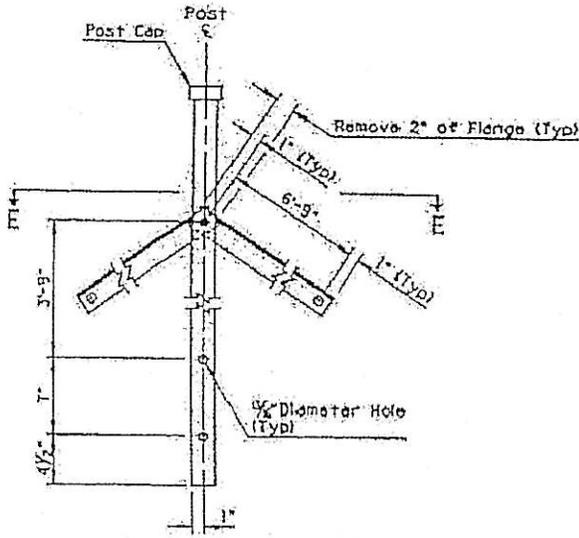
STATE OF ARIZONA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 STANDARD DRAWINGS
 ROADWAY CATTLE GUARD
 No. 7/94



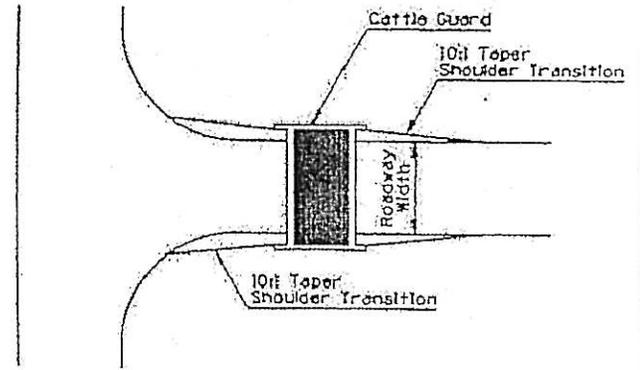
END VIEW



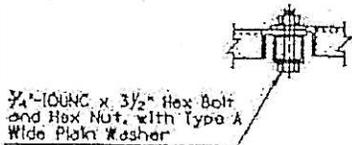
SECTION D-D



POST AND BRACE ASSEMBLY



SHOULDER TRANSITION AT CATTLE GUARDS



SECTION E-E

GENERAL NOTES

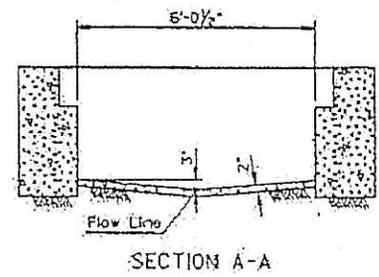
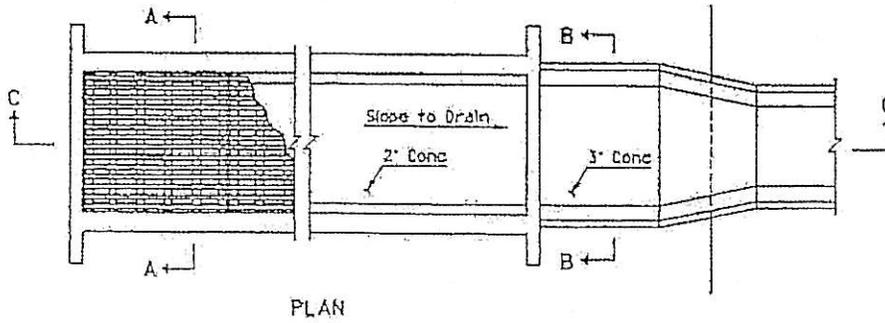
- ① 1. Material for shoulder transition shall be placed to the finished roadway elevation for the entire length of the transition. When the roadway is paved, Aggregate Subbase or Aggregate Base shall be used. When Roadway is Unpaved, a material equivalent to the existing roadway shall be used.

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DRAWINGS
ROADWAY CATTLE GUARD 44-10/95

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

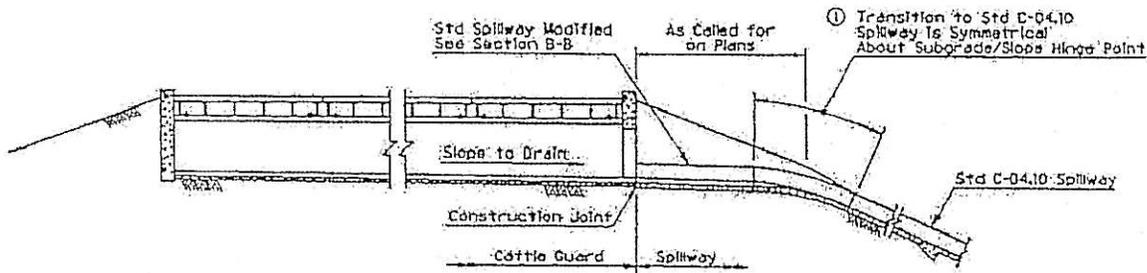
STANDARD DETAIL
ROADWAY
CATTLE GUARD

FIG.
D-202
Rev 3-8-05

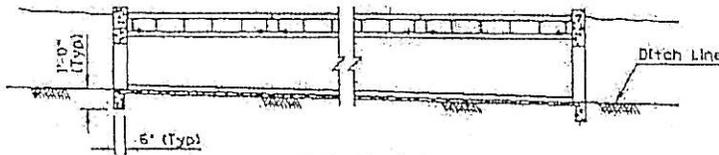


PLAN

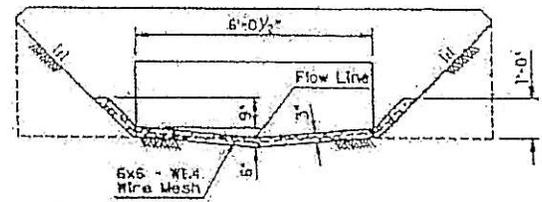
SECTION A-A



SECTION C-C
IN EMBANKMENT



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

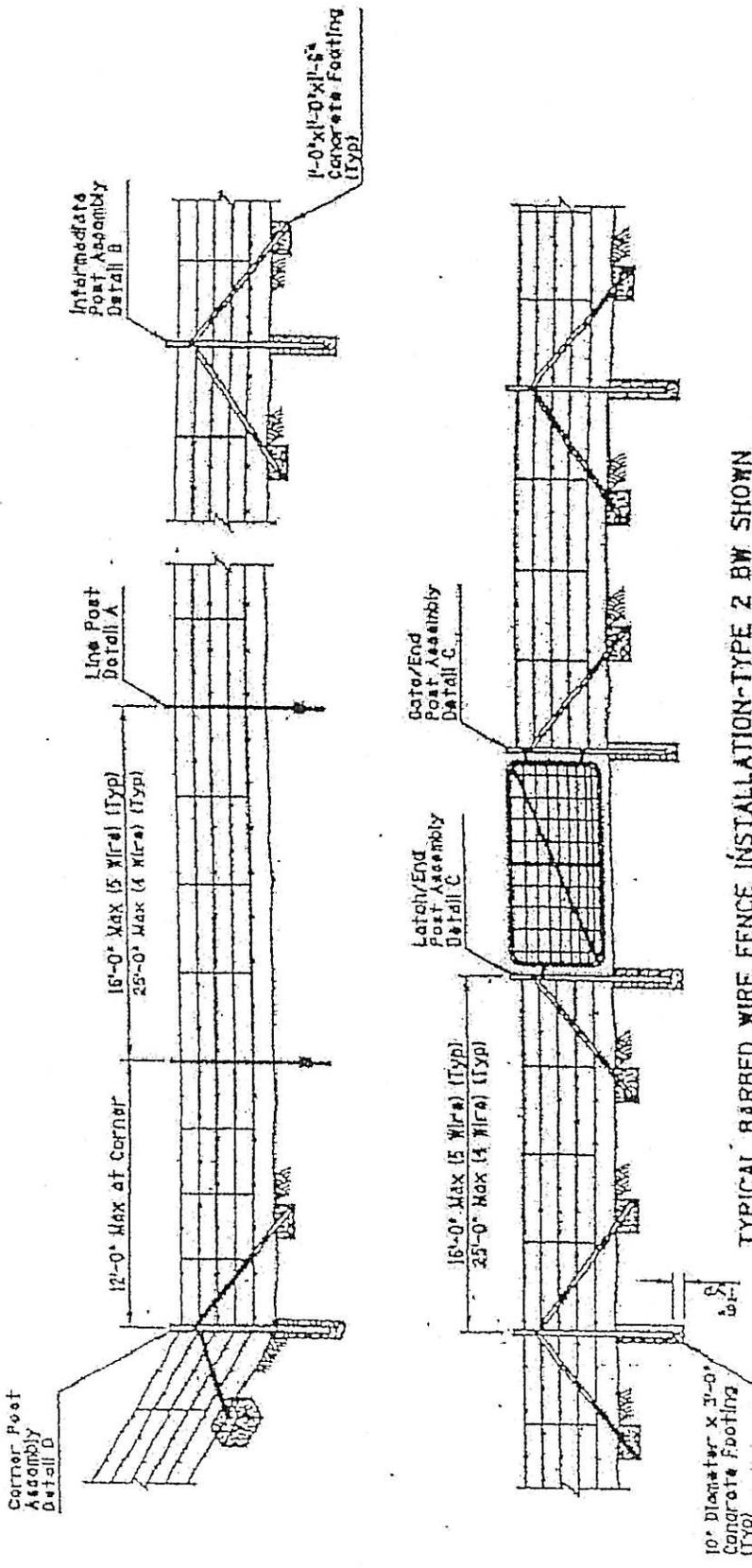


SECTION B-B

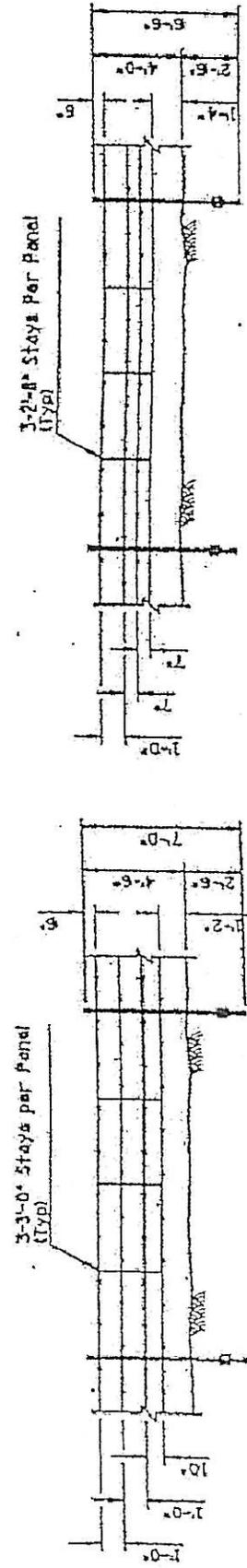
GENERAL NOTES

1. See Std C-11.10 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.

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DRAWINGS
CATTLE GUARD, DRAINAGE NOV. 7/94



TYPICAL BARBED WIRE FENCE INSTALLATION - TYPE 2 BW SHOWN



TYPE 1 BARBED WIRE (BW) (4 WIRE)

GENERAL NOTES

1. Intermediate Post Assembly shall be located as shown and at intervals not to exceed 650' or midway between or braced posts.
2. For some fences the bottom wire shall be barbed.
3. The stays on gate fences shall have their ends turned up, to prevent injuries to gangs.

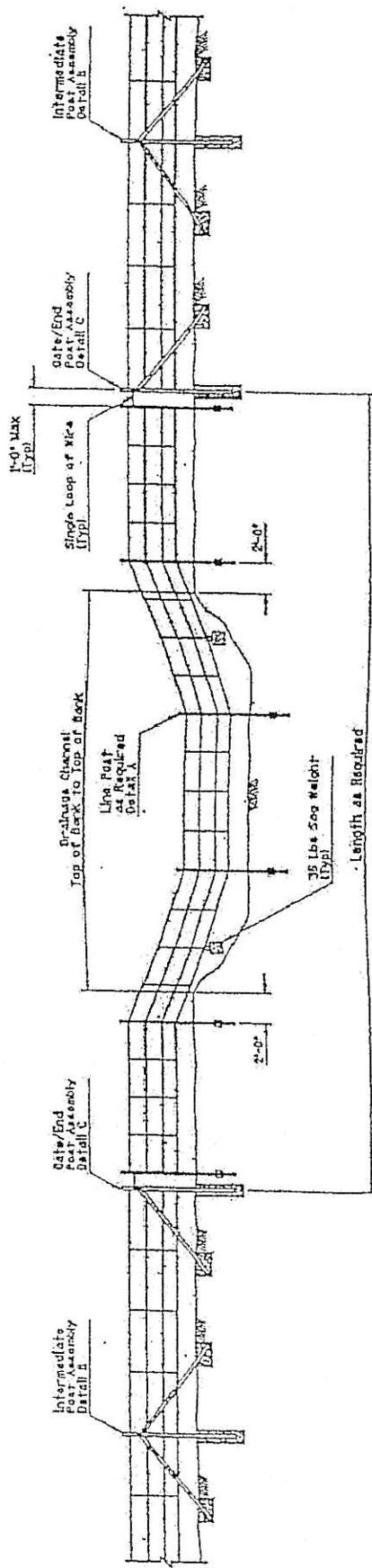
STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DRAWINGS

① FENCE BARBED WIRE No. 1/94

COCHISE COUNTY HIGHWAY
AND
FLOODPLAIN DEPARTMENT

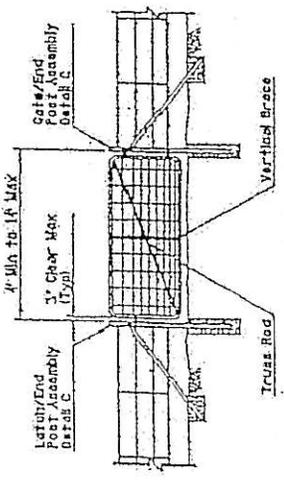
STANDARD DETAIL
FENCE, BARBED WIRE

FIG.
D-210
Rev 3-8-05

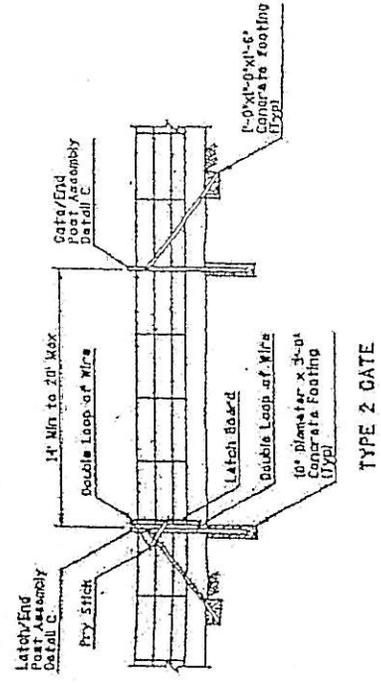
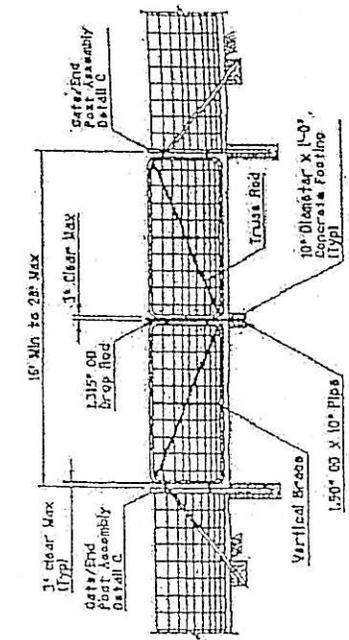


FLOOD GATE

TYPE 1 DOUBLE GATE

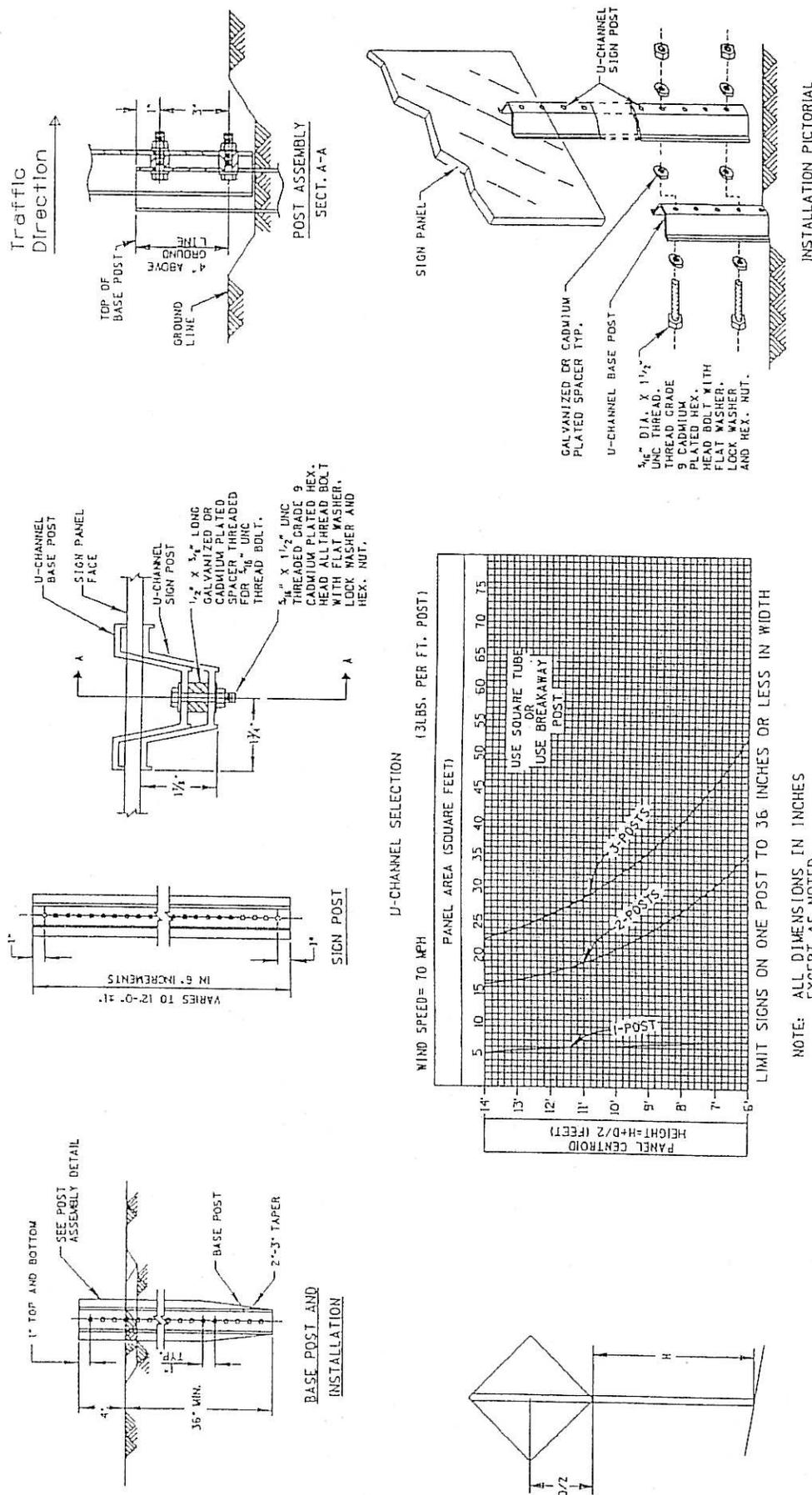


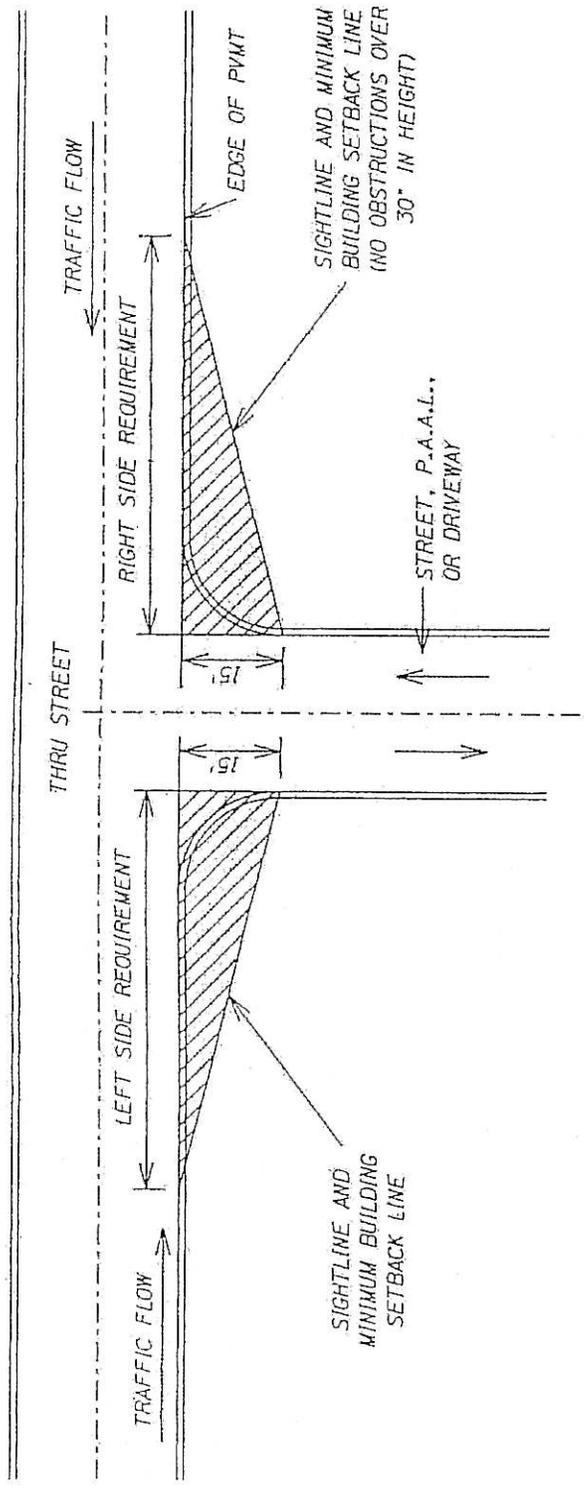
TYPE 1 SINGLE GATE



TYPE 2 GATE

STATE OF ARIZONA
 DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 STANDARD DRAWINGS
 ① FENCE, GATE, TYPE 1 AND 2 4/27/94
 FLOOD GATE

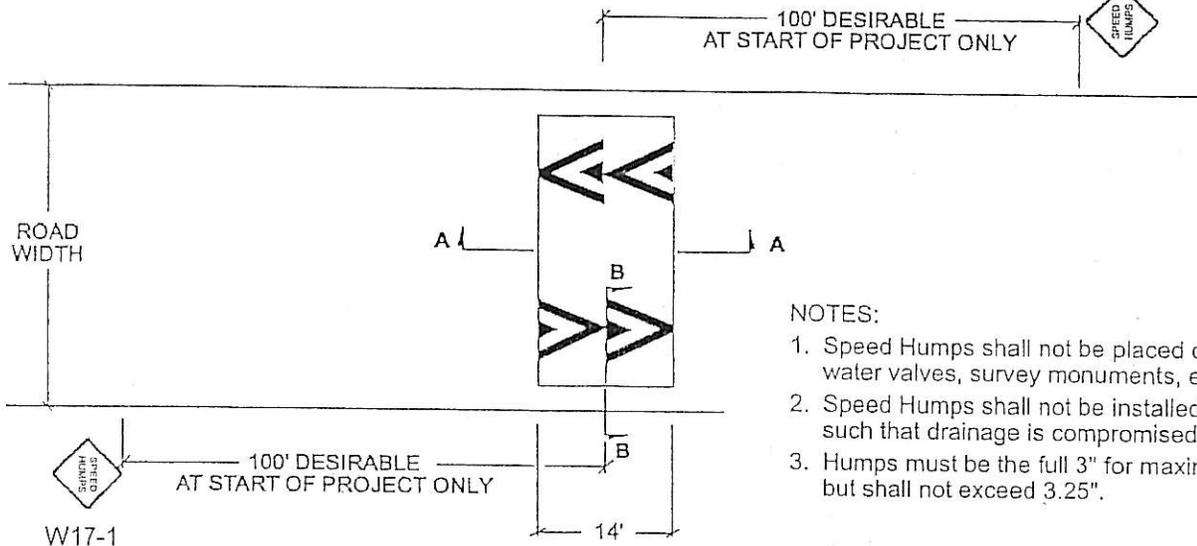




NOTE: THE SIGHT DISTANCES SHOWN ARE MEASURED FROM EDGE OF PAVEMENT TO EDGE OF PAVEMENT

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND HIGHWAY CONSTRUCTION DETAIL 3-10

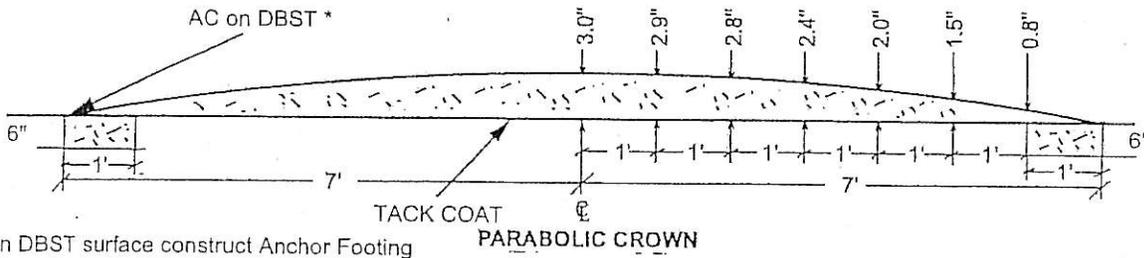
DESIGN SPEED OF MAJOR STREET (mph)	TWO-LANE ROAD		THREE- AND FOUR-LANE UNDIVIDED		FIVE-LANE UNDIVIDED	
	LEFT (NEAR) SIDE REQUIREMENT (ft)	RIGHT (FAR) SIDE REQUIREMENT (ft)	LEFT (NEAR) SIDE REQUIREMENT (ft)	RIGHT (FAR) SIDE REQUIREMENT (ft)	LEFT (NEAR) SIDE REQUIREMENT (ft)	RIGHT (FAR) SIDE REQUIREMENT (ft)
20	140	95	150	75	165	60
25	180	120	195	95	205	80
30	220	145	235	115	250	95
35	260	170	280	135	295	110
40	300	195	320	155	340	130
45	340	220	360	175	385	145
50	380	245	405	190	430	160
55	420	270	445	210	475	175
60	455	295	485	230	520	195



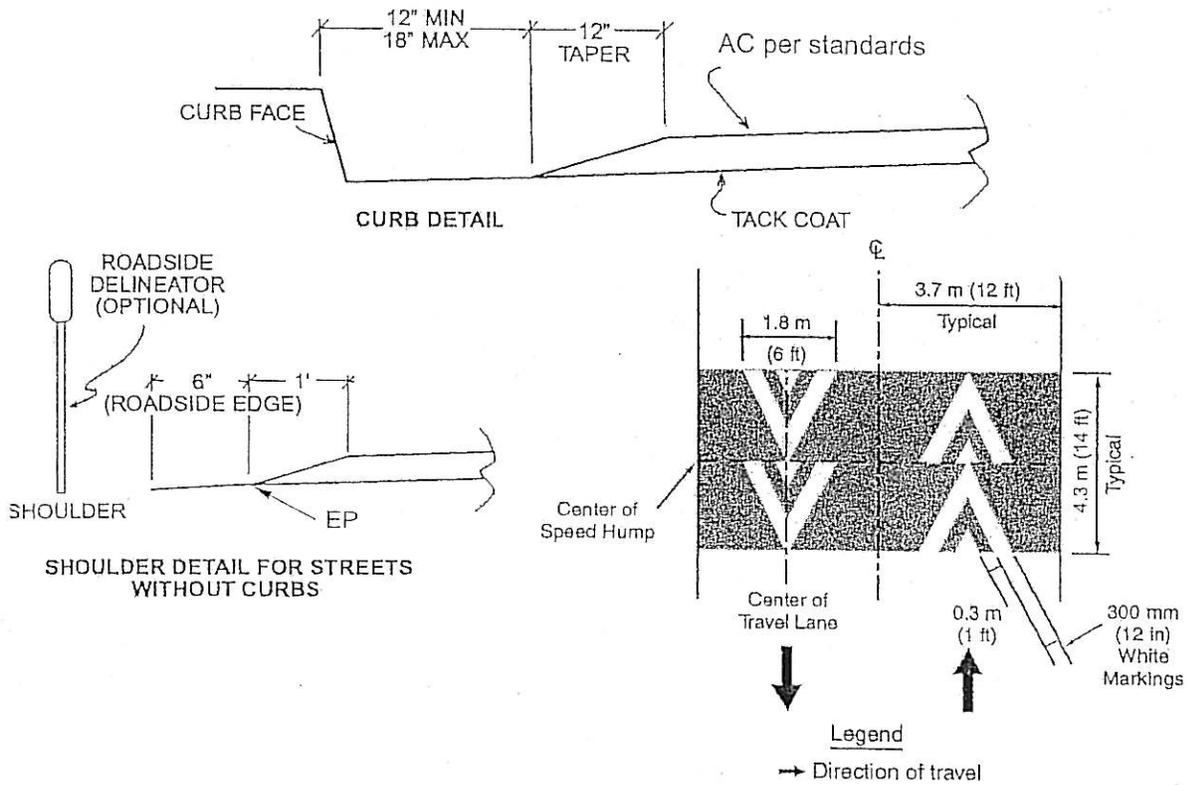
NOTES:

1. Speed Humps shall not be placed over manholes, water valves, survey monuments, etc.
2. Speed Humps shall not be installed in a location such that drainage is compromised.
3. Humps must be the full 3" for maximum effect, but shall not exceed 3.25".

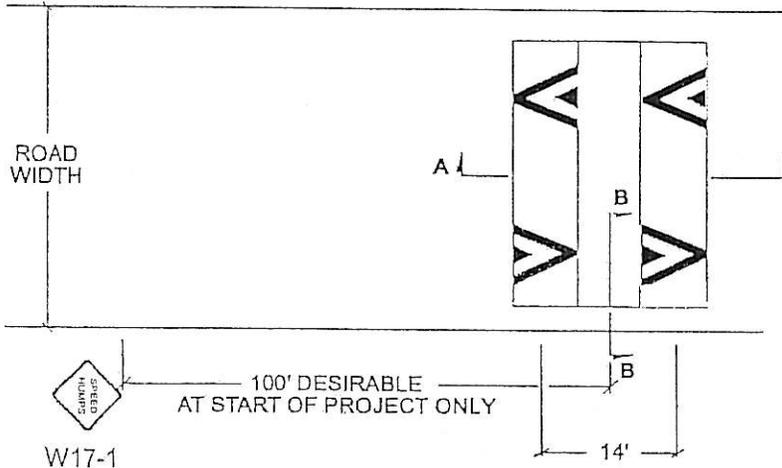
Section A-A



Section B-B



100' DESIRABLE
AT START OF PROJECT ONLY

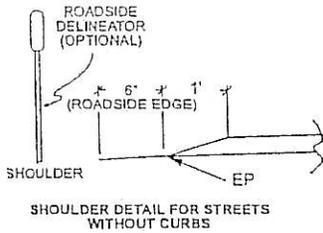
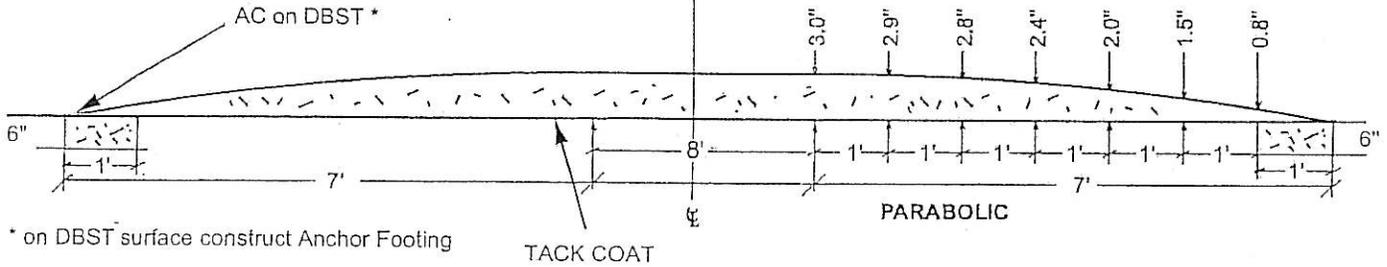


NOTES:

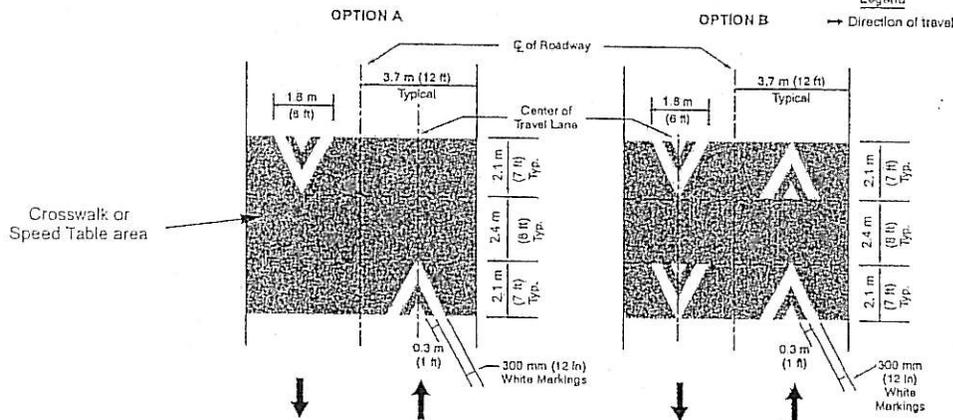
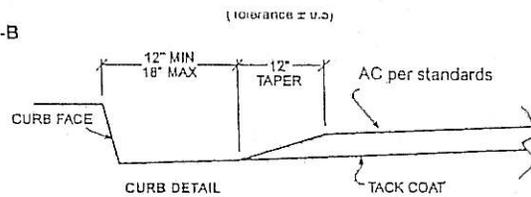
1. Speed Tables shall not be placed over manhole water valves, survey monuments, etc.
2. Speed Tables shall not be installed in a location such that drainage is compromised.
3. Tables must be the full 3" for maximum effect, but shall not exceed 3.25".

W17-1

Section A-A



Section B-B



SECTION E
COCHISE COUNTY SUPPLEMENT
TO MAG UNIFORM STANDARD SPECIFICATIONS

The Cochise County Standard Specifications for Public Improvements consists of the Uniform Standard Specifications and Details for Public Works Construction, 1998 edition, as sponsored by the Maricopa Association of Governments (MAG) and all revisions, except as otherwise provided for herein. Work performed within Cochise County right-of-way shall comply with these standards. The method of measurement and basis of payment as stated herein is for County contract work. 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 permittee and/or developer.

Specifications for work not contained within this standard or MAG standard shall comply with applicable section of the Arizona Department of Transportation, *Standard Specifications for Road and Bridge Construction*.

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.

Part 100 GENERAL CONDITIONS

SECTION 101

ABBREVIATIONS AND DEFINITIONS

101.1 ABBREVIATIONS

Add the following:

ADEQ Arizona Department of Environmental Quality
SWPPP Stormwater Pollution Prevention Plan

101.2 DEFINITIONS AND TERMS:

Section 101.2 is revised with the following:

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.

County: Cochise County, organized and existing under and by virtue of the laws of the State of Arizona.

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

Professional Engineer: A person who has a current engineering registration granted by the Arizona State Board of Technical Registration in one or more branches of engineering recognized by the board.

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

Licensed Surveyor: A person who has a current registration as a surveyor granted by the Arizona State Board of Technical Registration.

SECTION 104

SCOPE OF WORK

104.1.3 CLEANUP AND DUST CONTROL:

Section 104.1.3 is supplemented with the following:

Dust control requirements shall be those of the Arizona Health Department's Rules and Regulations for Air Pollution as applicable for Cochise County.

SECTION 105

CONTROL OF WORK:

Section 105 is supplemented with the following:

105.1 AUTHORITY OF THE ENGINEER:

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.

105.4 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 Specification and shall not take advantage of any error or omission in the Plans and/or specifications. The written dimensions on the Plans are presumed to be correct, but the Contractor is required to check carefully all dimensions 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 his 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 are a part of the Contract

105.6 COOPERATION WITH UTILITIES

Contractor is solely responsible for any damage to utilities resulting from Contractor's operations at the site. The use of hand tools (pothole) 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.

105.8 CONSTRUCTION STAKES, LINES AND GRADES:

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 in aggregate base course at centerline and edge of pavement 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 grade.
- (F) Grade and lines stakes for all structures, pipe lines, culverts and ditches.
- (G) Straddle points for permanent monuments.

105.12 MAINTENANCE DURING CONSTRUCTION:

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 County Engineer.

105.15 ACCEPTANCE:

- (A) PARTIAL ACCEPTANCE: Delete this paragraph.
- (B) FINAL ACCEPTANCE:

Also refer to SECTION C, part 5, CONSTRUCTION AND INSPECTION of the County Design Standards.

SECTION 106
CONTROL OF MATERIALS

106.2 SAMPLES AND TESTS OF MATERIALS:

Section 106.2 is supplemented 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 his weekly construction schedule the extent and type of quality assurance testing deemed necessary based on his 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.

SECTION 107

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107.5 SAFETY, HEALTH, AND SANITATION PROVISIONS:

Superseding the designated local Health Authority by substituting "Cochise County Health Department" for "Maricopa County Health Department."

107.2 PERMITS:

Section 107.2 is revised to read:

It is the Contractor's responsibility to obtain all permits and licenses, pay all fees, charges and taxes and prepare all required notices for the lawful execution of the work.

107.2.1 AZPDES

The Contractor shall be responsible for compliance with the Arizona Pollutant Discharge Elimination System (AZPDES) requirements administered by the Arizona Department of

Environmental Quality (ADEQ). Copies of the NOI and SWPPP shall be submitted to the County during the pre-construction meeting.

The Contractor shall develop, implement, update and revise the SWPPP, as necessary, to assure compliance with permit requirements.

Fines and penalties imposed by the ADEQ or the EPA for Contractor's failure to comply with any or all of the permit requirements shall be borne by the Contractor.

107.2.1.2 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 cost 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 bid item at a rate of 25% of the total bid price with the first progress payment, with the remaining 75% prorated over the entire length of the project.

SECTION 108

COMMENCEMENT, PROSECUTION, AND PROGRESS

Section 108.4 is supplemented with the following:

108.1.1 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. Contractor shall be represented at a minimum by a company official with signature authority on behalf of its organization. All pertinent subcontractor and utility companies shall also attend the conference.

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

- (A) List of all subcontractor
- (B) Construction Schedule
- (C) Traffic control plans
- (D) Emergency telephone numbers
- (E) Copies of all Permits required for project Construction
- (F) 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 submittals(s) shall be specifically shown in the construction schedule.

- (G) Mix designs
- (H) Manufacturer's certification for all materials
- (I) 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 and end date for the work will be determined.

108.4 CONTRACTOR'S CONSTRUCTION SCHEDULE:

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

Prior to commencement of the work, the Contractor shall prepare a detailed project work schedule and a detailed phasing plan that shall be submitted for review by the Engineer. The schedule shall be time scaled in calendar days and all activities recorded. Activities shall show sufficient detail to allow the reviewer to easily follow the sequence of the work. Activity descriptions shall be job-specific and not of a generic nature.

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 to the Engineer on the Thursday preceding that week's schedule for review. Any changes required in the submitted weekly operations and work schedule shall be promptly brought to the attention of the Engineer, in writing, for review before commencement of work. Information regarding the change shall include nature, location, type, and extent of change and the reasons for not following submitted work schedule.

The Contractor shall maintain daily Status Reports that include a complete record of daily activities, contractors work effort, manpower/equipment on site, schedule compliance, record of verbal communications, materials/equipment deliveries, safety/quality issues and weather.

108.5 LIMITATION OF OPERATIONS:

Regular work hours vary depending on time of year. The Contractor shall submit proposed weekday regular hours at the pre-construction 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.

108.8 GUARANTEE AND WARRANTY PROVISIONS:

Contractor warrants that all corrections made under this section shall be free of defects in workmanship or material for a period of one (1) year, commencing on the day of final acceptance of the corrections by the Engineer.

Failure by the Engineer to reject defective workmanship and/or material during construction, shall not be construed as an acceptance of said workmanship and/or material and Contractor

shall correct such workmanship and/or material at the request of the County at any time prior to final acceptance of the work or for a one (1) year period thereafter.

SECTION 109

MEASUREMENTS AND PAYMENTS

109.4 COMPENSATION FOR ALTERATION OF WORK

Revise the first sentence of Section 109.4.1 (B) to read "For an increase greater than 20 percent in either the total cost of the contract or the total cost of a major item, any adjustment made will only apply to that cost in excess of 120 percent of the original extended unit price bid."

Part 200 is supplemented with 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 and removed from the construction site.

202.2 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 safely 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 back filled 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 METHOD OF MEASUREMENT/BASIS OF PAYMENT

Removal of structures shall be considered incidental to the contract and shall be included in other bid items.

SECTION 211

FILL CONSTRUCTION

Section 211 is supplemented with the following:

211.3 COMPACTING:

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 is supplemented with 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 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 (2.20 mm) for gabion mattresses and 0.120 inches (3.05 mm) for gabion baskets. The metallic-coated steel wire shall have a zinc-5% Al coating with at least 275 g/m² per DIN 1548. 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 2-½ inches (60 mm) by 3-¼ inches (80 mm) 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 (3.80-mm) 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 (2.31 mm) (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 (2,080 kg per lineal meter) while remaining in a locked and closed condition. Properly formed interlocking fasteners shall be spaced from 4 inches to 6 inches (100 mm to 150 mm) and have a minimum 1 square inch (645 mm²) 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 (0.100 mm) 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 (76 mm)	-	90 to 100
1-1/2 inches (38 mm)	-	-
3/4 inch (19 mm)	-	20 to 90
3/8 inch (9.5 mm)	100	-
#4 (4.75 mm)	95 to 100	0 to 20
#6 (1.18 mm)	45 to 80	-
#50 (0.30 mm)	10 to 30	-
#100 (0.15 mm)	2 to 10	-

#200 (0.075 mm)

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 (100 mm) 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	0.48 maximum	ASTM D 4491
Apparent opening, US Std. sieve size	150-200	ASTM D 4751
Ultraviolet 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 (ft³)</u>
6 x 3 x 1	2	18
9 x 3 x 1	3	27
12 x 3 x 1	4	36

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 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 to 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 section; however the stone filling shall not exceed a 12-inch (300-mm) 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 filing operations.

The last lift of stone in each cell shall be level with the top of the gabion in order 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 in order 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 construction 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 bid, 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.

Part 200 is supplemented with the following new Section:

SECTION 224

RIPRAP CONSTRUCTION WITH HIGH SURVIVABILITY FABRIC

224.1 DESCRIPTION:

The work under this Section consists of furnishing all materials and constructing plain riprap with high survivability fabric.

224.2 MATERIALS:

PLAIN RIPRAP:

Riprap stone shall be angular and conform to Sections 703.1 STONE and 701.4 QUARRY STONE. The stone sizes shall be as indicated on the plans or special provisions.

224.2.2 BEDDING MATERIAL:

The bedding material for the Plain Riprap shall consist of processed natural material conforming to the requirements of Section 702.3. The material gradation shall conform to Select Material Type A or B or Aggregate Base as specified in Table 702-1.

224.2.3 FILTER FABRIC:

Filter Fabric shall be a woven or non-woven high survivability filter fabric meeting the following requirements.

Non-woven:

<u>Property</u>	<u>Requirement</u>	<u>Test Method</u>
Grab tensile strength, lbs	200	ASTM D 4632
Grab elongation at break, %	15 min., 115 max.	ASTM D 4632
Puncture strength, psi	80	ASTM D 4833
Burst strength, lbs	320	ASTM D 3786
Trapezoidal tear strength, lbs	50	ASTM D 4533
Permittivity second ⁻¹	0.50 minimum	ARIZ 730
Apparent opening, U.S. Std. sieve size	30-140	ASTM D 4751
Ultraviolet stability, %	70	ASTM D 4355

Woven:

Woven fabric shall meet the physical requirements listed above for non-woven fabric except that the grab elongation at break, percent, shall be 13 minimum, 115 maximum.

CONSTRUCTION REQUIREMENTS:

224.3.1 FILTER FABRIC:

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 which 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.

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 fabric shall be loosely laid and not placed in a stretched condition.

224.3.2 BEDDING MATERIAL:

The Bedding Material shall be placed uniformly on the filter fabric, to the depth specified on the Project Plans, and shall be free of mounds, dips, and windrows. The Bedding Material shall not be compacted.

224.3.3 PLAIN RIPRAP:

The plain riprap shall be carefully placed on the bedding material and filter fabric in such a manner as to not damage the fabric. If the Engineer determines that the placement of stone has damaged or displaced the filter fabric to the extent that it cannot function as intended, the Contractor shall remove the placed riprap stone and properly correct the damage to, and/or the displacement of, the filter fabric. Such correction may include the removal and subsequent replacement of the bedding material and fabric, and re-grading the affected area, each as determined by the Engineer.

The plain riprap shall be placed in a manner which will produce a reasonably well graded mass without segregation and with a minimum amount of voids, with the larger stone evenly distributed through the riprap mass. The individual placement of larger riprap stones may be required to obtain a uniform distribution of stone size.

224.4 MEASUREMENT:

The quantities of Plain Riprap with Filter Fabric shall be the completed item, in place within the limits of dimensions shown on the plans. The measurement will be in cubic yards and shall extend from the filter fabric to the top of the plain riprap. Quantities will be computed by the average end area method.

No separate measurement will be made for Filter Fabric or Bedding Material.

224.5 PAYMENT:

Payment for Plain Riprap with Filter Fabric will be at the contract unit price bid for each designated plain riprap gradation. The price shall be full compensation for furnishing all material, labor and equipment for installation of Plain Riprap With Filter Fabric, complete in place, including excavation, ground surface preparation, filter fabric, bedding material, plain riprap, and backfilling.

SECTION 301

SUBGRADE PREPARATION

Section 301 is supplemented with the following:

301.1 DESCRIPTION:

Roadway pavement for the purpose of this section shall include Asphalt Chip Seal.

301.2 PREPARATION OF SUBGRADE:

Subgrade preparation shall also include preparing subgrade to required line and grade for paved or unpaved shoulders, tapers, turnouts, and driveways, and all project locations where aggregate base and/or select material courses are used in accordance with the Project Plans.

The Contractor may use existing asphalt concrete and other existing bituminous roadway surfacing materials, removed during the project, as embankment fill. All materials used shall

be thoroughly crushed to sizes not exceeding two inches, or as approved by the Engineer. These asphalt/bituminous materials shall not be placed within two feet of sub grade elevation.

All unsuitable material and all excess material shall be disposed of in accordance with the requirements of Sections 205.2 and 205.6, respectively. When additional material is required for fill, it shall conform to Section 210.

301.3 RELATIVE COMPACTION:

Rock 6 inch or greater that becomes exposed due to scarification shall be removed from the scarified subgrade.

(D) All Graded Shoulders 95 percent

301.7 MEASUREMENT:

Measurement for Subgrade Preparation will be by the square yard. The area to be measured will be the total accepted area of new asphalt, chip seal or Portland cement pavement, including paved shoulders, tapers, and turnouts. Measurement will also include driveways that are paved or are surfaced with aggregate base or select materials. The area of concrete driveway and alley entrances located under or behind concrete curb and gutter will not be measured for this pay item.

Project earthwork quantities for Roadway Excavation, Borrow Excavation, and Fill Construction shall not be measured when they are omitted from the bidding schedule, such earthwork quantities shall be considered incidental to Subgrade Preparation.

SECTION 310

UNTREATED BASE

310.1 DESCRIPTION:

Aggregate base shall conform to the requirements of Section 702 of the Uniform Standard Specifications. Aggregate base shall be crushed in accordance with Section 702.2

310.2.2 WHEEL LOAD TEST

Prior to placement of surface course and in addition to standard density testing, the base course shall be wheel load tested. The contractor shall provide a full water truck for the test. The water truck shall be driven in each lane while the wheel path is observed for any failure.

310.4 PAYMENT:

Payment for untreated base shall be made by the square yard, per plan dimensions.

Part 300 is supplemented with the following new Section:

SECTION 317
ASPHALT MILLING

317.1 DESCRIPTION:

The work under this Section shall consist of milling existing asphalt concrete pavement where shown on the Plans or requested by the Engineer.

317.2 CONSTRUCTION REQUIREMENTS:

Contractor is responsible for locating all milling hazards on and below the surface within the area to be milled which may require special milling. Special milling is not a separate bid item and shall be paid for as Asphalt Milling.

The milling cut depth shall be the depth indicated on the Plans plus or minus 1/8 inch. Contractor shall remove the milled material and sweep the roadway clean with a power pick-up broom to the satisfaction of the Engineer.

The work shall result in a clean milled surface in the area indicated on the Plans to the specified depth and shall include the areas immediately around and next to any individual hazards located within the area to be milled.

The Contractor shall be responsible for continually checking the milling operation to determine that the proper depth of milling has been achieved, that the proper profile and cross slope are achieved, and that the surface texture is (a) free from longitudinal ridges, and (b) has a uniform pattern. The Contractor shall achieve a change in resulting surface by varying the forward speed of the milling machine or the speed of the mandrel.

317.3 MEASUREMENT:

Measurement for asphalt milling will be by the square yard and shall only include areas milled to the required depth and cross section.

317.4 PAYMENT:

Payment for asphalt milling measured as provide above, will be paid for at the contract price per square yard, which price shall be full compensation for the item complete as herein described and specified.

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.

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).

330.4.1 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..

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, on a daily basis 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 336

PAVEMENT MATCHING AND SURFACING REPLACEMENT:

Section 336 is supplemented with the following:

336.2.2 Pavements to be Removed:

All pavement shall be saw cut only.

336.3 TYPES AND LOCATIONS OF PAVEMENT AND SURFACING REPLACEMENT:

“T” Top pavement replacement shall be used for all AC or Chip Seal street excavations/trenching per Standard Detail 200, Type A.

All trench backfill material and base course shall be compacted to 100% maximum dry density.

336.4 MEASUREMENT: is replaced with the following:

Pavement matching and surface replacement is considered incidental and shall be included in those items that require this work.

336.5 PAYMENT: is replaced with the following:

No direct payment will be made for pavement matching and surface replacement. Payment shall be included in the items that require this work to include all material, backfill, compaction, labor and equipment.

Part 300 is supplemented with 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. A relocation is the horizontal movement or change in location on an existing improvement or item, as shown or described on the Project Plans. An 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. This work shall include the relocation of mailboxes. The term mailbox shall be used to describe both the mailbox receptacle and the supporting post.

351.2 MATERIALS:

All relocations and adjustments requiring reseating, replacement, and additional materials shall be accomplished using materials of the same or better quality in the existing improvements, as approved by the Engineer.

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 any posts necessary to relocate and adjust fences, gates, and other existing improvements; filling and compacting all holes left by such removals; and drilling, placing and/or driving the moved posts into their new locations, as appropriate for the types of posts to be moved.

Improvements, gates and fences 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 and adjustment of the improvements shall be repaired, or shall be replaced in kind by the Contractor, as approved by the Engineer, at the Contractor's expense.

All relocated and adjusted improvements shall exhibit the same quality and integrity, function, and appearance as the improvements did prior to relocation and adjustment. New, connecting improvements between the relocated and adjusted improvements and the unmoved

portion of the improvement shall be of the same type, quality, and strength as the existing improvement prior to relocation and adjustment.

If for any reason the improvement, fence, and/or gate to be moved 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 it can be permanently installed in its final location/configuration. Also, in such cases where the move cannot be accomplished within the same working day, a temporary substitute facility shall be provided to appropriately secure the enclosure, as approved by the Engineer.

351.4 MEASUREMENT:

The measurement of relocated or adjusted items will be the number of improvements, gates, and/or linear feet of relocated fence; and shall include all labor, equipment, and materials, including all additional new, connecting fences to secure the final enclosure, complete in place. 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 all labor, equipment, and materials, including replacement posts to correct conditions deemed hazardous, as required for a 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 improvement, gate, and/or linear foot of fence; and shall be full compensation for all construction tools, equipment, labor, materials, services, transportation, and all incidentals necessary to relocate and adjust the improvement, gate, and/or fence, including necessary connections to the unmoved remainder of the fence or other facility.

SECTION 401

TRAFFIC CONTROL

Section 401 is supplemented with the following:

401.1 DESCRIPTION is revised to:

Traffic control shall consist of traffic control devices, pilot trucks, flagmen, off-duty law enforcement officer and all other measures required to provide traffic control in accordance with the provisions and specifications of the Arizona Department of Transportation Traffic Control Manual for Highway Construction and Maintenance, current edition; the Manual on Uniform Traffic Control Devices (MUTCD), current edition; the Manual on Uniform Traffic Control Devices Handbook and current revisions (United States Department of Transportation, Federal Highway Administration), the special provisions and any field modifications made by the Engineer.

401.2 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 provide additional devices as determined by the Engineer, to safely control traffic.

The Engineer reserves the right to make contact with the traffic control subcontractor at any time to request any materials or services deemed necessary for the safety of the public or workers. The cost of these materials or services shall be incidental to the Traffic Control pay item.

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).

Stationary construction activity, that will last longer than three days, all advanced warning construction signs shall be mounted on channels driven into the ground. Each mile point of the project shall be signed with construction and speed limit signs, mounted on channels driven into the ground 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. Rocks shall not be used as a ballast. The amount of sandbags used shall be enough to provide adequate safety for the traveling public.

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 per the MUTCD.

Traffic cones shall only be used during daylight hours and shall be a minimum of 28" high. Daylight hours are defined as ½ hour after sunrise to ½ hour before sunset. All traffic cones shall have retroreflective bands installed as per MUTCD guidelines.

The Contractor shall use warning lights to mark traffic control devices at night.

The Contractor is responsible for all costs incurred in replacing all lost or damaged traffic control devices and traffic control warning signs.

Portable concrete barrier (PCB) installations shall be in accordance with Chapter 9 of the AASHTO Roadside Design Guide. Each section shall be properly connected to the adjacent section to provide barrier continuity to resist movement, snagging, and/or instability of impacting vehicle. PCB panels and connections shall meet NCHRP 350 Test Level 3.

The Contractor shall notify the Engineer prior to the removal of any permanent traffic control devices. The Contractor shall remove (without damage) all permanent signs including signposts that are no longer applicable and store them in the Contractor's onsite construction yard. The Engineer will notify the County to collect the signing and/or traffic control devices.

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 TRAFFIC CONTROL MEASURES:

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. 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 also show the duration with the start and end date of each phase. The County will within 10 working days review the plan and notify the Contractor of approval or note changes needed.

The Contractor shall appoint a Traffic Control Technician (other than the superintendent, foreman or barricade subcontractor), who has been properly trained in the application of work zone traffic control, to maintain all necessary traffic control devices. At the beginning and end of each workday, 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 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 conference.

The Contractor shall provide and maintain all necessary traffic control devices until acceptance of the project by the County.

All flaggers shall be properly trained and certified by a recognized source, such as the International Municipal Signal Association (IMSA) and shall carry proof of training with them at all times.

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:

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.

A road closure for the convenience of the Contractor is not authorized. Traffic restrictions are generally not permitted on major 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 as deemed applicable by the Engineer.

For construction or trenching that require 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. The Engineer, under unusual conditions, may authorize exceptions.

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. Access to all adjacent properties shall be maintained whenever possible. When access cannot be maintained, Contractor shall notify the adjacent residents at least 48 hours 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.

Rope, flagging, fencing and woven plastic tape may be used between barricades and channeling devices to provide additional safety.

The Contractor shall use Portable Concrete Barrier when construction hazards warrant, or as requested by the Engineer. Impact attenuation devices shall be provided by the Contractor commensurate with concrete barrier requirements.

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. Items of Traffic Control include but are not limited to the obliteration of existing and temporary 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 bid item.

No direct measurement for 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 bid item.

No direct measurement for removal of temporary pavements will be made. All sawcutting, and removal of aggregate base course materials and asphaltic concrete pavement shall be considered as included in the lump sum measurement for the Traffic Control bid item.

When included as a separate pay item within the bidding schedule, Portable Concrete Barrier shall be measured by the foot. Otherwise, portable concrete barrier shall not be measured and shall be considered a traffic control device and included in the Lump Sum bid price.

401.7 PAYMENT:

Section 401.7 is replaced the following:

Payment for Traffic Control shall be made on a lump sum basis. Payment for Traffic Control shall be full compensation for all labor, pilot cars, flaggers, off duty law enforcement officer, materials, traffic control devices, and miscellaneous incidental items necessary to complete the work.

Separate payment for Portable Concrete Barrier will only be made when Portable Concrete Barrier is included as a separate pay item within the bidding 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 locations shown on the project plans in accordance with Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2000, SECTION 905 GUARDRAIL.

Part 400 is supplemented with the following new section:

SECTION 421

WIRE FENCE

421.1 DESCRIPTION:

Wire line fences and gates shall consist of furnishing all materials and constructing line fence and gates of the types and sizes specified or shown on the plans, in accordance with the Type 1barbed wire (4 wire) fence details shown on the plans and the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, SECTION 903, WIRE FENCE.

Part 400 is supplemented with the following new section:

SECTION 423

CATTLE GUARDS

423.1 DESCRIPTION:

Cattle guards shall consist of furnishing all materials and constructing cattle guards new or reconstructing existing cattle guards at the locations as shown on the plans or as designated by the Engineer, in accordance with the details on the plans and the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, SECTION 906 CATTLE GUARDS.

Part 400 is supplemented with the following new Section:

SECTION 460

REMOVAL OF PAVEMENT MARKINGS AND RAISED PAVEMENT MARKERS

460.1 DESCRIPTION:

The Contractor shall furnish experienced supervision, labor, all materials, equipment, tools, transportation and supplies required accomplish the pavement marking removal in accordance with these specifications, where indicated on the Striping Plans, or where determined by the Engineer.

460.2 CONSTRUCTION:

The Contractor shall determine the type of pavement markings that exist in the field and the appropriate removal methods specified in this Section.

Existing traffic pavement markings shall not be covered over with slurry seal, black paint or stain of any kind.

The Contractor shall accomplish pavement marking obliteration as per the requirements indicated on the Plans or where determined by the Engineer. The Contractor shall be responsible for verifying the striping removal limits of the project before commencement of the work. The striping removal limits may exceed the construction project limits, or new striping limits in order to match and tie into the existing striping.

Existing pavement markings shall be removed to the fullest extent possible from the pavement as approved by the Engineer. The method used shall not materially damage the surface or texture of the useable pavement.

Sand or other material deposited on the pavement as a result of removing pavement markings shall be removed as the work progresses. Accumulations of sand or other material, which might interfere with drainage or might constitute adverse safety conditions to traffic, will not be permitted.

Where blast cleaning is used for the removal of pavement markings or for removal of objectionable material, the residue including dust shall be removed immediately after contact

between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation, or by other methods approved by the Engineer. Blasting shall not be used within 12 ft. of a lane occupied by traffic.

Any damage to the pavement caused by pavement marking removal shall be repaired by methods acceptable to the Engineer. When asphalt slurry is used to repair damage to the pavement caused by pavement marking removal or the obliteration of the marks remaining after the markings have been removed, the asphalt slurry shall be placed parallel to the new direction of travel and shall not be less than two feet in width.

If Chip Seal is used the entire roadway surface, edge of paved surface to edge of paved surface shall be covered.

460.3 METHOD OF MEASUREMENT:

Measurement for removing painted stripe, removing thermoplastic stripe and Type 1 - preformed plastic marking tape will be by the linear foot along the centerline of the pavement stripe to be removed. Skips in dashed lines will not be included in the measurement. Measurement for removing striping with a plan width greater or less than the basic 4" wide stripe will be made by the following method:

$$\frac{\text{Plan Width of Striping (inches)} \times \text{Linear Foot}}{4.0 \text{ (inches)}}$$

Double marking lines, consisting of two 4" wide stripes will be measured as two individual marking lines. Crosswalk lines, stop bars, stop lines, gore lines, cross hatch lines, chevron lines and railroad marking transverse lines will be measured for centerline length and adjusted for widths other than 4" as defined above.

Thermoplastic pavement symbols and legends will be measured by each unit removed.

Measurement for the removal of raised pavement markers and barrier markers for bridges, concrete, and guardrail will be by the unit for each marker removed.

460.4 BASIS OF PAYMENT:

Payment for Removing Painted Stripe will be at the unit contract price per linear foot for the length of painted line applied to the nearest foot.

Payment for Removing Painted Symbols and Removing Painted Legends will be per each for each symbol or legend removed.

Payment for Removing Thermoplastic Stripe and Removing Type 1 - Preformed Plastic Marking Tape will be per linear foot of striping removed.

Payment for Removing Raised Pavement Markers and for Removing Barrier Markers for Bridges, Concrete and Guardrail will be per each marker removed.

All damage to the surface of the road caused by pavement marking removal shall be repaired by the Contractor at his expense.

Part 400 is supplemented with the following new Section:

SECTION 461

PAINTED PAVEMENT MARKINGS

461.1 DESCRIPTION:

The work under this section shall consist of cleaning and preparing the pavement surface, furnishing all materials, experienced supervision, labor, equipment, tools, transportation, supplies and applying white or yellow, water-borne, lead-free, rapid-dry traffic paint and reflective glass beads at the locations and in accordance with the details shown on the plans, MUTCD, the requirements of these specifications, or where determined by the Engineer.

461.2 MATERIALS:

All material used in the formulation of the pavement marking paint shall meet the requirements of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction 2000 edition, SECTION 708 PERMANENT PAVEMENT MARKINGS. Any materials not specifically covered shall meet the approval of the Engineer.

Certificates of Compliance conforming to the requirements of Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, SECTION 106-05 shall be submitted for each lot or batch of paint prior to its use.

461.3 MEASUREMENT AND PAYMENT:

Measurement and payment for pavement markings shall be per ADOT Specifications.

Part 400 is supplemented with the following new Section:

SECTION 463

RAISED PAVEMENT MARKERS

463.1 DESCRIPTION:

The work under this section shall consist of cleaning and preparing the pavement surface, furnishing all materials, experienced supervision, labor, equipment, tools, transportation, supplies and placing raised pavement markers of the type specified at the locations and in accordance with the details shown on the plans and the requirements of these specifications, MUTCD, the requirements of these specifications, or where determined by the Engineer.

Raised Pavement Markers shall consist of furnishing all materials, placement, and installation in accordance with the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2000, SECTION 706 RAISED PAVEMENT MARKERS.

Part 400 is supplemented with the following new Section:

SECTION 464

ROADSIDE SIGN SUPPORTS

464.1 DESCRIPTION:

The work under this section shall consist of furnishing and installing U-channel sign post and foundations.

Sign post and foundations shall conform to the requirements of the Standard Details 131, Type "A".

464.2 MATERIALS:

Certificates of Analysis conforming to the requirements of Arizona Department of Transportation Standard Specifications for Road and Bridge Construction Section 106.05 shall be submitted for all sign posts.

U-channel posts shall be fabricated from steel conforming to the requirements of ASTM A 499 or hot-rolled carbon steel bars. The weight of the post shall be 2.00 pounds per foot for sign post and 1.12 pounds per foot for delineator post.

All sign post systems shall meet the requirements of the National Cooperative Highway Research Program (NCHRP) Report 350 for small sign supports. Contractor to provide manufactures installation instructions that conform to NCHRP Report 350 for the soil type applicable to the job site.

The manufacturer shall provide certification that the U-channel lap splice system will develop the full shear and bending yield strength of the sign post section being spliced.

All post shall be painted dark green.

Excessive damage to the finish of the posts during shipping, handling, or installation will result in rejection of the damaged posts.

Posts shall be a uniform, modified, flanged channel section as shown on Detail 131. 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 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 inches from the top and continuing at 1.0-inch increments.

Posts shall be machine straightened to have a smooth uniform finish, free from defects. All holes and edges shall be free from burrs. Permissible tolerance for straightness shall be within 1 /16 inch in 36 inches.

U-channel base posts shall be driven into the ground to a minimum depth of 36 inches.

Sign posts shall be erected plumb.

464.4 METHOD OF MEASUREMENT:

U-channel sign posts and base shall be measured by the unit each.

464.5 PAYMENT:

The accepted quantities U-channel sign posts and base post installations measured as provided above, will be paid for at the contract unit prices each and shall include all labor, excavation, materials, tools, equipment and incidentals, and for doing all the work involved in constructing foundations, furnishing and erecting the sign posts and furnishing all metal plates and hardware, as shown on the plans and as specified herein, complete in place.

Part 400 is supplemented with the following new Section:

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 minimum size of sign shall be per the MUTCD for Conventional Roads.

465.2 MATERIALS:

Certificates of Compliance conforming to the requirements of Arizona Department of Transportation Standard Specifications for Road and Bridge Construction Section 106.05 shall be submitted for all materials, including reflective sheeting, required for fabricating sign panels.

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 shall be cause for rejection of the signs.

465.2.1 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 209M.

Panel facing shall be prepared and covered with retroreflective sheeting in accordance with the recommendations of the sheeting manufacturer. Color and type of sheeting shall be as specified or shown on the plans.

All surfaces not covered shall be etched to reduce glare from reflected sunlight.

The retroreflective sheeting and color shall conform to the requirements of Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, section 1007. Splicing of retroreflective sheeting shall not be allowed on sign panels having a minimum dimension up to and including 4 feet.

Messages on these sign panels shall be reflectorized white or, if called for in the plans, opaque black and produced by silk screening or direct applied characters or lettering.

465.2.2 REFLECTIVE SHEETING:

Panels to be installed on Roadside Sign Supports shall be fabricated from flat sheet aluminum and shall be reflectorized as specified herein.

All surfaces of panels to be covered with retroreflective sheeting shall be prepared in accordance with the recommendations of the sheeting manufacturer.

(A) WARNING SIGNS:

Warning signs except No Passing Zone pennant signs shall be reflectorized with yellow retroreflective engineering grade sheeting or as specified by the Engineer. No Passing Zone pennant signs shall be reflectorized with yellow High Intensity grade retroreflective sheeting. Delineator and Type II markers shall be Diamond grade retroreflective sheeting.

(B) REGULATORY SIGNS:

Regulatory signs shall be reflectorized with silver-white retroreflective engineering grade sheeting unless otherwise shown on the plans.

Reflectorized red signs shall be reflectorized with silver-white retroreflective engineering grade 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 engineering grade sheeting as background. The red color shall be produced by silk screening.

All Stop Signs (R1-1) shall be reflectorized with retroreflective High Intensity Grade sheeting, per ASTM D4965 Type III, unless otherwise shown on the plans.

(C) STREET NAME SIGNS:

Street Name Signs shall be reflectorized with green or red as shown on the plans, retroreflective engineering grade sheeting as background. The characters shall be direct applied lettering reflectorized with silver-white retroreflective Engineering grade sheeting or as requested by the Engineer. Street Name Signs fabrication and installation shall conform to the requirements as detailed on the plans.

465.2.6 SILK SCREENED AND 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 reflective 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.

Retroreflective sheeting shall meet or exceed the minimum Specific Intensity Per Unit Area (SIA) requirements of AASHTO M 268.

465.3 CONSTRUCTION REQUIREMENTS:

465.3.1 FABRICATION:

Fabrication of the sign panels shall be in accordance with the details shown on the project plans and the requirements of these specifications. 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 and overlay sheets 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.

465.3.2 INSTALLATION OF SIGN PANELS:

The sign panels shall be installed on roadside sign supports in accordance with the details shown on the plans.

Minor scratches and abrasions resulting from fabrication, shipping and installation of panels may be patched; however, patching shall be limited to one patch per 54 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 face 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 shall not be allowed.

465.3.3 INSPECTION:

An inspection of the completely installed sign panels will be made by the Engineer for proper appearance, visibility, color, and proper installation.

Each sign panel face shall be cleaned thoroughly just prior to the inspection as 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.

The Contractor at no additional cost to the County shall correct all apparent defects disclosed by the inspection. If color variations or blemishes between aluminum extruded 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 the Contractor's expense.

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 0.1 square foot. The areas of each rectangular, square or triangular sign panel will be determined from the dimensions shown on the project 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 project Plans.

The total area of all sign panels of the same type will be rounded to the nearest square foot.

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.

Payment will be made for the total rounded area of each type of sign 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.

Part 400 add the following new Section:

SECTION 470

TRAFFIC SIGNAL AND INTERSECTION LIGHTING SYSTEMS

470.1 DESCRIPTION:

The work under this section shall consist of installing traffic signals and intersection lighting systems in accordance with applicable Arizona Department of Transportation Standards for Cochise County.

SECTION 601

TRENCH EXCAVATION, BACKFILLING AND COMPACTION:

Section 601 is supplemented with the following:

601.2.1 GENERAL:

All trenching across existing paved streets or improved driveways shall be bored unless approved by the Engineer.

601.4.3 BACKFILL:

Where mechanical compaction is used, backfill shall be placed in lifts no greater than two feet, to within 4 feet of finished grade. From a depth of 4 feet to finished grade the lifts shall not exceed 1 foot.

601.4.4 COMPACTION DENSITIES:

Minimum compaction for all trenching at all locations shall be 90%.

Compaction within an existing or proposed street prism shall be as follows: The material from surface to within 2 feet below surface shall be aggregate base per Table 702-1, compacted to 100% maximum dry density. From 2 feet below surface to 1 foot above pipe the material shall be aggregate base or select material Type B per Table 702-1 and compacted to 100% maximum dry density. From one foot above pipe to bottom of trench the material shall be Type B compacted to 95% or in accordance with the utility line being installed.

601.4.5 COMPACTION METHODS:

Mechanical compaction shall be used for all trenching within an existing or proposed street prism. No compaction by water consolidation or jetting shall be allowed.

601.4.7 RIGHTS-OF-WAY BELONGING TO OTHERS:

Backfill and compaction for trenches in right-of-way of Irrigation Districts, Flood Control Districts, Utilities, Railroads, State of Arizona, or other agencies and outside the limits of those of Contracting Agency shall be accomplished in accordance with their permit and/or specifications but shall, in no case, be less than provided in these specifications.

SECTION 603

INSTALLATION FOR HIGH DENSITY POLYETHYLENE PIPE

Section 603.4.2 is modified as following:

603.4.2 BEDDING:

Controlled low strength material (CLSM) shall be used for bedding of HDPE. The CLSM shall be ½ sack per Section 728 unless otherwise noted. Placement of the CLSM bedding shall be per Section 604 and extend to 12 inches above the pipe crown line.

Part 600 add the following new Section:

SECTION 622

PIPE CULVERT

622.1 DESCRIPTION:

The work under this section shall consists of furnishing pipe and all other materials required and the installing of pipe, including excavating, and furnishing, placing and compacting backfill material, all in accordance with the details shown on the plans and the requirements of these specifications.

When trenching to depths in excess of five feet is required, prior to construction, the contractor shall submit in writing to the Engineer a detailed description of its proposed trenching operations, including shoring methods.

622.2 MATERIAL:

The Contractor may furnish Reinforced Concrete Pipe or Corrugated Metal Pipe. Reinforced Concrete Pipe shall be Class III, Rubber Gasket, conforming to the requirements of Section 735. Galvanized, minimum 14 gage corrugated metal pipe, coupling bands and flared end section shall conform to the requirements of AASHTO M-36 and Sections 621 and 760. Flared end sections shall be installed at both ends.

Corrugated metal pipe shall use metal flared end sections conforming to ADOT standard Drawing C-13.25, reinforced concrete pipe shall use concrete flared end sections conforming to MAG Detail 545.

Bedding material for all pipe shall be select material per Table 702-1, Type B except the plasticity index shall not exceed 8 when tested in accordance with AASHTO T-90. The pH value shall be between 6.0 and 10.0, inclusive per Arizona Test Method 236.

As an alternate, bedding material may be 1 sack CLSM per Section 728

Backfill material shall be select material per Table 702-1, Type A or B, except the plasticity index shall not exceed 12 per AASHTO T-99 or the same as the bedding material.

622.3 INSTALLATION:

622.3.1 Bedding:

Bedding material shall be placed under and around the pipe to the elevation at the point of maximum width of the pipe (springline) and be placed in a manner which will prevent distortion, damage to, or displacement of the pipe from its intended location.

Bedding material shall also be placed so that adequate support will be provided in the haunch support areas for the pipe. Voids or loose soils which are found to occur due to improper placement or compaction of bedding materials will result in rejection of that portion of pipe installation.

Bedding shall be placed in uniform horizontal layers not exceeding eight inches in depth, before compaction, and compacted to 95% of maximum density.

CLSM shall be placed in uniform horizontal layers, not exceeding four feet in depth, and in a manner that will prevent voids in, or segregation of, the material, and will not float or shift the culvert. Vibrators may be required if the fluidity of the mixture is not sufficient to fill all voids. No backfilling above the CLSM shall be commenced until 24 hours after the slurry has been placed.

Pipe shall be handled carefully. All pipes which show defects due to negligence or rough handling shall be removed and replaced if so ordered by the Engineer.

622.3.2 Backfilling:

Backfill shall be brought up evenly on both sides of and for the full length of the pipe, first to the spring line and compacted then to an elevation one foot above the top of the pipe and compacted.

No compaction by water consolidation or jetting will be allowed.

Trench backfill shall be placed from one foot above the top of the pipe to the elevation at which base or surfacing materials are to be placed or to the top of the trench.

Backfill compacted by pneumatic or mechanical tamping devices, shall be placed in layers not more than eight inches in depth before compaction and compacted to 100% maximum density.

CLSM backfill placement above springline shall not commence within 24 hours of the placement of the underlying CLSM below springline. CLSM shall be placed in horizontal layers not exceeding four feet in depth. The slurry shall be compacted with internal vibrators.

622.3.3 Water Flow Testing

A water flow test shall be conducted after the first backfill lift is compacted. The purpose of the test is to ensure proper drainage function of the pipe culvert.

622.4 Measurement:

Measurement of Pipe Culvert will be the linear feet of pipe, measured to the nearest foot along the pipe centerline, from end to end of the pipe, and shall include the length of fittings. Measurement for Flared End Section will be by the unit each for the various sizes of pipe culvert.

622.5 Payment:

Payment for Pipe Culvert will be made at the unit bid price per linear foot, for each size culvert installed, and shall be full compensation for furnishing and installing the culvert as specified, including removal of obstructions, excavation, bedding, backfilling, hauling, compacting, culvert, coupling bands, materials, equipment, maintenance, surveying, and all incidentals cost to complete the item in accordance with the plans and these specifications.

Payment for Flared End Section will be made at the unit bid price each, complete in place.

Part 600 is supplemented with the following new Section:

SECTION 626

MISCELLANEOUS STRUCTURES (ROADWAY DRAINAGE AND IRRIGATION)

626.1 DESCRIPTION:

Work under this Section consists of constructing miscellaneous reinforced concrete roadway drainage and irrigation structures, at the locations and in accordance with the details shown on the project plans, and in conformance with these Specifications. Typical Miscellaneous Structures include but are not limited to headwalls, standpipes, junction boxes, catch basins, manhole shafts, delivery structures, headgates, turnouts, etc.

626.2 MATERIALS:

Concrete shall be Class AA or Class A, as indicated on the Project Plans, in the project Construction Special Provisions, or in the MAG Standard Details, and shall conform to the requirements of Section 725. Reinforcing steel shall conform to the requirements of Section 727. Masonry materials shall conform to the requirements of Sections 775 and 776. All other materials shall conform to the call-outs on the Project Plans, to the project Construction Special Provisions, to the MAG Standard Details, and/or to appropriate Part 700 materials specifications.

626.3 CONSTRUCTION:

Concrete construction shall be in accordance with the requirements of Section 505. Unless specified otherwise in the project Construction Special Provisions, all Miscellaneous Structures defined in Section 626.1 are Minor Structures as defined in Section 505.1, and may be furnished as precast structures, in accordance with the requirements of that section and these Specifications.

Excavation and backfill for Miscellaneous Structures shall be in accordance with the requirements of Section 206.

626.4 MEASUREMENT:

Measurement for this work will be by specific pay item quantities, or by the unit each, as specified in the contract documents. Measurement by the unit each for Miscellaneous Structures shall include all appurtenant accessories such as but not limited to frames, grates, covers, gates, trash racks, etc.

626.5 PAYMENT:

Payment for this work will be made at the contract unit price(s) per specific pay item quantities, or per the unit each. When the measurement is by the unit each, payment will be full compensation for the item, complete in place, including necessary excavation, materials, construction, fabrication and installation, backfilling, and appurtenant accessories, as described on the project plans and in these Specifications.