

GREENE COUNTY

DESIGN STANDARDS FOR PUBLIC ROAD IMPROVEMENTS

ADOPTED:

June 23, 1980

LAST AMENDED:

April 1, 2002



FOR THE UNINCORPORATED AREA OF GREENE COUNTY

GREENE COUNTY, MISSOURI

DESIGN STANDARDS

FOR

PUBLIC ROAD IMPROVEMENTS

PREPARED BY:

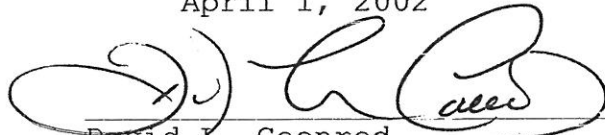
Kevin Lowe, P.E., Administrator
GREENE COUNTY HIGHWAY DEPARTMENT

APPROVED BY:


GREENE COUNTY PLANNING AND ZONING COMMISSION
March 19, 2002

APPROVED:


GREENE COUNTY COMMISSION
April 1, 2002



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Presiding Commissioner



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Commissioner 1st District



Jim Payne
Commissioner 2nd District

DESIGN STANDARDS FOR PUBLIC ROAD IMPROVEMENTS

GREENE COUNTY, MISSOURI

Amended April 1, 2002

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DESIGN STANDARDS

Section 1. Drawing Standards:

- (1) All engineering drawings shall be of uniform size 24 x 36 inches and shall have a standard title block on the lower right-hand corner of the sheet. Consultants shall place their own title block above or to the left. The registration seal of the responsible engineer shall be placed in a convenient place in the lower right-hand corner of each sheet of plans.
- (2) Whenever possible, engineering plans and profiles shall be drawn to a standard scale of one inch (1") equals fifty feet (50') horizontal and one inch (1") equals five feet (5') vertical. Drainage area maps, construction details and cross section or contour maps shall be drawn to a suitable scale.
- (3) Elevations on profiles and sections or as indicated on plans shall be U.S.G.S. datum, 1927 North American Datum, Mean Sea Level and North American Vertical Datum of 1929. At least two (2) permanent bench marks in the vicinity of each project shall be noted on the first drawing of each project and their location and elevation shall be clearly defined.
- (4) The top of each plan shall be either north or east, and the standard north arrow should be used. The stationing on street plans and profiles may be either from the left to right or from right to left, but on drainage and sanitary sewer plans the stationing shall always begin at the low point.
- (5) When more than one drawing is involved in one project, an overlap of not less than one hundred feet (100') should be provided. Each project shall show at least fifty feet (50') of topography on each side. All existing topography and any proposed changes, including utilities, telephone installations and so forth shall be shown on the plans and profile.
- (6) Revisions to drawings shall be indicated above the title block and shall show the nature of the revision and the date made.
- (7) Sheets showing typical symbols to be used in the preparation or engineering drawings are attached. Topography for which symbols are not standardized shall be indicated and named on plans and profiles. In utilizing the standard symbols for engineering plans, all existing utilities, telephone installations, sanitary and storm sewers, pavements, curbs, inlets and culverts and so forth shall be shown with a broken line; proposed facilities with a solid line; land, lot, and property lines to be shown with a slightly lighter solid line.

Easements shall be shown and, if known, the book and page number of the recording.

- (8) It shall be understood that the requirements outlined in these standards are only minimum requirements. When unusual subsoil or drainage conditions are suspected an investigation should be made and a special design prepared in line with good engineering practice.
- (9) Each plan should indicate owner for whom improvements are to be constructed.
- (10) Lot lines and dimensions shall be shown where applicable.

NOTE: Refer to the Standards of the City of Springfield for sanitary sewer design (However, trench backfill will be controlled by these Greene County Design Standards). Refer to the Greene County Storm Water Design Manual for stormwater design.

Section 2. Submission of Engineering Plans:

- (1) The original submission of engineering construction plans for streets, sanitary sewer and storm sewer shall be submitted the first time in three (3) sets of prints to the Greene County Planning Department within the Resource Management Department. One complete set to the Greene County Highway Department, plus, additional set of sewer plans for Greene County Highway Department approval prior to City review.
- (2) After approval of the engineering drawings, one (1) set of signed plans will be retained by the contractor on the job site and one (1) set each to be provided for the Greene County Highway Department and Stormwater Engineer.

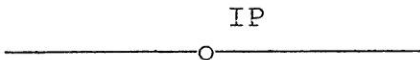
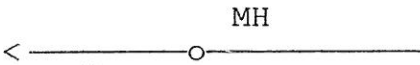
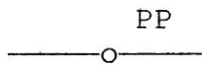
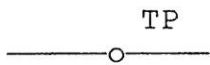
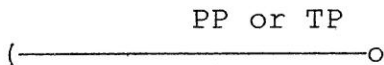






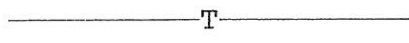
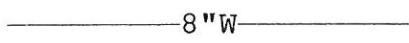
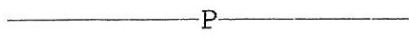
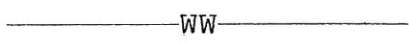
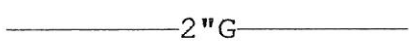
Section 3. Preconstruction Requirements:

- (1) After plans have been approved by the Greene County Resource Management Department and Greene County Highway Department, it is the developer's responsibility to provide for all necessary fees prior to construction.
- (2) A preconstruction meeting must be held at the Greene County Highway Department prior to starting construction work.

Section 4. Inspection Requirements:

- (1) Periodic inspections shall be required during construction work. These inspection requirements will be outlined in the individual standards of the streets, sewer, sidewalks, drainage or other public improvements.

Section 5. Standard Symbols For Engineer's Plans

| | | |
|---------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------|
|  | IP | Iron Pin |
|  | MH | Sanitary Sewer and Manhole (Show size, slope, elevation, and length between manholes) Show direction of flow. |
|  | PP | Power pole * High Voltage X Service Poles (show voltage if over normal distribution). |
|  | TP | Telephone Pole * High Voltage w/telephone X Service Pole w/telephone |
|  | PP or TP | Power or Telephone Anchor (Show Distance to pole). |
|  | GM | Gas Meter |
|  | WM | Water Meter |
|  | TMH | Telephone manhole (Show square or circular) |
|  | TMH | |
|  | GV | Gas Valve |
|  | WV | Water Valve |
|  | T | Underground Telephone Cable |
|  | 8"W | Water Line (Show size and type of material) |
|  | P | Underground Power Cable |
|  | WW | Underground White-Way Cable |
|  | 2"G | Gas Line (Show size and type of |

material)

Section 6. Street and Road standards:

(1) Clearing and Grubbing

- (a) A grading permit may be required (Contact Planning and Zoning office at 868-4005).
- (b) This work shall consist of clearing, grubbing, removing and disposing of vegetation within the limits of the right-of-way and easement area. The engineer will establish right-of-way and construction lines and will designate all trees, shrubs and plants that are to remain. The contractor shall preserve without damage the vegetation designated to remain. All trees, stumps, brush and hedge not designated to remain shall be cleared, grubbed or cleared as required and shall be disposed of in an acceptable manner. Stumps and roots in cut areas shall be grubbed to a depth of not less than 12 inches below the finished earth grade. In embankment areas undisturbed stumps and roots extending not more than 6 inches above the ground line may remain provided they are a minimum of 12 inches below the **finished** earth grade or the slope of the embankment except in areas to be excavated. Stump holes shall be backfilled with suitable material and compacted to the approximate density of the adjacent area. In lieu of grubbing stumps outside the slope limits stumps may be cut off not more than three inches (3") above the ground. Grubbing of borrow areas, channel changes and inlet and outlet easements will be required only to the extent necessitated by the proposed construction.

Section 7. Roadway, Drainage, Excavation, Embankment and Compaction:

- (1) This work consists of excavation, disposal or compaction of all materials encountered in the limits of the work. This work shall be performed in accordance with the specification and in conformance with the lines, grades, thickness, and typical cross sections as shown on the plans or established by the engineer.
- (2) Blasting shall be done in accordance with the provisions of Section 1803.6 of the Greene County Building Regulations.

Section 8. Construction Requirements:

- (1) General:

- (a) Prior to the beginning of excavation and embankment operations in any area, all necessary clearing, grubbing and stripping in that area shall have been performed. The excavation and embankment for roadways, intersections and entrances shall be made to the designated alignment, grade and cross section. Side slopes shall be cut or filled and finished to a reasonable smooth and uniform surface that will merge with the adjacent terrain without variation readily discernible from the road. Finishing by hand method will not be required, except that all brush, weeds, and other debris shall be removed from right-of-way. All utility cuts in roadbed shall be backfilled with compacted wet base. After installation of all utilities, grade stakes that have been disturbed shall be replaced.
- (2) Fieldstone:
 - (a) All loose fieldstone within the limits of the right-of-way shall be removed before commencing the operation of finish grading and small rock and boulders resulting from the operation of subgrade shall be removed from the roadway and shall be disposed of as directed by the engineer or inspector.
- (3) Shoulders:
 - (a) Earth shoulders shall be constructed of suitable material to the grade and the cross section shown on the plan and shall be compacted by the use of a steel wheel roller weighing not less than five (5) ton. The construction of shoulders shall start when sufficient surfacing has been completed and satisfactory strength has been obtained to permit shoulder operation. Equipment that will damage the surfacing will be prohibited from operating on the surface during shoulder operations. Surfacing and curbs shall be protected where equipment is crossing or turning.

Section 9. Subgrade Preparation:

- (1) Construction Requirements:
 - (a) Subgrade preparation and placement shall meet the requirements of Missouri Standard Specifications For Highway Construction, Division 200, Earthwork.
 - (b) The subgrade shall be substantially uniform in density throughout its entire width. It shall conform to the lines, grades, and typical cross sections shown on the

plans, or as established by the engineer. The subgrade shall be constructed to drain surface water to the side ditches or curbs. All ditches and curb areas shall be kept open by the contractor.

- (c) Prior to laying base or setting paving forms on projects where grading and paving are included as specified by the engineer or inspector, soft spots and unsuitable material shall be removed to a depth not to exceed 24 inches or as determined by the inspector and backfilled with approved stabilizing material.

(2) Subgrade Compaction:

- (a) Shall consist of compacting earth subgrade that is yielding or not substantially uniform in density. This item of work shall be performed when the subgrade density, following the use of the roller, is less than required under Greene County specifications.

Section 10. Curbs:

- (1) Curbs and gutters shall be required in all subdivisions unless the Board shall find all the following conditions to exist:

- (a) The average lot area in a residential subdivision is three (3) acres or in excess of three (3) acres.
- (b) Surface drainage can be adequately controlled with a ditched system constructed in accordance with the construction specifications of the Greene County Commission.
- (c) Curb and gutter may be required in order to extend the existing curb and gutter or where curb and gutter is required to control erosion.

(2) Concrete Curb and Gutter Requirements:

- (a) Prior to setting paving forms, the subgrade shall conform to the density requirements for compaction as set forth in the Missouri Standard Specifications For Highway Construction, latest edition. In residential areas, a minimum of four inches (4") of properly compacted base stone shall be used for fill under all curb and gutter and entire street area, as per Attachment B. Lots of three (3) acres or more are not required to have curb and gutter as per Attachment A. In industrial and commercial, eight inches (8") of properly compacted base stone shall be used as per Attachment C.

- (b) All concrete curb and gutter shall meet the construction tolerances and standards as set forth in the Missouri Standard Specifications For Highway Construction, Division 600.
 - (c) Concrete curb and gutter shall be constructed of Class B Concrete With Entrained Air, as per concrete specifications.
 - (d) Concrete curb and gutter shall be sprayed with curing compound as soon as the finishing operation has been completed. The method of curing and application of curing compound shall be to the standards set forth in the Missouri Standard Specifications for Highway Construction.
- (3) Curb Backfilling:
- (a) Backfill material shall be of an acceptable quality and shall be free from large rock.
 - (b) Curbs must be backfilled prior to paving street.

Section 11. Sub-base:

- (1) On tracts of land with average lot area of under three (3) acres, a minimum of five inches (5") of bituminous plant mix base over four inches (4") of properly compacted base rock (95% and over compaction) per Attachment B.
- (2) On tracts of land with an average lot area of three (3) acres or more, a minimum of five inches (5") of bituminous plant mix base over four inches (4") of properly compacted base rock (95% and over compaction) per Attachment A.
- (3) On commercial or industrial streets, a minimum of eight inches (8") of compacted rolled stone base with eight inches (8") of compacted bituminous mix as per Attachment C.
- (4) Sub-base preparation and placement must meet the Missouri Standard Specifications For Highway Construction, Division 300, Bases and Aggregate Surfaces.

Section 12. Street and Road Paving:

- (1) County roads and streets may be constructed of Portland Cement Concrete -- All concrete must meet the Missouri Standard Specifications for Highway Construction, Division 500, Rigid Pavements -- Sub-base must meet 95% and over compaction. Standard mix designs for machine placed (PCC-MF) and hand

finished (PCC-HF) concrete pavements shall be adhered to.

- (2) On tracts under three (3) acres, a two inch (2") asphalt wearing surface will be required over sub-base, per Attachment B. All bituminous asphalt mix shall meet all requirements of the Missouri Standard Specifications for Highway Construction, Division 400, Flexible Pavements.
- (3) On tracts of land three (3) acres or more, a two inch (2") asphalt wearing surface will be required over a minimum of five inches (5") of bituminous plant mix base over four inches (4") of properly compacted base rock (95% and over compaction) per Attachment A.

Section 13. Rollers and Compacting Bituminous Mix:

- (1) Shall meet all requirements of the Missouri Standard Specifications for Highway Construction, Division 400, Flexible Pavements.

Section 14. Weather Limitations:

- (1) Bituminous mixtures shall not be placed:
 - (a) When either the air temperature or the temperature of the surface on which the mixture is to be placed is below 40°F, or;
 - (b) On any wet or frozen surface, or;
 - (c) When weather conditions prevent the proper handling or finishing of the mixture.

Section 15. Acceptance of Improvements:

- (1) Article IV, Section 9, Subdivision Regulations. All utilities and improvements which are to be installed in street rights-of-way shall be completed prior to the installation of the curb and gutter and pavement construction.

Section 16. Inspections:

- (1) The required inspections as hereby listed:
 - (a) When construction is started;
 - (b) After subgrade has been prepared;
 - (c) When curb construction is started;

- (d) After curbs are finished;
 - (e) After curb backfill is completed;
 - (f) Before the black base is placed;
 - (g) During black base placement;
 - (h) When asphalt hot mix wearing surface is being placed;
 - (i) After completion of all streets and utility construction, but not later than 1 year after the recording date of the final plat, all right-of-way pins must be set defining public right-of-way;
 - (j) Final inspection for approval.
- (2) The following documentation must be furnished:
- (a) Copy of all concrete tickets,
 - (b) Copy of all bituminous plant mix tickets,
 - (c) Copy of all hot mix asphalt tickets.
- (3) Core test will be taken at Developer's expense (check for thickness).
- (4) Slump tests will be taken during concrete pours.
- (5) Air tests will be taken during concrete pours.
- (6) Concrete that fails to meet design specifications for slump and entrained air will be rejected at time of test.

Section 17. Streets:

- (1) New streets shall be considered in their relation to existing, platted or planned streets, to topographical conditions, public convenience and safety, and to the proposed land uses of land to be served by the proposed streets.
- (2) Land access streets shall be designed so as to discourage through traffic.
- (3) Provision must be made for the extension and continuation of arterial and collector streets into and from adjoining areas.
- (4) Subdivisions abutting or containing an existing or proposed arterial street, marginal access streets or reverse frontage

lots, access to abutting properties will be required.

- (5) The distance between the center lines of streets opening onto the opposite side of an existing or proposed street shall be not less than 150 feet.

Section 18. Cul-de-sacs:

- (1) Shall be permitted only on land access streets; shall not be longer than 800 feet and shall be provided at the closed end with a turnaround having a right-of-way width of at least 200 percent of the required street right-of-way width and a pavement diameter from back of curb to back of curb of at least 267 percent of the required pavement width but not less than 100 feet right-of-way and 81 feet of paving.

Section 19. Alignment:

- (1) Arterial and collector streets shall be designed so as to facilitate the flow of traffic. Minimum curve radii shall be selected and curves designed so as to facilitate the flow of traffic at anticipated vehicle speeds.
- (2) All streets shall have curves designed for any change of direction in excess of 1 degree.

Section 20. Sight Distance:

- (1) Proper sight distance shall be provided with respect to horizontal and vertical alignment. Measured along the center line, four feet (4') above grade, this shall be four hundred feet (400') for a primary arterial, three hundred feet (300') for secondary arterials, two hundred feet (200') for collectors, and one hundred fifty feet (150') for land access streets. Where two streets of different classification intersect, the sight distance for the higher classification shall prevail.

Section 21. Grade and Curves:

- (1) The minimum grade on all streets shall be one-half percent (1/2%). The maximum grade shall be 5 percent on primary arterials, 6 percent on secondary arterials, 8 percent on collectors and 10 percent on land access streets.
- (2) Vertical curves shall be used in changes of grade exceeding 2 percent. The length of vertical curve shall be no less than that determined by the formula:

L equals K A, where: L equals length of vertical curve. A

equals algebraic difference in grades, K shall be determined by the following table:

| | Crest | Sag |
|-------------|-------|-----|
| Arterial | 80 | 60 |
| Collector | 50 | 50 |
| Land Access | 28 | 35 |

- (3) Intersections shall be approached on all sides by leveling areas where the grade exceeds 7 percent. Such leveling areas shall have a minimum length of 75 feet measured from the intersection of the center lines within which no grade shall exceed a maximum 4 percent.

Section 22. Minimum Street and Pavement Widths:

- (1) Minimum right-of-way widths and width of paving and curb from back of curb to back of curb shall be as follows:

| | Type of <u>Street</u> | Right of <u>Way</u> | Paving & <u>Curb</u> |
|-------|--------------------------|------------------------|-------------------------|
| Local | <u>Minor Residential</u> | 40' | 21' - 27' |
| | <u>Residential</u> | 50' | 21' - 27' |

(Typical width is 27 feet but could go to 21 feet if less than 40 d.u. and less than 800 feet in length.)

| | | |
|-------------------------------------|-----|-----|
| <u>High Density Residential</u> | 50' | 29' |
|-------------------------------------|-----|-----|

(Access to multifamily residential; more than 100 d.u.)

| | | |
|-----------------------------------------|-----|-----------|
| <u>Industrial/ Commercial Local</u> | 60' | 36' - 49' |
|-----------------------------------------|-----|-----------|

(Provides access to industrial/commercial properties.)

| | | | |
|-----------|-----------------------------------|-----|-----------|
| Collector | <u>Residential</u> | 60' | 32' - 49' |
| | <u>Industrial/ Commercial</u> | 60' | 39' - 49' |

(Typical residential collector is 29 feet. Could go up to 49 feet depending on conditions; i.e., three lanes or four lanes.)

| | | |
|-----------------------|------------|------------------|
| Secondary Arterial | 70' - 80'+ | To be determined |
|-----------------------|------------|------------------|

individually

Major Arterial 100' +

To be determined
individually

Expressway 130' +

To be determined
individually

- (2) Provisions for additional street right-of-way width may be required by the Board in specific cases for the reasons of public safety and convenience. Additional off-street parking in industrial, commercial, and residential areas may also be required by the Board.
- (3) Provisions for an ultimate street right-of-way is required when:
 - (a) Subdivision fronts on a street which is presently below the minimum street width standards established herein.
 - (b) When a street appears on the Greene County Comprehensive Development Plan.
 - (c) The ultimate right-of-way line shall be one-half of the ultimate right-of-way, measured from the planned street center lines.

Section 23. Street intersections:

- (1) Intersections, involving the junction of more than two (2) streets shall be prohibited.
- (2) The angle of the intersection of the street center line shall not be less than 85 degrees when a collector or arterial street is involved, and 80 degrees for intersection of land access streets. Right angle intersection shall be used whenever practical.
- (3) Street curb intersections shall be rounded by a tangential arc with a minimum radius of 15 feet where a minor residential land access street is involved, 25 feet for intersections involving two residential land access streets, 30 feet for intersections involving collector or arterial streets; except where substantial use is anticipated by large trucks and semi-trailers; curb radius shall be increased to accommodate the anticipated use.
- (4) Radius corners or diagonal cutoffs shall be provided on the property lines and substantially concentric with the curb radius or parallel to the cord or the curb radius so as to

maintain the parkway width.

- (5) Clear sight triangles as required by the zoning order shall be indicated on the plat.

Section 24. Other Requirements:

- (1) Half streets are prohibited except where required in order to complete an existing half street.
- (2) Where the subdivision adjoins undeveloped land, streets shall be extended to the boundary lines of the subdivision as necessary to provide adequate access for the development of adjacent land. Temporary turnarounds shall be installed at the boundary lines or end of the proposed street by paving the full right of way at least 20 feet wide.
- (3) Streets shall be named so as to conform to existing street names and to avoid duplication.
- (4) In the A-1 and A-R Districts:
 - (a) A 50 foot right-of-way is required for all County maintained roads classified Residential. Other R/W must meet requirements of other classifications (See Section 22).
 - (b) A 50 foot access easement required for all private roads, Residential classification.
 - (c) For minor subdivisions a private driveway, exempt from any construction standards, be allowed to serve no more than two tracts which have no public road frontage.
 - (d) All major subdivisions be served by county maintained roads or private roads constructed to design standards for public roads.
 - (e) All new streets and roads shall be constructed of four inches (4") of compacted aggregate base rock, five inches (5") of Bituminous Plant Mix (black base), and surfaced with two inches (2") of asphalt pavement. Width of pavement, crown and shoulders shall remain as shown in Attachment "A".
- (5) Street Paving:

County streets may be constructed of Portland Cement Concrete or with bituminous plant mix. Seal coat will not be accepted on any street or road in Greene County.

(6) In the Residential, Commercial and Industrial Districts:

- (a) In Residential districts all streets shall be constructed of four inches (4") of base rock plus five inches (5") of Bituminous Plant Mix surfaced with two inches (2") of asphalt in accordance with Attachment "B".
- (b) In Industrial and Commercial districts all streets shall be constructed with eight inches (8") of rolled stone base plus eight inches (8") of bituminous plant mix surfaced with a two inch (2") asphalt driving surface.

NOTE: All asphaltic materials shall meet Missouri Standard Specifications for Highway Construction.

Plans and Specifications shall be approved by the Greene County Highway Department prior to starting any construction.

Section 25. Sidewalks:

- (1) Sidewalks shall be required on one side of the street within proposed subdivisions unless the streets fall under the following classifications, which would require sidewalks on both sides of these streets:
 - (a) Primary or secondary arterial streets as shown in the Greene County Thoroughfare Plan.
 - (b) Collector streets which are either shown in the Greene County Thoroughfare Plan or are designated as collector streets by the Planning and Zoning Board at the time of approval of the preliminary plat.
 - (c) Industrial and Commercial streets.
- (2) Outside edges of sidewalks shall be placed one foot inside the street right-of-way line. Residential or commercial sidewalks have minimum width of four feet (4') and must comply with the "Americans With Disabilities Act."
- (3) Sidewalks shall be constructed of class B AE (air entrained) concrete over four inches (4") of wet compacted base rock. Sidewalks shall be four inches (4") thick. When placing new driveways, existing sidewalk which was approved as a part of the subdivision improvements may be left in place provided it has not been broken or cracked. One-half inch thick expansion material shall be provided between existing concrete and new concrete. Where new sidewalk is constructed with the driveway

the sidewalk pavement shall match the required pavement thickness of the driveway.

- (4) The surface of the walk shall have a cross-slope of one quarter inch (1/4") per foot toward the street. Sidewalk plans should show the walk in plan, profile, and typical cross sections. For walks along unimproved streets it is necessary for the developer to pay to Greene County the estimated cost of exterior sidewalks, as laid out in the Greene County Subdivision Regulations. The profile may be omitted where street curbs are existing. If street plans are also being submitted the sidewalk shall be shown on the paving plans indicating the location of the walk.
- (5) Expansion joints one-half inch (1/2") in thickness shall be indicated on the plan at each side of the drives, at intersecting walks or curbs and other locations as needed. If sidewalks are placed adjoining curb and gutter, transverse expansion joints should be placed wherever there are expansion joints in the curb or gutter.
- (6) Wheelchair ramps are required at all street intersections and mid-block crossings. No drainage structure shall be permitted at ramps. Wheelchair ramps shall meet all ADA Standards.

Section 26. Installing Poles, Placing Pipe or Cable, Excavating, Boring, Cutting on County Roads or Rights-of-Way:

- (1) A minimum of \$5,000.00 bond shall be required made in favor of Greene County Highway Department. (A larger bond may be required as determined by the Greene County Highway Administrator.)
- (2) A right-of-way work permit shall be required prior to any work being started.
- (3) Plans must be submitted to and approved by the Greene County Highway Department prior to a permit being issued.
- (4) Barricades and signs must be placed in accordance with the Missouri Standard Specifications for Highway Construction and the Manual on Uniform Traffic Control Devices.
- (5) Boring:

When the cause for placement of cable and/or pipe to cross the roadway, such placement shall be by boring for said cable or pipe. If cable or pipe would require a size of 4" or greater, said cable or pipe shall require installation of a sleeve. In emergencies, cut or excavation in the driving surface may be

allowed by Highway Administrator approval in writing.

- (a) When work is of such a nature as to necessitate the cutting of a roadway surface, such cut area shall be restored with State approved high early strength concrete of a minimum of eight inches (8") thick with a minimum of two inches (2") of bituminous mix cap meeting Missouri Standard Specifications for Highway Construction. [Alternate: Twelve inches (12") of bituminous black base may be substituted for the eight inches (8") of concrete. This must be placed in three inch (3") lifts and compacted with an approved mechanical tamper or roller. This "Alternate" must first be approved in writing by the Highway Administrator.]
 - (b) It shall be the responsibility of parties performing the boring or cutting of a road to contact the Inspection Office of the Greene County Highway Department **24 hours before** any work is started or any repairs are made. Work or repairs done without contacting the Inspection Office may result in the rejection of any or all work or repairs being done.
 - (c) Prior to any excavations required to retrieve lodged or entangled pneumatic boring equipment, approval must be obtained from the Greene County Highway Department in writing. Repairs must be supervised and be in accordance with Attachment "D".
 - (d) Setback for boring pit has to be specified.
 - (e) Exposed casement shall be epoxy coated.
 - (f) Minimum cover for casing shall be 36".
 - (g) End of casing shall match 3:1 or existing sideslope.
- (6) Backfill:
- (a) Any cuts or excavations within two feet (2') of the driving surface shall be backfilled with wet crushed limestone base a minimum of twelve inches (12") deep in compacted lifts of no more than six inches (6'). Each lift shall be tamped thoroughly with a mechanical tamper before succeeding layers are placed. These cuts or excavations must be repaired within fifteen (15) days; No exceptions.
 - (b) The Contractor shall have the option of backfilling to the surface within the right of way with clean crushed

rock or paying the cost of compaction tests as deemed necessary by the Greene County Highway Department. Backfill and bedding material shall be crushed stone or crushed gravel conforming to the requirements of ASTM Standard C33, and having a gradation as follows:

| <u>Percent by Weight</u> | |
|--------------------------|----------|
| Passing 5/8 inch sieve | 100 |
| Passing 1/2 inch sieve | 75 - 100 |
| Passing 3/8 inch sieve | 30 - 75 |
| Passing No. 4 sieve | 5 - 25 |
| Passing No. 8 sieve | 0 - 6 |

- (c) If the rock backfill is used, a ditch check will be required at a minimum of every 300 feet. Greene County Highway Department may require flowable concrete backfill.
- (7) Cuts or excavations within the driving surface, if determined to be necessary by the Greene County Highway Administrator, shall be repaired **as per Attachment D**. Concrete and asphalt must meet the Missouri Standard Specifications For Highway Construction. These cuts or excavations must be temporarily repaired within a 24 hour period; No exceptions.
- (8) All installations of poles and wires must be set as close to property line as possible, no more than one foot (1') away. Lines and pipe must be within a four-foot (4') corridor along the property line and never in the ditch line or any closer to the driving surface than four feet (4').
- (9) It shall be the responsibility of parties performing such road and/or right-of-way work to contact the Greene County Highway Department for the necessary inspections and on completion of work.
- (10) Any deviation from these regulations will be on a case-by-case basis. Approval must be obtained from the Greene County Highway Administrator prior to any changes being made. Any deviation shall need approval in writing.

Section 27. Driveways:

- (1) Type 1 Driveway shall be a residential / field entrance 15'-40' wide, measured at the right-of-way line. In the A-1 and

A-R zoning districts, driveway shall have a minimum 10' side set back from property line. In the A-1 and A-R zoning districts, residential private driveways may be constructed of asphalt pavement, concrete pavement, or crushed rock or gravel. In all other zoning districts, residential private driveways shall be constructed of asphalt pavement or concrete pavement.

Asphalt drives shall be constructed within the right-of-way of 4 inches (4") of wet compacted base rock, 4 inches (4") of bituminous base mix, and two inches (2") of asphalt surface course. Concrete driveways shall be constructed of plain Class B "AE" (air entrained) concrete six inches (6") thick over four inches (4") of wet compacted base rock.

Gravel drives shall be constructed with a 2" minimum thickness of crushed rock having a maximum diameter of 2". There shall be a minimum of one foot (1') of cover over pipe culverts.

In the A-1 and A-R zoning districts, residential private drives and field entrances with corrugated metal pipe (CMP) or reinforced concrete pipe (RCP), shall have a minimum 2' shoulder, and 3:1 slope to ditch line. Flared End Sections will be required on all pipe with a thirty inch (30") diameter or larger.

- (2) Type 2 Driveway shall be a Commercial / Industrial entrance 24' - 60' wide, measured at the right-of-way line. Driveway shall have a minimum radius of 10 feet. Commercial / Industrial driveways shall be constructed within the right-of-way of (4") of wet compacted base rock, 8 inches (8") of bituminous base mix, and two inches (2") of hot mix surface course; or plain class B "AE" (air entrained) concrete (8") thick over four inches (4") of wet compacted base rock.

When curbs are present they shall extend to pipe within the right-of-way. Commercial / Industrial entrances with corrugated metal pipe (CMP) or reinforced concrete pipe (RCP), shall have a minimum 2' shoulder, and 3:1 slope to ditchline. Greene County Highway Department may require reinforced concrete pipe (RCP) if dictated by depth of fill or structural considerations.

Flared End Sections will be required on all pipe with a thirty inch (30") diameter or larger.

- (3) Driveways shall not be steeper than 4% within the right-of-way.
- (4) Minimum sight distance on driveways shall be measured 12' from

edge of pavement as follows;

375' @ 50 mph
325' @ 45 mph
275' @ 40 mph
225' @ 35 mph
200' @ 30 mph

Section 28. Subdivision Entry Signs:

- (1) Entry signs shall be located outside of right-of-way triangles.
- (2) Entry signs located within medians within the right-of-way shall be located a minimum of 10' beyond the radius point of the entrance drive.
- (3) No entry signs will be allowed on secondary arterial or greater classification roads.

Section 29. Mailboxes:

Construction of mailboxes of brick or other non-breakaway material will not be allowed on any roads of collector or higher classification.

Section 30. Gated Communities:

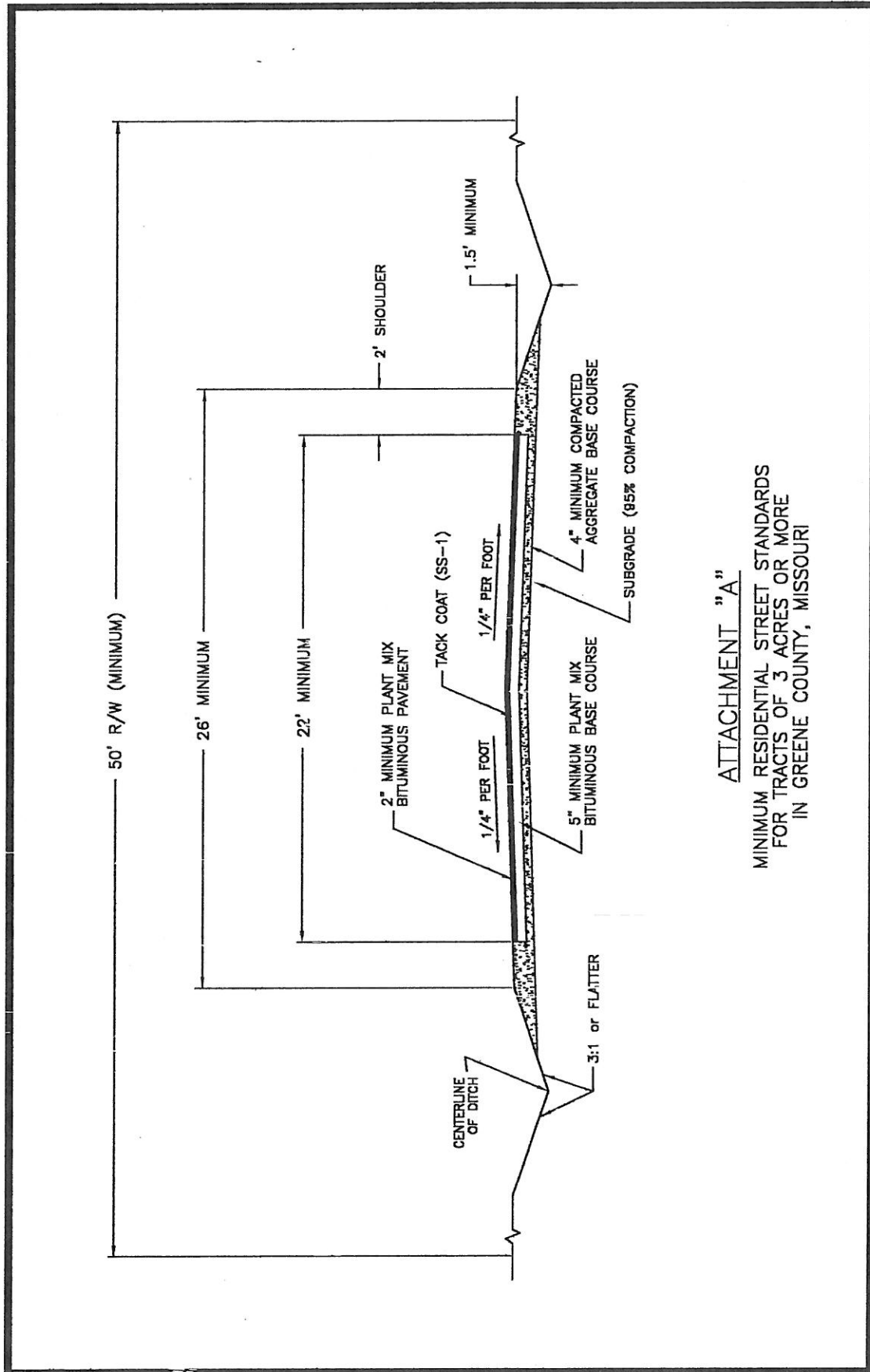
- (1) Entrances to gated communities shall be constructed according to current standards adopted by the City of Springfield.

Section 31. Corrugated Plastic Pipe (CPP):

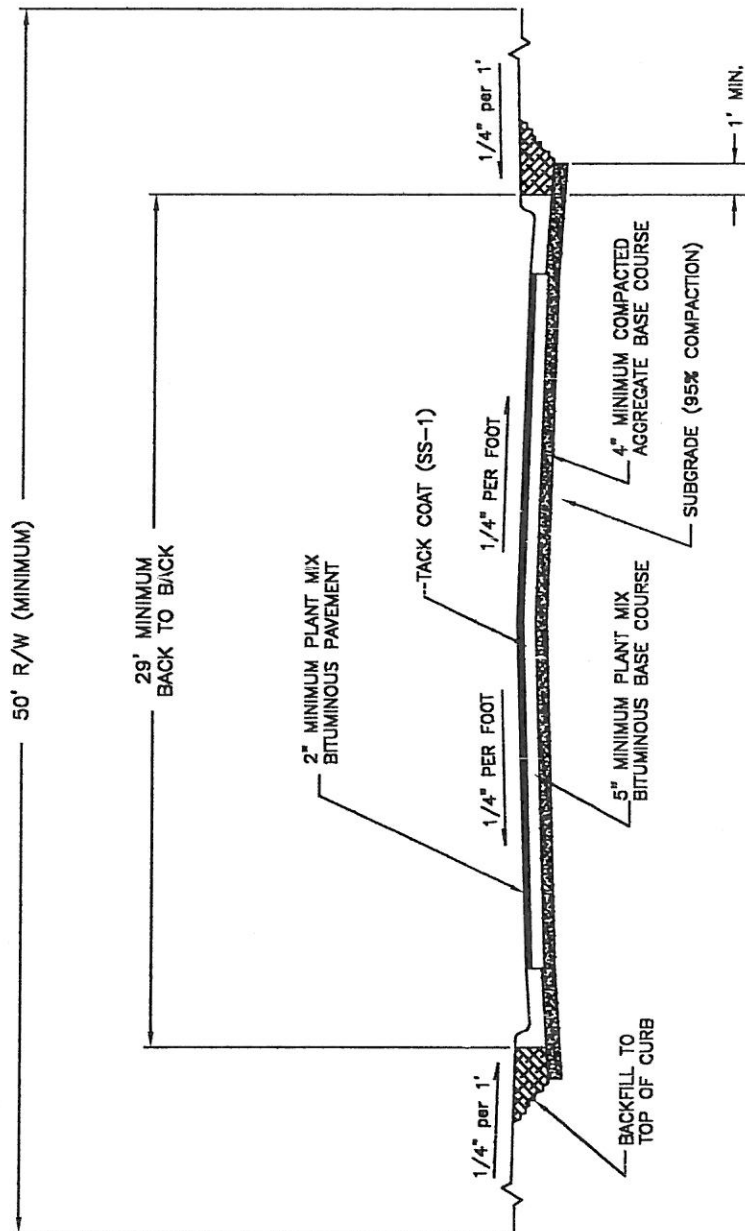
Corrugated Polyethylene Pipe is approved for use within public road right-of-way with the following conditions and restrictions:

- (1) Written approval must be obtained from the Stormwater Engineer for each installation (required by Section 109.2.1 of the Stormwater Design Standards).
- (2) Maximum allowable inside diameter is 36 inches.
- (3) Trench width excavation shall provide a minimum of six inches (6") of clearance outside the pipe.
- (4) Pipe shall be bedded upon a minimum of four inches (4") of 5/8" clean crushed rock.
- (5) Clean 5/8" crushed rock backfill shall extend to the center of the pipe.

- (6) A manufacturer's representative must meet with the County inspector and the contractor at the site when construction begins to review proper installation procedures and assure initial installation is begun correctly. A written report of the meeting will be provided to the Stormwater Engineer.
- (7) HDPE flared end sections will not be permitted.
- (8) Pipe bells shall not be used for wall penetrations at manholes, inlets and junction structures.
- (9) The pipe supplier shall provide written certification that the pipe meets the requirements of Sections 1047 of the Missouri Standard Specifications for Highway Construction; AASHTO M294 and M252; and ASTM F405 and F667.
- (10) An adaptor, approved by the Stormwater Engineer, must be provided when transitioning to other pipe materials.

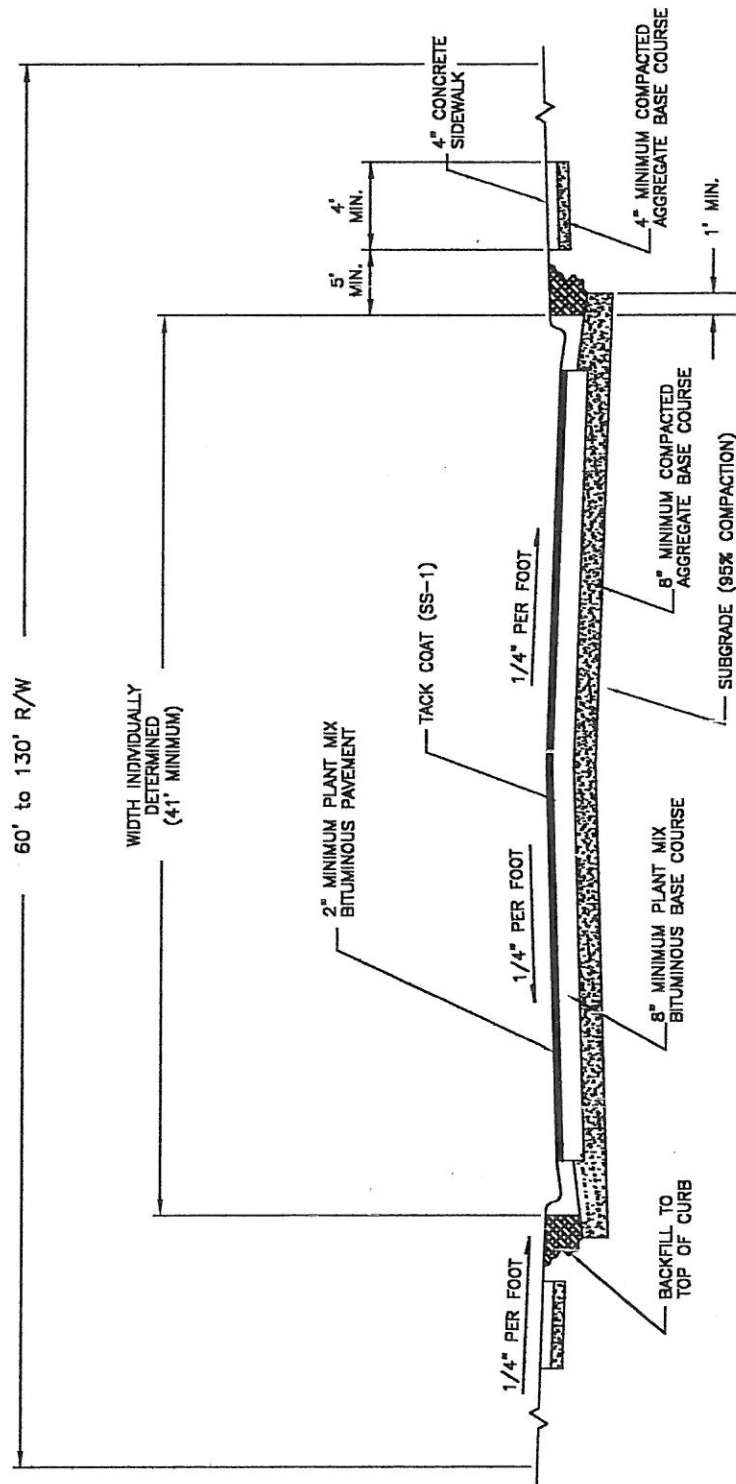


ATTACHMENT "A"
 MINIMUM RESIDENTIAL STREET STANDARDS
 FOR TRACTS OF 3 ACRES OR MORE
 IN GREENE COUNTY, MISSOURI



ATTACHMENT "B"

MINIMUM RESIDENTIAL STREET STANDARDS FOR
SUBDIVISIONS WITH LOTS OF LESS THAN
3 ACRES IN GREENE COUNTY, MISSOURI
(STORM DRAINAGE SYSTEM REQUIRED)



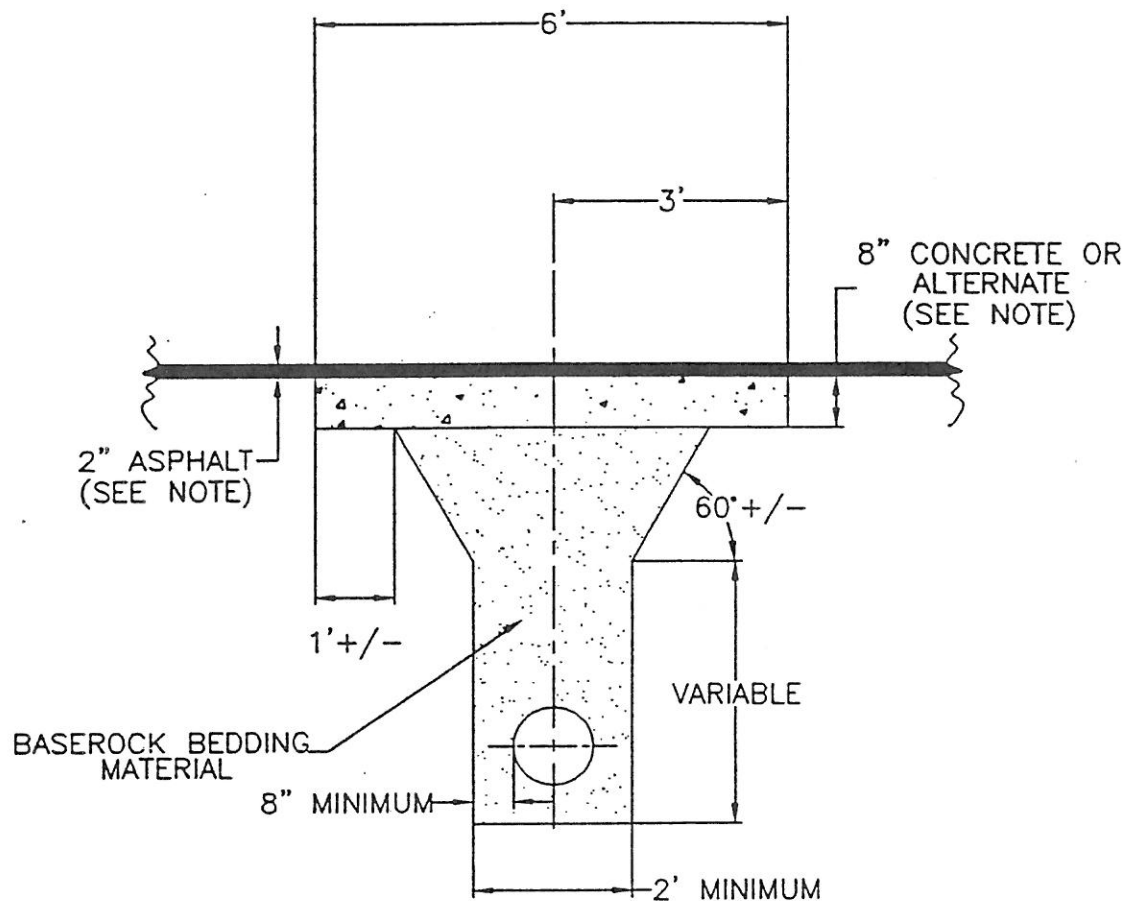
ATTACHMENT "C"

MINIMUM STREET STANDARDS FOR COMMERCIAL AND INDUSTRIAL STREETS IN GREENE COUNTY, MISSOURI

Note: Right-of-way shall be of sufficient width to contain all side slopes and ditches.

ATTACHMENT "D"

GREENE COUNTY HIGHWAY DEPARTMENT STREET CUT SPECIFICATIONS.



NOTE: ALL MATERIAL AND PLACEMENT OF MATERIAL MUST MEET THE SPECIFICATIONS SET FORTH IN THE LATEST EDITION OF THE MISSOURI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION.

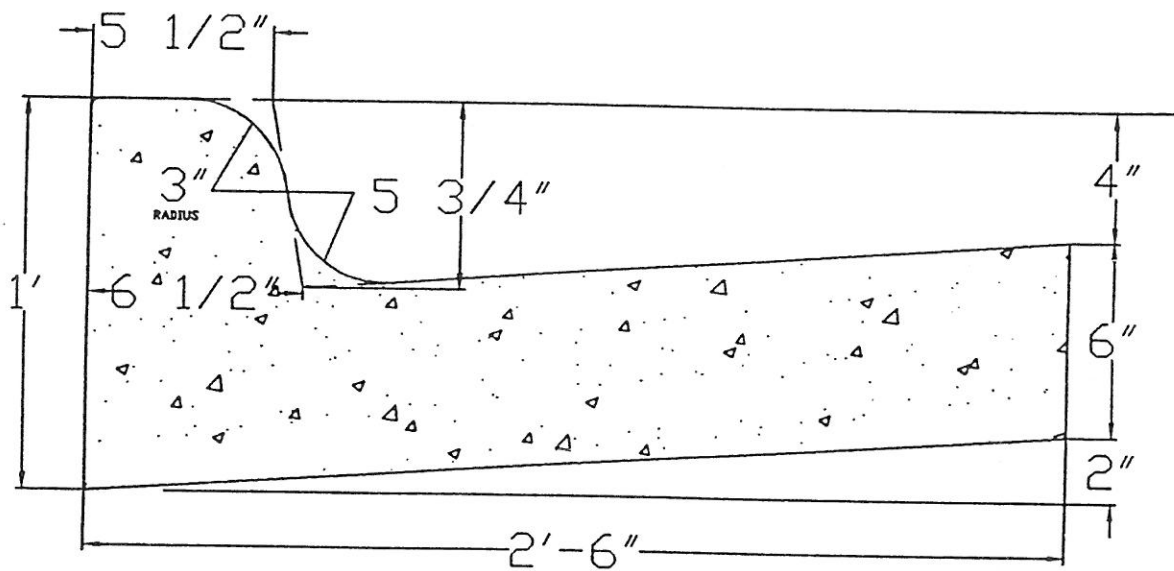
ASPHALT: 2" MINIMUM HOT MIX ASPHALT LAYED LEVEL WITH EXISTING ROAD SURFACE.

CONCRETE: HIGH EARLY PAVING (CONCRETE BASE)
ALTERNATE IS 10" BLACK BASE

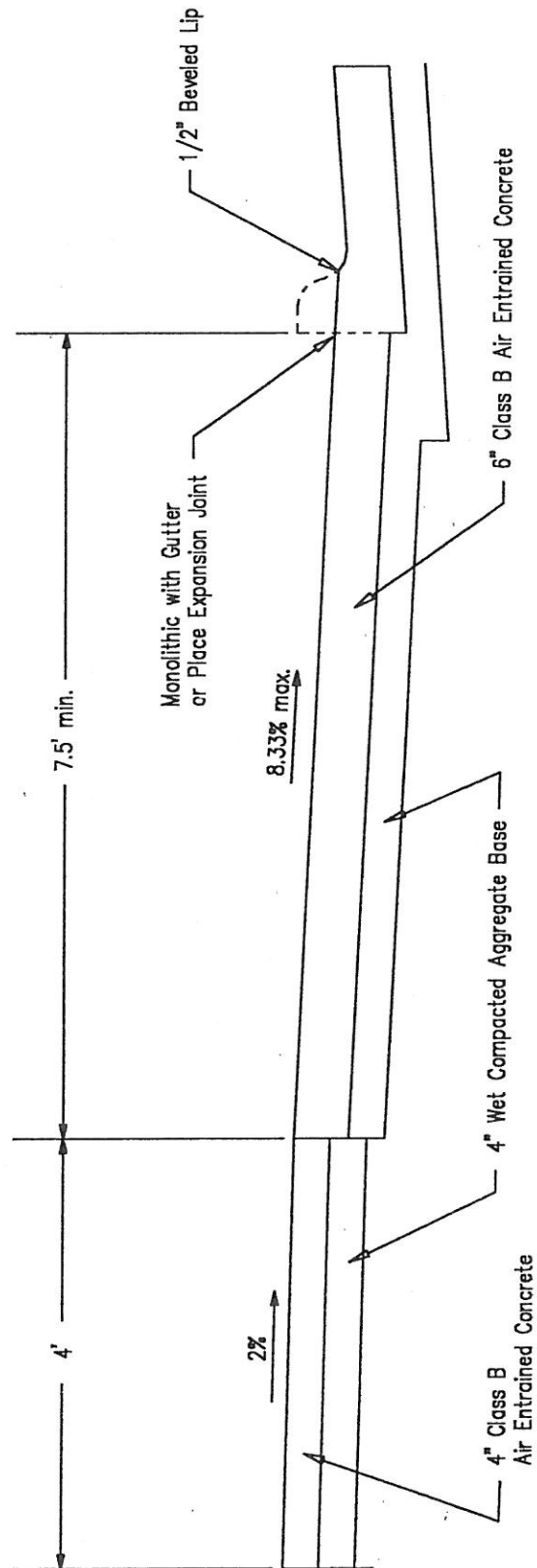
BEDDING MATERIAL SHALL BE PLACED IN LIFTS AND COMPACTED PER COUNTY SPECIFICATIONS.

CONTRACTOR IS TO SAW CUT AND REPLACE WITH 8" OF CONCRETE (OR ALTERNATE) AND 2" OF NEW ASPHALT AS SPECIFIED.

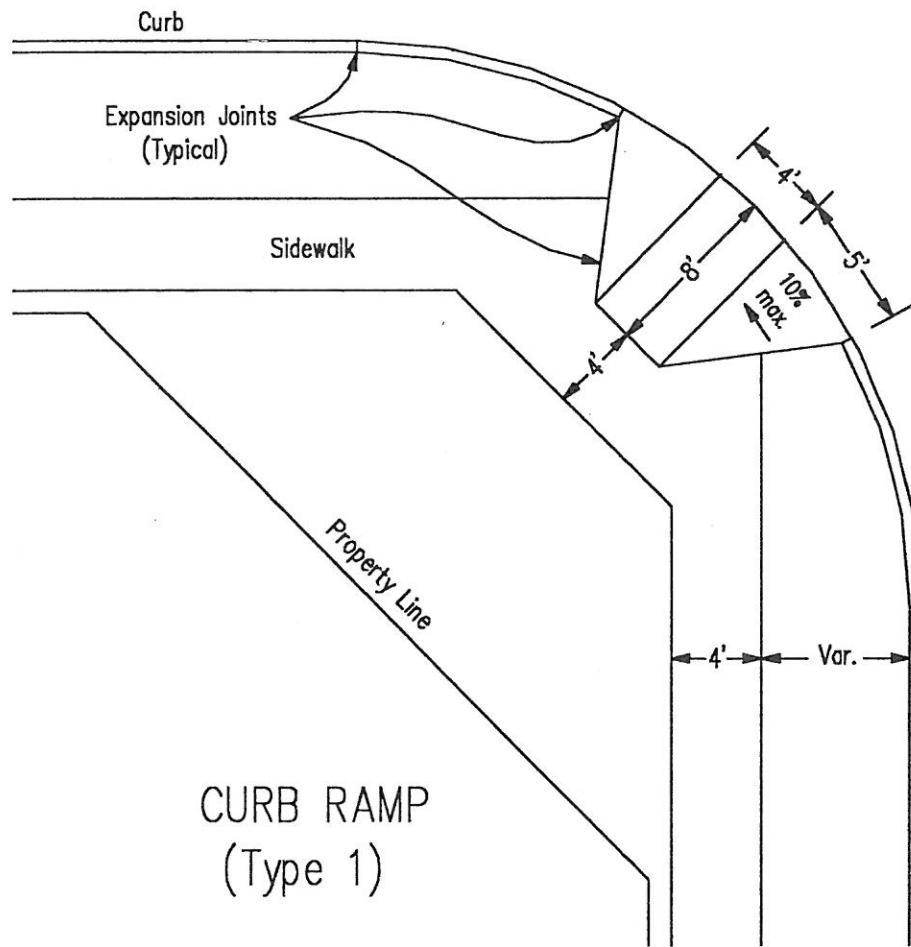
IT IS MANDATORY THAT A GREENE COUNTY INSPECTOR BE NOTIFIED BEFORE CONCRETE IS PLACED AND AFTER COMPLETION OF JOB.



Standard Concrete Curb and Gutter



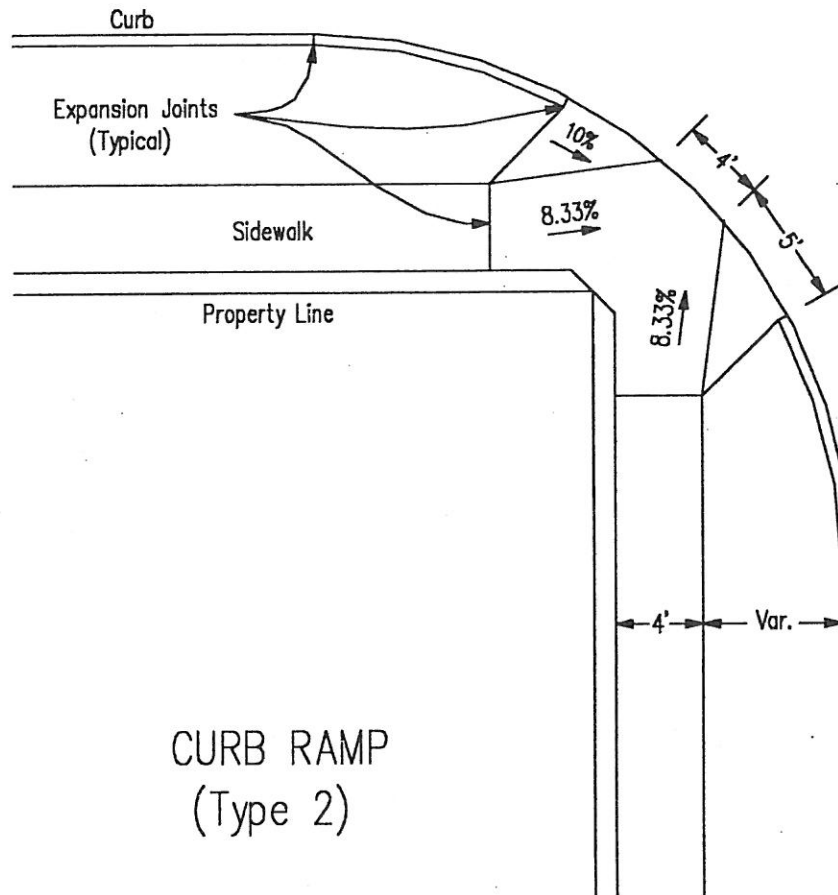
CURB RAMP (Typical) CROSS SECTION



CURB RAMP
(Type 1)

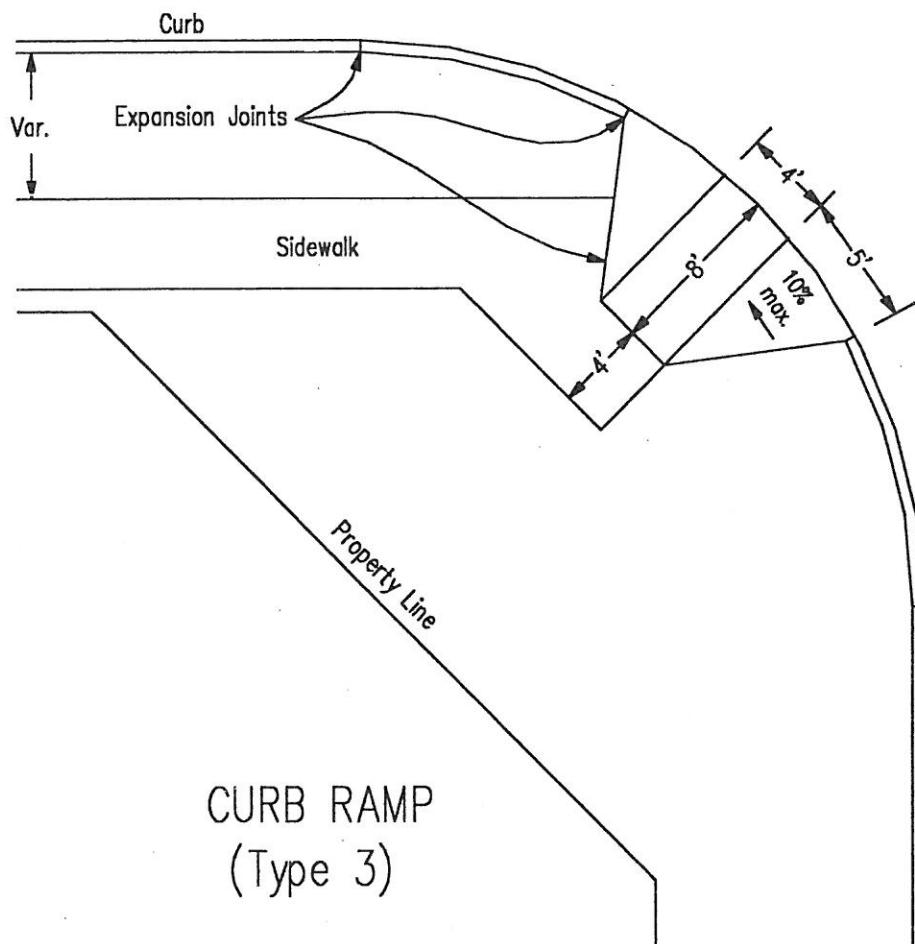
NOTES:

1. THE BOTTOMS OF RAMPS AT INTERSECTIONS SHALL BE CENTERED ON THE MIDPOINT OF THE CURB RADIUS.



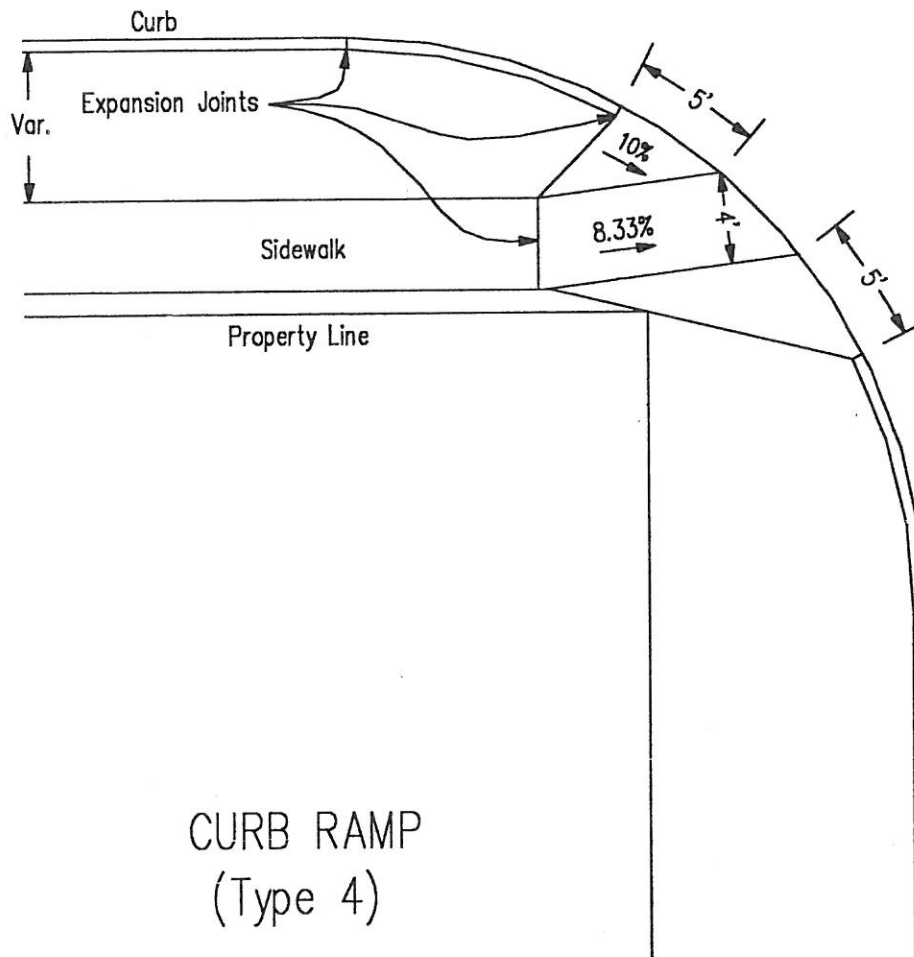
NOTES:

1. THE BOTTOMS OF RAMPS AT INTERSECTIONS SHALL BE CENTERED ON THE MIDPOINT OF THE CURB RADIUS.



NOTES:

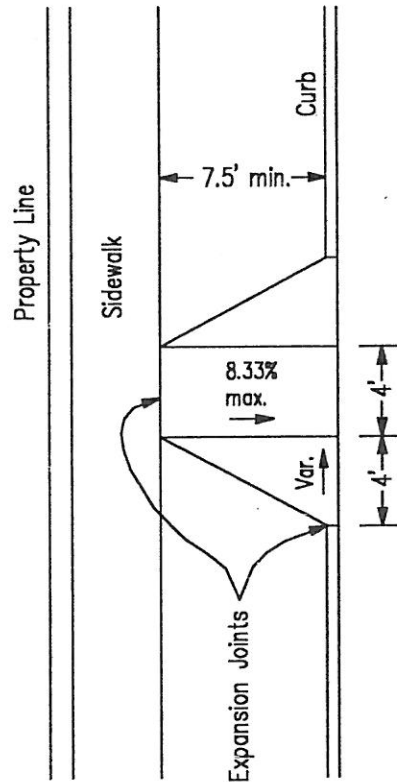
1. THE BOTTOMS OF RAMPS AT INTERSECTIONS SHALL BE CENTERED ON THE MIDPOINT OF THE CURB RADIUS.



CURB RAMP
(Type 4)

NOTES:

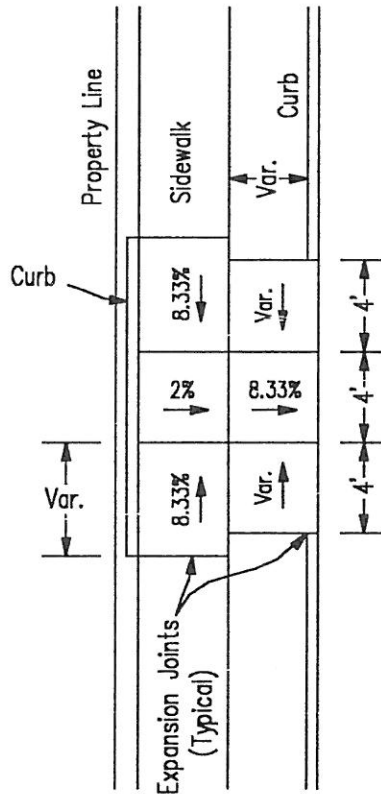
1. THE BOTTOMS OF RAMPS AT INTERSECTIONS SHALL BE CENTERED ON THE MIDPOINT OF THE CURB RADIUS.



CURB RAMP (Type 5)

NOTES:

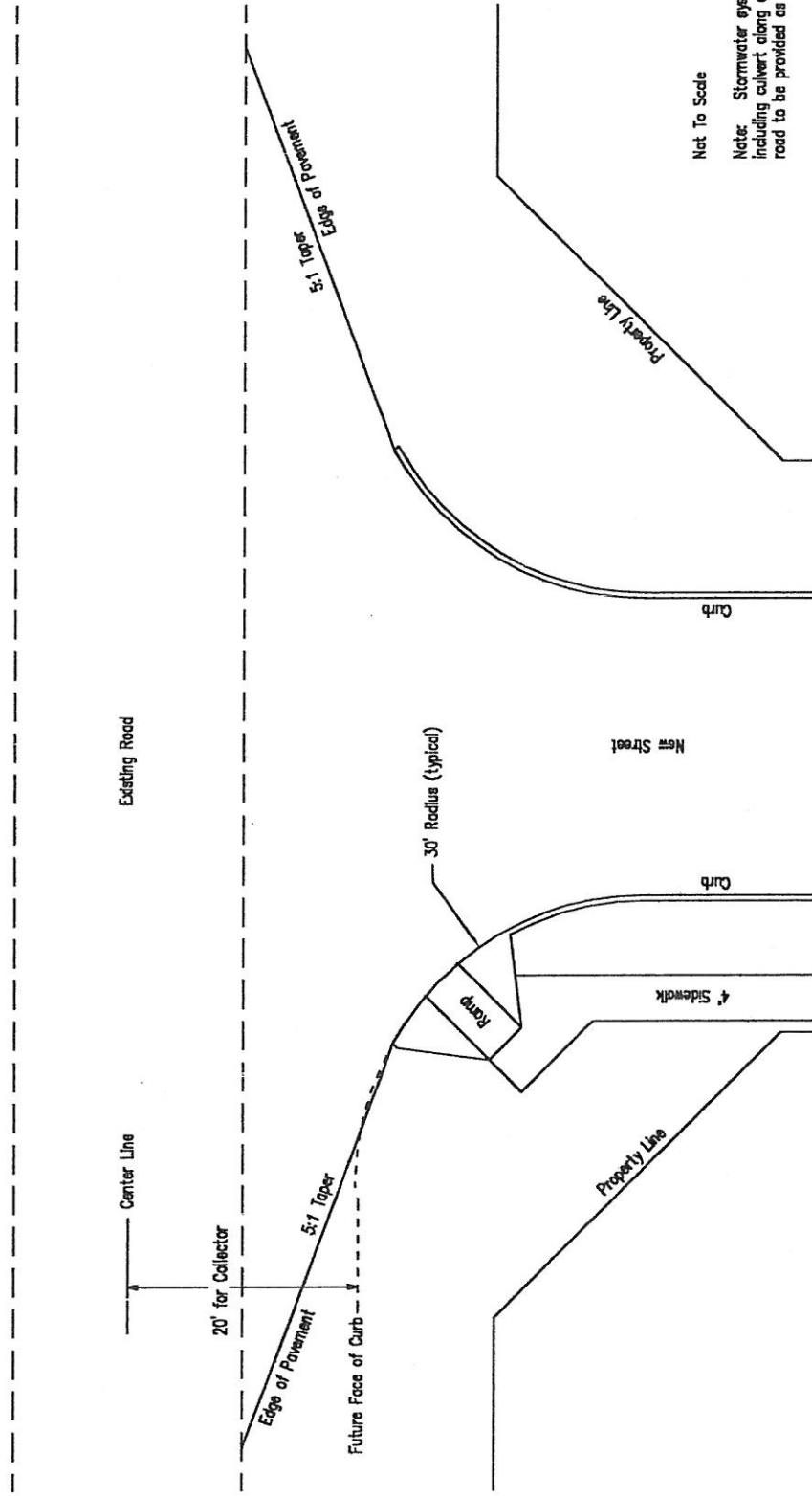
1. CURB RAMP (TYPE 6) SHALL BE USED FOR MID-BLOCK RAMPS WHEN THE DISTANCE BETWEEN THE SIDEWALK AND THE BACK OF CURB IS LESS THAN 7.5 FEET.



CURB RAMP (Type 6)

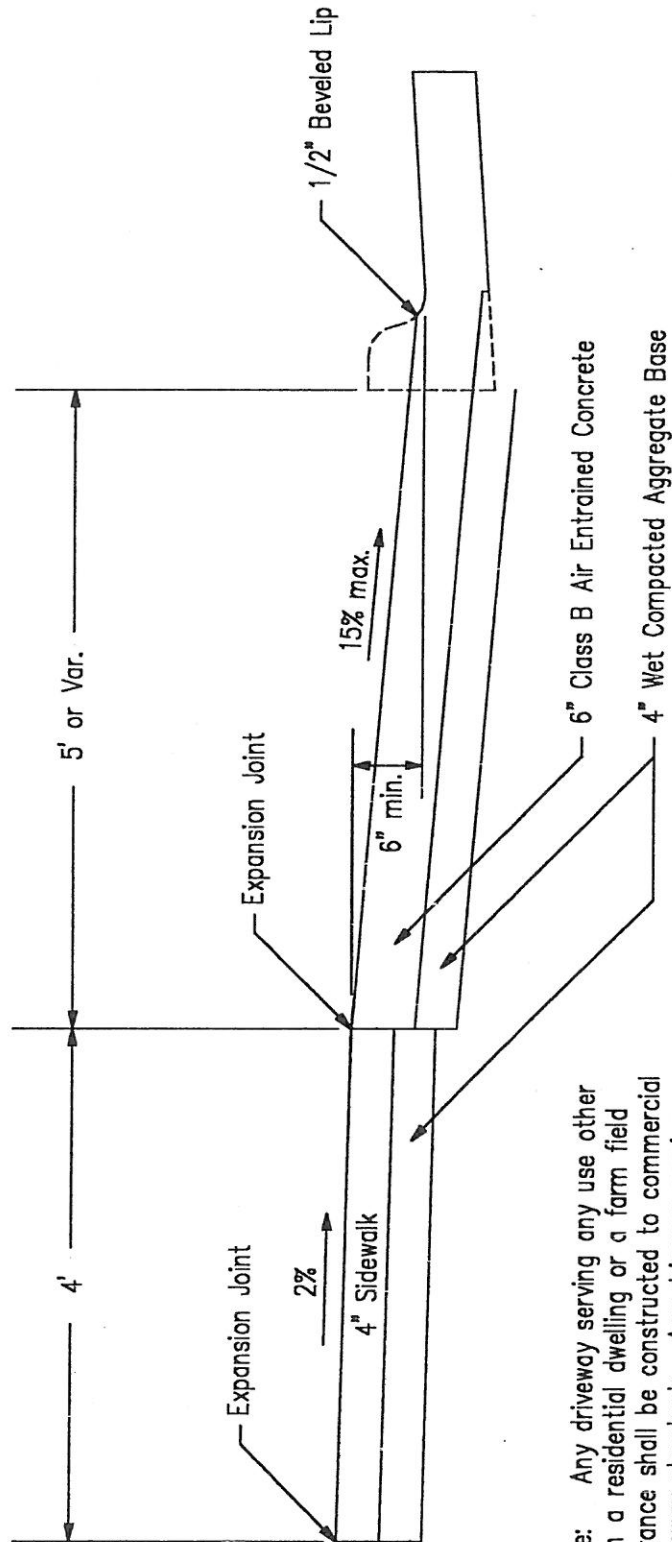
NOTES:

1. CURB RAMP (TYPE 6) SHALL BE USED FOR MID-BLOCK RAMPS WHEN THE DISTANCE BETWEEN THE SIDEWALK AND THE BACK OF CURB IS LESS THAN 7.5 FEET.



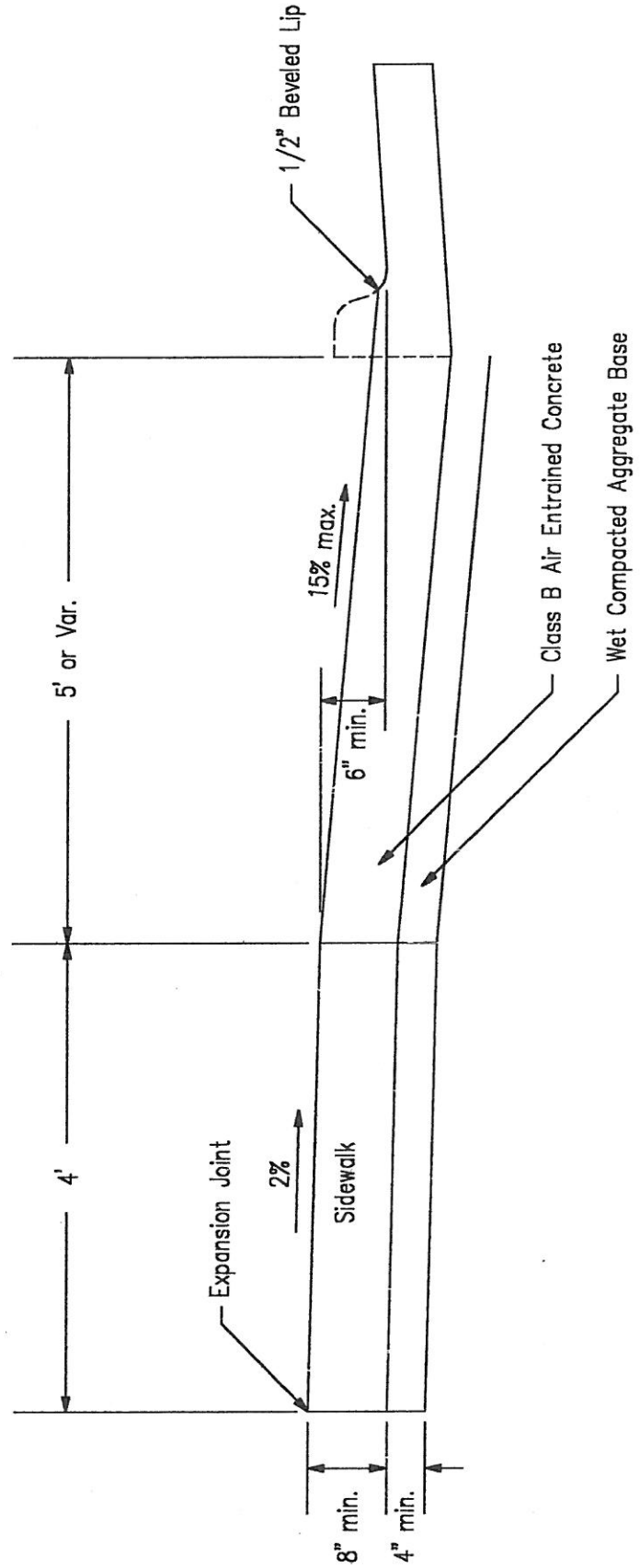
STANDARD NEW STREET CONNECTION FOR GREENE COUNTY, MISSOURI

RESIDENTIAL DRIVEWAY SECTION

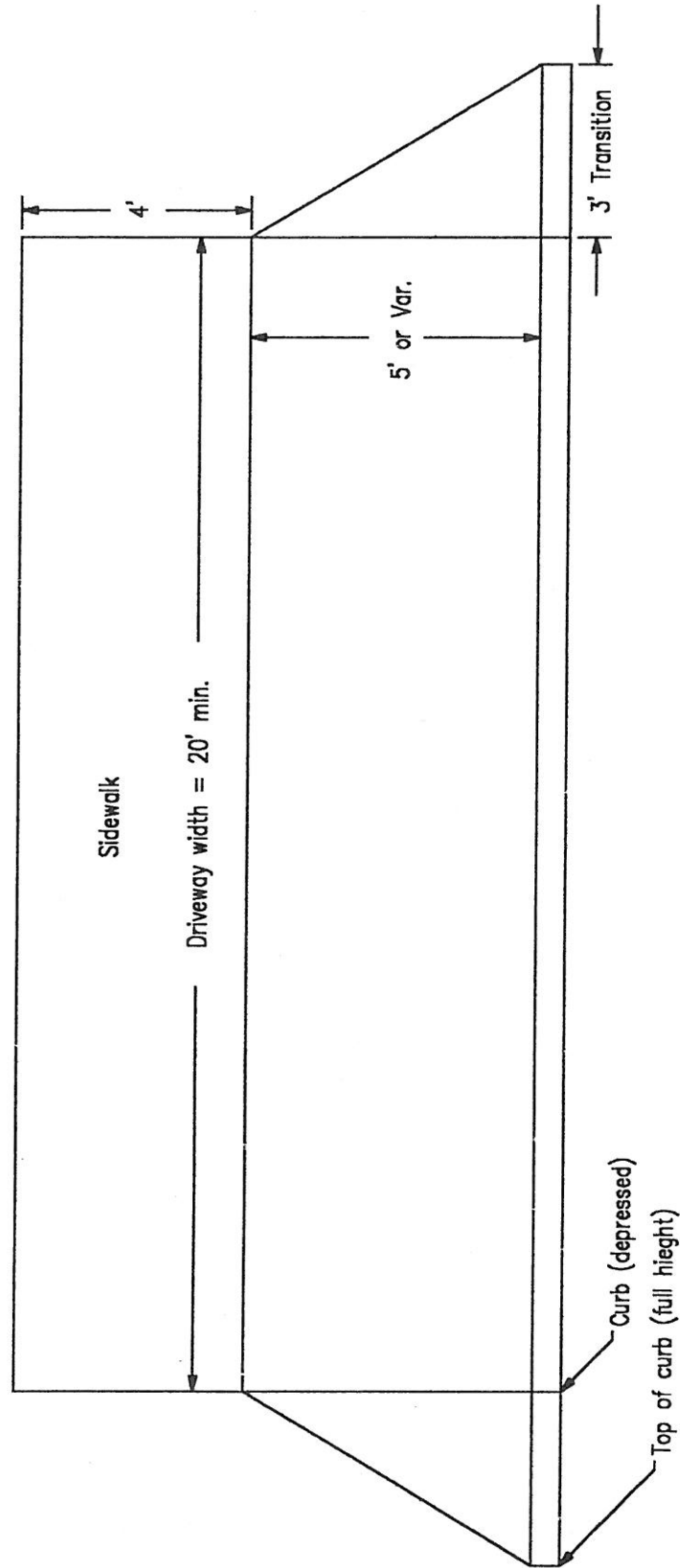


Note: Any driveway serving any use other than a residential dwelling or a farm field entrance shall be constructed to commercial driveway standards. Any driveway serving more than 4 dwelling units shall be constructed to commercial driveway standards.

COMMERCIAL DRIVEWAY SECTION

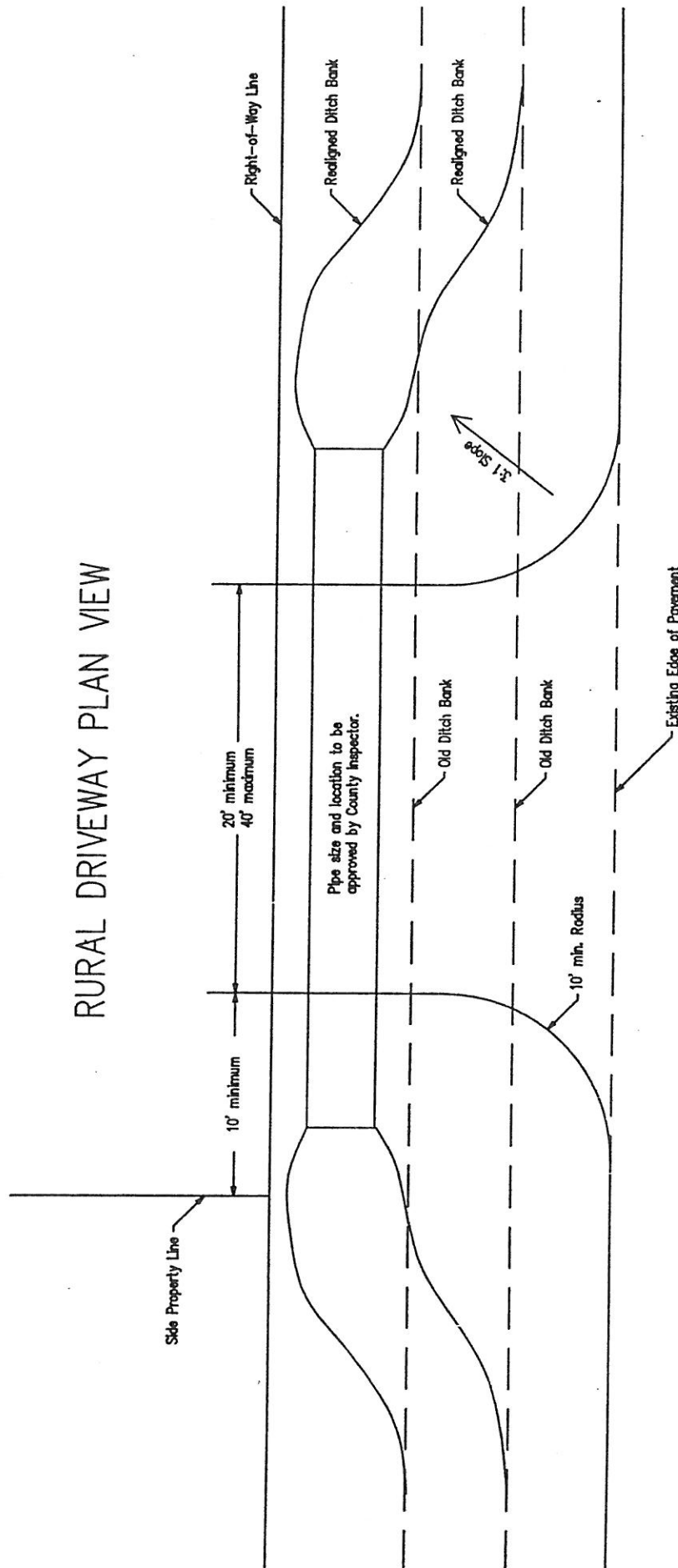


COMMERCIAL & RESIDENTIAL DRIVEWAY PLAN VIEW

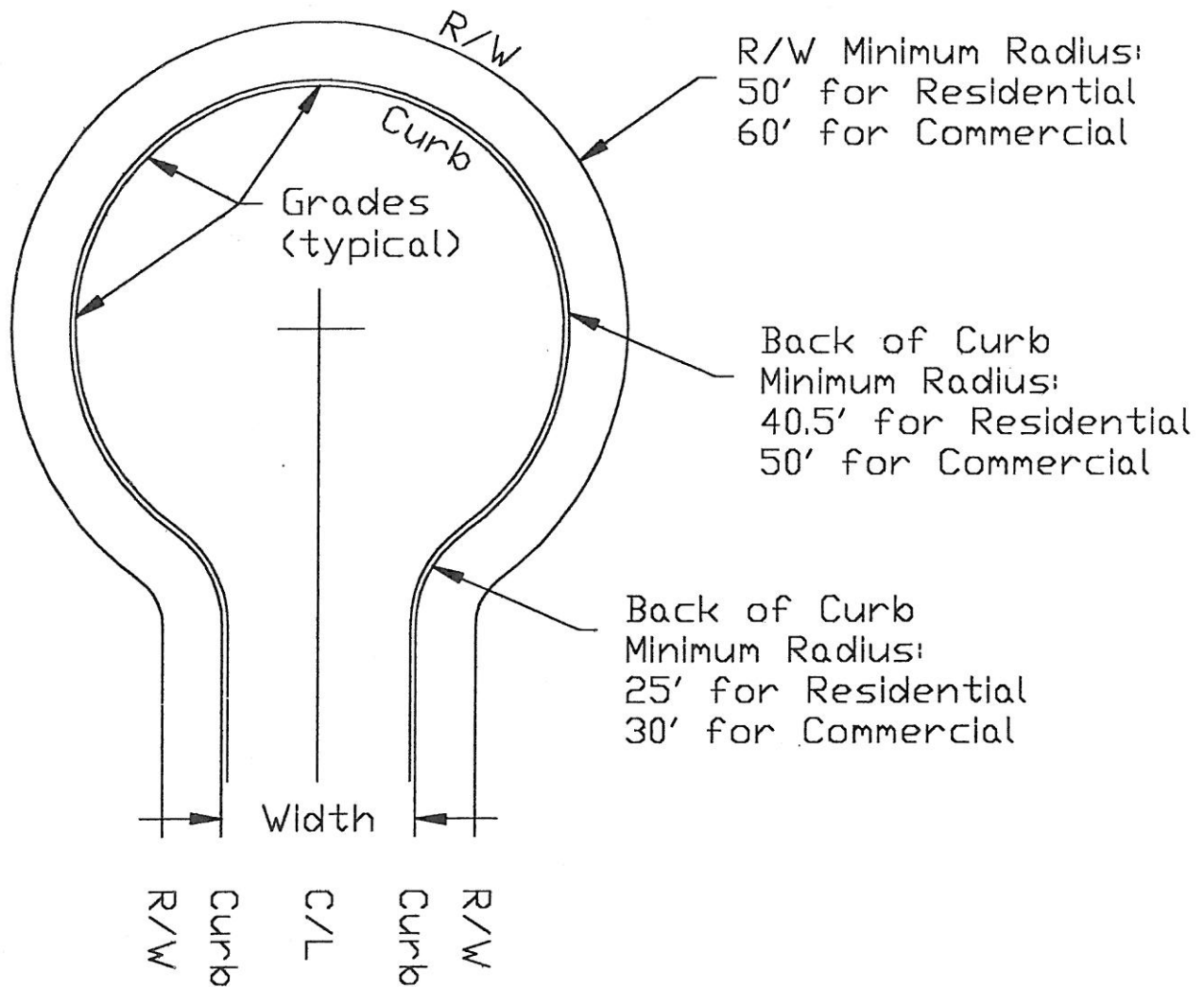


Note: Greene County Highway Department needs to be notified at 831-3591 prior to the placement of the driveway. Failure to do so may result in the removal and replacement of the driveway.

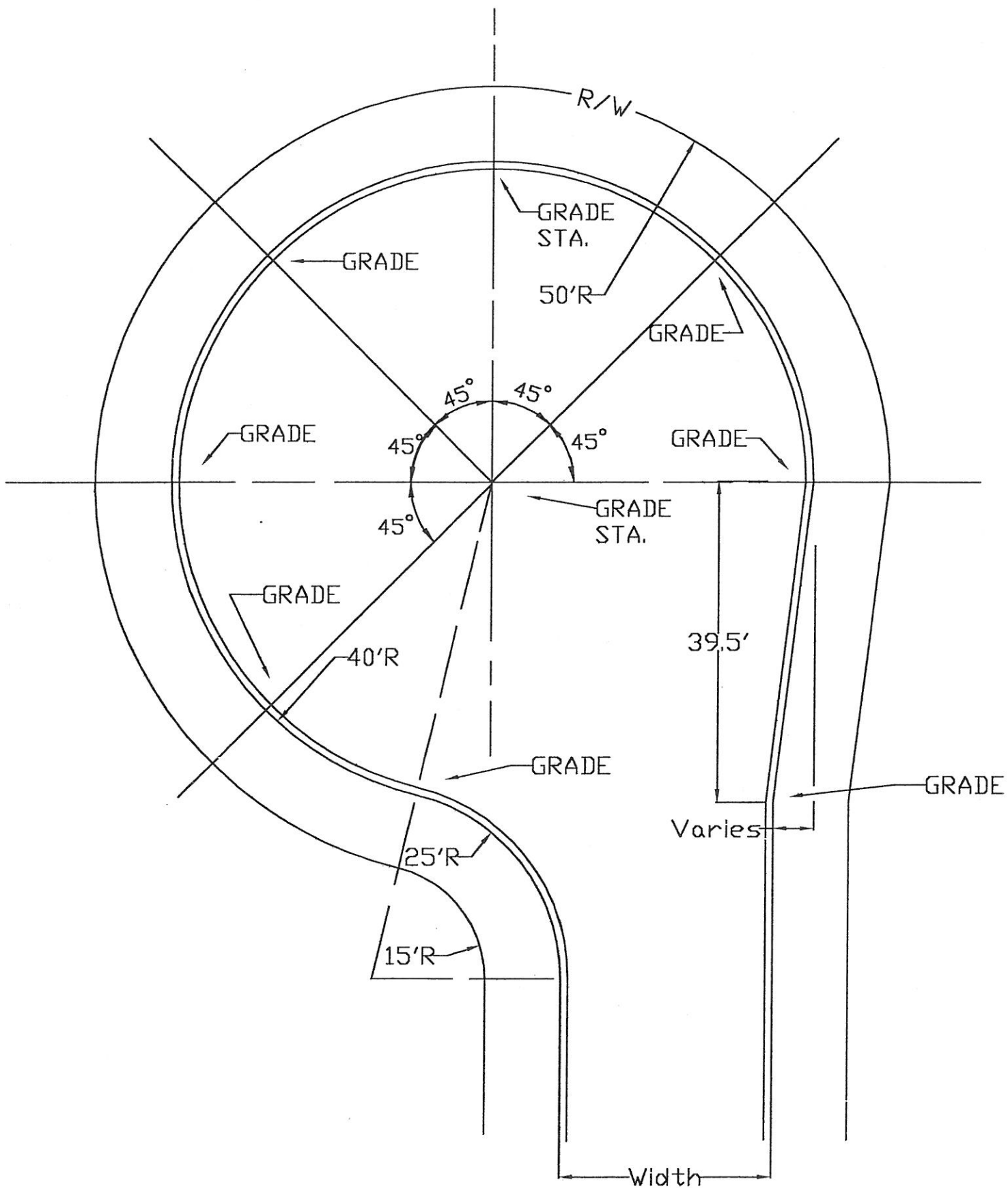
RURAL DRIVEWAY PLAN VIEW



Note: Greene County Highway Department needs to be notified at 831-3591 prior to the placement of the driveway. Failure to do so may result in the removal and replacement of the driveway.

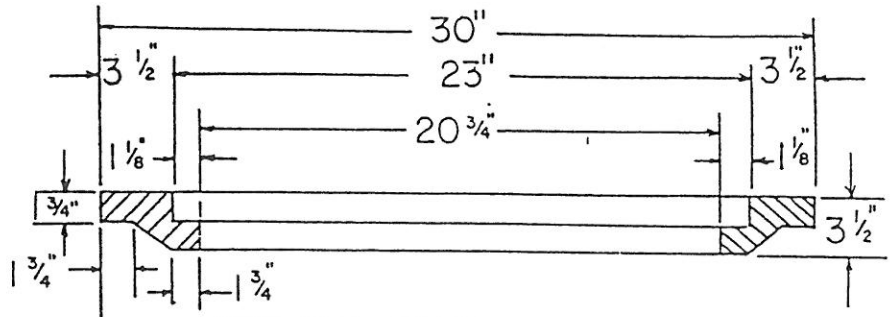


STANDARD CUL-DE-SAC FOR GREENE COUNTY, MISSOURI

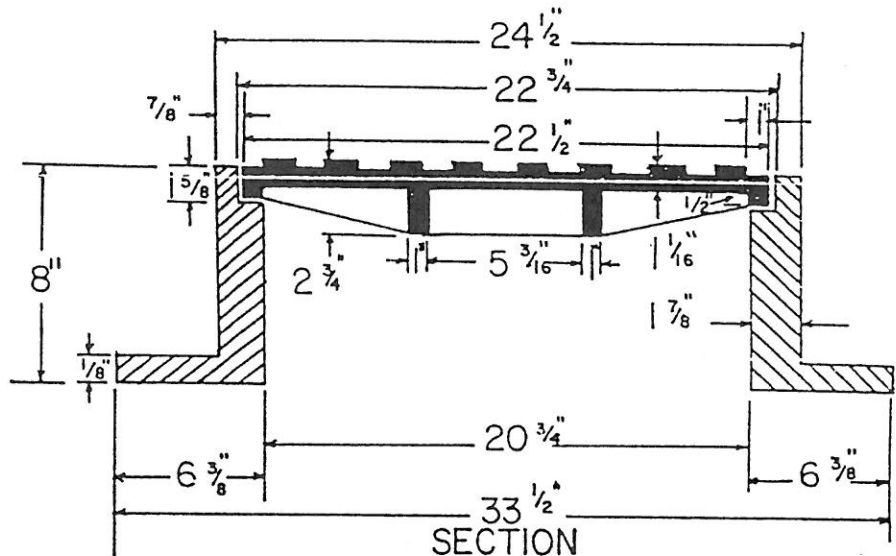


OFFSET CUL-DE-SAC

TYPE "A" RING AND COVER



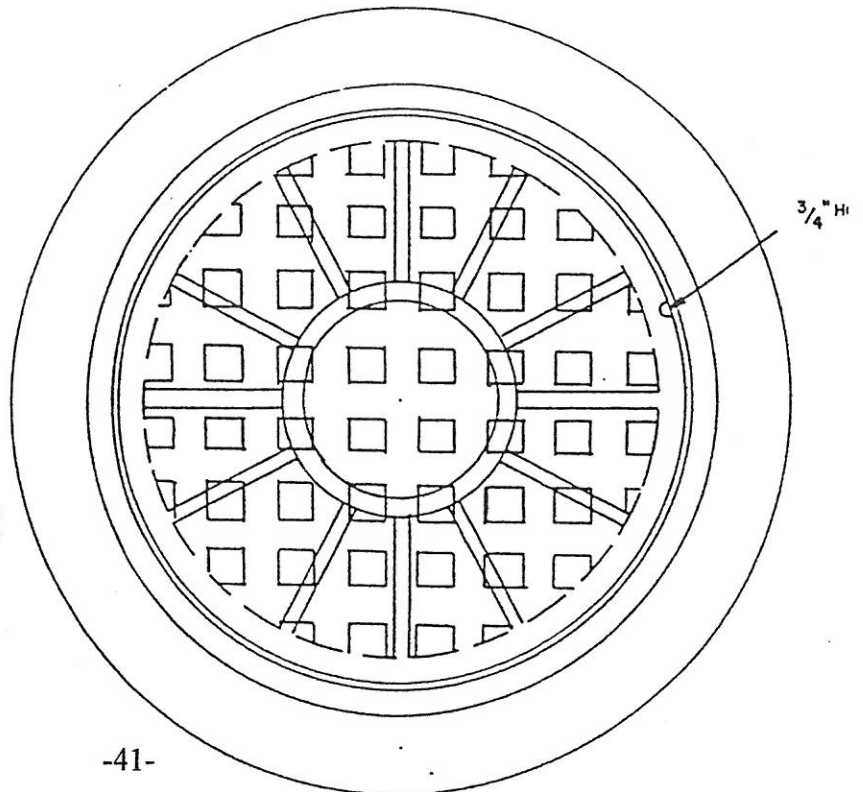
SECTION RING FOR SLAB
APPROXIMATE RING WEIGHT = 235 Lbs.



SECTION
HEAVY TRAFFIC MANHOLE RING AND COVER
APPROXIMATE RING WEIGHT = 370 Lbs.

TOTAL RING &
COVER WEIGHT
520 Lbs.

HEAVY TRAFFIC RING AND
COVER FOR STANDARD MANHOLE
APPROXIMATE LID WEIGHT =
150 Lbs.



Greene County
Design Standards

file code: e:dsgn3

TO: All Producers for Greene County
PROJECT: All SECTION:
ROUTE: All COUNTY: Greene
CLASS: PCCP HANDFINISHED Date: 1-1-91
AIR: YES Designed by: Greene Co. Hwy. Dept.

| | WT/FT | SP.G. | ABSORB. | AB.VOL |
|--------------------------------------------------|-------|-------|---------|--------|
| Source of C.A.: BURLINGTON LIMESTONE | 96 | 2.63 | 1 | .5850 |
| Source of F.A.: CLASS A RIVER SAND | 111 | 2.62 | .3 | .6789 |
| % Desired 38 | | | | |
| Cement | 94 | 3.15 | ----- | .4782 |
| Source - Fly Ash: MONTROSE GENERATING STATION | 94 | 2.62 | ----- | .5750 |

DESIGN ASSUMPTIONS

| Cement Factor | Gals. Wat/Sack | % Flyash | % Air |
|---------------|----------------|----------|-------|
| 6.35 | 5.0 | 15 | 5.5 |

| | |
|-----------------------------------|--------|
| Absolute Volume of Total Concrete | 4.2520 |
| Absolute Volume of Water/Sack | .6667 |
| Absolute Volume of Entrained Air | .2339 |
| Absolute Volume of Cement | .4065 |
| Absolute Volume of Fly Ash | .0862 |

Volume per Sack for Air, Cement, Fly Ash & Water 1.3933

| | |
|------------------------------------|-------------|
| Absolute Volume of Total Aggregate | 2.8587 |
| Absolute Volume of Fine Aggregate | 1.0863 |
| Fine Aggregate Proportion | 1.6001 1.60 |

| | |
|-------------------------------------|-------------|
| Absolute Volume of Coarse Aggregate | 1.7725 |
| Coarse Aggregate Proportion | 3.0299 3.05 |

FINAL PROPORTIONS ARE: 1.00 : 1.60 : 3.05

| MIX CHARACTERISTICS | BATCH WEIGHTS / | CUBIC YARD |
|--------------------------|-----------------|--------------|
| Volume of Cement .4065 | Cement | 506 lbs |
| Volume of Fly Ash .0862 | Fly Ash | 89 lbs |
| Volume of Sand 1.0862 | Sand | 1124 lbs |
| Volume of Stone 1.7843 | Stone | 1853 lbs |
| Volume of Water .6667 | Water | 31.7 gallon |
| Volume W/O Air 4.0299 | DRY YIELD | 21.29 cu.ft. |
| Volume with Water 4.2644 | TOTAL YIELD | 26.99 cu.ft. |

Absolute Volume of Entrained Air .2345
CEMENT FACTOR 6.33

PERCENT EXCESS MORTAR (E.M.)

| | | | |
|-----------------------|--------|-----------------|--------|
| Volume of C.A. | 3.0500 | Volume Mortar | 2.4801 |
| Abs. Volume of C.A. | 1.7843 | Excess Mortar | 1.2144 |
| VOIDS IN C.A. | 1.2657 | % EXCESS MORTAR | 96 |
| PERCENT AIR IN MORTAR | 9.5 | % ACTUAL SAND | 38 |

REMARKS:

Greene County
Design Standards

file code: e:dsgn4

TO: All Producers for Greene County
PROJECT: All SECTION:
ROUTE: All COUNTY: Greene
CLASS: PCCP MF Date: 1-1-91
AIR: YES Designed by: Greene Co. Hwy. Dept.

| | WT/FT | SP.G. | ABSORB. | AB.VOL |
|--------------------------------------------------|-------|-------|---------|--------|
| Source of C.A.: BURLINGTON LIMESTONE | 96 | 2.63 | 1 | .5850 |
| Source of F.A.: CLASS A RIVER SAND | 111 | 2.62 | .3 | .6789 |
| % Desired 38 | | | | |
| Cement | 94 | 3.15 | ----- | .4782 |
| Source - Fly Ash: MONTROSE GENERATING STATION | 94 | 2.62 | ----- | .5750 |

DESIGN ASSUMPTIONS

| | Gals. | Wat/Sack | % Flyash | % Air |
|--------------------------------------------------|--------|----------|----------|--------|
| Cement Factor 6.10 | | 4.8 | 15 | 5.5 |
| Absolute Volume of Total Concrete | | | 4.4262 | |
| Absolute Volume of Water/Sack | | | .6400 | |
| Absolute Volume of Entrained Air | | | .2434 | |
| Absolute Volume of Cement | | | .4065 | |
| Absolute Volume of Fly Ash | | | .0862 | |
| Volume per Sack for Air, Cement, Fly Ash & Water | | | | 1.3761 |
| Absolute Volume of Total Aggregate | | | 3.0501 | |
| Absolute Volume of Fine Aggregate | | | 1.1590 | |
| Fine Aggregate Proportion | | | 1.7072 | 1.70 |
| Absolute Volume of Coarse Aggregate | | | 1.8960 | |
| Coarse Aggregate Proportion | | | 3.2410 | 3.25 |
| FINAL PROPORTIONS ARE: | 1.00 : | | 1.70 : | 3.25 |

| MIX CHARACTERISTICS | | BATCH WEIGHTS / | CUBIC YARD |
|---------------------|--------|-----------------|--------------|
| Volume of Cement | .4065 | Cement | 487 lbs |
| Volume of Fly Ash | .0862 | Fly Ash | 86 lbs |
| Volume of Sand | 1.1541 | Sand | 1149 lbs |
| Volume of Stone | 1.9013 | Stone | 1900 lbs |
| Volume of Water | .6400 | Water | 29.2 gallon |
| Volume W/O Air | 4.1881 | DRY YIELD | 21.61 cu.ft. |
| Volume with Water | 4.4319 | TOTAL YIELD | 26.99 cu.ft. |

Absolute Volume of Entrained Air .2438
CEMENT FACTOR 6.09

PERCENT EXCESS MORTAR (E.M.)

| Volume of C.A. | 3.2500 | Volume Mortar | 2.5306 |
|-----------------------|--------|-----------------|--------|
| Abs. Volume of C.A. | 1.9013 | Excess Mortar | 1.1819 |
| VOIDS IN C.A. | 1.3487 | % EXCESS MORTAR | 88 |
| PERCENT AIR IN MORTAR | 9.6 | % ACTUAL SAND | 38 |

REMARKS: with paving machine

Greene County
Design Standards

file code: e:dsgn1

TO: All Producers for Greene County

PROJECT: All
ROUTE: All
CLASS: B
AIR: YES

SECTION:
COUNTY: Greene
Date: 1-1-91
Designed by: Greene Co. Hwy. Dept.

| | WT/FT | SP.G. | ABSORB. | AB.VOL |
|--------------------------------------------------|-------|-------|---------|--------|
| Source of C.A.: BURLINGTON LIMESTONE | 96 | 2.62 | 1 | .5872 |
| Source of F.A.: CLASS A RIVER SAND | 111 | 2.61 | .4 | .6816 |
| % Desired 38 | | | | |
| Cement | 94 | 3.15 | ----- | .4782 |
| Source - Fly Ash: MONTROSE GENERATING STATION | 94 | 2.62 | ----- | .5750 |

DESIGN ASSUMPTIONS

| Cement Factor | Gals. Wat/Sack | % Flyash | % Air |
|---------------|----------------|----------|-------|
| 5.80 | 5.2 | 15 | 5.5 |

| | |
|-----------------------------------|--------|
| Absolute Volume of Total Concrete | 4.6552 |
| Absolute Volume of Water/Sack | .6933 |
| Absolute Volume of Entrained Air | .2560 |
| Absolute Volume of Cement | .4065 |
| Absolute Volume of Fly Ash | .0862 |

| | |
|--------------------------------------------------|--------|
| Volume per Sack for Air, Cement, Fly Ash & Water | 1.4420 |
|--------------------------------------------------|--------|

| | |
|------------------------------------|---------------|
| Absolute Volume of Total Aggregate | 3.2132 |
| Absolute Volume of Fine Aggregate | 1.2210 |
| Fine Aggregate Proportion | 1.7914 - 1.80 |

| | |
|-------------------------------------|-------------|
| Absolute Volume of Coarse Aggregate | 1.9863 |
| Coarse Aggregate Proportion | 3.3827 3.40 |

FINAL PROPORTIONS ARE: 1.00 : 1.80 : 3.40

| MIX CHARACTERISTICS | | BATCH WEIGHTS / | CUBIC YARD |
|---------------------|--------|-----------------|------------|
| Volume of Cement | .4065 | Cement | 463 lbs |
| Volume of Fly Ash | .0862 | Fly Ash | 82 lbs |
| Volume of Sand | 1.2269 | Sand | 1157 lbs |
| Volume of Stone | 1.9965 | Stone | 1890 lbs |
| Volume of Water | .6933 | Water | 30.1 gal |
| Volume W/O Air | 4.4094 | DRY YIELD | 21.52 cf |
| Volume with Water | 4.6660 | TOTAL YIELD | 27.02 cf |

| | |
|----------------------------------|-------|
| Absolute Volume of Entrained Air | .2566 |
| CEMENT FACTOR | 5.79 |

PERCENT EXCESS MORTAR (E.M.)

| | | | |
|-----------------------|--------|-----------------|--------|
| Volume of C.A. | 3.4000 | Volume Mortar | 2.6695 |
| Abs. Volume of C.A. | 1.9965 | Excess Mortar | 1.2660 |
| VOIDS IN C.A. | 1.4035 | % EXCESS MORTAR | 90 |
| PERCENT AIR IN MORTAR | 9.6 | % ACTUAL SAND | 38 |

REMARKS:

Greene County
Design Standards

File code: e:dsgn2

TO: All Producers for Greene County
PROJECT: All SECTION:
ROUTE: All COUNTY: Greene
CLASS: B-1 Date: 1-1-91
AIR: YES Designed by: Greene Co. Hwy. Dept.

| | WT/FT | SP.G. | ABSORB. | AB.VOL |
|--------------------------------------------------|-------|-------|---------|--------|
| Source of C.A.: BURLINGTON LIMESTONE | 96 | 2.62 | 1 | .5872 |
| Source of F.A.: CLASS A RIVER SAND | 111 | 2.61 | .4 | .6816 |
| % Desired 38 | | | | |
| Cement | 94 | 3.15 | ----- | .4782 |
| Source - Fly Ash: MONTROSE GENERATING STATION | 94 | 2.62 | ----- | .5750 |

DESIGN ASSUMPTIONS

| Cement Factor | Gals. Wat/Sack | % Flyash | % Air |
|--------------------------------------------------|----------------|----------|-------------|
| 6.75 | 4.7 | 15 | 5.5 |
| Absolute Volume of Total Concrete 4.0000 | | | |
| Absolute Volume of Water/Sack .6267 | | | |
| Absolute Volume of Entrained Air .2200 | | | |
| Absolute Volume of Cement .4065 | | | |
| Absolute Volume of Fly Ash .0862 | | | |
| Volume per Sack for Air, Cement, Fly Ash & Water | | | 1.3394 |
| Absolute Volume of Total Aggregate 2.6606 | | | |
| Absolute Volume of Fine Aggregate 1.0110 | | | |
| Fine Aggregate Proportion | | | 1.4833 1.50 |
| Absolute Volume of Coarse Aggregate 1.6382 | | | |
| Coarse Aggregate Proportion | | | 2.7899 2.80 |
| FINAL PROPORTIONS ARE: 1.00 : 1.50 : 2.80 | | | |

MIX CHARACTERISTICS

BATCH WEIGHTS /

CUBIC YARD

| | | |
|--------------------------|-------------|--------------|
| Volume of Cement .4065 | Cement | 539 lbs |
| Volume of Fly Ash .0862 | Fly Ash | 95 lbs |
| Volume of Sand 1.0224 | Sand | 1122 lbs |
| Volume of Stone 1.6442 | Stone | 1812 lbs |
| Volume of Water .6267 | Water | 31.7 gallon |
| Volume W/O Air 3.7860 | DRY YIELD | 21.29 cu.ft. |
| Volume with Water 4.0063 | TOTAL YIELD | 27 cu.ft. |

Absolute Volume of Entrained Air .2203
CEMENT FACTOR. 6.74

PERCENT EXCESS MORTAR (E.M.)

| | | |
|----------------------------|-----------------|--------|
| Volume of C.A. 2.8000 | Volume Mortar | 2.3621 |
| Abs. Volume of C.A. 1.6442 | Excess Mortar | 1.2063 |
| VOIDS IN C.A. 1.1558 | % EXCESS MORTAR | 104 |
| PERCENT AIR IN MORTAR 9.3 | % ACTUAL SAND | 38 |

REMARKS:

Greene County
Design Standards

file code: e:dsgn6

TO: All Producers for Greene County
PROJECT: All SECTION:
ROUTE: All COUNTY: Greene
CLASS: B-2 Date: 1-1-91
AIR: YES Designed by: Greene Co. Hwy. Dept.

| | WT/FT | SP.G. | ABSORB. | AB.VOL |
|----------------------------------------------|-------|-------|---------|--------|
| Source of C.A.: CONCO QUARRIES, INC. | 96 | 2.62 | 1 | .5872 |
| Source of F.A.: MO, KS, OR ARK RIVER SAND | 111 | 2.61 | .4 | .6816 |
| % Desired 38 | | | | |
| Cement | 94 | 3.15 | ----- | .4782 |
| Source - Fly Ash: | 94 | 2.62 | ----- | .5750 |
| MONTROSE GENERATING STATION | | | | |

DESIGN ASSUMPTIONS

| | Gals. Wat/Sack | % Flyash | % Air |
|--------------------|----------------|----------|-------|
| Cement Factor 7.75 | 4.2 | 15 | 5.5 |

| | |
|-----------------------------------|--------|
| Absolute Volume of Total Concrete | 3.4839 |
| Absolute Volume of Water/Sack | .5600 |
| Absolute Volume of Entrained Air | .1916 |
| Absolute Volume of Cement | .4065 |
| Absolute Volume of Fly Ash | .0862 |

| | |
|--------------------------------------------------|--------|
| Volume per Sack for Air, Cement, Fly Ash & Water | 1.2443 |
|--------------------------------------------------|--------|

| | |
|------------------------------------|-------------|
| Absolute Volume of Total Aggregate | 2.2396 |
| Absolute Volume of Fine Aggregate | .8510 |
| Fine Aggregate Proportion | 1.2485 1.25 |

| | |
|-------------------------------------|-------------|
| Absolute Volume of Coarse Aggregate | 1.3876 |
| Coarse Aggregate Proportion | 2.3631 2.35 |

FINAL PROPORTIONS ARE: 1.00 : 1.25 : 2.35

| MIX CHARACTERISTICS | BATCH WEIGHTS / | CUBIC YARD |
|--------------------------|-----------------|--------------|
| Volume of Cement .4065 | Cement | 621 lbs |
| Volume of Fly Ash .0862 | Fly Ash | 110 lbs |
| Volume of Sand .8520 | Sand | 1078 lbs |
| Volume of Stone 1.3799 | Stone | 1753 lbs |
| Volume of Water .5600 | Water | 32.6 gallon |
| Volume W/O Air 3.2846 | | 21.17 cu.ft. |
| Volume with Water 3.4758 | DRY YIELD | 27.01 cu.ft. |

| | |
|----------------------------------|-------|
| Absolute Volume of Entrained Air | .1912 |
| CEMENT FACTOR | 7.77 |

PERCENT EXCESS MORTAR (E.M.)

| | | | |
|-----------------------|--------|-----------------|--------|
| Volume of C.A. | 2.3500 | Volume Mortar | 2.0959 |
| Abs. Volume of C.A. | 1.3799 | Excess Mortar | 1.1258 |
| VOIDS IN C.A. | .9701 | % EXCESS MORTAR | 116 |
| PERCENT AIR IN MORTAR | 9.1 | % ACTUAL SAND | 38 |

REMARKS:

Greene County
Design Standards

file code: e:dsgn5

TO: All Producers for Greene County
PROJECT: SECTION:
ROUTE: COUNTY: Greene
CLASS: CONCRETE BASE Date: 1-1-91
AIR: YES Designed by: Greene Co. Hwy. Dept.

| | WT/FT | SP.G. | ABSORB. | AB.VOL |
|----------------------------------------------|-------|-------|---------|--------|
| Source of C.A.: CONCO QUARRIES, INC. | 96 | 2.63 | 1 | .5850 |
| Source of F.A.: MO, KS, OR ARK RIVER SAND | 111 | 2.63 | .4 | .6764 |
| % Desired 38 | | | | |
| Cement | 94 | 3.15 | ----- | .4782 |
| Source - Fly Ash: | 94 | 2.62 | ----- | .5750 |
| MONTROSE GENERATING STATION | | | | |

DESIGN ASSUMPTIONS

| Cement Factor | Gals. Wat/Sack | % Flyash | % Air |
|---------------|----------------|----------|-------|
| 8.50 | 5.0 | 0 | 5.5 |

| | |
|-----------------------------------|--------|
| Absolute Volume of Total Concrete | 3.1765 |
| Absolute Volume of Water/Sack | .6667 |
| Absolute Volume of Entrained Air | .1747 |
| Absolute Volume of Cement | .4782 |
| Absolute Volume of Fly Ash | .0000 |

Volume per Sack for Air, Cement, Fly Ash & Water 1.3196

| | |
|------------------------------------|-------------|
| Absolute Volume of Total Aggregate | 1.8569 |
| Absolute Volume of Fine Aggregate | .7056 |
| Fine Aggregate Proportion | 1.0432 1.05 |

| | |
|-------------------------------------|-------------|
| Absolute Volume of Coarse Aggregate | 1.1467 |
| Coarse Aggregate Proportion | 1.9602 1.95 |

FINAL PROPORTIONS ARE: 1.00 : 1.05 : 1.95

| MIX CHARACTERISTICS | BATCH WEIGHTS / | CUBIC YARD |
|--------------------------|-----------------|-------------|
| Volume of Cement .4782 | Cement | 801 lbs |
| Volume of Fly Ash .0000 | Fly Ash | 0 lbs |
| Volume of Sand .7102 | Sand | 993 lbs |
| Volume of Stone 1.1408 | Stone | 1595 lbs |
| Volume of Water .6667 | Water | 42.6 gallon |
| Volume W/O Air 2.9959 | | |
| Volume with Water 3.1703 | DRY YIELD | 19.84 |

Absolute Volume of Entrained Air .1744
CEMENT FACTOR 8.52

PERCENT EXCESS MORTAR (E.M.)

| | | | |
|---------------------|--------|-----------------|--------|
| Volume of C.A. | 1.9500 | Volume Mortar | 2.0295 |
| Abs. Volume of C.A. | 1.1408 | Excess Mortar | 1.2203 |
| VOIDS IN C.A. | .8092 | % EXCESS MORTAR | 150.8 |
| | | % ACTUAL SAND | 38.1 |

REMARKS: One size paving stone mix without fly ash. Note addition cement has been added to this mix to provide for high ear strength concrete requirement.