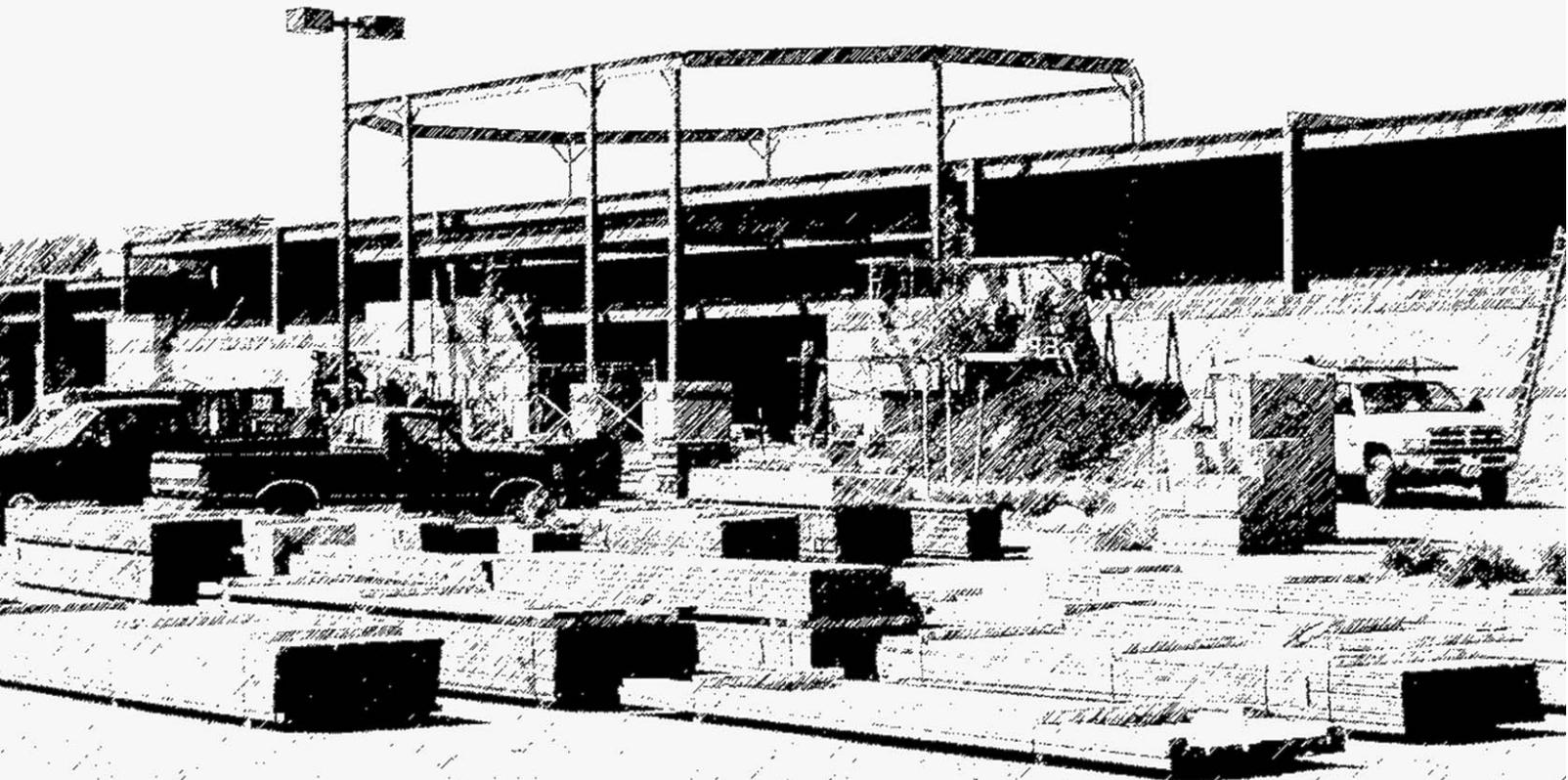


County of Monmouth

DEVELOPMENT REGULATIONS

Volume II

DESIGN STANDARDS



Adopted by the Board of Chosen Freeholders

Prepared and Administered by the Monmouth County Planning Board

County of Monmouth

DEVELOPMENT REGULATIONS

Volume II

DESIGN STANDARDS

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MONMOUTH COUNTY DEVELOPMENT REGULATIONS

DESIGN STANDARDS

VOLUME II

1.0 INTRODUCTION

The purpose of this document is to provide a comprehensive list of plan requirements, design standards, and guidelines for preparing engineering plans, studies and analyses in connection with subdivision and site plan applications requiring review by the Development Review Committee of the Monmouth County Planning Board. Figures containing design standards and details are included at the end of this document.

The following publications have been consulted for the purpose of developing the design standards, and shall be applicable to design of traffic control devices, bridges, culverts, roadway and roadside features:

- A Policy on Geometric Design of Highways and Streets - American Association of State Highway and Transportation Officials (AASHTO) most current addition.
- Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)
- New Jersey Department of Transportation Roadway Design Manual
- New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction
- Monmouth County Supplementary Specifications to the NJDOT Standard Specifications for Road and Bridge Construction

2.0 PLAN AND PLAT DETAILS

The plan and plat details listed below are generally considered to be the minimum details required to conduct a proper review of an application for development. The Monmouth County Engineer may require additional details and information not listed based on the scope and characteristics of the application. However, the county engineer may conduct a review and make recommendations to the Monmouth County Development Review Committee on an application for development that does not contain all of the plan and plat details listed if it is determined by the county engineer, that sufficient details and sufficient information has been provided with the application to conduct a proper review.

All plan and plat sheets shall include a title block containing the title of the plan, the project reference, block and lot numbers and municipality in which the development is located as appropriate, the scale of the plan, the name, address, license number, signature and embossed seal of the person preparing the plan, the date of original plan preparation and a list of revision dates.

2.1 SKETCH PLAT/CONCEPTUAL PLAN FOR SUBDIVISION OR SITE PLAN

The sketch plat/conceptual plan shall be based on the municipal tax map or some similarly accurate base information as a minimum.

The sketch plat/conceptual plan must be drawn at a scale of at least 1" = 100' if the area to be developed contains 120 acres or less and at a scale of at least 1" = 200' if the area to be developed contains more than 120 acres.

The sketch plat/conceptual plan shall include but is not limited to the following information:

- A key map at a scale of 1"=2,000' that clearly defines the area proposed for development, the location of the site and its relationship to the surrounding area.
- The name and address of the owner of the property proposed for development.
- The name and address of the applicant.
- The name and address of the person and firm preparing the plat/plan.
- The portion of the lot being subdivided or developed and the remainder if the entire tract is not proposed for development, and the area of each.
- The municipal tax block and lot numbers.
- A north arrow.
- The scale of the plat/plan (written and graphic).
- The zoning district in which the proposed development is located and a schedule of zone requirements, e.g.; lot area, frontage, depth and set-back requirements, density, floor area ratio, percent of lot coverage, and parking requirements with a comparison of zoning compliance relative to the proposed development.
- The location of existing structures within the area to be developed and within 200' of the site with an indication of which structures are to remain or to be raised.

- The location of existing roads and driveways within the area to be developed and within 200' of the site and dimensions of the right-of-way widths of the existing and proposed roads.
- The location of existing railroads within the area to be developed and within 200' of the site.
- The location of the proposed buildings if the application is for a development other than a subdivision.
- The number of proposed lots or dwelling units as applicable.
- The total number of square feet of the proposed building(s) if the building(s) is for either non-residential development or for mid-rise or high-rise residential development.
- The location of proposed parking areas.
- The location of proposed roads and/or driveways.
- The proposed lot lines and lot lines to be eliminated.
- The site topography and topography of land within 200' of the site shown at 2' contours.
- The location and direction of flow of existing streams, brooks swales, ditches, lakes, ponds, and drainage structures and drainage systems on the site to be developed and within 200' of the site.
- A delineation of the existing wood lines and clusters of trees within the area to be developed and along the existing road frontage.
- The location and width of all utility easements, drainage easements, access easements, etc., within the site to be developed and within 200' of the site.
- The location of any traffic signals along the site frontage or within 500' of the site.
- The phases or section boundaries of the development, if applicable.

2.2 PRELIMINARY SUBDIVISION PLANS (SUBDIVISION CONSTRUCTION PLANS)

Each preliminary plan sheet shall be either 24"X36" or 30"X42" and shall be of a scale of not less than 1"=50'.

Preliminary plans (subdivision construction plans) shall consist of a title sheet, a survey plat of the entire tract and the area to be developed, a lot layout plan, a lot yield plan, a topographic and drainage plan, drainage basin and drainage area

maps, a tree save plan, a landscape plan, a utility plan, road, drainage and utility profiles, stream profiles, road cross sections, stream cross sections, a lighting plan, a wetlands delineation plan, a strip map/plan of county road improvements, a traffic line striping and sign plan, a traffic control plan, soil logs, a soil erosion and sedimentation control plan, and detail sheets.

Preliminary plans (subdivision construction plans) that combine the features listed separately in the preceding paragraph, such as a single plan showing drainage and utility features or a plan showing landscaping and lighting features, will be accepted for review provided the details of the individual features are shown clearly and are distinguishable without the plan being cluttered, confusing or difficult to interpret.

2.2-1 TITLE SHEET

The title sheet of the preliminary plans (subdivision construction plans) shall include but is not limited to the following:

- A key map at a scale of 1"=2,000' that clearly defines the area proposed for development, the location of the site and its relationship to the surrounding area and a north arrow.
- The name and address of the applicant.
- The name and address of the owner of the property proposed for development.
- The name and address of the person and firm preparing the plat/plan with license number, seal and signature.
- The portion of the lot being subdivided or developed and the remainder if the entire tract is not proposed for development and the area of each.
- The municipality(ies) within which the development is located, the municipal tax block and lot numbers that the development is located on and the block and lot numbers of properties located within 200' of the development.
- A list of the names of the owners of property located within 200' of the development by block and lot numbers.
- A listing of the titles of each sheet and sheet numbers contained in the preliminary set of plans.
- A north arrow.
- The scale of the plat/plan (written and graphic).
- The zoning district in which the proposed development is located and a

schedule of zone requirements, e.g.; lot area, density, lot frontage and depth, setbacks, and parking with a comparison of that provided relative to the proposed development.

- A table of the development standards required and/or permitted under the zone district within which the development is located and that which is provided under the proposed development plan.

Example:

Front Yard Setback Required 75'	Front Yard Setback Provided 80'
Number of Lots Permitted 35 (@ 1 per acre)	Number of Lots Proposed 34
Minimum Frontage Permitted 250'	Minimum Frontage Provided 260'

- The number of proposed lots or dwelling units as applicable.
- The total number of square feet of the proposed building(s) if the building(s) is for either non-residential development or for mid-rise or high-rise residential development.

2.2-2 SURVEY PLAT

The survey of the property to be developed shall include but is not limited to the following:

- The name and address of the owner of the property proposed for development.
- The municipality within which the property is located and municipal tax block and lot numbers of the property that the development is located on.
- North arrow.
- The scale of the plat/plan (written and graphic).
- Existing lot lines with bearings and distances on the property being subdivided including any remainder.
- Existing survey monuments and markers on the property being subdivided including any remainder.
- Existing buildings and structures with type of use indicated on the property being subdivided including any remainder, and within 100' of the

property being subdivided.

- Existing roads, driveways, curbs, sidewalks storm water and utility inlets and manholes on the property being subdivided including any remainder, and within 100' of the property being subdivided.
- Existing easements (e.g. utility, drainage, sight triangle and access) and road rights-of-way on and abutting the property subdivided including any remainder.
- Existing road right-of-way centerline with dimensions to the existing right-of-way lines on either side of the road on and abutting the property subdivided including any remainder.
- Existing utilities with identification references as applicable (e.g., pole number and utility company) on the property being subdivided including any remainder, and within 100' of the property being subdivided.
- The location, size and direction of flow of all streams, brooks, drainage structures and drainage ditches on the property being subdivided including any remainder, and within 100' of the property being subdivided.
- The location and jurisdiction of existing traffic control devices within 100' of the property being subdivided including any remainder.
- A title block with the name of the person and firm preparing the plat with seal and signature.

2.2-3 LOT LAYOUT PLAN

The lot layout plan shall include but is not limited to the following:

- A north arrow.
- The scale of the plat/plan (written and graphic).
- The existing and proposed lot lines and notes indicating which lot lines are to be removed, if applicable.
- The right-of-way lines of each proposed road.
- The easement boundary lines of all drainage easements, sight triangle easements (see figure 5), access easements, conservation easements, stream easements, bridge or culvert easements, etc.
- The existing and proposed right-of-way lines of all existing roads.

- The full width dimension of all existing and proposed road rights-of-way, drainage easements, stream easements and access easements.
- The dimension of all right-of-way corner radii.
- The centerline of the right-of-way of all existing roads.
- The dimension of the existing and proposed right-of-way half width to the hundredths of a foot, as measured from the right-of-way centerline.
- The bearing and distance of each road right-of-way line and easement line.
- The bearing and distance of each lot line of each lot.
- The building setback lines of each lot in accordance with municipal zoning requirements.
- The area of each lot and the width of each road right-of-way.
- The phases or section boundaries of the development, if applicable.
- The proposed block and lot numbers
- The proposed street names

2.2-4 LOT YIELD PLAN

The lot yield plan shall be provided when a cluster design of the development is employed as permitted under municipal zoning regulations. The lot yield plan shall show the lot layout and road system as if a conventional subdivision design was employed in accordance with municipal zoning requirements.

The lot yield plan shall include but is not limited to the following:

- A north arrow.
- The scale of the plat/plan (written and graphic).
- The proposed lots and rights-of-way of each proposed road.
- The dimension of each lot line of each lot.
- The building setback lines of each lot in accordance with municipal zoning requirements.
- The area of each lot and the width of each road right-of-way.

2.2-5 A TOPOGRAPHIC, DRAINAGE AND UTILITY PLAN

A separate Utility Plan showing general drainage features and detailed utility features will be required for review where such is necessary for clarity and ease of interpretation of the individual plan features.

The topographic, drainage and utility plan shall include but is not limited to the following:

- A north arrow.
- The scale of the plat/plan (written and graphic).
- The plan shall include a survey baseline with stations and baseline offset dimensions at all points of curvature, points of tangency, angle points, beginning and end of work, manholes, storm sewer inlets, etc...
- The existing and proposed fences within the development and within 100' of the development.
- The existing and proposed edges of road pavement along county roads and along municipal roads that contain county drainage structures.
- The proposed edges of pavement for all new roads within the proposed subdivision.
- The location and width of existing and proposed roads and/or driveways within the development, on the opposite side of the existing road(s) that abut the development and within 200' of the development.
- The location and width of all existing and proposed depressed curb and vertical curb tapers.
- The location and dimension of existing and proposed driveway aprons.
- The location of existing and proposed handicap ramps.
- The location and width of sidewalks within the development and within 100' of the development.
- The existing and proposed curbs with notations indicating where existing curb is to be removed and/or replaced.
- The dimension of all curb radii.
- The beginning and end of new curb and where new curb is to meet existing curb.

- The existing and proposed retaining walls within the development and within 100' of the development with top of wall and bottom of wall elevations.
- The beginning and end of portions of existing roads to be milled and resurfaced, reconstructed or restored and a graphic representation of the areas to be milled and resurfaced, restored or reconstructed.
- The location of existing buildings with a note indicating which buildings are to remain and which buildings are to be removed.
- The location of each proposed building with first floor elevations indicated.
- The type of use of the existing and proposed buildings.
- The proposed lot lines and existing lot lines that are to be eliminated.
- The phases or section boundaries of the development, if applicable.
- The existing and proposed site topography and topography of land within 200' of the site shown at 2' contours.
- The high point of each road within the subdivision and within 350' of the subdivision.
- The location and width of all existing and proposed utility easements, drainage easements, access easements, landscape easements, conservation easements etc., within the site to be developed and within 200' of the site.
- The location, size, slope and type of material of existing and proposed underground utilities with invert and rim elevations at manholes
- The location of existing and proposed septic fields.
- The existing and proposed location of all utility poles and above ground utility equipment, including pumping stations and sanitary sewer treatment plants on and adjacent to the site and within 200' of the site and the identification number of all utility poles on and adjacent to the site and within 200' of the site.
- The location and direction of flow of existing streams, brooks, swales, ditches and other water courses on the site to be developed and within 200' of the site. The direction of flow is to be designated with arrows.
- The location of existing and proposed retention and detention facilities, including recharge basins and dry wells, sub-surface retention or detention facilities, lakes and ponds.

- The normal water surface elevation of all existing and proposed lakes and ponds within the site and within 200' of the site.
- The size, percent of slope, type, class of pipe and length of each segment of pipe of existing and proposed storm sewer systems on the site and within 200' of the site.
- The invert elevations of all storm sewer pipes at the beginning and end of each segment of pipe at storm sewer inlets, manholes, headwalls, flared end sections, detention and retention facility outlet structures, weirs, etc... At storm sewer inlets and manholes the invert elevations are to show which pipes are in-flowing and which are out-flowing.
- The elevations at the top and bottom of headwalls and weirs.
- The existing and proposed grate elevation of all storm sewer inlets.
- The existing and proposed rim elevations of all storm sewer manholes.
- The location and type of existing and proposed storm sewer inlets and manholes.
- The existing and proposed top of curb and gutter elevations at 50' intervals except that additional elevations may be required at intersections to assure positive drainage or in areas where the minimum required slope cannot be achieved (see figure 17).
- The location and dimension of rip-rap aprons.
- Wetlands delineation, 100 year flood hazard lines and stream encroachment lines within the site and within 100' of the site.
- The percent of slope between each of the proposed gutter grades.
- The location of soil borings.
- The location of all existing and proposed guiderail and the type of guiderail end treatment.

2.2-6 TRAFFIC CONTROL PLAN/DETOUR PLAN

A Traffic Control Plan/Detour Plan shall be submitted where it is necessary to close a portion of or the entire county road to accommodate road widening, road reconstruction or utility work or where it is necessary to close a portion of or all of a municipal road for the extension of or reconstruction of a county drainage structure.

The Traffic Control Plan/Detour Plan shall include but is not limited to the following:

- The type, size and location of traffic control devices that shall be used during construction.
- If the county road or municipal road at a county drainage structure is to be totally closed, a detour plan shall be submitted that indicates the route traffic will be diverted to during construction.
- The detour plan shall be approved by all other applicable bodies and agencies retaining jurisdiction (e.g. municipal police, municipal engineer, New Jersey Department of Transportation, etc.).

2.2-7 TRAFFIC SIGNING AND STRIPING PLAN

A Traffic signing and striping plan shall include but is not limited to the following:

- A north arrow.
- The scale of the plat/plan (written and graphic)
- Existing painted centerlines, traffic islands, cross hatching, lane lines, shoulder lines/edge lines and stop bars, existing designated turn lanes, painted arrows, words and/or symbols, existing passing and no-passing zones, existing cross-walks, existing parking spaces and no-parking zones existing loading zones and reflective pavement markers on the existing roads that border the development and are within 500' of the development.
- Proposed painted centerlines, traffic islands, cross hatching, lane lines, shoulder lines/edge lines and stop bars, proposed designated turn lanes, painted arrows, words and/or symbols, proposed passing and no-passing zones, proposed crosswalks, proposed parking spaces and no-parking zones, loading zones and proposed reflective pavement markers on the existing and proposed roads that border the development and are within 500' of the development and proposed road approaches to a county road (see figures 9, 10, 11 & 12).
- Dimension of existing and proposed traffic lanes, shoulders and transitions.
- The location and length of existing traffic line striping to be removed and grinding specified as the method used for removal.
- The width, color and material of all proposed traffic line striping in accordance with Monmouth County standards.
- All existing and proposed traffic signs with the Manual of Uniform Traffic Control Devices (MUTCD) designation and sizes, colors and legends if custom designed.

2.2-8 ROAD PLAN AND PROFILES

Road profiles shall include but are not limited to the following:

- The scale of the plan both horizontal and vertical.
- Baseline stations at 50' intervals.
- Existing and proposed crown of the road.
- Existing and proposed top of curb and gutter of the road.
- Existing and proposed crown, gutter and top of curb elevations at 50' intervals.
- Percent of the existing and proposed slope along the crown between stations.
- Percent of the existing and proposed slope along the gutter between stations.
- Percentage of the existing and proposed slope along the top of curb between stations.
- Location of existing and proposed underground utilities with slope of pipe and invert and manhole rim elevations.
- Location of existing and proposed storm sewers with slope of pipe, invert elevations and grate elevations at storm sewer inlets and invert and rim elevations at manholes.
- Location of existing and proposed drainage structures such as bridges, culverts and pipes that convey storm water flow across the road, with invert elevations.

2.2-9 ROAD CROSS SECTIONS

Road cross sections shall include but are not limited to the following:

- The scale of the plan both horizontal and vertical.
- Road Cross Sections shall be shown with station designations at 50' intervals and shall include the following:
 - Existing and proposed crown elevations.
 - Existing and proposed gutter elevations.

- Existing and proposed top of curb elevations.
- Elevations at the existing and/or proposed right-of-way line.
- Percent of proposed road cross slope between the crown and the existing edge of pavement and between the existing edge of pavement and proposed edge of pavement.
- Percent of slope between the existing and/or proposed right-of-way line and proposed edge of road pavement.
- Location of existing and proposed underground utilities with stations and pipe data such as size, type of pipe at road crossings and inverts and rim elevations at manholes.
- Location of existing and proposed storm sewers with stations and pipe data such as size, type of pipe at road crossings and inverts and grate elevations at inlets.
- Location of existing and proposed drainage structures such as bridges, culverts and pipes that convey storm water flow across the road, with type, size and invert elevations.

2.2-10 STREAM PROFILES

Stream profiles shall include but are not limited to the following:

- Station designations at 50' intervals.
- The scale of the plan both horizontal and vertical.
- Normal water surface elevation
- Top of bank elevations
- Bottom of stream elevations
- The 100 year flood elevation

2.2-11 STREAM CROSS SECTIONS

Stream cross sections shall include but are not limited to the following:

- The scale of the plan both horizontal and vertical.
- Stream cross sections shall be shown with station designations at 50' intervals and must include but are not limited to the following:

- Normal water surface elevation
- Top of bank elevations
- Bottom of stream elevations
- The 100 year flood elevation

2.2-12 TREE SAVE PLAN

A Tree Save Plan shall include but is not limited to the following:

- A north arrow
- The scale of the plan (written and graphic)
- The limits of wooded areas within the county road right-of-way and within 50' of the proposed county road right-of-way if these areas are densely wooded.
- Identification of trees to be saved within densely wooded areas.
- Identification of trees to be removed within densely wooded areas.
- The diameter of the trunks of existing trees measured at breast height within the county road right-of-way and within 50' of the proposed right-of-way for areas that are not densely wooded.
- The genus, species and common name of the existing trees within the county road right-of-way and within 50' of the proposed right-of-way for areas that are not densely wooded.
- Identification of trees to be removed and trees to be saved within the county road right-of-way and within 50' of the proposed right-of-way for areas that are not densely wooded.
- The method of protecting existing trees that are to be saved, during construction.

2.2-13 LANDSCAPE PLAN

A Landscape Plan shall include but is not limited to the following:

- A north arrow
- The scale of the plan (written and graphic)
- A delineation of the existing wood lines and clusters of trees within the area

to be developed and along the existing road frontage.

- The diameter of trees measured at breast height, genus and species of trees, shrubs and ground cover, identification of perennials, annuals and other features and materials within the existing and proposed right-of-way and the diameter of trees measured at breast height, genus and species of trees, shrubs and ground cover, identification of perennials, annuals and other features and materials such as rocks, water, walls, fences and paving materials within 50' of the existing and proposed county road right-of-way. Clusters of trees within this area may be generally described.
- Identification of trees, shrubs, ground cover, perennials and annuals to be planted within the county road right-of-way and within 50' of the proposed right-of-way and other materials such as rocks, water, walls, fences, and paving materials to be installed within the existing and proposed county road right-of-way and within 50' of the existing and proposed county road right-of-way.
- The number of trees, and shrubs to be planted along a tree line or within clusters grouped by genus and species and the number and identification of ground cover, perennials and annuals to be planted within the county road right-of-way and within 50' of the proposed right-of-way.
- A legend of symbols used to identify the genus and species of trees and shrubs to be planted.
- A plant list of trees and shrubs identifying the genus, species and common name of proposed trees, shrubs and ground cover to be planted within the county road right-of-way and within 50' of the proposed right-of-way. The list must include the size of the trees and/or shrubs to be planted and the average height of the planting at maturity.
- The location of existing and proposed sidewalks, fences, decorative walls, retaining walls and berms.
- Existing and proposed contour lines at 50' intervals.
- The location of all landmark trees within the project site and/or county right-of-way. Each tree shall be indicated on the landscape plan with an identification number, species name, diameter, elevation at plant base, and area of critical root zone or drip line. Landmark trees are defined as: (1) a tree associated with an historic event or person, (2) a tree having a direct impact on the development of an area; (3) a tree associated with a scenic view or focal point; or (4) a tree that has become noteworthy as a result of rarity or due to a peculiar, or rare, abnormality.
- The location of all Significant Trees, (defined as the largest known individual trees of each species in New Jersey as listed by the New Jersey Department

of Environmental Protection (NJDEP) Bureau of Forestry; large trees approaching the diameter of the known largest tree: and/or species that are rare to that area or of particular horticultural or landscape value).

- A schedule of planting by optimum season. Schedule shall also include known time periods when specific plant material should not be installed.
- Details for the method of construction for all rock placements, water features, sculptures, monuments, art, fences, walls, and other building and paving materials located adjacent to the county right-of-way.
- Identification of areas to receive top soil and seed or sod.
- Delineation of all easements including but not limited to: conservation easements, landscape buffer easements and sight triangle easements (see figure 5), drainage easements, utility easements, etc.
- Details of methods used to plant the trees and shrubs.
- Details of the rate of application of grass seed and method of planting.

2.2-14 SITE DRAINAGE AREA MAPS

Two site drainage area maps must be submitted. One pre-development drainage area map and one post-development drainage area map.

Drainage Area Maps must include but are not limited to the following:

2.2-14.1 Pre-Development Drainage Area Map

- A north arrow
- The scale of the plan (written and graphic)
- Site topography with contours at 2' intervals.
- A delineation of each existing sub-drainage basin within the area to be developed and a delineation of existing basins that lie partially within the site but that extend off-site.
- An identifying reference for each drainage basin depicted on the drainage area map.
- The area of each existing sub-basin shown on the drainage area map with the existing rate of storm water runoff generated within each sub-basin for the two (2), ten (10), twenty-five (25) and one hundred (100) year storm event.

2.2-14.2 Post Development Drainage Area Map

- A north arrow
- The scale of the plan (written and graphic)
- Site topography with contours at 2' intervals.
- A delineation of each proposed sub-drainage basin within the area to be developed and a delineation of proposed basins that lie partially within the site but that extend off-site.
- An identifying reference for each drainage basin depicted on the drainage area map.
- The area of each proposed sub-basin shown on the drainage area map with the proposed rate of storm water runoff generated within each sub-basin for the two (2), ten (10), twenty-five (25) and one hundred (100) year storm event.

2.2-15 DRAINAGE AREA MAPS OF DRAINAGE AREAS TRIBUTARY TO COUNTY DRAINAGE STRUCTURES

Drainage Area Maps shall include but are not limited to the following:

- A delineation of the site area that drains to the county drainage structure and a delineation of the total upland drainage area that drains to the county drainage structure depicted on a map that includes site topography. This map must include the amount of the site in acres, that drains to the county drainage structure and the amount of the total upland drainage area in acres, that drains to the county drainage structure.

2.2-16 SOIL EROSION AND SEDIMENTATION CONTROL PLAN

The Soil Erosion and Sedimentation Control Plan shall include all the appropriate measures, methods and techniques to control soil erosion and sedimentation as required by the Freehold Soil Conservation District pursuant to the New Jersey Soil Erosion and Sedimentation Control Act (NJSA 4:24-39).

2.2-17 DETAIL SHEETS

Detail sheets are to be placed at the end of the set of preliminary plans (subdivision construction plans). Generally details of Soil Erosion and Sedimentation Control measures should be placed on separate sheets. Any combination of details placed on single sheets for features such as: water and sewer utilities, storm water management facilities and drainage systems, pavement, sidewalk and curb construction, landscape, retaining walls, lighting, site identification signs and traffic signs, will be accepted for review provided the details of the individual features are shown

clearly and are distinguishable without the plan being cluttered, confusing or difficult to interpret.

Detail sheets shall include but are not limited to the following:

- Typical cross section of a county road in accordance with Monmouth County standards (see figure 3).
- Storm sewer inlet and manhole chamber details for each type to be constructed and for existing inlets or manholes to be modified (see figure 19).
- Storm sewer grate casting and manhole casting detail for each type to be constructed and for each existing inlet and manhole to be modified.
- Storm sewer flared end section, headwall and storm water retention and detention outlet structure details
- Storm sewer weir/orifice and trash rack details for outlet structures
- County storm sewer system pipe bedding detail
- Soil logs
- County road pavement cross section detail (figures 3 & 4)
- County road full faced curb detail (see figure 4)
- County road depressed curb detail (see figure 14)
- County road vertical curb taper detail (see figure 15)
- County road pavement repair detail (with existing curb) (see figure 4)
- County pavement repair detail (without existing curb) (see figure 4)
- Concrete driveway apron detail (see figure 13)
- Sidewalk detail
- Handicap ramp detail
- Traffic sign details in accordance with the Manual of Uniform Traffic Control Devices
- Traffic sign post and installation details in accordance with Monmouth County standards (see figure 8)
- Reflective pavement marker detail

- Traffic signal and foundation details in accordance with Monmouth County standards
- Guiderail details including end treatments in accordance with New Jersey Department of Transportation standards
- Brick paver detail
- Grass concrete paver detail
- Ballard and ballard installation detail
- Fence and fence installation detail
- Deciduous tree planting detail
- Evergreen tree planting detail
- Deciduous and evergreen shrub planting detail
- Guying and staking detail for trees
- Tree protection detail
- Stabilized construction entrance detail
- Silt fence installation detail
- Inlet filter detail
- Sanitary sewer manhole detail
- Water hydrant and valve installation detail
- Water and sewer pipe bedding detail
- Thrust block detail
- Light pole and foundation details

2.3 FINAL SUBDIVISION PLAT

Each final subdivision plat shall be either 24”X36” or 30”X42” and shall be of a scale of not less than 1”=50’.

The final subdivision plat shall be prepared in accordance with the New Jersey Map Filing Law (NJSA 46:23-9.8) and shall include but is not limited to the following:

- A key map at a scale of 1"=2,000' that clearly defines the area proposed for development, the location of the site and its relationship to the surrounding area.
- The name and address of the owner of the property proposed for development.
- The name and address of the applicant.
- A north arrow.
- The scale of the plat/plan (written and graphic).
- The block and lot numbers of all proposed lots within the subdivision.
- The name of streets within the subdivision and adjacent to the subdivision.
- The setback lines in accordance with municipal zoning requirements.
- The location of each proposed building.
- The proposed lot lines and existing lot lines that are to be eliminated.
- Bearings and distances of all lots lines within the subdivision.
- Monmouth County road right-of-way with dimensions from the centerline to the right-of-way line with bearings and distances along the boundary of the right-of-way.
- Sight triangle easements (see figure 5), drainage easements, construction easements, access easements, conservation easements, easements for landscape buffers, utility easements, easements for maintenance and reconstruction of county drainage structures and drainage facilities with bearings and distances along the boundary of each easement.
- Notations indicating rights-of-way, sight triangle easements (see figure 5), drainage easements, construction easements, access easements, easements for maintenance and reconstruction of county drainage structures and drainage facilities, granted and/or dedicated to the County of Monmouth.
- The location of existing railroad rights-of-way within and adjacent to the area to be developed.
- The number of proposed lots.

2.4 SITE PLANS

Each site plan sheet shall be either 24"X36" or 30"X42" and shall be of a scale of not less than 1"=50'.

Site plans shall consist of a title sheet, a survey plat of the entire tract and the area to be developed, a topographic and drainage plan, drainage basin and drainage area maps, a tree save plan, a landscape plan, a utility plan, road, drainage and utility profiles, stream profiles, road cross sections, stream cross sections, a lighting plan, a wetlands delineation plan, a strip map/plan of county road improvements, a traffic line striping and sign plan, a traffic control plan, soil logs, a soil erosion and sedimentation control plan, and detail sheets.

Site plans that combine the features listed separately in the preceding paragraph, such as a single plan showing drainage and utility features or a plan showing landscaping and lighting features, will be accepted for review provided the details of the individual features are shown clearly and are distinguishable without the plan being cluttered, confusing or difficult to interpret.

2.4-1 TITLE SHEET

The title sheet of the site plans shall include but is not limited to the following:

- A key map at a scale of 1"=2,000' that clearly defines the area proposed for development, the location of the site and its relationship to the surrounding area and a north arrow.
- The name and address of the applicant.
- The name and address of the owner of the property proposed for development.
- The name and address of the person and firm preparing the plat/plan with license number, seal and signature.
- The portion of the lot being developed and the remainder if the entire tract is not proposed for development and the area of each.
- The municipality(ies) within which the development is located, the municipal tax block and lot numbers that the development is located on and the block and lot numbers of properties located within 200' of the development.
- A list of the names of the owners of property located within 200' of the development by block and lot numbers.
- A listing of the titles of each sheet and sheet numbers contained in the set of site plans.
- A north arrow.
- The scale of each sheet in the set of site plans (written and graphic).
- The zoning district in which the proposed development is located and a

schedule of zone requirements, e.g.; lot area, density, floor area ratio, percentage of lot coverage, lot frontage, depth and setback requirements, and parking requirements with a comparison of compliance with zoning requirements relative to the proposed development.

- A table of the development standards required and/or permitted under the zone district within which the development is located and that which is provided under the proposed development plan.

Example:

Front Yard Setback Required 75'	Front Yard Setback Provided 80'
% of Lot Coverage Permitted 56%	% of Lot Coverage Provided 60%
Minimum Frontage Permitted 250'	Minimum Frontage Provided 260'

- The number of proposed dwelling units as applicable.
- The total number of square feet of the proposed building(s) if the building(s) is for either non-residential development or for mid-rise or high-rise residential development.

2.4-2 SURVEY PLAT

The survey of the property to be developed shall include but is not limited to the following:

- The name and address of the owner of the property proposed for development.
- The municipality within which the property is located and municipal tax block and lot numbers of the property that the development is located on.
- North arrow.
- The scale of the plan (written and graphic).
- Existing lot lines with bearings and distances on the property being developed.
- Existing survey monuments and markers on the property being developed.
- Existing buildings and structures with type of use indicated on the property being developed, and within 100' of the property being developed.

- Existing roads, driveways, curbs, sidewalks storm water and utility inlets and manholes on the property being developed, and within 100' of the property being developed.
- Existing easements (e.g. utility, drainage, sight triangle and access) and road rights-of-way on and abutting the property developed.
- Existing road right-of-way centerline with dimensions to the existing right-of-way lines on either side of the road on and abutting the property developed.
- Existing utilities with identification references as applicable (e.g., pole number and utility company) on the property being developed, and within 100' of the property being developed..
- The location, size and direction of flow of all streams, brooks, drainage structures and drainage ditches on the property being developed, and within 100' of the property being developed.
- The location and jurisdiction of existing trafficcontrol devices within 100' of the property being developed.
- A title block with the name of the person and firm preparing the plat with seal and signature.

2.4-3 TOPOGRAPHIC, DRAINAGE AND UTILITY PLAN

A separate Utility Plan showing general drainage features and detailed utility features will be required for review where such is necessary for clarity and ease of interpretation of the individual plan features.

The topographic, drainage and utility plan shall include but is not limited to the following:

- A north arrow.
- The scale of the plat/plan (written and graphic).
- The plan shall include a survey baseline with stations and baseline offset dimensions at all points of curvature, points of tangency, angle points, beginning and end of work, manholes, storm sewer inlets, etc...
- The existing and proposed fences within the development and within 100' of the development.
- The existing and proposed edges of road pavement along county roads and along municipal roads that contain county drainage structures.

- The proposed edges of pavement for all new roads and/or driveways within the proposed development.
- The location and width of existing and proposed roads and/or driveways within the development, on the opposite side of the existing road(s) that abut the development and within 200' of the development.
- The location and width of all existing and proposed depressed curb and vertical curb tapers.
- The location and dimension of existing and proposed driveway aprons.
- The location of existing and proposed handicap ramps.
- The location and width of sidewalks within the development and within 100' of the development.
- The existing and proposed curbs with notations indicating where existing curb is to be removed and/or replaced.
- The dimension of all curb radii.
- The beginning and end of new curb and where new curb is to meet existing curb.
- The existing and proposed retaining walls within the development and within 100' of the development with top of wall and bottom of wall elevations.
- The beginning and end of portions of existing roads to be milled and resurfaced, reconstructed or restored and a graphic representation of the areas to be milled and resurfaced, restored or reconstructed.
- The location of existing buildings with a note indicating which buildings are to remain and which buildings are to be removed.
- The location of each proposed building with first floor elevations indicated.
- The type of use of the existing and proposed buildings.
- The proposed lot lines and existing lot lines that are to be eliminated.
- The phases or section boundaries of the development, if applicable.
- The existing and proposed site topography and topography of land within 200' of the site shown at 2' contours.
- The high point of each road or driveway within the development and the high point of each road within 350' of the development.

- The location and width of all existing and proposed utility easements, drainage easements, access easements, landscape easements, conservation easements etc., within the site to be developed and within 200' of the site.
- The location, size, slope and type of material of existing and proposed underground utilities with invert and rim elevations at manholes
- The location of existing and proposed septic fields.
- The existing and proposed location of all utility poles and above ground utility equipment, including pumping stations and sanitary sewer treatment plants on and adjacent to the site and within 200' of the site and the identification number of all utility poles on and adjacent to the site and within 200' of the site.
- The location and direction of flow of existing streams, brooks, swales, ditches and other water courses on the site to be developed and within 200' of the site. The direction of flow is to be designated with arrows.
- The location of existing and proposed retention and detention facilities, including recharge basins and dry wells, sub-surface retention or detention facilities, lakes and ponds.
- The normal water surface elevation of all existing and proposed lakes and ponds within the site and within 200' of the site.
- The size, percent of slope, type, class of pipe and length of each segment of pipe of existing and proposed storm sewer systems on the site and within 200' of the site.
- The invert elevations of all storm sewer pipes at the beginning and end of each segment of pipe at storm sewer inlets, manholes, headwalls, flared end sections, detention and retention facility outlet structures, weirs, etc... At storm sewer inlets and manholes the invert elevations are to show which pipes are in-flowing and which are out-flowing.
- The elevations at the top and bottom of headwalls and weirs.
- The existing and proposed grate elevation of all storm sewer inlets.
- The existing and proposed rim elevations of all storm sewer manholes.
- The location and type of existing and proposed storm sewer inlets and manholes.

- The existing and proposed top of curb and gutter elevations at 50' intervals except that additional elevations may be required at intersections to assure positive drainage or in areas where the minimum required slope cannot be achieved (see figure 17).
- The location and dimension of rip-rap aprons.
- Wetlands delineation, 100 year flood hazard lines and stream encroachment lines within the site and within 100' of the site.
- The percent of slope between each of the proposed gutter grades.
- The location of soil borings.
- The location of all existing and proposed guiderail and the type of guiderail end treatment.

2.4-4 TRAFFIC CONTROL PLAN/DETOUR PLAN

A Traffic Control Plan/Detour Plan shall be submitted where it is necessary to close a portion of or the entire county road to accommodate road widening, road reconstruction or utility work or where it is necessary to close a portion of or all of a municipal road for the extension of or reconstruction of a county drainage structure(s).

The Traffic Control Plan/Detour Plan shall include but is not limited to the following:

- The type, size and location of traffic control devices that shall be used during construction.
- If the county road or municipal road at a county drainage structure is to be totally closed, a detour plan shall be submitted that indicates the route traffic will be diverted to during construction.
- The detour plan shall be approved by all other applicable bodies and agencies retaining jurisdiction (e.g. municipal police, municipal engineer, New Jersey Department of Transportation, etc.).

2.4-5 TRAFFIC SIGNING AND STRIPING PLAN

A Traffic signing and striping plan shall include but is not limited to the following:

- A north arrow.
- The scale of the plat/plan (written and graphic)
- Existing painted centerlines, traffic islands, cross hatching, lane lines, shoulder lines/edge lines and stop bars, existing designated turn lanes, painted arrows, words

and/or symbols, existing passing and no-passing zones, existing cross-walks, existing parking spaces and no-parking zones existing loading zones and reflective pavement markers on the existing roads that border the development and are within 500' of the development.

- Proposed painted centerlines, traffic islands, cross hatching, lane lines, shoulder lines/edge lines and stop bars, proposed designated turn lanes, painted arrows, words and/or symbols (see figures 9, 10, 11 & 12), proposed passing and no-passing zones, proposed cross-walks, proposed parking spaces and no-parking zones, loading zones and proposed reflective pavement markers on the existing and proposed roads that border the development and are within 500' of the development and proposed road approaches to a county road.
- Dimension of existing and proposed traffic lanes, shoulders and transitions.
- The location and length of existing traffic line striping to be removed and grinding specified as the method used for removal.
- The width, color and material of all proposed traffic line striping in accordance with Monmouth County standards.
- Existing and proposed traffic signs with the Manual of Uniform Traffic Control Devices (MUTCD) designation and sizes, colors and legends if custom designed.

2.4-6 ROAD AND DRIVEWAY PLAN AND PROFILES

Road and driveway profiles shall include but are not limited to the following:

- The scale of the plan both horizontal and vertical.
- Baseline stations at 50' intervals.
- Existing and proposed crown of the road/driveway.
- Existing and proposed top of curb and gutter of the road/driveway.
- Existing and proposed crown, gutter and top of curb elevations at 50' intervals.
- Percent of the existing and proposed slope along the crown between stations.
- Percent of the existing and proposed slope along the gutter between stations.
- Percentage of the existing and proposed slope along the top of curb between stations.

- Location of existing and proposed underground utilities with slope of pipe and, invert and manhole rim elevations.
- Location of existing and proposed storm sewers with slope of pipe, invert elevations and grate elevations at storm sewer inlets and invert and rim elevations at manholes.
- Location of existing and proposed drainage structures such as bridges, culverts and pipes that convey storm water flow across the road/driveway, with invert elevations.

2.4-7 ROAD AND DRIVEWAY CROSS SECTIONS

Road and driveway cross sections shall include but are not limited to the following:

- The scale of the plan both horizontal and vertical.
- Road/driveway Cross Sections shall be shown with station designations at 50' intervals and shall include the following:
 - Existing and proposed crown elevations.
 - Existing and proposed gutter elevations.
 - Existing and proposed top of curb elevations.
 - Elevations at the existing and/or proposed right-of-way line.
 - Percent of proposed road/driveway cross slope between the crown and the existing edge of pavement and between the existing edge of pavement and proposed edge of pavement.
 - Percent of slope between the existing and/or proposed right-of-way line and proposed edge of road pavement.
 - Location of existing and proposed underground utilities with stations and pipe data such as size, type of pipe at road/driveway crossings and inverts and rim elevations at manholes.
 - Location of existing and proposed storm sewers with stations and pipe data such as size, type of pipe at road crossings and inverts and grate elevations at inlets.
 - Location of existing and proposed drainage structures such as bridges, culverts and pipes that convey storm water flow across the road/driveway, with type, size and invert elevations.

2.4-8 STREAM PROFILES

Stream profiles shall include but are not limited to the following:

- Station designations at 50' intervals.
- The scale of the plan both horizontal and vertical.
- Normal water surface elevation
- Top of bank elevations
- Bottom of stream elevations
- The 100 year flood elevation

2.4-9 STREAM CROSS SECTIONS

Stream cross sections shall include but are not limited to the following:

- The scale of the plan both horizontal and vertical.
- Stream cross sections shall be shown with station designations at 50' intervals and must include but are not limited to the following:
 - Normal water surface elevation
 - Top of bank elevations
 - Bottom of stream elevations
 - The 100 year flood elevation

2.4-10 TREE SAVE PLAN

A Tree Save Plan shall include but is not limited to the following:

- A north arrow
- The scale of the plan (written and graphic)
- The limits of wooded areas within the county road right-of-way and within 50' of the proposed county road right-of-way if these areas are densely wooded.
- Identification of trees to be saved within densely wooded areas.
- Identification of trees to be removed within densely wooded areas.

- The diameter of the trunks of existing trees measured at breast height within the county road right-of-way and within 50' of the proposed right-of-way for areas that are not densely wooded.
- The genus, species and common name of the existing trees within the county road right-of-way and within 50' of the proposed right-of-way for areas that are not densely wooded.
- Identification of trees to be removed and trees to be saved within the county road right-of-way and within 50' of the proposed right-of-way for areas that are not densely wooded.
- The method of protecting existing trees that are to be saved, during construction.

2.4-11 LANDSCAPE PLAN

A Landscape Plan shall include but is not limited to the following:

- A north arrow
- The scale of the plan (written and graphic)
- A delineation of the existing wood lines and clusters of trees within the area to be developed and along the existing road frontage.
- The diameter of trees measured at breast height, genus and species of trees, shrubs and ground cover, identification of perennials, annuals and other features and materials within the existing and proposed right-of-way and the diameter of trees measured at breast height, genus and species of trees, shrubs and ground cover, identification of perennials, annuals and other features and materials such as rocks, water, walls, fences and paving materials within 50' of the existing and proposed county road right-of-way. Clusters of trees within this area may be generally described.
- Identification of trees, shrubs, ground cover, perennials and annuals to be planted within the county road right-of-way and within 50' of the proposed right-of-way and other materials such as rocks, water, walls, fences, and paving materials to be installed within the existing and proposed county road right-of-way and within 50' of the existing and proposed county road right-of-way.
- The number of trees, shrubs and ground cover to be planted along a tree line or within clusters grouped by genus and species.
- A legend of symbols used to identify the genus and species of trees and shrubs to be planted.

- A plant list of trees, shrubs and ground cover identifying the genus, species and common name of proposed trees, shrubs and ground cover to be planted within the county road right-of-way and within 50' of the proposed right-of-way. The list must include the size of the trees, shrubs and/or ground cover to be planted and the average height of the planting at maturity.
- The location of existing and proposed sidewalks, fences, decorative walls, retaining walls and berms.
- Existing and proposed contour lines at 50' intervals.
- The location of all landmark trees within the project site and/or county right-of-way. Each tree shall be indicated on the landscape plan with an identification number, species name, diameter, elevation at plant base, and area of critical root zone or drip line. Landmark trees are defined as: (1) a tree associated with an historic event or person, (2) a tree having a direct impact on the development of an area; (3) a tree associated with a scenic view or focal point; or (4) a tree that has become noteworthy as a result of rarity or due to a peculiar, or rare, abnormality.
- The location of all Significant Trees, (defined as the largest known individual trees of each species in New Jersey as listed by the New Jersey Department of Environmental Protection (NJDEP) Bureau of Forestry; large trees approaching the diameter of the known largest tree: and/or species that are rare to that area or of particular horticultural or landscape value).
- A schedule of planting by optimum season. Schedule shall also include known time periods when specific plant material should not be installed.
- Details for the method of construction for all rock placements, water features, sculptures, monuments, art, fences, walls, and other building and paving materials located adjacent to the county right-of-way.
- Identification of areas to receive top soil and seed or sod.
- Delineation of all easements including but not limited to: conservation easements, landscape buffer easements and sight triangle easements (see figure 5), drainage easements, utility easements, etc...
- Details of methods used to plant the trees and shrubs.
- Details of the rate of application of grass seed and method of planting.

2.4-12 SITE DRAINAGE AREA MAPS

Two site drainage area maps must be submitted. One pre-development drainage area map and one post-development drainage area map.

Drainage Area Maps must include but are not limited to the following:

2.4-12.1 Pre-Development Drainage Area Map

- A north arrow
- The scale of the plan (written and graphic)
- Site topography with contours at 2' intervals.
- A delineation of each existing sub-drainage basin within the area to be developed and a delineation of existing basins that lie partially within the site but that extend off-site.
- An identifying reference for each drainage basin depicted on the drainage area map.
- The area of each existing sub-basin shown on the drainage area map with the existing rate of storm water runoff generated within each sub-basin for the two (2), ten (10), twenty-five (25) and one hundred (100) year storm event.

2.4-12.2 Post Development Drainage Area Map

- A north arrow
- The scale of the plan (written and graphic)
- Site topography with contours at 2' intervals.
- A delineation of each proposed sub-drainage basin within the area to be developed and a delineation of proposed basins that lie partially within the site but that extend off-site.
- An identifying reference for each drainage basin depicted on the drainage area map.
- The area of each proposed sub-basin shown on the drainage area map with the proposed rate of storm water runoff generated within each sub-basin for the two (2), ten (10), twenty-five (25) and one hundred (100) year storm event.

2.4-13 DRAINAGE AREA MAPS OF DRAINAGE AREAS TRIBUTARY TO COUNTY DRAINAGE STRUCTURES

Drainage Area Maps shall include but are not limited to the following:

- A delineation of the site area that drains to the county drainage structure and

a delineation of the total upland drainage area that drains to the county drainage structure depicted on a map that includes site topography. This map must include the amount of the site in acres, that drains to the county drainage structure and the amount of the total upland drainage area in acres, that drains to the county drainage structure.

2.4-14 SOIL EROSION AND SEDIMENTATION CONTROL PLAN

The Soil Erosion and Sedimentation Control Plan shall include all the appropriate measures, methods and techniques to control soil erosion and sedimentation as required by the Freehold Soil Conservation District pursuant to the New Jersey Soil Erosion and Sedimentation Control Act (NJSA 4:24-39).

2.4-15 DETAIL SHEETS

Detail sheets are to be placed at end of the set of site plans. Generally details of Soil Erosion and Sedimentation Control measures should be placed on separate sheets. Any combination of details placed on single sheets for features such as: water and sewer utilities, storm water management facilities and drainage systems, pavement, sidewalk and curb construction, landscape, retaining walls, lighting, site identification signs and traffic sign, will be accepted for review provided the details of the individual features are shown clearly and are distinguishable without the plan being cluttered, confusing or difficult to interpret.

Detail sheets shall include but are not limited to the following:

- Typical cross section of a county road in accordance with Monmouth County standards (see figures 3 & 4).
- Storm sewer inlet and manhole chamber details for each type to be constructed and for existing inlets or manholes to be modified (see figure 19).
- Storm sewer grate casting and manhole casting detail for each type to be constructed and for each existing inlet and manhole to be modified.
- Storm sewer flared end section, headwall and storm water retention and detention outlet structure details
- Storm sewer weir/orifice and trash rack details for outlet structures
- County storm sewer system pipe bedding detail
- Soil logs
- County road pavement cross section detail (see figures 3 & 4)
- County road full faced curb detail (see figure 4)

- County road depressed curb detail (see figure 14)
- County road vertical curb taper detail (see figure 15)
- County road pavement repair detail (with existing curb) (see figure 15)
- County pavement repair detail (without existing curb) (see figure 15)
- Concrete driveway apron detail (see figure 13)
- Sidewalk detail
- Handicap ramp detail
- Traffic sign details in accordance with the Manual of Uniform Traffic Control Devices
- Traffic sign post and installation details in accordance with Monmouth County standards (see figure 8)
- Reflective pavement marker detail
- Guiderail details including end treatments in accordance with New Jersey Department of Transportation standards
- Brick paver detail
- Grass concrete paver detail
- Ballard and Ballard installation detail
- Fence and fence installation detail
- Deciduous tree planting detail
- Evergreen tree planting detail
- Deciduous and evergreen shrub planting detail
- Guying and staking detail for trees
- Retaining wall detail
- Stabilized construction entrance detail
- Silt fence installation detail
- Inlet filter detail

- Sanitary sewer manhole detail
- Water hydrant and valve installation detail
- Water and sewer pipe bedding detail
- Thrust block detail
- Light pole and foundation details

2.5 MINOR SUBDIVISION PLAT

Each minor subdivision plat shall be either 24"X36" or 30"X42" and shall be of a scale of not less than 1"=50'.

The minor subdivision plat shall be prepared in accordance with the New Jersey Map Filing Law (46:23-9.8) and shall include but is not limited to the following:

- A key map at a scale of 1"=2,000' that clearly defines the area proposed for development, the location of the site and its relationship to the surrounding area.
- The name and address of the owner(s) of the property to be subdivided.
- The name and address of the applicant.
- A north arrow.
- The scale of the plat (written and graphic).
- The block and lot numbers of all proposed lots within the subdivision.
- The name of streets adjacent to the subdivision.
- The setback lines in accordance with municipal zoning requirements.
- A legend with municipal zoning requirements and a comparison of lot characteristics provided relative to the zoning requirements.
- Bearings and distances of all lot lines within the subdivision.
- The location of existing buildings with a note indicating which buildings are to remain and which buildings are to be removed.
- The location of each proposed building with first floor elevations indicated.
- The type of use of the existing and proposed buildings.

- The proposed lot lines and existing lot lines that are to be eliminated.
- Monmouth County road right-of-way with dimensions from the centerline to the right-of-way line with bearings and distances along the boundary of the right-of-way.
- Sight triangle easements (see figure 5), drainage easements, construction easements, access easements, conservation easements, easements for landscape buffers, utility easements, easements for maintenance and reconstruction of county drainage structures and drainage facilities with bearings and distances along the boundary of each easements.
- Notations indicating rights-of-way, sight triangle easements, drainage easements, construction easements, access easements, easements for maintenance and reconstruction of county drainage structures and drainage facilities, granted and/or dedicated to the County of Monmouth.
- The location of existing railroad rights-of-way within and adjacent to the area to be developed.
- The number of proposed lots.
- Site topography with contours at 2' intervals.
- An indication of how access is to be provided (e.g., K-turn driveways).
- Notations indicating materials to be used to construct driveways.
- Identification of existing sidewalks
- The location size and material to be used for proposed sidewalks
- Wetlands delineation, 100 year flood hazard lines and stream encroachment lines within the site and within 100' of the site.
- The location, size, slope and type of material of existing and proposed underground utilities with invert and rim elevations at manholes
- The location of existing and proposed septic fields.
- The existing and proposed location of all utility poles and above ground utility equipment, including pumping stations and sanitary sewer treatment plants on and adjacent to the site and the identification number of all utility poles on and adjacent to the site.
- The location and direction of flow of existing streams, brooks, swales, ditches and other water courses on the site.

- The location of existing and proposed retention and detention facilities, including recharge basins and dry wells, sub-surface retention or detention facilities, lakes and ponds.
- A delineation of the existing wood lines and clusters of trees within the area to be subdivided and along the existing road frontage.
- The diameter of trees measured at breast height, genus and species of trees and shrubs within the existing and proposed county road right-of-way and within 50' of the county road right-of-way. Clusters of trees within this area may be generally described.
- Identification of trees and shrubs to be planted within the county road right-of-way and within 50' of the proposed right-of-way.
- A legend of symbols used to identify the genus and species of trees and shrubs to be planted.
- A plant list of trees and shrubs identifying the genus, species and common name of proposed trees and shrubs to be planted within the county road right-of-way and within 50' of the proposed right-of-way. The list must include the size of the trees and/or shrubs to be planted and the average height of the planting at maturity.
- The location of existing and proposed fences, decorative walls retaining walls and berms.
- Identification of areas to receive top soil and seed or sod.
- Delineation of conservation easements, landscape buffer easements and (see figure 5) easements.
- Details of methods used to plant the trees.
- Details of the rate of application of grass seed and method of planting.

2.6 SEPARATE CONSTRUCTION PLANS STRIP MAPS FOR COUNTY ROAD, COUNTY ROAD INTERSECTION AND COUNTY BRIDGE OR CULVERT IMPROVEMENTS

At the discretion of the county engineer, plans for construction or reconstruction of county roads, county road intersections and/or county bridges and culverts may be required as submissions separate from the set of plans submitted for the associated subdivision or site plan. Where these plans are required for county improvements to be constructed adjacent to the proposed development, a limited amount of related on-site improvements shall be shown on the construction plans.

2.6-1 PLAN DETAILS FOR IMPROVEMENTS TO COUNTY ROADS AND ROADWAY PLAN DETAILS FOR COUNTY BRIDGE AND CULVERT IMPROVEMENTS

Plans for improvements to county roads and the roadway plan sheets for county bridge improvements shall be provided on separate sheets with a maximum size of 24" x 36". Plans shall be on a scale of 1" = 20' or 1" = 30'. Profiles shall be on a vertical scale of 1" = 2'. The following is a list of the minimum information which shall be included on typical roadway plans:

- A baseline controlled field survey shall be used to locate existing topographic features. The baseline shall be clearly indicated on the construction plans. The beginning and end of the baseline, as well as all angle points shall have a minimum of three (3) ties each which shall also be indicated on the construction plans. The field survey shall be sufficient to include the probable project limits plus reasonable extensions to show matches to existing conditions. The minimum length of topographic survey shall be 500 feet on each side of a county bridge, 300 feet from the beginning and end of each road segment improvement and 300 feet at each approach to an intersection, but in any case shall be of sufficient length to design and construct proper horizontal and vertical transitions.
- Cross sections at a minimum of 50' intervals along the existing baseline. Cross sections shall extend a minimum of 50' on either side of the roadway centerline. Additional cross sections shall be provided at intersections, driveways and other critical areas as appropriate. Existing and proposed elevations shall be indicated at the top of curb, gutter, existing edge of pavement and at the centerline. The cross section scale shall be either 1" = 5' or 1" = 10' for both the horizontal and vertical dimensions.
- A minimum of three benchmarks tied to the North American Vertical Datum of 1988.
- Baseline stations and offset dimensions shall be provided for all points of curvature, points of tangency, angle points and at beginning and end of work.
- Elevations shall be identified by baseline station and offset if not clearly shown at 50' stations.
- Spot elevations shall be provided at intersections as necessary (see figure 17). At a minimum, elevations shall be provided at PC's, PT's and the mid-point of each curve.
- Inlets and manholes shall be identified by type, and the baseline station, offset, invert elevations, and elevations on the top of grate and top of castings shall be provided. For inlets not in travel lanes, the gutter shall be depressed two inches at the grate and the gutter elevations on the calculated profile line indicated (see figure 18).

- All pipe diameters, slopes and class. Drainage outfalls and end treatments such as flared end sections shall be located by baseline station and offset dimension. Inverts shall be provided for all existing and proposed pipes and outfalls.
- All curve data including radii, tangent lengths, deflection angles and arc lengths.
- All existing and proposed right-of-way lines and property lines with bearings and distances. The length of all proposed right-of-way courses which begin or end at an existing right-of-way or property line shall be referenced using a dimension. All proposed right-of-way offsets shall be referenced by a set dimension from the survey baseline.
- All existing and proposed utilities.
- The limits of Monmouth County standard curb and pavement section at intersecting streets and driveways.
- The overall limits of work, as well as any limits of milling, leveling, overlay and/or limits of full pavement reconstruction.
- Centerline and gutterline profiles, with grades and vertical curve data indicated.
- Driveway profiles with proposed improvements including grades and apron treatments.
- The New Jersey Department of Transportation Standard Construction Details as modified by the Monmouth County Engineering Department and/or Monmouth County standard details shall be used for improvements along county roadways. The appropriate details shall be included with the construction plans. Developers are advised to contact the Monmouth County Engineering Department regarding any current amendments to the standard Monmouth County details.
- Construction Specifications shall be the current New Jersey Department of Transportation Specifications for Road and Bridge Construction utilized by the Monmouth County Engineering Department as modified by the Monmouth County Supplementary Specifications. Copies of these Supplementary Specifications are available on request from the Monmouth County Engineering Department.

2.6-2 PLAN DETAILS FOR IMPROVEMENTS TO COUNTY BRIDGES AND CULVERTS

Bridge and culvert plans shall be provided on separate sheets of size 24" x 36". All bridge details shall be drawn on a scale no greater than 1" = 6'. The plans shall contain the following minimum details:

- Plan of proposed structure.
- Elevation of proposed structure.
- Section through proposed structure along roadway centerline.
- Section through proposed deck or culvert perpendicular to roadway centerline or along proposed stream centerline for skewed structures.
- Elevation of abutment (not applicable for box culverts).
- Footing plans.
- Detail sections through proposed wingwalls for all concrete structures and through abutments for all structures except box culverts.
- Detailed sections of box culverts where applicable.
- All other details necessary to adequately construct the proposed structure.
- As determined by the county engineer, the developer shall be required to provide as-built mylars (3 mil double matte) of the construction plans following completion of the improvements. If the developer fails to provide as-built mylars within 30 days of the completion of all punch list items, Monmouth County may proceed against the bond to fund any necessary survey work.
- All road and bridge construction plans shall be signed and sealed by a professional engineer licensed in the State of New Jersey.
- The developer shall be required to submit a design package signed and sealed by a professional engineer licensed in the State of New Jersey. The design package shall include, but not be limited to the following:
 - (1) Survey field notes
 - (2) Right-of-way/easement calculations
 - (3) Geometric calculations
 - (4) Drainage calculations
 - (5) Traffic report
 - (6) Structural calculations
- The design package must be sufficiently detailed to allow a thorough analysis and review of methods employed in the design of the project.

- Sample construction plans for bridge/culvert improvements are available upon request to the Monmouth County Engineering Department.

2.6-3 PLAN DETAILS FOR TRAFFIC SIGNING AND STRIPING PLANS

Signing and Striping plans shall be prepared at a scale of 1" = 20' or 1" = 30'.
 Signing and striping plans shall indicate the following:

- Existing striping, including centerline, traffic islands and cross hatching, shoulder/edge line, lane markings, pavement marking symbols. Width and color of pavement markings must be indicated. Limits of passing/no passing zones 1000 feet from the termini of the lane transitions.
- Existing Traffic Signs by size and type with Manual of Uniform Traffic Control Devices (MUTCD Designation), to remain.
- Existing signs by size and type (MUTCD Designation) to be removed.
- Existing signs by size and type (MUTCD Designation) to be relocated and the location to which the sign will be relocated.
- Existing custom made signs by size, color and legend to be removed, to remain or to be relocated
- Proposed signs by size and type (MUTCD Designation) to be installed.
- Proposed custom made signs by size, color and legend.
- Sign and post installation details (see figure 8).
- Existing pavement markings to remain. Details, including width and color or pavement markings shall be provided.
- Existing and proposed Right of Way.
- Utility poles, guide rail, mailboxes trees and other roadside appurtenances which may impact the placement of signs.
- Existing raised pavement markers. Details including color and type of marking shall be included.
- Proposed raised pavement markers. Details including color and type of marking shall be included.
- Plans shall include a note stating that prior to the installation of traffic line

striping and associated pavement markings, the proposed striping and pavement markings will be marked-out for inspection and approval by the Monmouth County Traffic Engineer.

- As-Built plans shall be provided as determined by the Monmouth County Traffic Engineer.

2.6-4 CONSTRUCTION PLAN DETAILS AND SPECIFICATIONS FOR TRAFFIC SIGNALS ON COUNTY ROADS

Design shall comply with a Policy on Geometric Design of Highways and Streets by the American Association of State Highway and Transportation Officials (ASSHTO), the Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition and the Monmouth County Traffic Safety Engineering Division Design Standards. Signal timing shall be derived utilizing accepted methodologies (i.e.: SIDRA software). In addition, all timing and phase calculations shall be based on assuming fully or semi-actuated operation of the traffic signal.

A Gap Analysis shall be provided prior to consideration of a traffic signal. The gap analysis should indicate the number of gaps in traffic flow available to accommodate future turning movements in and out of a proposed access during periods of the roadway peak and site trip generator peak hours. Peak hours should include morning, midday, evening and Saturday peak hours.

A Traffic Signal Warrant Analysis shall be submitted to the county prior to consideration of a new traffic signal. The Warrant Analysis shall include the following:

- 24-hour traffic count data, broken down in one-hour increments by direction, for a period of not less than one week. A summary of the traffic data shall be provided for a typical weekday, and a Saturday.
- Manual turning movement counts shall be conducted at existing intersections. Traffic data shall be provided for the morning (6 A.M. – 9 A.M.), midday (11 A.M. – 1 P.M.), and evening (4 P.M. – 7 P.M.) and Saturday peak periods (11 A.M. - 3 P.M.). Manual count data shall include vehicle classification and pedestrian volumes. Traffic data shall not be collected on Mondays, Fridays, Sundays, or legal holidays. However, there may be exceptions to these days due to circumstances related to the roadway and/or site traffic flow.
- Anticipated turning movement traffic count data. Anticipated traffic volume data shall include, as a minimum, AM, Midday, PM and Saturday peak hour flows. The peak hours shall be determined based on the 24-hour traffic count data. Anticipated Turning movement traffic volume data shall be provided for the development build - out year.
- Any information relating to the timing of phased development must be provided.

- A summary of the most recent three-year crash (accident) history. This requirement would not be applicable for new access locations.
- A comparison of existing and anticipated traffic volume with the criteria set forth in the Manual on Uniform Traffic Control Devices.

Design of traffic signals shall conform to the standards set forth herein, current Monmouth County specifications, the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction (Current Edition), NJDOT Roadway Design Manual, Monmouth County Traffic Safety Engineering Division Design Standards and all other NJDOT manuals, guidelines and procedures with subsequent addenda.

Traffic count data shall be evaluated to perform a level of service determination. The intersection corner sight distance shall be determined and recommendations shall be made for clearing the sight triangle. Approach sight distance shall be measured to determine the need for advance flashers or other advance warning devices. Results of the Level of service determination, findings of the intersection corner and approach sight distance studies and recommendations shall be forwarded to the county in the conceptual submission and in the final design package.

The design vehicle for turning movements shall not be selected until all traffic data has been collected and analyzed. Recommendations for a design vehicle based on field investigations and input from local police agencies shall be forwarded to the county for review and/or comment.

The design for the turning lanes and corner radii shall not commence until the county approves the recommendations or selects an alternate design vehicle.

Dedicated left and through lanes shall be 12 feet wide, while dedicated right and shared lanes abutting the curb without edge or shouldering shall be at least 13 feet wide (see figure 10). The minimum width for the single receiving lane shall be 15 feet.

Existing parking regulations affecting the design shall be reviewed and shall include all parking restrictions necessary for the redesign of these improvements. The local municipality shall be requested to amend existing or pass new ordinances establishing modified parking regulations.

Appropriate resolutions shall be prepared establishing traffic regulations pertaining to the operation of the proposed traffic signal.

A separate Traffic Signal Operational Plan (24" x 36") shall be prepared showing only functional information as necessary for the county's submission to the New Jersey Department of Transportation (NJDOT) Bureau of Traffic Engineering and Investigation. Functional information shall include, but not be limited to, phasing sequence; signage; pavement markings and signal layout.

Timing Directive(s) shall be included as part of the submission package and shall be prepared on 8 ½" x 11" sheet(s). This package shall be consistent with Monmouth County standards and specifications and shall include the following: semi-actuated or fully-actuated operation; yellow and all red clearance intervals; minimum and maximum green times (green times must be consistent with LOS analyses); signal head number designations; permitted phasing sequences; and pre-timed operation for detection failure. LOS analyses; and calculations for determining clearance intervals shall be provided on separate sheets but should be included in the Timing Directive submission package. The Timing Directive shall also be shown on a separate plan sheet and included as part of the construction documents.

A Traffic Signal Electrical Plan shall be prepared showing traffic signal hardware including controller, meter cabinet, junction boxes, phasing sequence, regulatory and street name signs mounted on signal standards and mast arms, conduit, block wiring diagram, signal heads and signs legend, construction notes including height of pole mounted signal heads, table of items to be constructed, existing and proposed Right-of-Way, utilities, guiderail and other roadside appurtenances affecting layout of traffic signal components. Pavement markings, excluding notes and labels, shall also be shown for informational purposes, but should be screened to minimize clutter. A note shall be placed on the electrical plan stating that the contractor shall obtain electrical service for the intersection in the name of the municipality within which the controller is located.

Construction details of hardware components must be included in the construction documents. This information can be made available by the county. However, the county will not be responsible for any reproduction costs.

Traffic Signal Electrical, Signing/Striping and Traffic Signal Operational Plans shall be in 1"=20' or 1" = 30' scale.

Specifications shall be prepared in accordance the New Jersey Department of Transportation 1989 Standard Specifications for Road and Bridge Construction and as supplemented by Monmouth County Specifications. A sample specification package can be provided by the county. Final specifications must be submitted and approved by Monmouth County.

An Estimate of Quantities in tabular form shall be prepared indicating the name of the item, unit and quantity. It is strongly recommended that interim phase submission (30%) be submitted prior to moving forward with final design. The 30% submission should include conceptual layout of traffic signal foundations, mast arms, signal heads and pavement markings. The initial submission should also include recommendations and justification for the proposed design features including intersection geometry, lane configuration, traffic signal phasing and timing.

3.0 CONTENTS OF STUDIES AND ANALYSES

3.1 CONTENTS OF A TRAFFIC IMPACT STUDY/ANALYSIS

A traffic impact study, signed and sealed by a New Jersey licensed professional engineer, shall be submitted for proposed developments that generate 50 or more peak-hour, peak-direction vehicle trips. This threshold will be met based on 50 or more project generated trips at either the road peak hour or project peak hour. Seasonal high traffic volumes may be required to establish the threshold value.

The determination of the threshold value will be based upon the Institute of Transportation Engineers (ITE) Trip Generation Manual current edition at the time the development application is determined to be complete.

The Monmouth County Development Review Committee may require a traffic impact study or traffic impact statement for a proposed development that does not meet the threshold value for a traffic impact study when special circumstances exist that include but are not limited to the following:

- The proposed development will generate heavy truck traffic.
- The proposed development will generate bus traffic.
- The proposed development is near an historical site or within an historic district or urban area.
- The proposed development is near a school or a major public facility such as a regional library.
- The proposed development is within a central business district.
- The proposed development contains a drive-through facility that requires one or more stacking lanes.
- The proposed development is within 500' of a signalized intersection.
- The proposed development would contain a new road or driveway that would result in turning movement conflicts with adjacent roads or driveways, or roads or driveways on the opposite side of the abutting street.
- The proposed development is located in an area where special safety concerns exist or would be created as a result of the proposed development.
- The following outline contains the required contents of a traffic impact study. It is intended to be a guide for preparing a traffic impact study. The Monmouth County Traffic Engineer may accept a traffic impact study that is not organized in accordance with the outline, providing it is prepared in a logical and organized manner. The county traffic engineer may increase or

reduce the scope of the traffic impact study as is necessary to conduct a proper review, depending on the type, location and scale of the development or if special safety concerns exist or would be created as a result of the proposed development.

I. Introduction

A. Name of applicant and project name

B. Description of project

1. Type and size (number of residential units, square footage of each building for commercial, office or warehouse uses or other appropriate unit of measure for other land uses)
2. Existing zoning of site and adjacent to the site
3. Unique functional or operational characteristics
4. Project phasing (year of completion of each phase and size of each phase using the appropriate unit of measure for each use within each phase)
5. Location of access points

C. Location of site

1. Area location map

D. Items addressed at pre-application meeting

E. Study area (scope of study)

1. Study area map (the study area map shall include municipal and county boundaries as applicable, all roads and highways within the study area and the location of proposed site access roads and drive-ways)
2. Justification for establishing limits of study area

II. Area characteristics and base traffic conditions

A. Description of types of land uses on-site and in the immediate area surrounding the site (shall include a description of land uses and general zoning requirements)

B. Description of transportation systems within the study area (supplemented with diagrams and maps as necessary)

1. Functional classification of roads
2. Number of lanes and/or shoulders
3. Lane and shoulder widths
4. Posted speed limits
5. Location of traffic signals
 - a. Signal timing
6. Location of one-way streets
7. Location of sidewalks, bikeways and pedestrian crossings
8. Location of transit facilities including train stations, bus stops, bus lanes and commuter parking lots
9. Location of transit routes and service frequency including travel demand management and transportation management association's service and routes
10. Locations of traffic safety concerns. A summary and analysis of crash history at intersections including driveways, within the study area

where three or more crashes have occurred over the most recent three-year period.

- III. Existing traffic at each intersection within study area (maps and diagrams shall be included that depict the following items and features)
 - A. Existing traffic counts at road peak hour and at projected site peak hour. Intersection directional and turning movement traffic counts shall be collected between 6am-9am, 11am-2pm and 4pm-7pm for a weekday. Data must be collected on a Tuesday, Wednesday or Thursday, excluding legal holidays and the Tuesday, Wednesday or Thursday prior to legal holidays, and following legal holidays. For retail uses, traffic data shall also be obtained on Saturdays, between 11am-3pm. Other uses, such as recreational and religious facilities, may require that traffic data be obtained at other periods. Traffic volume data shall be summarized for one-hour periods, in 15-minute intervals and include vehicle classification and pedestrian volumes. Individual turning movement counts for the highest one hour for morning, midday and evening peak hours shall be depicted on diagrams.
 1. Directional distribution (number and percentage of trips oriented to the north, south, east and west)
 - B. Truck movements and distribution (number and percentage of trips oriented to the north, south, east and west)
 - C. Volume to capacity analysis
 - D. Gap analysis
 - E. Queue length studies (maximum and average lengths per lane for each peak hour shall be included)
 - F. Levels of service (the analyses shall be conducted in accordance with the procedures outlined in the highway capacity manual, latest edition. "Highway Capacity Software (HSC)" or other highway capacity manual based software shall be used to determine intersection levels of service for individual lane groups, approaches and overall intersection) Seasonal adjustment to traffic volumes
- IV. Site traffic
 - A. Trip generation rates and source (based on the latest addition of the Institute of Transportation Engineers Trip Generation Handbook (ITE) values unless more use specific information is provided and accepted)
 - B. Site traffic generated during peak impact hours (maps and diagrams shall be included showing the number and percentage of site peak hour and road peak hour trips oriented to the north, south, east and west at each proposed road or driveway. Intersection directional and turning movement traffic counts shall be collected between 6am-9am, 11am-2pm and 4pm-7pm for a weekday. Data must be collected on a Tuesday, Wednesday or Thursday, excluding legal holidays and the Tuesday, Wednesday or Thursday prior to legal holidays, and following legal holidays. For retail uses, traffic data shall also be obtained on Saturdays, between 11am-3pm. Other uses, such as recreational and religious facilities, may require that traffic data be obtained at other periods. Traffic volume data

shall be summarized for one-hour periods, in 15-minute intervals and include vehicle classification and pedestrian volumes. Individual turning movement counts for the highest one hour for morning, midday and evening peak hours shall be depicted on diagrams)

1. Traffic generated at each phase of development (design year)
 2. Number of reduced peak-hour site trips due to assignment of trips to transit or to implementation of a transportation management plan
 - a. Methodology used to reduce trips
 3. Amount of traffic by type (cars, trucks, buses)
- C. Site truck and/or bus route
1. Location of loading areas
 2. Type of truck and/ or bus used for design of truck and/or bus route
- D. Drive-through/drive-up facilities
1. Location
 2. Queue length at peak use
- E. Distribution
1. Volume and percentage of site traffic entering and existing the site with directional distribution generated at each proposed road or driveway within the proposed development and at each intersection within the study area consistent with the adjacent road traffic patterns (maps and diagrams shall be included showing the number and percentage of trips oriented to the north, south, east and west)
 2. Method used for assigning traffic to access points
 3. Methods used for assigning traffic to road network within study area
 4. Number of reduced peak-hour site trips due to assignment of trips to transit or to implementation of a transportation management plan
- V. Non-site traffic within study area (maps and diagrams shall be provided)
- A. Definition of design year
1. Proposed developments within study area (land use and size), traffic generated by each of these developments and the status of the approval of each of these developments.
 2. Background growth (indicate growth rate and justification for growth rate being applied. Generally, a growth rate of 2-3% compounded annually is acceptable)
 3. Non-site traffic in year of first occupancy
 4. Non-site traffic in year of phased occupancy
 5. Non-site traffic in design year (at full occupancy)
- VI. Capacity analysis/safety analysis (maps and diagrams shall be provided)
- The analyses shall be conducted in accordance with the procedures outlined in the Highway Capacity Manual, latest edition. "Highway Capacity Software (HCS)" or other highway capacity manual based software shall be used to determine intersection levels of service for individual lane groups, approaches and overall intersection. Levels of service (LOS) analyses shall be included for the following scenarios:
- Existing year LOS (year of the study)

- Development build year LOS without the proposed development
 - Development build year LOS with the proposed development
 - Ten year projected LOS without the proposed development
 - Ten year projected LOS with the proposed development
- A. Post development levels of service at site access points and at each intersection within the study area
 1. At each phase of development if applicable
 - B. Post development volume to capacity analysis at each access point and at each intersection within the study area
 1. At each phase of development if applicable
 - C. Post development gap analysis at each access point and at each intersection
 1. At each phase of development if applicable
 - D. Identify locations of traffic safety concerns

VII. Findings and recommendations

- A. Description of improvements necessary to mitigate traffic circulation and traffic safety concerns. Mitigation of impacts will be required for lanes that are projected to deteriorate to level of service “D” or lower or that are deteriorated beyond 1½ levels of service. Recommendations for mitigation shall be provided for deterioration below acceptable levels of service for the following scenarios:

- Development build year with the proposed development
- Ten year with proposed development
 1. Traffic signal warrants analysis if applicable
 2. Detour plan and traffic control plan for improvements as necessary
 3. Fair share apportionment of costs for each improvement as applicable

The fair share contribution shall be calculated as follows:

- Fair share contribution = $(AT / (ET \times (1 + GR)^n + AT + ST)) \times (CC \times 1.1)$
- AT = Anticipated applicant’s development traffic
- ET = Existing traffic volume recorded at the intersection
- GR = background growth rate (generally 2-3 %)
- n = Number of years until build-out of site
- ST = Other site specific development traffic
- CC = Capital improvement program construction cost estimate.
The 1.1 multiplier provides a 10% contingency cost factor.

VIII. Appendix

- A. Traffic count data sheets
- B. Gravity model and trip distribution
- C. Turning movement counts
- D. Highway capacity software summary analyses
- E. Site plan (the site plan is not required to be a particular scale, but shall be no larger than an 11" x 17" foldout)

3.2 CONTENTS OF A DRAINAGE ANALYSIS/STORM WATER MANAGEMENT PLAN

A drainage analysis/storm water management plan, signed and sealed by a New Jersey licensed professional engineer, shall be submitted for all proposed developments that would create one (1) acre or more of impervious surfaces, for developments where a storm sewer connection is proposed into a county drainage system or county drainage structure, or for developments, including parking areas, located along a county road that would create five thousand (5,000) square feet or more of impervious surface that drains toward a county road or county drainage structure or facility.

The following outline contains the required contents of a drainage analysis/storm water management plan. It is intended to be a guide for preparing a drainage analysis. The county engineer may accept a drainage analysis/storm water management plan that is not organized in accordance with the outline, providing it is prepared in a logical and organized manner. The county engineer may increase or reduce the scope of the drainage analysis as is necessary to conduct a proper review.

I. Introduction

- A. Name of project and name of applicant
- B. Description of project
 - 1. Type of land use and size
- C. Location of site
 - 1. Area location map
- D. Description of site
 - 1. Land characteristics(physical description of the site)
 - 2. Soils map
- E. Existing drainage patterns (description and drainage area map)
- F. Proposed drainage patterns (description and drainage area map)

II. Analysis

- A. Tributary area/drainage area (A)
 - 1. Existing and proposed development site area that drains or will drain to an existing or proposed county drainage structure, county drainage system or county drainage facility, including off-site county drainage structures, systems and facilities (include drainage area map)
 - 2. Existing and proposed total upland area that drains or will drain to an existing or proposed county drainage structure, system or facility,

including off-site county drainage structures, systems and facilities (include drainage area map) that the site drains or will drain to.

- B. Rainfall intensity (I)
 - 1. Rainfall intensity occurring at the time of concentration based on sandy hook rainfall curves for a 25 year storm frequency (see figure 23)
- C. Rainfall coefficient (C)
 - 1. Composite rainfall coefficient for each drainage area based on county's design criteria
- D. Flow Rate (Q)
 - 1. Peak runoff rate in cubic feet per second (CFS) entering county drainage system or facility (include outflows from upstream detention or retention basins and facilities)
 - 2. Calculations which address the adequacy of any existing county drainage systems or facilities which will accept storm water from the development
- E. Soil logs and percolation tests

III. Summary of results and conclusions (summary of the overall analysis including the results of capacity analyses and a determination of the adequacy of existing storm water systems and facilities with recommendations for improvements to existing storm water systems and facilities to address any deficiencies)

IV. Appendix

- Pre and post development drainage area maps
- Runoff coefficients chart (see figure 25)
- Nomograph (see figure 24)
- Rainfall intensity curves (see figure 23)
- Storm sewer tabulation charts
- TR-55 calculations (existing and proposed conditions)

4.0 OFF TRACT IMPROVEMENTS TO COUNTY ROADS AND COUNTY DRAINAGE FACILITIES

The applicant of a proposed development may be required to construct off tract improvements to county roads or county drainage facilities, make a fair share contribution toward off tract improvements to county roads or drainage facilities or make a payment to the county in lieu of improving or reconstructing off tract improvements to county roads or county drainage facilities.

4.1 OFF TRACT IMPROVEMENTS TO COUNTY ROADS AND COUNTY ROAD INTERSECTIONS.

The applicant of a proposed development with the exception of the developments listed below, may be required to mitigate impacts to off-tract county roads and/or county road intersections by improving or reconstructing said county roads and/or intersections, by making a fair share contribution toward improving or reconstructing said offtract county roads and/or intersections or by making a payment in lieu of

improving or reconstructing said county roads and/or intersections.

Exceptions:

- Developments that contain less than three (3) new lots and do not contain new streets or shared driveways that connect to a county road.
- Developments that contain less than one (1) acre of impervious surfaces and do not abut a county road.
- Developments that abut a county road and contain less than 5,000 square feet of impervious area.

4.1-1 CONSTRUCTION OF OFF TRACT IMPROVEMENTS TO COUNTY ROADS AND COUNTY ROAD INTERSECTIONS

The applicant shall be required to mitigate traffic impacts from a proposed development on a county road and/or county road intersection by making improvements to or reconstructing the affected county road and/or county road intersection based on the following criteria:

- Traffic impacts from a development shall not be permitted to degrade any approach to a county road intersection that operates at Level of Service (LOS) D or lower. If the traffic impacts from the development would degrade any approach to the county road intersection below a LOS D, the applicant shall be responsible for making improvements to that location so that the approach LOS is no worse than the LOS without the Development's traffic. For signalized intersections, redistribution of green time shall not be permitted if that redistribution results in any approach or the intersection degrading to LOS D or lower.
- If an approach to a county road intersection operates at LOS C or Middle B after post development traffic impacts from the development traffic including background growth have been analyzed, the approach may be degraded to LOS D. However, in no instance will any approach to a county intersection be permitted to be deteriorated more than 1 ½ levels of service.
- For unsignalized intersections, the applicant of a development shall be required to install a traffic signal and associated improvements at a county road intersection and bear all associated costs, including construction, engineering and right-of-way acquisition when such installation is necessary to mitigate traffic impacts to a county road intersection based on the above criteria provided that traffic signal warrants as established by the Manual of Uniform Traffic Control Devices are met.
- Improvements to county road segments impacted by development traffic may be required. Improvements that may be required include additional traffic lanes, vertical and horizontal road reconstruction and realignment and traffic

safety enhancement to mitigate traffic impacts based on traffic volumes and traffic safety considerations. For county road segments, in no instance shall any single travel lane of a county road be permitted to exceed 1,000 vehicles per hour as a result of proposed development traffic.

4.1-2 FAIR SHARE CONTRIBUTIONS TOWARD OFF-TRACT IMPROVEMENTS TO COUNTY ROADS AND COUNTY ROAD INTERSECTIONS

The applicant may be required to submit a fair share contribution toward county road and intersection improvements. Traffic data contained in the Traffic Impact Statement or Traffic Impact Study will be used to establish a Fair Share Cost Assessment. The fair share contribution shall be calculated based on the following formula:

$$\text{Fair Share Contribution} = (\text{AT}/(\text{ET} \times (1 + \text{GR})^n + \text{AT} + \text{ST})) \times (\text{CC} \times 1.1)$$

- AT = Anticipated Applicant's Development Traffic
- ET = Existing Traffic Volume Recorded at the intersection
- GR = Background Growth Rate (Generally 2-3 %)
- n = Number of years until build-out of the site
- ST = Other Site Specific Development Traffic
- CC = Capital Improvement Program Construction Cost Estimate. The multiplier provides a 10% contingency cost factor.

The applicant of a proposed development may be required to make a fair share contribution toward improvements to off-tract county roads and county intersections after the improvements have been completed if a period of less than three (3) years has elapsed between the date the improvements were completed and the date that a formal development application is received.

4.1-3 PAYMENT TO THE COUNTY IN LIEU OF OFF-TRACT IMPROVEMENTS TO COUNTY ROADS AND COUNTY ROAD INTERSECTIONS

If the construction of off-tract improvements to county roads and county road intersections by the developer is determined to be impractical by the county engineer, if the county engineer determines that improvements required to mitigate impacts from development traffic can be incorporated into improvements to be undertaken by the county, or if the development is located along a scenic county road, the applicant of the development may be required to make a payment to the county in lieu of installing the improvements.

4.2 OFF TRACT IMPROVEMENTS TO COUNTY DRAINAGE FACILITIES

Applicants of proposed developments with the exceptions listed below, may be required to mitigate traffic and/or drainage impacts to off-tract county drainage structures, county drainage systems and/or other county drainage facilities by improving, extending, expanding or reconstructing the affected off-tract drainage facilities, by making a fare share contribution toward improving, extending,

expanding or reconstructing the affected off-tract drainage facilities, and/or by making a payment in lieu of improving, extending, expanding or reconstructing the affected off tract drainage facilities.

Note: Off-tract county drainage facilities include but are not limited to county drainage structures, such as pipes, culverts and bridges that abut the development site.

Exceptions:

- Developments that contain less than three (3) new lots and do not contain new streets or shared driveways that connect to a county road.
- Developments that contain less than one (1) acre of impervious surfaces, that do not abut a county road or county drainage structure, drainage system or drainage facility or where improvements required by other agencies and approving authorities do not affect a county drainage structure, drainage system or drainage facility.
- Developments that generate traffic that does not impact a county drainage structure, drainage system or drainage facility.

Traffic generated by a development is considered to impact or adversely affect a county drainage structure, drainage system or other drainage facility based on the following:

- Traffic generated by the development for reasons of traffic safety as well as roadway capacity will cause, or accelerate the need for the county drainage structure, drainage system, drainage facility or the road approach to a county drainage structure to be improved, extended, expanded or reconstructed.
- Municipal requirements pertaining to a development application, such as widening of the roadway adjacent to a county drainage structure, or other improvements proposed by a developer will cause, or accelerate the need for the county drainage structure, drainage system, or other drainage facility or the road approach to a county drainage structure, to be improved, extended, expanded or reconstructed.

Storm water runoff produced by a development is considered to impact or adversely affect a county drainage structure, drainage system, or other drainage facility based on the following:

- The downstream county drainage structure, drainage system or other drainage facility is determined by the county engineer to be hydraulically inadequate and;
- (1) the development is situated in a drainage basin upstream of the county drainage structure, drainage system or other drainage facility that is less

than one-half (½) square mile (320 Acres) or,

- (2) the development is situated in a drainage basin upstream of the county drainage structure, drainage system or other drainage facility that is one-half ½ square mile (320 Acres) or larger and the area of the development that drains to the county drainage structure, drainage system or other drainage facility, is twenty percent (20%) or more of the total upland drainage area.

4.2-1 CONSTRUCTION OF OFF-TRACT IMPROVEMENTS TO COUNTY DRAINAGE FACILITIES

If an applicant of a proposed development proposes to widen the roadway adjacent to a county bridge, pipe or culvert that is not scheduled for replacement by the county, the developer may be required to extend the subject culvert or pipe to the full width of the proposed right-of-way and may be required to widen any affected bridges to the width of road pavement plus five (5) feet for sidewalks.

If the county engineer determines that extending the county drainage structure is impractical due to the structural composition of the structure, the developer may be required to reconstruct the structure.

If the county engineer has determined that a county drainage structure located downstream of a proposed development is hydraulically inadequate and the affected structure is not scheduled for reconstruction, the developer may be required to reconstruct the structure.

The developer will be obligated to provide all construction plans for reconstruction of the structure, parcel maps for any rights-of-way and easements, documents and plans necessary to obtain applicable permits, pay the full cost of right-of-way and easement acquisitions and pay the full cost of the reconstruction.

4.2-2 FAIR SHARE CONTRIBUTIONS TOWARD OFF-TRACT IMPROVEMENTS TO DOWNSTREAM COUNTY DRAINAGE FACILITIES

The applicant of a development shall be required to submit a fair share contribution toward improvement of or reconstruction of a downstream county drainage structure, county drainage system and/or county drainage facility where storm water runoff from the proposed development will drain to a downstream county drainage structure, drainage system or drainage facility that is determined by the county engineer to be hydraulically inadequate. On-site detention/retention facilities shall not be included in calculating the hydraulic capacity of a county drainage structure, drainage system or drainage facility. Developments except residential subdivisions of three lots or less and site plans containing less than one acre of impervious surfaces, will be considered as directly increasing the hydraulic requirements of a downstream county drainage structure, county drainage system and/or county drainage facility and are therefore subject to a fair share contribution based upon the following:

- The downstream county drainage structure, drainage system or other drainage facility is determined by the county engineer to be hydraulically inadequate and;

(1) the development is situated in a drainage basin upstream of the county drainage structure, drainage system or other drainage facility that is less than one-half (½) square mile (320 Acres) or,

(2) the development is situated in a drainage basin upstream of the county drainage structure, drainage system or other drainage facility that is one-half (½) square mile (320 Acres) or larger and the area of the development that drains to the county drainage structure, drainage system or other drainage facility, is twenty percent (20%) or more of the total upland drainage area.

The county engineer will determine the hydraulic capacity of the downstream county drainage structure, drainage system or other drainage facility by the most conservative method. The hydraulic capacity of the downstream county drainage structure will be calculated assuming that there are no detention or retention facilities within the upland drainage area.

Drainage area calculations contained in the Drainage Analysis/Storm Water Management Plan and/or drainage area map will be used to establish a Fair Share Cost Assessment. The fair share contribution shall be calculated based on the following formula:

$$\text{Fair Share Contribution} = \text{DA/TA} \times (\text{CC} \times 1.1)$$

DA = Drainage area of the development tributary to the downstream structure

TA = Total upland drainage area tributary to the downstream structure

CC = Construction cost estimate. The 1.1 multiplier provides a 10% contingency cost factor.

When the county engineer finds that a project situated in a drainage basin as above defined for which drainage facilities have previously been installed or altered by the county in order to correct a previously existing adverse drainage condition, the developer may be required to make a fair share contribution to the county based on the above formula.

The proportion of the cost of such facilities to be paid by a developer whose proposed subdivision or site plan would drain into such facility will be equal to the proportion that the acreage of the proposed development bears to the acreage of the entire drainage area.

The fair share contribution will be based on the actual cost of the drainage facility installation or alteration, engineering and right-of-way acquisition.

4.2-3 FAIR SHARE CONTRIBUTION TOWARD RECONSTRUCTION OF A COUNTY DRAINAGE STRUCTURE IN LIEU OF EXTENDING THE STRUCTURE

If the applicant of a development is required to widen the roadway adjacent to a county bridge, pipe or culvert or if an applicant of a proposed development makes a contribution to widening the roadway adjacent to a county bridge, pipe or culvert and the existing drainage structure is scheduled for replacement by the county, the developer may be required to make a contribution to the county toward the cost of reconstruction of the drainage structure.

The contribution will be established based on the following:

- If the development is adjacent to one corner of the structure, i.e. the development is situated along one side of the waterway and is located on one side of the road, the developer will be required to contribute 25% of the cost of reconstruction of the structure plus 10% for contingencies.
- If the development is adjacent to two corners of the structure, i.e. the development is situated along two sides of the waterway and is located on one side of the road, or the development is situated along one side of the waterway and is located on two sides of the road, the developer will be required to contribute 50% of the cost of reconstruction of the structure plus 10% for contingencies.
- The contribution shall be based on an estimate of the cost of the construction prepared by the county engineer and shall include the cost of engineering, permit applications, property acquisition and construction plus 10% for contingencies.

The applicant of a proposed development may be required to make a fair share contribution toward improvements to off tract and/or downstream county drainage structures, county drainage systems and county drainage facilities if a period of less than three (3) years has elapsed between the date the improvements were completed and the date that a formal development application is received.

5.0 DESIGN STANDARDS

5.1 RIGHTS-OF-WAY AND EASEMENTS

5.1-1 ROAD RIGHTS-OF-WAY

Right-of-way widths of county roads that abut proposed subdivisions and site plans shall conform to the right-of-way widths on the Monmouth County Road Plan which is an adopted element of the Monmouth County Master Plan (Growth Management Guide). If the existing right-of-way width of a county road that abuts a proposed subdivision or site plan does not conform to the right-of-way width shown on the Monmouth County Road Plan the dedication of additional right-of-way shall be required.

Where a county road is intersected by an existing or proposed municipal road or state highway, or where two county roads intersect, the right-of-way lines of the roads shall be connected at the intersection by a 25' corner radius.

The subdivision or site plan shall include a notation showing the additional right-of-way as follows: "Dedicated to the County of Monmouth". Bearings and distances shall be shown along the boundary of the dedicated area on the subdivision or site plan.

If the subdivision or site plan is located on both sides of a county road the full width of the right-of-way shown on the Monmouth County Road Plan shall be dedicated to the County of Monmouth. If the subdivision or site plan is along only one side of the county road, one-half (1/2) of the required right-of-way width shall be dedicated, measured from the existing right-of-way centerline.

Where by reason of special or unusual conditions, to conform to the adopted Monmouth County Road Plan, or to conform to a realignment plan or road widening plan determined to be necessary by the county engineer, additional right-of-way dedication in excess of the proposed right-of-way width shown on the Monmouth County Road Plan may be required. If it is determined that the requirement for the dedication of additional right-of-way in excess of that shown on the Monmouth County Road Plan is not reasonably related to the anticipated impacts of the subdivision or site plan, the area of such additional right-of-way shall be reserved for future acquisition and all building setbacks and site improvement setbacks shall be measured from the limits of the reserved area.

The applicant shall be required to submit a deed to the County of Monmouth that describes the required right-of-way dedication if the application is for minor subdivision or site plan approval. The applicant may be required to submit a deed to the County of Monmouth that describes the required right-of-way dedication if the application is for a major subdivision. Sample deeds can be found on the Monmouth County Planning Board website @ www.monmouthplanning.com.

5.1-2 SIGHT TRIANGLE EASEMENTS

Sight triangle easements shall be required at all existing and proposed road or street intersections with a county road and at driveways as determined to be necessary by the county traffic engineer (see figure 5). In special circumstances sight triangles may be required at proposed driveways that intersect a county road.

Where sight triangle easements are determined to be necessary at a proposed driveway on a county road located in an urban area and where sight triangle easements are required at a new road or street on a county road that is located in an urban area, the size of the easement may be adjusted when the strict application of sight triangle easement standards would result in a substantial reduction in existing on-street parking.

Sight triangle easements at proposed road or street intersections shall be measured along the centerline of the existing and/or proposed road or street 90' from the point where the centerline of the proposed road or street intersects the centerline of the county road and along the centerline of the county road 300' from the point where the centerline of the proposed road or street intersects the centerline of the county road (see figure 5).

If it is determined by the county engineer that the design of a subdivision does not allow for the standard sight triangle easements to be located entirely on property owned or controlled by the applicant and the applicant has documented reasonable attempts to acquire any portions of the standard sight triangle easements from adjacent property owners, a modified sight triangle easement may be accepted. The minimum acceptable sight triangle easement area is described as follows:

- The area bounded by the right-of-way lines of the county road and proposed road or street and a straight line connecting a point measured along the centerline of the proposed road or street 25 feet the edge of pavement of the county roadway and a point on the center of each lane of the county road that approach the intersection a measured distance that equals 10 times the posted speed limit.

Nothing shall be constructed, erected, placed, planted or allowed to grow in a manner as to obstruct vision along the county road from the road, street or driveway that approaches the county road between a height of two and one-half (2 ½) feet and ten (10) feet above the centerline grade of either road whichever is lower.

The height of objects within the sight triangle easement may be further restricted if the contour or grade of the land within the sight triangle easement is such that objects within the sight triangle easement would obstruct a driver's line of sight as described in these regulations (see figure 6).

The plan shall show bearings and distances around the easement boundary and shall include the following notation: "Sight Triangle Easement granted to the County of Monmouth.

The applicant shall be required to submit a deed of sight triangle easement to the County of Monmouth that describes the required easement area Sample deeds can be found on the Monmouth County Planning Board website @ www.monmouth-planning.com.

5.1-3 EASEMENTS FOR MAINTENANCE AND RECONSTRUCTION OF COUNTY DRAINAGE STRUCTURES

Easements for maintenance and reconstruction of the drainage structures shall be required at all county drainage structures that abut a subdivision or site plan or are within 50' of a subdivision or site plan. The easements shall be 50' X 100'. The easement is to be measured 50' from and parallel to the centerline of the road in which the drainage structure is located and 50' from and parallel to the center of the waterway.

In special circumstances based on site conditions and road and/or stream alignment, the county engineer may recommend easement dimensions that vary from the standard described above.

If replacement of the drainage structure involved is planned by the county and construction and/or temporary by-pass easements are proposed or anticipated by the county engineer, additional easements and easement dimensions that vary from the standard described above may be required.

The required easement shall be shown on the subdivision or site plan at a scale of at least of 1" =50. Bearings and distances shall be shown along the easement boundary. The plan shall include the following notation: "Easement granted to the County of Monmouth for Maintenance and Reconstruction of County Drainage Structure (insert county drainage structure reference)".

The applicant shall be required to submit a deed of easement to the County of Monmouth for maintenance and reconstruction of the county drainage structure. Sample deeds can be found on the Monmouth County Planning Board website @ www.monmouthplanning.com.

5.1-4 DRAINAGE EASEMENTS

Storm sewer systems that extend along a county road that collect storm water runoff from a county road, storm sewer systems that convey storm water runoff from a county road to a municipal, state or private storm sewer system or storm sewer systems that convey storm water runoff from a county road to a waterway are under Monmouth County jurisdiction.

Drainage easements to the County of Monmouth shall be required for maintenance and reconstruction of the drainage systems described above. The size and extent of the drainage easements will be determined on a case by case basis as recommended by the county engineer.

The subdivision or site plan shall include the following notation: "Easement granted to the County of Monmouth for maintenance and reconstruction of the county drainage system." Bearings and distances shall be shown along the boundary of the easement on the subdivision or site plan.

The applicant shall be required to submit a deed of easement to the County of Monmouth for maintenance and reconstruction of the county drainage system. Sample deeds can be found on the Monmouth County Planning Board website @ www.monmouthplanning.com.

5.1-5 OTHER EASEMENTS AND RIGHTS-OF-WAY

Other easements including but not limited to construction easements, slope easements, guiderail easements and traffic signal maintenance easements shall be required as necessary to construct and maintain improvements to county roads,

county drainage structures, county drainage systems and county drainage facilities associated with the development. The developer shall be responsible for the acquisition of any off-site easements and rights-of-way that are necessary to construct improvements to county roads, county drainage structures, county drainage systems and county drainage facilities that are required in conjunction with approval of the development.

The developer shall be required to attempt to acquire said off-site easements and rights-of-way by making reasonable offers to the affected property owners. If the developer is unsuccessful in his/her attempts to acquire the necessary easements and rights-of-way, proper documentation of same must be provided. The county engineer on behalf of the Monmouth County Development Review Committee, may recommend to the Board of Chosen Freeholders that the county undertake the acquisition of the required easements and rights-of-way through negotiations and/or by instituting its of power of eminent domain. The developer shall reimburse the county to cover all of the cost associated with the acquisition including but not limited to property parcel maps in accordance with county parcel map details, property appraisals, legal fees, filing fees and the cost of the properties acquired. Sample construction easement deeds can be found on the Monmouth County Planning Board website @ www.monmouthplanning.com.

5.1-6 ENCROACHMENTS IN THE RIGHT-OF-WAY

Subdivisions and site plans shall be designed to so that no part of the county right-of-way is used to conduct private business. The county road right-of-way is to be kept clear of buildings, structures, any portion of a detention or retention basin, sales or merchandise displays, vehicle parking areas, vehicles service areas, service equipment and appurtenances thereto, and fences, walls, advertising signs or business identification signs unless approved by the Monmouth County Development Review Committee.

5.2 CONTROL OF ACCESS TO COUNTY ROADS AND ACCESS DESIGN STANDARDS

Road, street or driveway access shall not be permitted on the following portions of a county road:

- **Jughandle**
- **Along any portion of an interchange**
- **Entrance or exit ramp of an interchange or jughandle, including any portion of an acceleration or deceleration lane**

5.2-1 MINOR SUBDIVISIONS

5.2-1.1 Access Location and Access Restrictions

Access to a county road shall not be permitted if the minor subdivision also abuts a

municipal road and access to the municipal road can be reasonably provided. Access will not be permitted immediately adjacent to a county drainage structure or within the area protected by guiderail extending from a county drainage structure.

5.2-1.1A Sight Distance

5.2-1.1A-1 Intersection Sight Distance

Proposed driveway access to a county road shall be located to maximize sight distance along the county road. New driveways shall be located so as to provide an unobstructed line of sight as established by the following horizontal and vertical measurements. The location of the sight line horizontally is measured from a point 15' behind the edge of pavement of the county road on the center of the driveway to a point equal to a distance of ten times the posted speed limit at the center of the lane on the county road approaching the intersection. The required distance along the county road may be adjusted, if it is demonstrated that the actual travel speed (85th percentile speed) on the county road varies significantly from the posted speed limit. The location of the sight line vertically is measured at a height of 3.5' above the finished grade of the driveway (driver's eye) and at a height of 4.0' above the grade of the county road (approaching vehicle) (see figure 6).

5.2-1.1A-2 Left Turn Sight Distance

New driveways shall be located to provide adequate sight distance for drivers to safely turn left from the county road into the driveway. An unobstructed line of sight for drivers turning left into the new driveway shall be provided as established by the following horizontal and vertical measurements. The location of the sight line horizontally is measured from a point in the center of the lane on the county road approaching the intersection 50' from the centerline of the new driveway to a point located a distance equal to ten times the posted speed limit on the center of the on-coming lane. This required distance may be adjusted, if it is clearly demonstrated through field data that the actual travel speed (85th percentile speed) on the county road varies significantly from the posted speed limit. The location of the sight line vertically for the driver turning left into the new driveway is measured at a height of 3.5' above the grade of the county road (driver's eye) and at a height of 4.0' above the grade of the county road (approaching/on-coming vehicle).

5.2-1.1A-3 Stopping Sight Distance

At the discretion of the county engineer stopping sight distance standards applied to vehicles traveling on the county road approaching vehicles slowing or stopped at the new driveway, may be considered in determining the appropriate location of a new driveway. Stopping sight distance will be based on guidelines contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO) for the posted speed limit on the county road. Stopping sight distance requirements are not to be applied in place of intersection sight distance requirements. Rather, stopping sight distance requirements shall be used as a supplement to intersection

sight distance requirements as determined to be necessary by the county engineer. *Expanded or redeveloped sites that access an existing street or driveway will also be required to meet the requirements prescribed herein.*

Where the sight line criteria cannot be met, and the applicant is unable to remove the line of sight obstruction certain turning movements at the intersection may be prohibited (see figure 9).

5.2-1.1B Common or Shared Driveways

Where driveway access is proposed from more than one (1) lot that abuts a county road combined driveway access may be required so that only one (1) common or shared driveway access is provided at the county road.

5.2-1.1C Maximum Number of Driveways Per Lot

Where driveway access is permitted at a county road no more than one two-way driveway shall be permitted for any individual lot.

Two access driveways may be permitted for an individual lot where one-way driveway circulation is permitted.

5.2-1.1D Driveway Spacing

Where more than one (1) driveway is permitted at a county road from a minor subdivision consisting of more than one (1) new lot, a minimum distance of at least 25' shall be provided between the closest edges of the driveways. The 25' distance shall be measured at the point of the widest portion of the driveway at the edge of pavement of the county road. The widest portion of the driveway shall include driveway apron flares and corner radii.

Where a minor subdivision is located at the corner of two intersecting roads the driveway shall not be located within 10' of the point of tangency of the existing or proposed corner radius.

Unless mitigating site conditions and design constraints are identified by the applicant's design professional to the satisfaction of the county engineer, no portion of a driveway shall be located within 10' of a side property line. The 10' distance shall be measured at the point of the widest portion of the driveway at the edge of pavement of the county road. Driveway apron flares and corner radii are considered as portions of the driveway.

5.2-1.2 Access Geometry and Driveway Design

5.2-1.2A On-Site Vehicle Turn Around

All driveways to the county road on minor subdivisions must be designed with provisions for on-site vehicle turn-around (see figure 2) so that vehicles are not forced

to back out into the county road. At a minimum, the driveway must be designed in accordance with the passenger vehicle turning radius templates contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO).

5.2-1.2B Driveway Width

Single Family or Two- Family residential driveways shall be a minimum width of 12', with a minimum apron flare of 5' on each side of the driveway or 10' radii provided at the terminus of the driveway at the county road.

Common or shared driveways for Single Family or Two-Family residential lots shall be a minimum width of 20', with a minimum apron flare of 5' on each side of the driveway or 10' radii provided at the terminus of the driveway at the county road.

5.2-1.2C Maximum Driveway Slope

The grade of a driveway approach to a county road generally, shall be no greater than 3% for a minimum distance of 25' from the edge of pavement of the intersecting road. Based on site design constraints identified by the applicant's design professional, the maximum grade of the driveway approach may be exceeded. However, in no instance shall the driveway approach grade be more than 7%.

The vertical profile of the driveway approach to the county road shall be designed to prevent impacting of the road or driveway by the front, rear or undercarriage of a vehicle. Where concrete aprons are provided or required the maximum grade differential between the slope of the apron and the cross slope of the roadway shall not be more than 8 %.

5.2-1.2D Angle of Driveway

Driveways used for two-way operation shall intersect the county road at right angles (90° as measured at the centerlines of the intersecting driveway and the county road). If due to mitigating site conditions it is not practical for the driveway to intersect the county road at 90° a maximum angle of 80° may be permitted.

Driveways used for one-way operation shall not intersect the county road at angles smaller than 45°.

5.2-1.2E Depressed Curb and Apron

Depressed curb shall be provided where curb is required, proposed or exists along a county road at a proposed driveway (see figure 14). The depressed curb shall extend to a distance of at least 10' further than the width of the driveway unless corner radius curb is required or provided. The depressed curb shall extend to the points on either side of the driveway where the corner radius curb meets the curb along the county road. Depressed curb is to consist of class "B" air entrained gray concrete (Portland cement) and measure 6" at the top, 8" at the base, 20" in

height and have a 1 ½” reveal (see figure 14).

Reinforced concrete aprons may be required at driveways. Aprons shall be class “B” air entrained concrete (Portland cement) 6” thick and reinforced with welded wire fabric (6” X 6”–8/8). Depressed curb must be provided where concrete aprons are required or provided (see figure 13).

Where new curb is required or provided along a county road the pavement must be saw cut and repaired in accordance with county requirements and standards contained in these regulations (see figure 4).

5.2-1.2F Paved Driveway

The driveway at a county road shall be paved with bituminous concrete, reinforced concrete or other approved material for the full width of the driveway for a distance of at least 25’ from the edge of pavement of the county road.

5.2-2 MAJOR SUBDIVISIONS (Public Rights-of-Way - Residential or Non-Residential)

5.2-2.1 Access Location, Access Spacing, Access Restrictions and Intersection Design

5.2-2.1A Reverse Frontage, Marginal Access Roads and Service Roads

Individual lots that are part of a common subdivision tract will not be permitted to have individual separate accesses to the county road. Major subdivisions of land that abut a county road shall be designed using reverse frontage, marginal access roads or service roads (see figure 1) unless the county engineer determines that site constraints, or special or unusual circumstances exist that prohibit the application of the reverse frontage design, marginal access roads or service roads.

5.2-2.1B Alternate Access

Access to a county road shall not be permitted if the subdivision also abuts a municipal road and access to the municipal road can be reasonably provided.

Consideration will be given to providing alternate access to the county road if the subdivision contains 50 or more lots.

5.2-2.1C Access at County Drainage Structure

Road or street access will not be permitted immediately adjacent to a county drainage structure or within the area protected by guiderail extending from a county drainage structure.

5.2-2.1D Sight Distance

5.2-2.1D-1 Intersection Sight Distance

Proposed roads and streets access to a county road shall be located to maximize sight distance along the county road. New roads and streets shall be located so as to provide an unobstructed line of sight as established by the following horizontal and vertical measurements. The location of the sight line horizontally is measured from a point 15' behind the edge of pavement of the county road on the center of the approach lane of the new road or street to a point equal to a distance of ten times the posted speed limit at the center of the lane on the county road approaching the intersection. The required distance along the county road may be adjusted, if it is demonstrated that the actual travel speed (85th percentile speed) on the county road varies significantly from the posted speed limit. The location of the line vertically is measured at a height of 3.5' above the finished grade of the new road or street (driver's eye) and at a height of 4.0' above the grade of the county road (approaching vehicle) (see figure 6).

5.2-2.1D-2 Left Turn Sight Distance

New road or streets shall be located to provide adequate sight distance for drivers to safely turn left from the county road into the road or street. An unobstructed line of sight for drivers turning left into the new road or street shall be provided as established by the following horizontal and vertical measurements.

The location of the sight line horizontally is measured from a point in the center of the lane on the county road approaching the intersection 50' from the centerline of the new road or street to a point located a distance equal to ten times the posted speed limit on the center of the on-coming lane. This required distance may be adjusted, if it is clearly demonstrated through field data that the actual travel speed (85th percentile speed) on the county road varies significantly from the posted speed limit. The location of the sight line vertically for the driver turning left into the new road or street is measured at a height of 3.5' above the grade of the county road (driver's eye) and at a height of 4.0' above the grade of the county road (approaching/on-coming vehicle).

5.2-2.1D-3 Stopping Sight Distance

At the discretion of the county engineer stopping sight distance standards applied to vehicles traveling on the county road approaching vehicles slowing or stopped at the new driveway new road or street, may be considered in determining the appropriate location of a new driveway new road or street. Stopping sight distance will be based on guidelines contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO) for the posted speed limit on the county road. Stopping sight distance requirements are not to be applied in place of intersection sight distance requirements. Rather, stopping sight distance requirements shall be used as a supplement to intersection sight distance requirements as determined to be necessary by the county engineer.

Expanded or redeveloped sites that access an existing street or driveway will also be required to meet the requirements prescribed herein.

Where the sight line criteria cannot be met, and the applicant is unable to remove the line of sight obstruction certain turning movements at the intersection may be prohibited(see figure 9).

5.2-2.1E Common Driveways/Single Lot Driveways

If the county engineer has determined that site constraints, or special or unusual circumstances exist that prohibit the application of reverse frontage subdivision design or marginal access roads/service roads, access may be permitted at the county road from a limited number of residential lots. Consideration will be given to the land use characteristics of the surrounding area and existing driveway spacing in the area of the subdivision. If access is provided from more than one individual lot located on a county road common or shared driveways may be required.

If driveway access to a county road from a residential lot or lots within a major subdivision is permitted, additional improvements to the county road may be required that include but are not limited to additional pavement widening for by-pass areas (see figure 7) and for acceleration or deceleration into the driveway(s).

Roads and driveways shall be located to maximize sight distance and shall comply with the sight distance requirements and standards contained in these regulations (see figure 5).

5.2-2.1E-1 Driveway Width

Single Family or Two-Family residential driveways shall be a minimum width of 12', with a minimum apron flare of 5' on each side of the driveway or 10' radii provided at the terminus of the driveway at the county road.

Where common or shared residential driveways are permitted from lots in a major subdivision on a county road, such driveways shall be a minimum width of 20', with a minimum apron flare of 5' on each side of the driveway or 10' radii provided at the terminus of the driveway at the county road.

5.2-2.1E-2 Maximum Driveway Slope

The grade of a driveway approach to a county road generally, shall be no greater than 3% for a minimum distance of 25' from the edge of pavement of the intersecting road. Based on site design constraints identified by the applicant's design professional, the maximum grade of the driveway approach may be exceeded. However, in no instance shall the driveway approach grade be more than 7%.

The vertical profile of the driveway approach to the county road shall be designed to prevent impacting of the road or driveway by the front, rear or undercarriage of a vehicle.

Where concrete aprons are provided or required the maximum grade differential between the slope of the apron and the cross slope of the roadway shall not be more than 8 %.

5.2-2.1E-3 Angle of Driveway

Driveways used for two-way operation shall intersect the county road at right angles (90° as measured at the centerlines of the intersecting driveway and the county road). If due to mitigating site conditions it is not practical for the driveway to intersect the county road at 90°, a maximum angle of 80° may be permitted.

Driveways used for one-way operation shall not intersect the county road at angles smaller than 45°.

5.2-2.2E-4 Depressed Curb and Apron

Depressed curb shall be provided where curb is required, proposed or exists along a county road at a proposed driveway. The depressed curb shall extend to a distance of at least 10' further than the width of the driveway unless corner radius curb is required or provided. The depressed curb shall extend to the points on either side of the driveway where the corner radius curb meets the curb along the county road. Depressed curb is to consist of be class "B" air entrained gray concrete (Portland cement) and measure 6" at the top, 8" at the base, 20" in height and have a 1 ½" reveal (see figure 14).

Reinforced concrete aprons may be required at driveways (see figure 13). Aprons shall be class "B" air entrained concrete (Portland cement) 6" thick and reinforced with welded wire fabric (6" X 6"—8/8). Depressed curb must be provided where concrete aprons are required or provided.

Where new curb is required or provided along a county road the pavement must be saw cut and repaired in accordance with county requirements and standards contained in these regulations (see figure 4).

5.2-2.2E-5 Paved Driveway

Driveways at a county road shall be paved with bituminous concrete, reinforced concrete or other approved material for the full width of the driveway for a distance of at least 25' from the edge of pavement of the county road.

5.2-2.2E-6 On-Site Vehicle Turn Around

In cases where residential driveway access is permitted on a county road from lots within a major subdivision, driveways at the county road must be designed with provisions for on-site vehicle turn-around (see figure 2) so that vehicles are not forced to back out into the county road. The on-site vehicle turn around must be designed in accordance with the passenger vehicle turning radius templates contained the current edition of A Policy on Geometric Design of Highways and Streets

published by American Association of State Highway and Transportation Officials (AASHTO).

5.2-2.2F Spacing of New Roads and Streets

In determining location and spacing between new roads and streets consideration will be given to the following variables:

- *Stopping sight distance and intersection sight distance (AASHTO and Monmouth County Standards)*
- *Posted or operating speed of the county road*
- *Types of vehicles that will access the development*
- *Volume of traffic generated at each new road or street*
- *Existing and anticipated traffic on the county road*
- *Weaving and merging distances of traffic on the county road*
- *Distance required to enable exiting traffic to enter the traffic stream on the county road without creating significant speed differences*
- *Conflicting vehicle turning movements in the vicinity of the new road or street*
- *Acceleration rates of vehicles exiting the new road or street in question and the adjacent site*
- *Storage distances for back to back left turn lanes on the county road*
- *Type and design of the county road*
- *Queuing distances (backups) of existing and anticipated traffic at intersections and driveways along the county road*
- *Traffic signal coordination requirements*
- *Surrounding land uses*
- *Whether the development is located in an urban, suburban or rural environment.*

Generally, only one new road or street from a major subdivision shall access a county road unless the frontage of the subdivision abutting the county road equals or exceeds 1,100'. Where the frontage of the subdivision abutting the county road

equals or exceeds 1,100', two (2) new road or street accesses may be permitted on the same side of the county road at intervals of not less than 550' as measured between the centerlines of the new roads or streets. In determining the spacing of new roads and streets consideration shall be given to existing and proposed roads and streets on either side of the development and on the opposite side of the county road.

For undivided county roads, access to subdivisions on county roads shall align with existing or proposed roads and streets located on the opposite side of the county road. If the county engineer determines that design constraints or special circumstances exist that prohibit such roads and streets to be aligned then the new roads or streets may be offset from the existing or proposed road or street on the opposite side of the county road by not less than 250' feet as measured between the centerlines of the roads or streets.

Care will be used within specific roadway environments to avoid the repeated use of minimum spacing standards to maintain the operational integrity of the county road while providing appropriate access where it is essential.

5.2-2.2F-1 Proximity to Adjacent Property Line

Generally new roads and streets shall be located at least 125' from an adjacent property line. If the county engineer determines that mitigating site conditions and design constraints exists that prohibit the strict application of the road or street spacing requirements, adjustments to the required spacing may be applied. However, no portion of a road or street shall be located within 10' of a side property line. The 10' distance shall be measured at the point of the widest portion of the proposed road or street at the edge of pavement of the county road. The corner radii of the proposed road or street are considered as portions of the proposed road or street.

Provision of appropriate sight distance and sight triangles shall be considered in determining the proper location for a new road or street at a county road (see figures 5 &6).

5.2-2.2G Access Geometry and Road or Street Intersection Design

5.2-2.2G-1 Angle of Intersection

Roads, streets and driveways shall intersect the county road at right angles (90° as measured at the centerlines of the intersecting roads, streets or driveways and the centerline of the county road). If due to mitigating site conditions it is not practical for the roads, streets or driveways to intersect the county road at 90°, a maximum angle of 80° may be permitted.

5.2-2.2G-2 Profile of a Road or Street Approach to a County Road

The grade of a road, street or driveway approach to a county road generally, shall

be no greater than 3% for a minimum distance of 25' from the edge of pavement of the intersecting county road. Based on site design constraints identified by the applicant's design professional and accepted by the county engineer, the maximum grade of the driveway approach may be exceeded. However, in no instance shall a road, street or driveway approach grade to a county road be more than 7%.

The vertical profile of a road, street or driveway approach to the county road shall be designed to prevent impacting of the road, street or driveway by the front, rear or undercarriage of a vehicle.

A maximum grade differential between the slope of the new road, street or driveway and the cross slope of the county road shall not be more than 8 %.

5.2-2.2G-3 Width of Roads or Streets that Intersect a County Road

The minimum width of a new road or street at its intersection with a county road shall be 28'. This minimum new road width shall consist of a 12' wide approach lane with a 1' wide shoulder and a 12' departure lane with a 3' wide shoulder. If shoulder striping is not required or provided on the new road and where curb is provided along the new road at its intersection with the county road, the centerline of the new road shall be located to provide a 13' wide approach lane and a 15' wide departure lane.

Wider lane widths and /or additional lanes may be required on the new road or street that intersects a county road as is determined to be necessary by the Monmouth County Traffic Engineer based on traffic volumes, the types of vehicles that will use the new road or street and other traffic safety considerations.

5.2-2.2G-4 Corner Radii/Curb Return Radii

The minimum corner radii where a new road or street intersects a county road shall be 35'. Larger corner radii may be required to ensure that vehicles turning into and out of the subdivision road or street do not cross the centerline of the new road, street or driveway, or cross the centerline of the county road or encroach on an adjacent traffic lane. The determination of the appropriate turning radii shall be based on turning radii of vehicle types that are anticipated to use the intersection. Required minimum turning radii for various vehicle types will be based on turning radii templates contained in the current edition of [A Policy on Geometric Design of Highways and Streets](#) published by American Association of State Highway and Transportation Officials (AASHTO).

5.2-2.2G-5 Americans With Disabilities Act (ADA) Requirements

All Road and Street intersections shall be designed to satisfy ADA requirements. Where curb returns are provided or required at the intersection of a new road or street and a county road depressed curb must be provided to meet the "Americans with Disability Act" design requirements whether or not sidewalks are provided.

5.2-2.2G-6 Stop Sign and Stop Bar

A stop sign and stop bar shall be provided at each road or street approach to a county road. The stop bar and stop sign shall be designed, fabricated, located and installed in accordance with the current addition of the Manual of Uniform Traffic Control Devices in accordance with the design standards contained herein and as more specifically directed by the county traffic engineer.

5.2-2.2G-7 Left Turn Storage Lanes

A one-way or two-way left turn lane may be required on a county at the intersection of a new road or street (see figure 10) based on but not limited to one or more of the following:

- The 85th percentile speed of vehicles traveling on the county road in proximity of the new road or street is greater than 40 miles per hour,
- Warrants for a left turn lane are met based on criteria contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO).
- During the site or road traffic peak hour it is anticipated that 3 or more vehicles will queue on the county road waiting to turn left into the development.
- Traffic projections indicate that 26 vehicles or more will make left turns into the development during the road or site peak hour.
- During site or road peak hour it is anticipated that 2 or more semi-trailer trucks will queue on the county road waiting to turn left into the development.
- Traffic safety concerns including but not limited to existing roadway geometry, conflicting traffic movements and proximity of existing driveways or road access.

Where a left turn lane is provided or required on a county road the minimum width of the left turn lane shall be 12' (see figure 10).

Where a left turn lane is provided or required on a county road the minimum width of the through lanes shall be 12'.

Where a left turn lane is provided or required on a county road paved shoulders must be provided at a minimum width of 3'.

Where a left turn lane is provided or required on a county road traffic signs and traffic line striping must be installed in accordance with the current addition of the Manual of Uniform Traffic Control Devices, the current edition of A Policy on

Geometric Design of Highways and Streets published by the American Association of State Highway and Transportation Officials (AASHTO), in accordance with the design standards contained herein and as more specifically directed by the county traffic engineer.

5.2-2.2G-8 By-Pass Areas

Where the left turning movements into the subject property from the county road are not significant enough to warrant a formal left turn lane, the county engineer may require a traffic by-pass to allow through traffic to bypass a vehicle waiting to make a left turn into the subject site. This may require the acquisition of additional right-of-way, which is the responsibility of the developer. Traffic volumes and posted speed limits will be taken into consideration in determining the need for a by-pass area. Generally, a by-pass area will not be required on county roads where the posted speed limit is less than 40 MPH, where through traffic volumes are low or moderate and where the proposed development is projected to generate fewer than 15 left turns from the county road during the peak hour.

A by-pass area shall be a section of widened pavement along a portion of the county road on the side opposite the new road that serves left turns into the development. The by-pass area shall extend to a distance of 100' in each direction along the county road as measured from the extended curblines or edge of pavement of the new road. The widening for the by-pass shall extend to a distance of 20' from the painted centerline of the county road and shall begin and end with pavement tapers designed in accordance with county design standards (see figure 7).

5.2-2.2G9 Jughandles and Overpasses

Where left turns are prohibited from the county road into a development based on high traffic volumes on the county road and generated by the development, the construction of a jughandle or overpass may be required to provide for left turn ingress and/or egress. The installation of a traffic signal may be required in conjunction with a jughandle. Any property acquisitions necessary to construct the jughandle shall be the responsibility of the developer.

5.2-2.2G-10 Centerline and Lane Transitions

Where the painted centerline of the county road is shifted to provide for a left turn lane or to create a by-pass area on the opposite side of the development (see figures 7 & 10), the centerline and/or lane lines shall be re-painted with the appropriate transitions in accordance with the Manual of Uniform Traffic Control Devices.

If the designated speed limit of the county road is 40 MPH or less, the following formula should be used:

$$\frac{WS^2}{60}$$

If the designated speed limit of the county road is greater than 40 MPH, the following formula should be used:

WS

“W” represents the width of the shift of the centerline or lane line and “S” represents the speed limit.

5.2-2.2G-11 Center Islands/Traffic Control Islands

Where center islands are provided within a new road or street that intersects a county road the minimum width of the new road or street approach to a county road shall be 14' which shall consist of a 12' lane and 1' shoulders on each side of the lane.

Where center islands are provided within a new road or street that intersects a county road the minimum width of the new road or street departure from the county road shall consist of a 12' lane with a 1' shoulder between the lane line and the center island and a 3' shoulder on the right side of the lane line.

Where center islands are provided in a new road or street at a county road no portion of the island shall be located within the county road right-of-way unless a traffic control island is required by the county to prohibit turning movements into or out of the subdivision (see figure 9).

Center Islands to restrict turning movements shall be designed in accordance with design standards contained herein and as more specifically directed by the county traffic engineer (see figure 9).

A traffic control island may be required at the intersection of a new road or street and a county road to prohibit turning movements (see figure 9), to separate traffic lanes, to create ramps for right turns into or right turns out of a subdivision and/or to create a refuge for pedestrians crossing the intersection based on but not limited to one or more of the following:

- Required intersection sight distance cannot be provided,
- A left turn lane cannot be provided on the county road,
- Left turns into or out of the new road or street would require vehicles to cross more than one lane of traffic in each direction on the county road, including a center left turn lane,
- There would be insufficient gaps within the flow of traffic on the county road to safely permit left turns into and/or left turns out of the site,
- The new road or driveway would be in close proximity of an existing intersection,

- The new road or driveway would be located across from or within a merge lane, acceleration or deceleration lane, or entrance or exit to a ramp or jughandle,
- There are reasonable alternate access provisions, such as a jughandle(s) that provide for U-turns,
- The site has frontage on an adjacent municipal road or state highway,
- The existing road circulation patterns in proximity of the site permit vehicles to enter or exit the site from either direction of travel,
- Relatively high volumes of traffic will enter or exit the subdivision.

Traffic control islands shall be designed in accordance with the current addition of the Manual of Uniform Traffic Control Devices, the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO), in accordance with the design standards contained herein and as more specifically directed by the county traffic engineer (see figure 9).

5.2-2.2H Acceleration / Deceleration Lane

Where deemed necessary by the county engineer, acceleration and deceleration lanes shall be provided. The length of these lanes and associated lane transitions will be determined by the county traffic engineer based on the traffic generated by the development and the existing and projected traffic on the abutting county road.

5.2-2.2I Emergency Access

Emergency access points shall be a maximum width of 15', and shall be designed so as not to be readily visible and usable by the general motoring public. The emergency access should be gated and signed to allow access for emergency vehicles only. Emergency access drives shall be located to allow for the safe ingress and egress of the emergency vehicles. The emergency access from the county road to the development must consist of grass concrete pavers or equivalent. Use of the emergency access to accommodate pedestrians and/or bicycles may be permitted if the installation of the appropriate signs is approved by the county traffic engineer.

5.2-2.2J Temporary Construction Access

Temporary construction access on county roads may be permitted at the discretion of the county engineer. Any entrance must afford adequate sight distance for drivers of vehicles entering and exiting the driveway (see figure 6). In considering approving such access the county engineer will take into consideration the acceleration and deceleration rates of the construction vehicles. Soil conservation methods must be employed to prevent the tracking of soils onto the county road. Paving of a

portion of the driveway at the county road may be required. A Monmouth County Highway Department Road Opening permit must be obtained for any driveway to be used for construction access whether such driveway is temporary or is at the approved location for the site access.

5.2-2.2K Traffic Signs

Traffic control signs shall conform to the Manual on Uniform Traffic Control Devices, latest edition, and the New Jersey Department of Transportation specifications. The county may require increasing the standard sign size where it is necessary due to site specific conditions.

The location of traffic control signs shall conform to the current edition of the Manual on Uniform Traffic Control Devices, latest edition, and the New Jersey Department of Transportation specifications. The county may determine that adjustments to the sign locations are necessary due to site specific conditions.

Installation of traffic control signs shall conform to the Manual on Uniform Traffic Control Devices and Monmouth County standards.

Materials for traffic control signs shall conform to the Manual on Uniform Traffic Control Devices, latest edition, the New Jersey Department of Transportation specifications and Monmouth County standards. Use of plywood or other non-ferrous materials will not be permitted even under temporary conditions.

5.2-2.2L Advertising Signs

The installation of advertising signs within the county right-of-way shall not be permitted unless permission is granted by the Monmouth County Development Review Committee based upon the recommendation of the Monmouth County Traffic Safety Engineering Division. The applicant may be required to enter into an Indemnification agreement with the County of Monmouth if such agreement is recommended by Monmouth County Planning Board Counsel.

5.2-2.2M Pavement Markings

Pavement marking materials installed on a county road shall be long-life extruded thermoplastic. Long traffic lines shall be in extruded thermoplastic material. Other pavement markings such as directional arrows, "ONLY"s, diagonal stripes, markings for railroad crossings, crosswalks and stop bars shall be in thermoplastic or as directed by the county traffic engineer.

Pavement marking colors shall either be white or yellow and shall conform to the current edition of the Manual of Uniform Traffic Control Devices and as directed by the county traffic engineer.

Centerline markings installed on the county road shall be 4" wide yellow, extruded thermoplastic material. Dashed centerlines, dashed lane lines shall consist of 10'

long stripes, extruded thermoplastic material, separated by 30' long gaps. Where two 4" centerline markings are installed, they shall be separated by a gap of 4"-6". The gap shall be consistent with the remaining portion of the road.

Existing centerline markings across from a new subdivision street shall be removed by the grinding method a minimum of 25' on either side of the extended centerline of the new street. Where centerline markings are altered due to the installation of left turn lanes, the plans must indicate the limits of No Passing zones on the approach and departure sides of the proposed lane striping.

Where passing zones fall below the minimum criteria established by the MUTCD, the passing zones must be eliminated and a no passing zone shall be installed.

Lane lines shall be used to delineate two separate travel lanes, where traffic moves in the same direction. Lane lines shall be 4" wide white, extruded thermoplastic material, except at intersections to delineate exclusive turning lanes, where 8" wide white extruded thermoplastic material shall be used.

Edge lines shall be used to delineate the right edge of the travel lane. Edge lines shall be 4" wide white extruded thermoplastic material. Existing edge lines shall be removed a minimum distance of 25' from the centerline of a new street that enters the county road.

Cross-hatching shall be installed to delineate painted channelizing islands. Cross-hatch lines shall be either white or yellow extruded thermoplastic material, and shall consist of 24" wide lines, separated by 12' gaps.

Stop bars shall be used at all new street and driveway locations. Stop bars shall consist of 24" wide white extruded thermoplastic material. Stop bars must be located a minimum of 4' behind the extended edge of pavement of the county road or a minimum of 4' behind an existing or proposed depressed curb for existing or future handicap ramps.

Pavement markings consisting of words and symbols shall be used to indicate mandatory lane use. They shall be white and shall consist of extruded thermoplastic material.

Painted crosswalks may be required as determined to be appropriate by the county traffic engineer, at locations where a new public street enters the county road where sidewalks exist or are proposed. Crosswalk lines across municipal roads or county roads shall consist of 6" wide white extruded thermoplastic material, separated by a 6' gap. In urban areas or areas with heavy pedestrian traffic as determined by the county traffic engineer, crosswalks across county roads shall consist of 2' wide by 6' long white extruded thermoplastic material, separated by 2' gaps (see figure 12).

Raised pavement markings (RPM's) shall be installed at locations where existing RPM's require removal as a result of modifying the centerline location. RPM

materials, and installation shall conform to Monmouth County specifications.

5.2-2.2N Maintenance of Traffic Control Devices

The County of Monmouth is not responsible for maintaining traffic control signs, traffic striping, or pavement markings outside the county right-of-way or on a driveway or street approach to the county roadway that is not under Monmouth County jurisdiction.

5.2-2.2O Traffic Signals

Where a subdivision or site plan is expected to generate an amount of traffic, or create a traffic safety hazard, which would warrant the installation of a traffic signal, the county traffic engineer may recommend that the land developer prepare plans, specifications, and construct a traffic signal to facilitate traffic entering and leaving the land development.

Where it is determined at the time of review of the land development that a traffic signal may be warranted in the near future, the land developer may be required to post a performance guarantee to cover the cost of designing and constructing a traffic signal. This performance guarantee shall be separate from other performance guarantees posted by the land developer and shall remain in effect for five (5) years from the date of the first occupancy within the land development.

If and when the traffic signal becomes warranted during this five (5) year period, the land developer shall prepare plans, specifications, and construct the traffic signal. Upon successful inspection and activation of the traffic signal installation, which shall be performed in accordance the county's procedures, the county shall accept ownership and maintenance responsibility of said installation. The Developer shall be responsible for providing As-Built plans within seven (7) days of the signal activation.

In all cases, no traffic signal shall be installed unless it meets the warrants as specified in the current edition of the Manual of Uniform Traffic Control Devices and the New Jersey Department of Transportation authorizes the design and installation of such signal.

The county traffic engineer may permit the relocation of existing county owned traffic signals and electrically illuminated signs provided an equally satisfactory and adequate site can be provided which is approved by the New Jersey Department of Transportation. This also applies to pull boxes, conduits, cabinets and other constituent parts of traffic signals and electrical sign installations.

5.2-2.2P Traffic Signal Restrictions

New traffic signals shall not be permitted at locations where the following conditions exist:

- Where the signal does not meet the installation criteria as outlined in the Monmouth County Development Regulations.
- Adequate sight distance to the traffic signal cannot be achieved.
- 95 percentile traffic queues anticipated for any time period would extend to an adjacent signal.
- 95 percentile traffic queues from an existing traffic signal would extend to the proposed access location.
- Access from an existing driveway or road adjacent to the new access could not be combined.
- The installation of a traffic signal would adversely affect the safety and efficient operation of a county road.

5.2-3 SITE PLANS (Multi-Family Residential or Non-Residential Driveways)

5.2-3.1 Access Location, Access Spacing, Access Restrictions and Intersection Design

5.2-3.1A Marginal Access Roads, Service Roads and Common Driveways

Marginal access roads, service roads (see figure 1) and common driveways to limit the number of access points and driveway conflicts along a county road shall be encouraged or required as determined to be necessary by the county traffic engineer.

5.2-3.1B Alternate Access

Access to a county road shall not be permitted if the site plan also abuts a municipal road or adjacent driveway and access to the municipal road or adjacent driveway can be reasonably provided.

5.2-3.1C Backing out or Maneuvering of Vehicles Not Permitted

Driveways on a county road shall be designed so that vehicles are not forced to back out into the county road.

Driveways on a county road shall be designed so that vehicles do not maneuver into or out of on-site parking spaces within the portion of the driveway that is within 20 feet of a county road.

Loading areas shall be located and designed so that vehicles are not required to maneuver or back out onto a county road.

5.2-3.1D Drive-Through

A Drive-through shall be designed so as not to allow vehicles to stack through the site driveway and onto the county roadway. The site plan shall provide a minimum distance of 50 feet from the rear of the maximum queue (or 95-percentile queue) to a point where vehicles can freely maneuver into the site driveway circulation pattern.

5.2-3.1E Loading

Off-street loading areas are not permitted within the county right-of-way or within sight lines or sight triangles (see figures 5 & 6). Loading areas shall be designed so that vehicles maneuvering into or out of loading areas do not enter the path of vehicles entering the site.

Off-street loading areas shall be designed so that vehicles that load and/or unload on the site do not maneuver into or out of the loading area within the county road. Loading areas must be designed and located so that vehicles can maneuver into and out of the loading areas without backing out onto the county road.

5.2-3.1F Parking

Off-street parking spaces and parking isle lanes other than approved ingress and egress driveways, shall not be permitted within the county right-of-way. Off-street parking areas shall be designed so that vehicles maneuvering into or out of parking spaces do not enter the path of vehicles entering the site. Off-street parking areas shall be designed to prevent the maneuvering of vehicles into or out of parking spaces within any portion of an entrance driveway that is within 20 feet of the edge of pavement of a county road. Off-street parking areas shall be designed to permit all vehicles to turn around on the site to prevent vehicles from backing out onto the county road.

Off-street parking shall not be permitted or placed in such a manner as to restrict intersection corner sight distance from the site driveway or an adjacent intersecting street or driveway (see figure 6).

Approved on-street parking shall not obstruct sight distance from the site driveway or an adjacent intersecting street or driveway (see figure 6).

5.2-3.1G Access at County Drainage Structure

Driveway access will not be permitted immediately adjacent to a county drainage structure, within the area protected by existing guiderail extending from a county drainage structure or within the area where future guiderail would be installed based on New Jersey Department of Transportation standards.

5.2-3.1H Sight Distance

5.2-3.1H-1 Intersection Sight Distance

Proposed driveway access to a county road shall be located to maximize sight distance along the county road. New driveways shall be located so as to provide an unobstructed line of sight as established by the following horizontal and vertical measurements. The location of the sight line horizontally is measured from a point 15' behind the edge of pavement of the county road on the center of the driveway to a point equal to a distance of ten times the posted speed limit at the center of the lane on the county road approaching the intersection. The required distance along the county road may be adjusted, if it is demonstrated that the actual travel speed (85th percentile speed) on the county road varies significantly from the posted speed limit. The location of the sight line vertically is measured at a height of 3.5' above the finished grade of the driveway (driver's eye) and at a height of 4.0' above the grade of the county road (approaching vehicle) (see figure 6).

5.2-3.1H-2 Left Turn Sight Distance

New driveways shall be located to provide adequate sight distance for drivers to safely turn left from the county road into the driveway. An unobstructed line of sight for drivers turning left into the new driveway shall be provided as established by the following horizontal and vertical measurements. The location of the sight line horizontally is measured from a point in the center of the lane on the county road approaching the intersection 50' from the centerline of the new driveway to a point located a distance equal to ten times the posted speed limit on the center of the on-coming lane. This required distance may be adjusted, if it is clearly demonstrated through field data that the actual travel speed (85th percentile speed) on the county road varies significantly from the posted speed limit. The location of the sight line vertically for the driver turning left into the new driveway is measured at a height of 3.5' above the grade of the county road (driver's eye) and at a height of 4.0' above the grade of the county road (approaching/on-coming vehicle).

5.2-3.1H-3 Stopping Sight Distance

At the discretion of the county engineer stopping sight distance standards applied to vehicles traveling on the county road approaching vehicles slowing or stopped at the new driveway, may be considered in determining the appropriate location of a new driveway. Stopping sight distance will be based on guidelines contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO) for the posted speed limit on the county road. Stopping sight distance requirements are not to be applied in place of intersection sight distance requirements. Rather, stopping sight distance requirements shall be used as a supplement to intersection sight distance requirements as determined to be necessary by the county engineer.

Expanded or redeveloped sites that access an existing street or driveway will also be required to meet the requirements prescribed herein.

Where the sight line criteria cannot be met, and the applicant is unable to remove the line of sight obstruction certain turning movements at the intersection may be prohibited (see figure 9).

5.2-3.11 Spacing of New Driveways

In determining location and spacing between driveways consideration will be given to the following variables:

- ***Stopping sight distance and intersection sight distance (AASHTO and Monmouth County Standards)***
- ***Posted or operating speed of the county road***
- ***Types of vehicles that will access the site***
- ***Volume of traffic generated at each site driveway***
- ***Existing and anticipated traffic on the county road***
- ***Weaving and merging distances of traffic on the county road***
- ***Distance required to enable exiting traffic to enter the traffic stream on the county road without creating significant speed differences***
- ***Conflicting vehicle turning movements in the vicinity of the site driveway***
- ***Acceleration rates of vehicles exiting the site in question and adjacent site***
- ***Storage distances for back to back left turn lanes on the county road***
- ***Type and design of the county road***
- ***Queuing distances (backups) of existing and anticipated traffic at intersections and driveways along the county road***
- ***Traffic signal coordination requirements***
- ***Surrounding land uses***
- ***Whether the development is located in an urban, suburban or rural environment.***

Generally, only one new two-way driveway shall access a county road from a proposed development. In determining the spacing of new driveways consideration shall be given to existing and proposed roads and driveways on either side of the

development and on the opposite side of the county road.

Two access driveways may be permitted for an individual site where one-way driveway circulation is permitted.

Where more than one (1) two-way driveway is permitted at a county road from a site a minimum distance of at least 550' shall be provided between the closest edges of the driveways. The 550' distance shall be measured at the point of the widest portion of the driveway at the edge of pavement of the county road. The widest portion of the driveway shall include driveway apron flares and corner radii.

Where a site plan is located at the corner of two intersecting roads no portion of the new driveway, including apron and corner radii, shall be located within 10' of the point of tangency of the existing or proposed corner radius.

Unless mitigating site conditions and design constraints are identified by the applicant's design professional to the satisfaction of the county engineer, no portion of a driveway shall be located within 10' of a side property line. The 10' distance shall be measured at the point of the widest portion of the driveway at the edge of pavement of the county road. Driveway apron flares and corner radii are considered as portions of the driveway.

For undivided county roads, access to a site shall align with existing or proposed roads or driveways located on the opposite side of the county road. If the county engineer determines that design constraints or special circumstances exist that prohibit such driveways and/or roads to be aligned then the new driveway may be offset from the existing or proposed road driveway on the opposite side of the county road by not less than 250' feet as measured between the centerlines of the roads or driveways.

Provision of appropriate sight triangles, if required, shall be considered in determining the proper location for a new road or street at a county road (see figure 5).

Care will be used within specific roadway environments to avoid the repeated use of minimum spacing standards to maintain the operational integrity of the county road while providing appropriate access where it is essential for traffic circulation into and out of the site.

5.2-3.1J Access Geometry and Driveway Intersection Design

5.2-3.1J-1 Angle of Intersection

Driveways shall intersect the county road at right angles (90° as measured at the centerlines of the intersecting driveway and the centerline of the county road). If due to mitigating site conditions it is not practical for the roads, streets or driveways to intersect the county road at 90°, a maximum angle of 80° may be permitted.

5.2-3.1J-2 Profile of a Driveway Approach to a County Road

The grade of a driveway approach to a county road generally, shall be no greater than 3% for a minimum distance of 25' from the edge of pavement of the intersecting county road. Based on site design constraints identified by the applicant's design professional and accepted by the county engineer, the maximum grade of the driveway approach may be exceeded. However, in no instance shall a driveway approach grade to a road be more than 7%.

The vertical profile of a driveway approach to the county road shall be designed to prevent impacting of the road, street or driveway by the front, rear or undercarriage of a vehicle.

A maximum grade differential between the slope of the new driveway and the cross slope of the county road shall not be more than 8 %.

Where concrete aprons are permitted or required the maximum grade differential between the slope of the apron and the cross slope of the roadway shall not be more than 8 %.

5.2-3.1J-3 Width of Driveways that Intersect a County Road

The minimum width of a driveway for non-residential or multi-family residential use shall be 24'. In determining the width of the driveway the types of vehicles that will use the driveway shall be considered. As a minimum a new driveway must be designed to accommodate a single unit truck.

Where, due to anticipated traffic volumes and/or frequency of truck traffic it is determined that the new driveway must be striped with centerlines, lane lines and shoulder or edge lines the minimum width of a new driveway approach to a county road as measured from the centerline shall be 13' which shall consist of a 12' lane and a 1' shoulder.

Where, due to anticipated traffic volumes and/or frequency of truck traffic it is determined that the new driveway must be striped with centerlines, lane lines and shoulder or edge lines the minimum width of a new driveway departure from a county road as measured from the centerline shall be 15' which shall consist of a 12' lane and a 3' shoulder.

Wider lane widths and /or additional lanes may be required on the new driveway that intersects a county road as is determined to be necessary by the county traffic engineer based on traffic volumes, the types of vehicles that will use the new road or street and other traffic safety considerations.

5.2-3.1J-4 Corner Radii/Curb Return Radii/Driveway Aprons

The minimum corner radii where a new road or street intersects a county road shall be 15'. Larger corner radii may be required to ensure that vehicles turning into and

out of the new driveway do not cross the centerline of the new driveway, or cross the centerline of the county road or encroach on an adjacent traffic lane.

Where driveway aprons are permitted or required the apron shall flare out a minimum of 5' on each side of the driveway at the terminus of the driveway at the county road. Larger driveway flares may be required to ensure that vehicles turning into and out of the new driveway do not cross the centerline of the new driveway, or cross the centerline of the county road or encroach on an adjacent traffic lane.

The determination of the appropriate turning radii shall be based on turning radii of vehicle types that are anticipated to use the intersection. Required minimum turning radii for various vehicle types will be based on turning radii templates contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO).

5.2-3.1J-5 Driveway and Apron Material

Driveways at a county road shall be paved with bituminous concrete, reinforced concrete or other approved material for the full width of the driveway for a distance of at least 25' from the edge of pavement of the county road.

Where concrete aprons are permitted or required the aprons shall consist of class "B" air entrained concrete (Portland cement) 6" thick and reinforced with welded wire fabric (6" X 6"– 8/8) (see figure 13).

Where concrete aprons are permitted or required depressed curb shall be provided at a proposed driveway. The depressed curb shall extend to a distance of at least 10' further than the width of the driveway where the apron flares out at the county road. Where curb radii are permitted or required the depressed curb shall extend to the point of curvature at the edge of the county road. Depressed curb shall consist of class "B" air entrained gray concrete (Portland cement) and measure 6" at the top, 8" at the base, 20" in height and have a 1 ½" reveal (see figure 14).

Where depressed curb is installed at a new driveway the county road pavement must be saw cut and repaired in accordance with county requirements and standards contained in these regulations (see figure 4).

5.2-3.1J-6 Americans With Disabilities Act (ADA) Requirements

All driveway intersections shall be designed to satisfy ADA requirements. Where curb returns are provided or required at the intersection of a new road or street and a county road depressed curb must be provided to meet the "Americans with Disability Act" design requirements whether or not sidewalks are provided.

5.2-3.1J-7 Stop Sign and Stop Bar

A stop sign and stop bar shall be provided at each new driveway approach to a

county road. The stop bar and stop sign shall be designed, fabricated, located and installed in accordance with the current edition of the Manual of Uniform Traffic Control Devices in accordance with the design standards contained herein and as more specifically directed by the county traffic engineer.

5.2-3.1J-8 Left Turn Storage Lanes

A one-way or two-way left turn lane may be required on a county road at the intersection of a new driveway (see figure 10) based on but not limited to one or more of the following:

- The 85th percentile speed of vehicles traveling on the county road in proximity of the new driveway is greater than 40 miles per hour,
- Warrants for a left turn lane are met based on criteria contained in the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO).
- During the site or road traffic peak hour it is anticipated that 3 or more vehicles will queue on the county road waiting to turn left into the development.
- Traffic projections indicate that 26 vehicles or more will make left turns into the development during the road or site peak hour.
- During site or road peak hour it is anticipated that 2 or more semi-trailer trucks will queue on the county road waiting to turn left into the development.
- Traffic safety concerns including but not limited to existing roadway geometry, conflicting traffic movements and proximity of existing driveways or road access.

Where a left turn lane is provided or required on a county road the minimum width of the left turn lane shall be 12'.

Where a left turn lane is provided or required on a county road the minimum width of the through lanes shall be 12'.

Where a left turn lane is provided or required on a county road paved shoulders must be provided at a minimum width of 3'.

Where a left turn lane is provided or required on a county road traffic signs and traffic line striping must be installed in accordance with the current edition of the Manual of Uniform Traffic Control Devices, the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO), in accordance with the design standards contained herein and as more specifically directed by the county traffic engineer.

5.2-3.1J-9 By-Pass Areas

Where the left turning movements into the subject property from the county road are not significant enough to warrant a formal left turn lane, the county engineer may require a traffic by-pass to allow through traffic to bypass a vehicle waiting to make a left turn into the development. This may require the acquisition of additional right-of-way, which is the responsibility of the developer. Traffic volumes and posted speed limits will be taken into consideration in determining the need for a by-pass area. Generally, a by-pass area will not be required on county roads where the posted speed limit is less than 40 MPH, where through traffic volumes are low or moderate and where the proposed development is projected to generate fewer than 15 left turns from the county road during the peak hour.

A by-pass area shall be a section of widened pavement along a portion of the county road on the side opposite the driveway that serves left turns into the development. The by-pass area shall extend to a distance of 100' in each direction along the county road as measured from the extended curblines or edge of pavement of the site driveway. The widening for the by-pass shall extend to a distance of 20' from the painted centerline of the county road and shall begin and end with pavement tapers designed in accordance with county design standards (see figure 7).

5.2-3.1J-10 Jughandles and Overpasses

Where left turns are prohibited from the county road into a development based on high traffic volumes on the county road and generated by the development, the construction of a jughandle or overpass may be required to provide for left turn ingress and/or egress. The installation of a traffic signal may be required in conjunction with a jughandle. Any property acquisitions necessary to construct the jughandle shall be the responsibility of the developer.

5.2-3.1J-11 Centerline and Lane Transitions

Where the painted centerline of the county road is shifted to provide for a left turn lane or to create a by-pass area (see figures 7 & 10) on the opposite side of the development, the centerline and/or lane lines shall be re-painted with the appropriate transitions in accordance with the current edition of the Manual of Uniform Traffic Control Devices.

If the designated speed limit of the county road is 40 MPH or less, the following formula should be used:

$$L = \frac{WS^2}{60}$$

If the designated speed limit of the county road is greater than 40 MPH, the following formula should be used:

$$L = WS$$

“L” represents the length of the transition, “W” represents the width of the shift of

the centerline or lane line and “S” represents the speed limit.

5.2-3.1J-12 Center Islands/Traffic Control Islands

Where center islands are provided within a new driveway that intersects a county road the minimum width of the new driveway approach to a county road shall be 14' which shall consist of a 12' lane and 1' shoulders on each side of the lane.

Where center islands are provided within a new driveway that intersects a county road the minimum width of the new driveway departure from the county road shall consist of a 12' lane with a 1' shoulder between the lane line and the center island and a 3' shoulder on the right side of the lane line.

Where center islands are provided in a new driveway at a county road no portion of the island shall be located within the county road right-of-way unless a traffic control island is required by the county to prohibit turning movements into or out of the subdivision (see figure 9).

Center Islands shall be designed in accordance with design standards contained herein and as more specifically directed by the county traffic engineer.

A traffic control island may be required at the intersection of a new driveway and a county road to prohibit turning movements (see figure 9), to separate traffic lanes, to create ramps for right turns into or right turns out of a development and/or to create a refuge for pedestrians crossing the intersection based on but not limited to one or more of the following conditions:

- Required intersection sight distance cannot be provided (see figure 6),
- A left turn lane cannot be provided on the county road,
- Left turns into or out of the new driveway or street would require vehicles to cross more than one lane of traffic in each direction on the county road, including a center left turn lane,
- There would be insufficient gaps within the flow of traffic on the county road to safely permit left turns into and/or left turns out of the site,
- The new driveway would be in close proximity of an existing intersection,
- The new driveway would be located across from or within a merge lane, acceleration or deceleration lane, or entrance or exit to a ramp or jughandle,
- There are reasonable alternate access provisions, such as a jughandle(s) that provide for U-turns,
- The site has frontage on an adjacent municipal road or state highway,

- The existing road circulation patterns in proximity of the site permit vehicles to enter or exit the site from either direction of travel,
- Relatively high volumes of traffic will enter or exit the development.

Traffic control islands shall be designed in accordance with the current edition of the Manual of Uniform Traffic Control Devices, the current edition of A Policy on Geometric Design of Highways and Streets published by American Association of State Highway and Transportation Officials (AASHTO), in accordance with the design standards contained herein and as more specifically directed by the county traffic engineer.

5.2-3.1K Acceleration / Deceleration Lane

Where deemed necessary by the county engineer, acceleration and deceleration lanes shall be provided. The length of these lanes and associated lane transitions will be determined by the county traffic engineer based on the traffic generated by the development and the existing and projected traffic on the abutting county road.

5.2-3.1L Emergency Access

Emergency access points shall be a maximum width of 15', and shall be designed so as not to be readily visible and usable by the general motoring public. The emergency access should be gated and signed to allow access for emergency vehicles only. Emergency access drives shall be located to allow for the safe ingress and egress of the emergency vehicles. The emergency access from the county road to the development must consist of grass concrete pavers or equivalent. Use of the emergency access to accommodate pedestrians and/or bicycles may be permitted if the installation of the appropriate signs is approved by the county traffic engineer.

5.2-3.1M Temporary Construction Access

Temporary construction access on county roads may be permitted at the discretion of the county engineer. Any entrance must afford adequate sight distance for drivers of vehicles entering and exiting the driveway (see figure 6). In considering approving such access the county engineer will take into consideration the acceleration and deceleration rates of the construction vehicles. Soil conservation methods must be employed to prevent the tracking of soils onto the county road. Paving of a portion of the driveway at the county road may be required. A Monmouth County Highway Department Road Opening Permit must be obtained for any driveway to be used for construction access whether such driveway is temporary or is at the approved location for the site access.

5.2-3.1N Traffic Signs

Traffic control signs shall conform to the current edition of the Manual on Uniform

Traffic Control Devices, latest edition, and the New Jersey Department of Transportation specifications. The county may require increasing the standard sign size where it is necessary due to site specific conditions.

The location of traffic control signs shall conform to the current edition of the Manual on Uniform Traffic Control Devices, latest edition, and the New Jersey Department of Transportation specifications. The county may determine that adjustments to the sign locations are necessary due to site specific conditions.

Installation of traffic control signs shall conform to the current edition of the Manual on Uniform Traffic Control Devices and Monmouth County standards.

Materials for traffic control signs shall conform to the Manual on Uniform Traffic Control Devices, latest edition, the New Jersey Department of Transportation specifications and Monmouth County standards. Use of plywood or other non-ferrous materials will not be permitted even under temporary conditions.

5.2-3.10 Advertising Signs

The installation of advertising signs within the county right-of-way shall not be permitted unless permission is granted by the Monmouth County Development Review Committee based upon the recommendation of the Monmouth County Traffic Safety Engineering Division. The applicant may be required to enter into an Indemnification agreement with the County of Monmouth if such agreement is recommended by Monmouth County Planning Board Counsel.

5.2-3.1P Pavement Markings

Pavement marking materials installed on a county road shall either be long-life extruded thermoplastic, or long-life spray extruded thermoplastic. Long traffic lines shall be in extruded thermoplastic material. Other pavement markings such as directional arrows, "ONLY"s, diagonal stripes, markings for railroad crossings, crosswalks and stop bars shall be in extruded thermoplastic or as directed by the county traffic engineer.

Pavement marking colors shall either be white or yellow and shall conform to the Manual of Uniform Traffic Control Devices and as directed by the county traffic engineer.

Centerline markings installed on the county road shall be 4" wide yellow, extruded thermoplastic material. Dashed centerlines, dashed lane lines shall consist of 10' long stripes, extruded thermoplastic material, separated by 30' long gaps. Where two 4" centerline markings (double lines) are installed, they shall be separated by a gap of 4"-6". The gap shall be consistent with the gap between the double lines on the remaining portion of the road.

The removal of existing centerline markings across from the driveway of a large development, may be required by the county traffic engineer. If required the existing

centerline shall be removed by the grinding method a minimum of 25' on either side of the extended centerline of the new driveway. Where centerline markings are altered due to the installation of left turn lanes, the plans must indicate the limits of No Passing zones on the approach and departure sides of the proposed lane striping. Where passing zones fall below the minimum criteria established by the MUTCD, the passing zones must be eliminated and a no passing zone shall be installed.

Lane lines shall be used to delineate two separate travel lanes, where traffic moves in the same direction. Lane lines shall be 4" wide white, extruded thermoplastic material, except at intersections to delineate exclusive turning lanes, where 8" wide white extruded thermoplastic material shall be used.

Edge lines shall be used to delineate the right edge of the travel lane. Edge lines shall be 4" wide white extruded thermoplastic material. The removal of existing edge lines may be required by the county traffic engineer. Where required the existing edge lines shall be removed a minimum distance of 25' from the centerline of a new driveway that enters the county road.

Cross-hatching shall be installed to delineate painted channelizing islands. Cross-hatch lines shall be either white or yellow extruded thermoplastic material, and shall consist of 24" wide lines, separated by a 12' gaps.

Stop bars shall be used at all new driveway locations. Stop bars shall consist of 24" wide white extruded thermoplastic material. Stop bars must be located a minimum of 4' behind the extended edge of pavement of the county road or a minimum of 4' behind an existing or proposed depressed curb for existing or future handicap ramps.

Pavement markings consisting of words and symbols shall be used to indicate mandatory lane use. They shall be white and shall consist of extruded thermoplastic material.

Painted crosswalks may be required as determined to be appropriate by the county traffic engineer, at locations where a new driveway enters the county road where sidewalks exists or are proposed. Crosswalk lines across county roads, municipal roads or driveways shall consist of 6" wide white extruded thermoplastic material, separated by a 6' gap. In urban areas or in areas with heavy pedestrian traffic as determined by the county traffic engineer, crosswalks across a county road shall consist of 2' wide by 6' long white extruded thermoplastic material, separated by 2' gaps (see figure 12).

Raised pavement markings (RPM's) shall be installed at locations where existing RPM's require removal as a result of modifying the centerline location. RPM materials, and installation shall conform to Monmouth County specifications.

5.2-3.1Q Maintenance of Traffic Control Devices

The County of Monmouth is not responsible for maintaining traffic control signs, traffic striping, or pavement markings outside the county right-of-way or on a driveway or street approach to the county roadway that is not under Monmouth County jurisdiction.

5.2-3.1R Traffic Signals

Where a subdivision or site plan is expected to generate an amount of traffic, or create a traffic safety hazard, which would warrant the installation of a traffic signal, the county traffic engineer may recommend that the land developer prepare plans, specifications, and construct a traffic signal to facilitate traffic entering and leaving the land development.

Where it is determined at the time of review of the land development that a traffic signal may be warranted in the near future, the land developer may be required to post a performance guarantee to cover the cost of designing and constructing a traffic signal. This performance guarantee shall be separate from other performance guarantees posted by the land developer and shall remain in effect for five (5) years from the date of the first occupancy within the land development.

If and when the traffic signal becomes warranted during this five (5) year period, the land developer shall prepare plans, specifications, and construct the traffic signal. Upon successful inspection and activation of the traffic signal installation, which shall be performed in accordance the county's procedures, the county shall accept ownership and maintenance responsibility of said installation. The Developer shall be responsible for providing As-Built plans within seven (7) days of the signal activation.

In all cases, no traffic signal shall be installed unless it meets the warrants as specified in the Manual of Uniform Traffic Control Devices and the New Jersey Department of Transportation authorizes the design and installation of such signal.

The county traffic engineer may permit the relocation of existing county owned traffic signals and electrically illuminated signs provided an equally satisfactory and adequate site can be provided which is approved by the New Jersey Department of Transportation. This also applies to pull boxes, conduits, cabinets and other constituent parts of traffic signals and electrical sign installations.

5.2-3.1S Traffic Signal Restrictions

New traffic signals shall not be permitted at locations where the following conditions exist:

- Where the signal does not meet the installation criteria as outlined in the Monmouth County Development Regulations.

- Adequate sight distance to the traffic signal cannot be achieved.
- 95 percentile traffic queues anticipated for any time period would extend to an adjacent signal.
- 95 percentile traffic queues from an existing traffic signal would extend to the proposed access location.
- Access from an existing driveway or road adjacent to the new access could not be combined.
- The installation of a traffic signal would adversely affect the safety and efficient operation of a county road.

5.3 COUNTY ROAD DESIGN STANDARDS

The design of roadway improvements shall be in accordance with current American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets, New Jersey Department of Transportation standards, Monmouth County design standards and design guidelines contained in the Monmouth County Scenic Road Plan. Construction details shall follow the New Jersey Department of Transportation construction detail sheets as modified by Monmouth County.

5.3-1 County Road Width

The minimum width of a county road that is not classified as a scenic county road, from edge of pavement to edge of pavement, is 40'. The minimum half-width of a county road that abuts a development shall be 20' which generally will consist of a 12' wide through lane and an 8' wide shoulder. The 20' half-width shall be measured from the painted centerline of the road not from the centerline of the road right-of-way unless otherwise directed by the county engineer.

The preceding county road standards may be adjusted in accordance with design guidelines contained in the Monmouth County Scenic Road Plan at the discretion of the Monmouth County Development Review Committee.

5.3-2 Lane Widths

Other county road design configurations may be required where additional lanes are necessary. The following lane widths shall be provided on county roads:

- Through lanes with shoulder shall be 12'
- Through lanes without shoulders shall be 15'
- Left turn lanes shall be 12'

- Right turn lanes shall be 15’.
- Two-Way Center Left Turn Lanes shall be a minimum of 14’.
- Shoulder Width – Shoulder widths shall be a minimum of 3’ and a maximum width of 10’.

5.3-3 Road Cross-Slope

Widening of a county road or new road construction shall be designed to obtain the best practical horizontal and vertical alignments. The cross slopes on a widened county road shall be between 2% and 3%. Cross slopes on new roadways shall be 2.5%. The minimum cross slope for overlays of existing roadways shall be 2%. Careful consideration shall be given to impacts on existing intersections, driveways and sidewalks.

5.3-4 Super-elevation

Super-elevations of a county road shall not be permitted without the approval of the Monmouth County Engineer. In those circumstances where Super-elevation is permitted, the roadway cross section shall be broken a minimum of three feet from the outside curb line or edge of pavement to provide for a minimum 2.5% cross slope to the gutter.

5.3-5 Crown and gutter profile

The minimum crown and gutter profile slopes shall be 0.5%. Careful consideration shall be given to impacts on existing intersections, driveways and sidewalks. On sag curves, the gutter line profile grades may need to be broken to maintain the minimum 0.5% required.

5.3-6 Pavement Section

The county pavement cross-section specifications are (see figure 3):

- Surface course - FA-BC, Mix I-5, 2” thick
- Base course - Bituminous stabilized base course, Mix I-2, 6” thick
- Sub-base course - Dense graded aggregate conforming to Subsection 901.08 of the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction (1989 edition or most current edition) 6” thick (As required by county engineer)

The minimum final pavement thickness for any roadwork shall be not less than 8”.

5.3-7 Pavement Joint for Road Widening

5.3-7.1 No Existing Curb

The county road shall be sawcut 2' from the edge of the existing pavement where curb does not exist. The standard county road pavement section shall be installed between the sawcut and the new edge of pavement or new curb line (see figure 4).

5.3-7.2 Existing Curb

The county road shall be sawcut 1' from the curb line. The standard county road pavement section shall be installed between the sawcut and the new edge of pavement or new curb line (see figure 4).

5.3-8 Pavement Overlay/Resurfacing

If determined to be necessary by the county engineer, a 2" overlay shall be provided along the development frontage from the existing centerline to the new curbline. Milling will be required to key in the new pavement at the centerline.

Where the county road is to be resurfaced/overlaid, the area to be resurfaced/overlaid shall be milled for at least 50' from the limits of work at either end. Feathering into the adjacent pavement will not be permitted.

5.3-9 Curb

Curb must be provided along the development property that abuts a county road. The curb line must be located no closer than 20' from the painted centerline of the county road. The curbing shall be constructed of Class "B" gray air entrained concrete and measure 6" at the top, 8" at the base, 20" in height and have a reveal of 8" (see figure 4). Based on existing conditions in the area surrounding the site and where the site frontage is minimal, a lower curb reveal may be required as determined by the county engineer.

Vertical curb tapers shall be required at the beginning and end of a new curbline where existing curb does not exist along the properties adjacent to the new curbline. Vertical curb tapers shall be 10' in length, 2" in height at the low end and meet the height of the new curb at the high end (see figure 15).

The preceding county road standards may be adjusted in accordance with design guidelines contained in the Monmouth County Scenic Road Plan at the discretion of the Monmouth County Development Review Committee.

5.3-10 Pavement Repair for Replacement of Existing Curb

Where curb along a county road is to be replaced, the existing curb shall be removed, the county road pavement shall be sawcut 1' from the curbline through the surface course of pavement only. The surface course of pavement shall be removed and the new curb shall be face formed. The surface course of pavement

shall be replaced with fine aggregate bituminous concrete between the sawcut and new curb (see figure 4).

5.3-11 Treatment of the County Right-of-Way and Area Immediately Adjacent to the Right-of-Way

The area behind the curb/edge of pavement and within the county right-of-way must be graded at either a 2% incline or decline. The area must be treated with 4" of topsoil and hydro-seeded. Grading from the right-of-way back into the development property must be at a maximum slope of 2 feet horizontal to one foot vertical (see figure 3).

The preceding county road standards may be adjusted in accordance with design guidelines contained in the Monmouth County Scenic Road Plan at the discretion of the Monmouth County Development Review Committee.

5.3-12 Utility Poles

Utility poles shall be located a minimum of 6' from the edge of pavement of a county road. The county engineer may authorize adjustments to the strict adherence to this standard for relocations of three (3) poles or less. The applicant must provide a letter to the county stating that the utility company approves the location of the utility poles.

5.3-13 Sidewalks

If sidewalks are required by the municipal approval authority along any portion of a development that abuts a county road, the sidewalks are to be installed 4 feet from the right-of-way line unless otherwise directed. Sidewalks must be a minimum of 4' wide and shall consist of 4" thick Portland cement.

Since the County of Monmouth does not assume any maintenance responsibility for sidewalks, sidewalks will not be required by the Monmouth County Development Review Committee as a condition of approval unless it is to replace existing sidewalk.

5.3-14 Pavement Tapers

Pavement tapers shall be provided at the beginning and end of any portion of a county road that is to be widened where the existing pavement at either end of the widening is not consistent with the width of the area being widened. The pavement taper at the beginning of the widening (approach side) is to be 50' in length. The pavement taper at the end of the widening (departure side) is to transition at 15:1 (15' of taper for every 1' of widening). Curb may be required along the pavement taper and will be determined based on site conditions.

5.3-15 Guiderail

5.3-15.1 Guiderail Warrants and Construction Details

Warrants for guiderail installation shall be based on AASHTO Roadside Design Guidelines and New Jersey Department of Transportation standards.

Length of need calculations, post spacing, fixed object treatment, etc... shall be in accordance with New Jersey Department of Transportation standards and as more specifically directed by the county engineer.

5.3-15.2 Type of Material

Guiderail shall consist of galvanized steel posts and rails. Where a development is located along a scenic county road and guiderail is required, other surface color or surface treatment of the guiderail may be used as approved by the county engineer, to minimize the visual impact of the guiderail on the surrounding streetscape.

5.3-15.3 Guiderail End Treatments

Breakaway Cable Terminals (BCT) shall be installed at the guiderail terminus for roads where the speed limit is less than 40 MPH.

Slotted Rail Terminals or Extruded Terminals (ET 2000) shall be used for roads where the speed limit is 40 MPH or greater. Alternative end treatments shall only be permitted if approved by the county engineer.

5.4 COUNTY STORM WATER MANAGEMENT SYSTEMS DESIGN CRITERIA AND DESIGN STANDARDS

Adequate drainage facilities shall be provided in county roads where a subdivision or site plan will contribute storm water runoff to the road or where county roads are widened or otherwise improved. The system must be sized for all areas tributary to it.

5.4-1 DESIGN CRITERIA

Storm sewer systems must be designed to convey the peak runoff from a 25-year storm under full flow conditions. Minimum design velocity at flowing full conditions shall be three feet per second. Maximum design velocity shall not exceed fifteen feet per second. Hydraulic losses at inlets, outlets, junctions, bends, etc., must be considered in the design.

5.4-1.1 Hydrology

Hydrology is the science which deals with the movement of water upon and beneath the earth. It allows the engineer to determine the amount of runoff from a corresponding rainfall. The following sections will show the various methods of determining runoff rates.

5.4-1.1A Rational Method

The Rational Method is based on the Rational Formula, $Q=CIA$. This method is used for drainage basins of 25 acres or less.

(a) Rainfall Intensity, I

The intensity, I, is the average rainfall rate in inches per hour for the period of maximum rainfall of a given frequency having a duration equal to the time of concentration. Refer to the "Monmouth County Rainfall Intensity Curves" (see figure 23). For design purposes, a storm with a return frequency of 25 years should be used. In some instances, the estimated time of concentration should reflect future or ultimate conditions.

(b) Runoff Coefficient, C

The Runoff Coefficient is a dimensionless value between 0.10 and 0.90 which represents the percentage of rainfall which results in runoff. Typical runoff coefficients for various types of land use and surface conditions recommended for use in Monmouth County are listed in figure 25.

(c) Drainage Basin Area, A

The drainage basin area to the point of interest should be determined with the use of topographical maps. The drainage basin ridgeline and calculated area should be indicated on the topographic map.

5.4-1.1B Modified Rational Method (MRM)

This procedure is a modification of the rational method which approximates the runoff hydrograph by either a triangular or trapezoidal shape. With this method, a uniform rainfall intensity is assumed for the rainfall averaging period and is equal to the entire duration of the storm.

A typical example illustrating the use of this method is worked out in detail in Appendix A-9 of the "Standards for Soil Erosion and Sediment Control in New Jersey," April 1987 edition. These standards and subsequent amendments shall be used in determining the design of county drainage systems.

5.4-1.1C Technical Release #55 (SCS Method)

This method is a tabular hydrograph method as presented in Technical Release #55 (TR 55) published by the Soil Conservation Service, U.S. Department of Agriculture. This method may be used for watersheds with drainage areas of less than five square miles.

5.4-1.1D Other Methods

Some other methods to determine runoff rates are Special Report (SR) 38, U.S. Soil Conservation Service TR-20 model, the U.S. Army Corps of Engineers HEC-1 model, and the Log-Pearson Type III method.

5.4-1.2 Hydraulics

While hydrology determines the rates and volumes of runoff, hydraulics determines the depth of flow in an open or closed conduit.

5.4-1.2A Open Channel Design (Manning's Equation)

Normal depth of flow, d_N , is computed using Manning's equation by trial and error solution defines the channel cross section and provides a form for computing the normal depth. Values of the channel roughness coefficient "n" for use in the Manning's equation are given in figure 25.

5.4-1.2B Closed Conduit Design

Storm sewer system must be designed so they can convey the peak runoff from a 25-year storm under full flow conditions. Minimum design velocity at flowing full conditions shall be three feet per second. Maximum design velocity shall not exceed fifteen feet per second. Hydraulic losses at inlets, outlets, junctions, bends, etc., must be considered in the design.

5.4-2 Storm Sewer Inlets

5.4-2.1 Spacing and Type of Inlets

"B" type storm sewer inlets shall be provided along county roads at intervals of at least 350' feet. More frequent spacing of inlets may be required so that no inlet in a county road will receive storm water flow of more than 6.0 cubic feet per second.

Inlets shall also be placed at low points or at other locations where there is a potential for ponding.

Where the subdivision road intersects the county road, gutter drainage along the county road must be intercepted by storm water inlets on the upstream side of a new road or driveway to prevent storm water from crossing the intersection. Dished type gutters to carry drainage through an intersection will not be permitted unless the high point of the gutter upstream of the intersection is less than 150' from the intersection.

"E" type storm sewer inlets may be permitted where the county engineer has determined that site conditions require the use of "E" type inlets.

Seepage Pits are not allowed in the county right-of-way since they are prone to clogging with sediments and ultimate failure.

Storm sewer Inlets that incorporate sediment traps, oil separators trash traps, etc. are maintenance-intensive and must be approved by the county engineer.

If an existing storm sewer inlet needs to be relocated to allow for pavement widening, a modified inlet may be used if the offset of the new inlet grate is three feet or less (see figure 19). If the offset is greater than three feet, the existing inlet must be converted to a manhole and a new inlet must be constructed at the new edge of pavement. Storm water is to be relayed from the new inlet to the manhole with appropriately designed and sized reinforced concrete pipe.

Where curb along a county road is waived by the Monmouth County Development Review Committee as recommended by the county engineer, "B" type inlets are to be installed with 10' long vertical curb tapers on each side of the inlet (see figure 15).

5.4-2.1A Grate Type

All storm sewer inlets within the pavement of the county right-of-way must have bicycle type grates. For "B" inlets, Campbell Foundry Company pattern numbers 2617 or 2618 can be used or equivalent as approved by the county engineer.

5.4-2.1B Grate Elevation

The grates of storm sewer inlets not in a travel lane shall be depressed 2" below the design profile elevation. The surrounding road pavement shall be graded and contoured flush with the grate elevation (See figure 18). The curbheads of the inlets shall be 2" greater in height than the typical curbface to maintain a consistent top of curb profile. At locations where the grates must be installed in the traveled way or at curb returns at intersections, grate elevations shall meet the existing surrounding grade and must not be depressed.

5.4-3 Drainage Ditches

Drainage ditches along the sides of county roads shall be eliminated and replaced with storm sewers of adequate capacity.

5.4-4 Storm Sewer Pipes

5.4-4.1 Type of Pipe

All sub-surface storm sewers within the county right-of-way shall be made of reinforced concrete pipe or ductile iron pipe.

5.4-4.2 Class of Pipe

The class of reinforced concrete pipe to be used within the county right-of-way shall be at a minimum of Class III. If conditions are such that cover over the pipe must be reduced below the acceptable values for Class III, higher classes of pipe (Class IV or Class V) shall be used as appropriate in accordance with specifications of the most current publication of the Concrete Pipe Association of New Jersey. Where ductile iron pipe is approved, CL 52 shall be used.

5.4-4.3 Diameter of Pipe

The minimum pipe diameter for pipe constructed within the county right-of-way shall be 15”.

The pipe diameter must be properly sized in to accommodate with the county’s design criteria for closed conduit system design.

5.4-4.4 Depth of Cover

The depth of cover over a storm sewer pipe within the county right-of-way shall be a minimum of 6 inches. Acceptable depths of cover for each class of pipe shall be based on specifications of the most current publication of the Concrete Pipe Association of New Jersey.

5.4-4.5 Pipe Transitions

Where pipe sizes are less than 48 inches in diameter, all transitions in slope, changes in horizontal direction, junctions of pipes and change in pipe sizes shall be confined to manholes, catch basins, or other accessible structures designed for such purposes. Where 48 inch pipe lines and larger are used, vertical and horizontal deflections may be accomplished using 100 foot radii curves, or greater if approved by the county engineer.

5.4-4.6 Storm Water Pipes in Driveways

Where a drainage ditch exist within the county road right-of-way, and where the proposed development is for a minor subdivision, and where driveway access is approved by the Monmouth County Development Review Committee, the driveway may be carried over the ditch by the installation of concrete pipe or ductile iron pipe with adequate hydraulic capacity as approved by the county engineer. Flared end pipe sections must be provided at the beginning and end of the pipe.

Where a drainage ditch exists within the county road right-of-way and where a major subdivision or a development of multi-family homes, commercial, industrial, office, warehousing use is proposed, the drainage ditch shall be replaced with a sub-surface storm sewer system approved by the county engineer.

5.4-4.7 End Treatment

5.4-4.7A Headwall

Gravity headwalls shall not be used for pipes with diameters of 60" and greater. Cast-in-place reinforced concrete footings, headwalls and wing walls as necessary shall be used.

5.4-4.7B Flared End Sections

If field conditions allow, this form of treatment is preferred at the outfall of county drainage systems for pipe diameters less than 60".

5.4-4.8 Grassed Swales

Where grassed swales are permitted or required along a scenic county road or to comply with New Jersey Department of Environmental Protection water quality standards, these grassed swales shall be located as far from the road within the right-of-way, as possible. The center profile of grassed swales within the county road right-of-way shall have a slope of not less than 2%. Side slopes shall be no less than 5' horizontal to 1' vertical.

5.4-4.9 Regional Detention/Retention Facilities

The use of regional detention/retention facilities are strongly encouraged and may be required. Where all or a portion of one or more developments are proposed within a drainage basin, the storm water flow from the developments may be directed into detention/retention facilities that will accommodate the storm water from all of the proposed developments within the basin.

5.5 LANDSCAPING ALONG COUNTY ROADS

Street trees, which shall be planted along all county roads, subject to review and approval by the Monmouth County Shade Tree Superintendent. All shade trees shall be minimum of 2 -2 ½ inch caliper, Balled and Burlapped, and conform to the American Standard of Nursery Stock (latest edition).

5.5-1 Street Tree Spacing

Spacing of existing shade trees shall determine the spacing standards for new shade trees unless otherwise directed by the Monmouth County Shade Tree Superintendent. Shade trees may be inter-planted between existing shade trees; however, the species should remain the same, or have similar growth habit and visual characteristics.

Shade trees shall spaced evenly along the street, however, if a specific effect is desired, the trees may be massed at critical points or shall be a combination of both. If columnar trees are to be planted, the spacing may be closer. All tree

spacing shall be subject to review and approval by the county shade tree superintendent.

All trees shall adhere to the following minimum planting distances for all utility or site infrastructure clearances:

- All trees shall be planted a minimum six (6) feet from the edge of pavement except where underground or overhead utilities are present, then the minimum distance shall be fifteen (15) feet for small trees, twenty (20) feet for medium trees, and thirty (30) feet for large trees
- All trees shall be planted a minimum ten (10) feet from all drain inlets, catch basins, and trench drains.
- All trees shall be planted a minimum ten (10) feet from any driveway aprons.
- All trees shall be planted a minimum five (5) feet from any sidewalk.

Shade trees along county roads shall generally be of the same species unless specified otherwise by the county shade tree superintendent. Shade trees shall vary in species from road to road. Where shade trees along a county road include a variety of species, the general growth habit and scale of the trees should be similar so as to produce continuity.

The following table should be used for general guidance in the spacing of shade trees to be planted along county roads. Specific situations or specific design requirements require review and approval of the modification of standards by the county shade tree superintendent.

Tree Size	Height in feet	Spacing in feet
Large trees	45+	40
Medium trees	30 - 45	30
Small trees	below 30	25

All deciduous trees shall be a minimum of two (2) inches in caliper as measured at one (1) foot above the ground. The size of evergreens and shrubs shall be allowed to vary depending on setting and type of tree or shrub.

The minimum height of all proposed deciduous trees shall be eleven (11) feet. The minimum height of all ornamental trees shall be allowed to vary depending on setting and type of tree.

5.5-2 Grass and Topsoil

Identification of all areas to receive topsoil and seed, sod or other approved

vegetative cover. Topsoil removed during the course of construction within county right-of-way shall be stockpiled and redistributed on all re-graded surfaces within county right-of-way. A minimum even cover of four (4) inches of shall be redistributed to all disturbed areas of the affected right-of-way and shall be stabilized by seeding, application of sod or use of other approved vegetative material. If excess topsoil remains, the thickness of cover shall be increased. If additional topsoil is required, it shall be the responsibility of the developer to provide comparable topsoil. Topsoil shall not be removed from the site nor is topsoil to be used as spoil. Topsoil removed during the course of construction shall be stockpiled and redistributed so as to provide a nearly equal amount of cover to all disturbed areas of the affected right-of-way and shall be stabilized by seeding or planting on all slopes up to ten (10%) percent as shown on the Final Grading Plan. All slopes and drainage swales over ten (10%) percent shall be stabilized.

In cases where additional topsoil may be required, the imported material must be a friable, loamy soil, reasonably free of debris, objectionable weeds and stones; possess a natural pH of 5.0 to 7.5; have an organic content greater than 2.00 percent; and contain no toxic substances that may be harmful.

Details of the rate and application method for grass seed. (See table)

Soil Type	Maintenance Character Use	Seed Mix Use	Pounds per acre	Seeding Depth	Optimum Installation
Well to Excessively Well Drained Soils	Right of Way Wildlife Areas	Weeping Lovegrass Sericea Lespedeza	2 20	...” - 1/2”	3/1 - 8/1
	Unmowed (Coarse Area)	Switchgrass	25	...” - 1/2”	4/1 - 6/1
	Unmowed	Weeping Lovegrass Crownvetch	3 12	1/2” - 1”	3/1 - 8/1
	Unmowed (Road Banks)	Perennial Ryegrass Crownvetch Spreading Fescue	25 12 25	...” - 1/2”	2/15 - 5/1 8/15 - 10/15
Coarse Textured Soils	Unmowed (Suppress woody growth)	Weeping Lovegrass Flatpea	3 30	1/2” - 1”	3/1 - 8/1
	Unmowed	Sheep Fescue, Perennial Ryegrass	45 10	...” - 1/2”	2/15 - 5/1 8/15 - 10/15

Soil Type	Maintenance Character Use	Seed Mix Use	Pounds per acre	Seeding Depth	Optimum Installation
Moderately to Well Drained Soils	Detention Basins, Dikes, Diversion (sun/open shade)	Tall Fescue Spreading Fescue Kentucky Bluegrass	30 30 30	...” - 1/2”	2/15 - 5/1 8/15 - 10/15
	Unmowed Area (meadow)	Tall Fescue Sericea Lespedeza	25 20	...” - 1/2”	2/15 - 5/1 8/15 - 10/15
	Mowed Areas (Shade & Shade Sites)	Spreading Fescue Red Fescue Kentucky Bluegrass Perennial Ryegrass	15 15 25 10	...” - 1/2	2/15 - 5/1 8/15 - 10/15 (Shade & Cool sites only)
	Right of Way Wildlife Areas	Weeping Lovegrass Sericea Lespedeza	2 20	...” - 1/2”	3/1 - 8/1
	Unmowed (Coarse Area)	Switchgrass	25	...” - 1/2”	4/1 - 6/1
	Unmowed	Weeping Lovegrass	3 12	1/2” - 1”	3/1 - 8/1
	Unmowed (Road Banks)	Perennial Ryegrass Crownvetch Spreading Fescue	25 12 25	...” - 1/2”	2/15 - 5/1 8/15 - 10/15
	Poorly Drained Soils	Mowed & Unmowed (Sunny wet areas)	Reed Canarygrass Redtop Perennial Ryegrass	20 4 20	...” - 1/2”
Detention Basins, Dikes, Diversion (sun/open shade)		Tall Fescue Spreading Fescue Kentucky Bluegrass	30 30 30	...” - 1/2”	2/15 - 5/1 8/15 - 10/15

5.5-3 Planting Notes/Soil Backfill mixture

All plant holes shall be backfilled with 1/3 subsoil and 2/3 soil mixture. The soil

mixture shall be a combination of two (2) parts native loamy soil, one (1) part coarse sandy topsoil, and one (1) part peat humus or peat moss. A 10-6-4 fertilizer at a rate of ½ lb. per hole or liquid fertilizer as per label shall be mixed with the backfill soil mixture. The backfill soil mixture shall be free of all rocks and debris.

5.5-4 Guying and staking

All deciduous trees under three (3) inches in caliper shall be staked. All deciduous trees three (3) inches in caliper or greater shall be guyed. All evergreen trees under eight (8) feet shall be staked. All evergreen trees eight (8) feet or greater shall be guyed. Guying and staking detail shall be included on Landscape Plan. Guying and staking may be omitted if specific site conditions permit, subject to review and approval by the county shade tree superintendent.

All deciduous and evergreen trees requiring stakes shall have a minimum of three (3), six (6) to eight (8) foot cedar or oak stakes, no less than two (2) inches in diameter, installed in a triangular pattern to anchor the tree against the prevailing winds. Each stake shall be set two (2) feet into the ground parallel to the tree just beyond the root ball. Each tree shall be secured to the stakes with double strand twisted malleable #10 gauge annealed steel wire. The wire shall be looped through a two-ply fabric bearing rubber hose ½” minimum I.D. and secured approximately 2/3’s up the tree or just at first branches. All stakes and wires shall be removed after two years.

All deciduous and evergreen trees requiring guy wires or cables shall have a minimum of three (3), three (3) foot long cedar or oak stakes, no less than three (3) inches in diameter, installed in a triangular pattern to anchor the tree against the prevailing winds. Each guying stake shall be installed at a 45° angle away from the tree. Each guy wire or cable shall be looped through a two-ply fabric bearing rubber hose ½” I.D. and secured approximately 2/3’s up the tree or just at first branches. Each guy wire or cable shall have a turnbuckle to tension the wire or cable. All stakes and guy wires or cables shall be removed after two years.

Protective barriers shall be installed around each plant and/or group of plants that are to be retained within the county right-of-way and within 50 feet of the proposed county right-of-way. Barriers shall be self-supporting and shall not be attached to the vegetation being protected. Barriers shall be a minimum of four (4) feet high and constructed of highly visible orange plastic mesh that is durable and that will last until construction is completed. A silt fence shall be installed along the outside perimeter base of the plastic mesh fence to prevent siltation from occurring in areas where shrubs or trees are to be retained. All roots shall be pruned one foot beyond the fence using a vibrating knife or narrow trencher. The trench shall be immediately backfilled and covered with a minimum of three (3) inches of mulch. All protected areas shall be signed to identify that tree preservation efforts are underway and to define the limit of construction.

No construction equipment; construction material; or temporary soil deposits, shall be placed within five (5) feet of an existing shrub or within the crown spread of an

existing tree designated to be retained on the Landscape Plan.

Protective tree wells or retaining walls shall be installed around each plant and/or groups of plants that are to be retained within the county right-of-way, or within fifty (50) feet of the county right-of-way, where the base of the trunk is to be lower than the surrounding finished grade by more than nine (9) inches. No tree well or retaining wall shall be installed within five (5) feet of an existing shrub, or within the drip line of an existing designated to be retained on the Landscape Plan.

5.5-5 Buffer Areas

A buffer may be required along county roads where topography, or existing vegetation alone, does not provide sufficient visual screening. The Development Review Committee may determine that the proposed development requires additional buffering to minimize adverse impacts such as incompatible land uses, noise, glaring light, and traffic. All landscape buffers shall be designed to provide a year-round visual screen to minimize the adverse impacts from a site adjacent to a county road. The buffer may consist of plants, land contouring, fencing, walls, rocks, boulders, mounds, berms, or combinations thereof to achieve the stated objectives. All buffers shall take into consideration the existing and proposed site conditions including landscape patterns.

Where required, a minimum width of planted buffer of fifty (50) feet shall be provided along county right-of-way.

The Development Review Committee may consider alternatives to the minimum planted buffer width in those cases where such buffer width becomes impractical.

Proposed buffers shall take into consideration the existing surrounding landscape and vegetative patterns. All buffers should be designed to provide maximum visual protection to adjacent properties. All buffers should appear as natural to the site and the surrounding area, as possible.

In cases where buffers incorporate land contouring to achieve visual screening, the resulting contours should appear as part of the natural site topography.

All buffers shall consist of plant material of such size and species, as to provide year round visual screening within three(3) growing seasons. The use of native or indigenous plant material may be utilized in specific cases upon review and approval by the county shade tree superintendent .

5.5-6 Plant Selection

All plant materials proposed on the Landscape Plan shall be subject to the review and approval of the county shade tree superintendent.

All plant materials used shall be true to name and size in conformity with the American Standard of Nursery Stock (latest edition) and shall be typical of their

species and variety. All plants shall have normal, well-developed branches and vigorous root systems. Plants shall be sound, healthy, vigorous, free from defects, disfiguring knots, abrasions of the bark, sunscald injuries, plant diseases, insect eggs, borers and all other forms of infection. All plants shall be nursery grown, unless specifically approved by the county shade tree superintendent. All plants shall be grade "A" nursery stock. Proof of plant material origin shall be presented to the county shade tree superintendent for review and approval, prior to delivery of material to the project site.

All plant material shall be climatically suitable for that particular climatic zone in which the project is located.

Plant material must be tagged at the source by the Landscape Architect or agent in charge. All plants (B&B or container) shall be clearly identified as to Genus, specie, variety, Common Name and size on weather-proof labels securely attached prior to delivery to the project site. All plants shall be protected from wind and heat damage during transit to the job site by a tarpaulin. Individual plant material labels shall not be removed prior to final site inspection and approval by the county shade tree superintendent .

5.5-7 Planting Specifications

All plant holes shall be excavated to the same depth as the root ball or container. The width of the hole for all trees shall be twelve (12) inches wider than the root ball or outer edge of bare-root plant. The width of the hole for all shrubs shall be six (6) inches wider than the root ball or outer edge of the bare root plant.

The root ball of all plants shall be set on undisturbed soil or if disturbed, shall be compacted prior to installation of plant material. In areas where the soil content is clay, the base of the hole shall be loosened an addition six (6) inches in all directions to promote good soil porosity and aeration.

Burlap and lacing material shall be cut and removed from the top 1/3 of all root balls. Plants with wire baskets shall have the upper 1/3 of the basket cut and removed from the site.

All plant holes shall be backfilled with a soil mixture consisting of two (2) parts native loamy soil, one (1) part coarse sandy topsoil, and one (1) part peat humus or peat moss. A 10-6-4 fertilizer at a rate of ½ lb. per hole or liquid fertilizer as per label shall be mixed with the backfill soil mixture. The backfill soil mixture shall be free of all rocks and debris. One half of the planting hole shall be backfilled and then thoroughly watered in. The remaining portion of the planting hole shall then be backfilled and watered in thoroughly.

All plant material shall bear the same relation to finish grade as it bore to existing grade at the nursery. All plants shall be set straight and upright within the hole. A five (5) inch high saucer shall be made with backfill around the perimeter of the hole of all trees to aid in water retention. A three (3) inch high saucer shall be made

with backfill around the perimeter of the hole of all shrubs to aid in water retention. In areas with poor soil drainage, all plants shall be raised higher and shall have an added layer of topsoil mixed with coarse sand to increase porosity and aeration.

All newly planted trees and shrubs shall be mulched with a minimum four (4) inches of wood chips, bark chips, or shredded hardwood mulch. A two (2) inch clear space shall remain between the base of the trunk and the mulch to prevent rot and insect damage to the bark. All other mulching material must be approved by the county shade tree superintendent prior to installation.

All material and/or work may be rejected either before or after installation by the county shade tree superintendent if it does not meet the requirements of the specifications. All rejected material shall be removed from the site by the contractor.

5.5-8 Pruning

All deciduous trees shall be pruned at time of planting to thin and shape the canopy. Branches extending below six (6) feet shall be pruned. All evergreen trees and shrubs shall only be pruned to remove damaged or broken branches. All deciduous shrubs shall be pruned to thin branch tips and foliage by 1/3 and to shape the plant. All cuts shall be made within ¼ inch of a lateral branch or bud. Under no circumstances shall the central leader of any deciduous or evergreen tree be cut.

5.6 SPECIAL LANDSCAPE CONSIDERATIONS FOR SCENIC COUNTY ROADS

An applicant/developer shall design the streetscape along a county road in accordance with scenic road guidelines contained in the Monmouth County Scenic Road Plan. This document identifies Monmouth County roads that are considered “scenic roads” and includes design guidelines for road and landscape treatments.

All major subdivision or site plan applications located along a designated Scenic Road shall include as part of the required plan submission, a Landscape Plan for the on-site area within fifty(50)feet of the county right-of-way along the frontage of the designated Scenic Roadway.

5.6-1 Scenic Roadways Landscape Pattern Identification

As part of the development review process for all major site plan and subdivision applications located along a designated Scenic Road within Monmouth County, the Monmouth County Development Review Committee, or their designee, will evaluate each project for existing landscape patterns within county right-of-way and adjoining landscape, and may offer comments and/or recommendations for preserving or enhancing established landscape resources. A pre-application conference with Development Review staff is recommended, so as to explore the following:

- (a) The Landscape review process and to identify the existing landscape patterns along a particular Scenic Road. Projects located along designated

Scenic Roads shall submit Landscape Plans showing the designated section(s) of scenic roadway and area within fifty (50) feet of the county right-of-way.

- (b) Identify potential impacts to the established visual quality and character along designated county Scenic Roads resulting from the proposed development.
- (c) Projects located along designated Scenic Roads shall submit Landscape Plans showing mitigation to the landscape pattern along a scenic roadway including landscape improvements and tree protection measures.
- (d) Identify applicable landscape design standards and potential requirements pertaining to existing landscape features or patterns along designated county scenic road right-of-way.
- (e) Existing physical features located along designated county scenic roads that reflect historic significance; reflect unique methods of construction or use of unique materials in construction, shall be preserved and maintained, to retain the quality and character of the Scenic Road. Existing fences or walls displaying historic significance, unique methods of construction or unique use of construction material, shall be permitted to remain, on a case by case basis, provided there is no obstruction to the sight lines of an adjacent road or intersection, and that proper indemnification is provided to the county.
- (f) The use of native, or indigenous, plant materials is encouraged along designated county scenic roads.

5.6-2 Allée of Trees (formal planting)

Two rows of formally planted trees or shrubs that are twice as high as the width of the road and whose crowns form a canopy, shall be planted along section(s) of scenic roadways as recommended by the Monmouth County Shade Tree Superintendent in an effort to establish or re-create an existing an allée of trees. The planting of an allée of trees shall conform to the following standards:

- All healthy existing shade trees shall be saved and incorporated into the establishment of all new allées of trees wherever conditions permit.
- All trees shall be planted in accordance with the spacing standards set forth in the section on Street Trees.
- All trees shall be planted in accordance with the standards set forth in the section on Planting Specifications.
- All trees shall be planted in accordance with the standards set forth in the section on Utility and Site Infrastructure Clearances.

5.6-3 Canopied Road (informal planting)

A mature forest of trees growing informally within close proximity to the roadway edge that meet to form a canopy. A canopied road pattern shall be planted along section(s) of Scenic Roadways as recommended by the county shade tree superintendent. The planting of a canopied road pattern shall conform to the following standards:

- All healthy existing trees shall be saved and incorporated into the establishment of a new canopied road pattern wherever conditions permit.
- All trees shall be native or indigenous to the site or region.
- All new trees shall be planted so as to replicate the existing quality and character of the surrounding landscape, to the greatest extent possible. The species and quantity of plants shall vary depending on existing and proposed site conditions and the effect desired.
- All trees shall be planted in accordance with the standards set forth in the section on Planting Specifications.
- All trees shall be planted in accordance with the standards set forth in the section on Utility and Site Infrastructure Clearances.

5.6-4 Filtered Vegetative Patterns

A filtered vegetative pattern shall refer to trees and shrubs of various maturity growing within close proximity to the road and whose growth permits a filtered view through the under-story of young and mature tree trunks and shrub branches to an open landscape scenery beyond. A filtered vegetative pattern shall be planted along section(s) of scenic roadways as recommended by the county shade tree superintendent. The planting of the filtered vegetative pattern shall conform to the following standards:

- All healthy existing trees and shrubs shall be saved and incorporated into the establishment of a new filtered vegetative pattern wherever conditions permit.
- All trees and shrubs shall be native or indigenous to the site or region.
- All trees and shrubs shall be planted either singularly, intermittently, or in groups within close proximity to the edge of the road so as to re-create the natural growing pattern of a filtered vegetative pattern. The species and quantity of plants shall vary depending on existing and proposed site conditions and the effect desired.
- All trees and shrubs shall be planted in accordance with the standards set forth in the section on Planting Specifications.

- All trees shall be planted in accordance with the standards set forth in the section on Utility and Site Infrastructure Clearances

5.6-5 Spatial Landscape Sequences

A spatial landscape sequence shall refer to the irregular serpentine manner that the edge of a forest and expanse of field in the forefront of the forest may grow at varying distances from the edge of a road. This variable edge defines the spatial sequence of rooms through which a road traverses within the landscape (see figure 21). The spatial landscape sequence pattern shall be planted along section(s) of scenic roadways as recommended by the county shade tree superintendent. The planting of the spatial landscape sequence shall conform to the following standards:

- All healthy existing trees and shrubs shall be saved and incorporated into the establishment of a new spatial landscape sequence pattern wherever conditions permit.
- All trees and shrubs shall be native or indigenous to the site or region.
- All trees and shrubs shall be planted either singularly, intermittently, or in groups in an irregular serpentine manner to the edge of the road so as to recreate the natural growing pattern and varying distance of the forest edge from the road. The species and quantity of plants shall vary depending on existing and proposed site conditions and the effect desired.
- All trees and shrubs shall be planted in accordance with the standards set forth in the section on Planting Specifications.
- All trees shall be planted in accordance with the standards set forth in the section on Utility and Site Infrastructure Clearances.

5.6-6 Ornamental Landscape

An ornamental landscape refers to formal and informal landscape designs of estate homes incorporating designs that originated prior to the twentieth century characterized by well manicured hedges, lawns, floral beds and hardscape elements. The ornamental landscape pattern shall be planted along section(s) of Scenic Roadways as recommended by the county shade tree superintendent. The planting of an ornamental landscape shall conform to the following standards:

- All healthy existing trees and shrubs shall be saved and incorporated into the establishment of a new ornamental landscape pattern wherever conditions permit.
- Although traditionally, ornamental landscapes do not always incorporate a majority of native and indigenous plant material landscape plans should incorporate native or indigenous plant material to the greatest extent possible.

- All landscaping shall be installed in accordance with the approved landscape plan for the each unit of the major subdivision or site plan located along the Scenic Road.
- All trees and shrubs shall be planted in accordance with the standards set forth in the section on Planting Specifications.
- All trees shall be planted in accordance with the standards set forth in the section on Utility and Site Infrastructure Clearances.

5.6-7 Landscape Panorama or Vista

A landscape panorama or vista is an unobstructed distant view of landscape with limited vegetation in close proximity to the observer providing a wide arc of vision from the road. Such views normally occur at high points on a road where trees and shrubs are not densely spaced providing a wide overlook. A landscape panorama may be created or maintained along Scenic Roadways as recommended by the county shade tree superintendent. The establishment of a landscape panorama shall conform to the following standards:

- Existing vegetation may be selectively cleared to promote the wide arc of vision associated with a landscape panorama. The selective clearing of any vegetation shall be directed by the county shade tree superintendent .
- The planting of all street trees or other landscape patterns may be waived by the county shade tree superintendent and Monmouth County Development Review Committee in order to promote the landscape panorama pattern.

5.6-8 Grass Swales (Scenic Roads)

Where drainage and topographic conditions permit, grass swales may be utilized along all designated scenic county roads in place of subsurface drainage systems as recommended by the county engineer.

All grass swales shall be designed to utilize the natural contour of the land, where applicable, to aid in the drainage of water from roadway surfaces and surrounding area.

The maximum foreslope grade of all swales shall not exceed five (5) feet horizontal to one (1) foot vertical.

The backslope grade of all grass swales shall not exceed three (3) feet horizontal to one (1) foot vertical. In circumstances where the backslope grade is permitted to exceeds three (3) feet horizontal to one (1) foot vertical, alternate slope stabilization methods shall be required.

5.6-9 Fences and Walls

All fences and/or walls shall be erected within property lines, and no fence or wall shall be erected so that it will encroach upon the county right-of-way without specific waiver by the Development Review Committee and provision of proper indemnification provided to the county.

No fence and/or wall shall be erected along a county right-of-way so as to impact the view along a county designated Scenic Road, except where safety requirements dictate. Height and design requirements of walls and fences shall conform to municipal ordinance requirements.

All fences and/or walls shall be maintained in a safe, sound, upright condition and in accordance with the approved plan on file with the Monmouth County Planning Board and municipal construction code official.

The finished side of a fence shall face outward from the property on which it is erected, unless otherwise directed by the Development Review Committee.

The following fences and fencing materials are specifically prohibited along and adjacent to county rights-of-ways: barbed-wire fences, razor wire, sharp pointed metal fences, canvas, cloth, electrically charged fences and temporary fences, such as expandable fences and collapsible fences. Snow fencing to minimize drift conditions, shall be permitted during the winter snow season, only.

5.6-10 Street Furniture

All street furniture including, but not limited to, trash receptacles, benches, planters, phone booths, etc., shall be reviewed and approved on a case by case basis by the Development Review Committee.

5.6-11 Landscaping on Channelized Islands or Traffic Islands

All channelized islands or traffic islands with less than two hundred fifty (250) square feet of area shall be paved. Decorative paving material, such as brick, concrete paver, or similar paving material may be permitted on channelized islands or traffic islands.

All channelized islands or traffic islands with greater than two hundred fifty (250) square feet of area shall be planted with either turf, groundcovers, annuals, perennials, or shrubs and shall not exceed thirty (30) inches in height as measured above the centerline grade of the intersecting street or driveway.

Deciduous ornamental and/or shade trees may be permitted on channelized islands or traffic islands of five thousand (5,000) square feet or greater. All trees shall be planted a minimum eight (8) feet from edge of pavement. Tree canopies shall be maintained at no lower than ten (10) feet above the centerline grade of the intersecting street or driveway.

5.6-12 Landscaping on Medians

All medians fifteen (15) feet in width or less, that are not required to be paved, shall be planted with either turf, groundcovers, annuals, perennials, or shrubs and shall be maintained to a height of thirty (30) inches as measured from the centerline grade of the adjacent street or driveway.

Deciduous ornamental and shade trees may be permitted on medians sixteen (16) feet in width. All trees shall be planted a minimum eight (8) feet from edge of pavement. Tree canopies shall be maintained at no lower than ten (10) feet above the centerline grade of the intersecting street or driveway.

5.7 TRAFFIC SIGNAL DESIGN STANDARDS

All traffic signal equipment, including signs, traffic signal foundations, controllers, junction boxes and conduit shall be placed within the road right-of-way. Design of traffic signals shall conform to the current edition of the Manual on Uniform Traffic Control Devices and the guidelines provided below:

5.7-1 Signal Indications

Signal indications should be located as follows:

(a) one receiving lane; no protected/permissive left turn:

on the far right side of the intersection (overhead plus pole mounted) and/or on far left side (pole mounted);

on the near left side (overhead) for “stop bar definition” treated as additional indications;

on the near right side (pole mounted) if necessary.

(b) one receiving lane; protective/permissive left turn:

on the far right side of the intersection (2 overhead);

on far left side (pole mounted);

on the near left side (overhead) for “stop bar definition” treated as additional indications;

on the near right side (pole mounted) if necessary.

(c) two or more receiving lanes – see a & b:

number of overhead signal heads depends on actual number of receiving lanes; one per lane.

In any case, minimum of 3 indications shall be required for every approach.

All overhead indications shall be 12"; pole mounted indications shall be 12" (8" can be used only for pedestrian traffic).

Vehicular signal heads shall be mounted 10 feet above ground.

Pedestrian signal heads shall be mounted 8 feet above ground.

Pedestrian signal heads shall be installed on at least n-1 approaches in all design cases, where n=number of approaches.

Pedestrian signal indications shall be symbols (man walking and hand), 16" with Sun glare screen.

All RED, YELLOW, GREEN, ARROWS and PEDESTRIAN INDICATIONS shall be LEDs.

All LED indications shall be identified on the Signal Face Legend.

5.7-2 Traffic Signal Foundations, Standards and Assemblies

Traffic signal standards and transformer bases shall be of aluminum alloy to support traffic signal mast arms up to 35 feet in length. In case of mast arms exceeding length of 35 feet, traffic signal standard shall be steel. The following combinations of standards, mast arms and foundations shall be utilized:

<u>Traffic Signal Standard</u>	<u>Mast Arm</u>	<u>Foundation</u>
Type "C"	15', 20'	Type "SFT"
Type "K"	20', 25', 30'	Type "SFK"
Type "T"	15', 20'	Type "SFT"
Type "MTS"	15', 20', 25', 30', 35'	Type "MTF"
Type "S"	30', 35', 40', and up	Type "STF"

- Traffic Signal Standard type "K" shall be specified only when needed to support the designed loading or designed loading plus any anticipated future loads.
- Traffic signal hardware shall not be painted nor color coated. It shall be of aluminum original color.
- Traffic signal standards shall be located as follows:
 - The minimum offset from the face of curb or edge of pavement to the center of the aluminum standard shall be 32".
 - The minimum offset from the face of curb or edge of pavement to the center of the steel standard shall be 10'.

- Standards and foundations shall not be located in the ADA accessible ramp areas nor shall they obstruct sidewalks or crosswalks and shall provide a minimum clearance of 3 ft. to comply with the minimum ADA standards.
- Standards shall be located away from curves of corners with radius of less than 15', less than 30' where trucks and buses turn occasionally, less than 50' where large trucks combination and buses turn frequently.
- The minimum offset from the standards, mast arms, signals and luminaires to primary power lines shall be 10 feet, or 5 feet horizontally and 6 feet vertically to secondary power lines of less than 750 volts.
- Standards shall not be located in front of guide rails or any natural or manmade deflecting barrier. Their location shall allow for guide rail deflection and pedestrian reach to push the push button.
- Standards shall support pedestrian signals and push button where feasible.

5.7-3 Vehicle Detection

Video cameras and/or other overhead vehicle detection devices shall be utilized as the primary type of detection. Use of loop and microwave detectors shall be minimized and only used when directed by the Traffic Safety Engineering Division. Layout of the loops shall be in accordance with the Traffic Safety Engineering Division's standard detail_drawing.

5.7-4 Conduit

Conduits are to cross all approaches, creating a loop, as opposed to a horseshoe configuration. In case of a T- intersection, closing run shall be under the sidewalk.

Only Rigid Metallic Conduits (RMC) shall be used; 3" diameter conduits for all traffic signal circuits, 1 ½" diameter for loop cables for telephone service, and 3" for overhead electrical service. A No. 8 ground wire shall be specified in each conduit exclusive of loop conduit from the curb to the junction box.

Rigid Non-Metallic Conduit (RNMC) may be used for interconnect conduits between intersections or for conduits to control "Red Signal Ahead" signs. A ground wire shall be installed in RNMC.

Multiple runs of conduit shall be placed in a common trench. When the trench is in the roadway, the conduit is specified as Conduit Under Roadway (CUR). In all other cases, conduits are specified as Conduit Under Ground (CUG). When a conduit run is installed as a combination of type CUG and CUR, both construction items on that run shall be indicated with appropriate quantities.

5.7-5 Traffic Signal Cable

All vehicular indications shall be wired with a 7/c #14 cable.

All pedestrian indications shall be wired with a 5/c #14 cable.

All push-buttons shall be individually wired with a 2/c #14 cable.

All microwave and other overhead detection systems shall be wired in accordance with the manufacturer's specifications.

All loop detectors shall be wired with a 2/c shielded (2 twisted pairs) #14 cable.

5.7-6 Traffic Signal Controllers

Eight-phase controllers shall be utilized and shall comply with Monmouth County's Supplementary Standard Specifications.

Controllers shall be placed such that they are placed as far from the travel way as possible; minimize vulnerability to being struck by vehicles; minimize encroachment on the sidewalk and ramps; provide adequate clearance for pedestrians and ADA accessibility; allow the cabinet door to swing away from the street side; provide maximum visibility of signal indications for persons facing open controller cabinet.

A 4' x 6' x 4" thick concrete pad shall be installed adjacent to the signal foundation in front of the cabinet door.

5.7-7 Junction Boxes

18" x 36" Junction Boxes, shall be installed throughout the signal system. Junction boxes shall be provided, at a minimum, for each foundation, at tie-in points where loop detectors enter the system.

5.7-8 Level of Service Criteria

New, and or modified signal systems shall be designed to operate at no less than Level of Service C, overall. An individual lane group shall operate at no less than Level of Service D. Further deterioration in Levels of Service may be permitted in areas where roadway improvements are not feasible due to right-of-way or environmental constraints.

5.7-9 Traffic Signal Interconnect

Interconnect and appropriate offsets shall be provided for new traffic signals installed within ½ mile of an existing traffic signal.

5.7-10 Maintenance and Protection of Traffic

Section 110.01 of the 1989 Standard Specifications for Road and Bridge Construction and amendments thereto as published by the New Jersey Department of Transportation and as amended herein shall apply for the maintenance and protection of traffic. The following is added to Section **110.01 Maintenance and Protection of Traffic:**

Monmouth County Route [route number] will not be permitted to be closed to traffic at any time during the contract period. Alternate lane closings will be permitted as described below.

Reduction of the number of lanes available for traffic or constriction of existing widths of traveled way will not be permitted between the hours of 6:00 AM and 9:00AM, and between the hours of 3:00 PM and 7:00 PM. The hours of construction operations at each site will be determined by the county.

Work which will interfere with traffic or restrict the width of travelled way available for traffic shall not be performed on Saturdays, Sundays, or legal holidays, unless otherwise directed or approved by the county.

The maintenance and protection of traffic with minimum interference is of first importance. The Contractor shall provide and maintain to the satisfaction of the county, adequate and safe means of passage of vehicular and pedestrian traffic at all times throughout the project length. This requirement shall include vehicular (including fire, police and other emergency vehicles and school buses) and pedestrian access to all residences, businesses, schools and public buildings adjoining or affected by the work. Sufficient width shall be provided at driveways to allow safe and convenient turning through them and the outside edges shall be plainly marked as required by the Engineer.

All work shall be accomplished between **9:00 AM and 4:00 PM Monday through Friday**. Start and stop times may be altered at the discretion of the county traffic engineer. Weekend work may be permitted with prior approval and is the sole discretion of the county traffic engineer.

The Contractor and/or the Sub-contractor shall be responsible for all maintenance and protection of traffic (vehicular, pedestrian, construction personnel, and county personnel performing inspections, sampling, testing, or taking measurements required for the project), prior to and during the application of all pavement markings. All procedures and materials used for maintenance and protection of traffic shall be in accordance with the current Manual on Uniform Traffic Control Devices, Part VI.

All workers shall wear reflectorized orange fluorescent garments such as a safety vest regardless of the time of day.

The Contractor shall maintain, as a minimum, two (2) traffic lanes (one in each

direction) throughout the project site, at all times during periods of construction activity. However, the Contractor will be permitted to maintain one lane with alternating traffic for a period not to exceed ten (10) working days. The use of one lane with alternating traffic shall be restricted to the hours between 9:00 a.m. and 3:00 p.m. Monday through Friday, unless permission to do otherwise is provided by the county traffic engineer. Uniformed police officers shall be employed during periods when traffic is to be maintained using a single, alternating lane. The minimum lane width(s) at any time shall be eleven (11) feet. The Contractor shall provide to the county a traffic control plan which complies with MUTCD and which indicates the personnel, signs, traffic directors, traffic cones, drums, lights, equipment and all other incidentals necessary for the safe maintenance and protection for traffic as above described. Said traffic control plan shall be submitted to the county a minimum of two (2) weeks prior to the start of construction. No work shall commence unless approval of the plan is granted by the county traffic engineer. This traffic control plan shall clearly detail the means and methods to be employed for the accommodating the shifting of traffic during the performance of specific tasks as depicted on the progress schedule. The plan shall also indicate the maintenance and protection of traffic measures to be taken at areas to be used for equipment and materials storage. No work shall commence without approval of the plan by the county traffic engineer. Detailed plans as must show the staging of lane closures, available lane widths and time estimates.

The contractor shall reference Standard New Jersey Department of Transportation traffic detail sheets as necessary to accommodate the maintenance and protection of traffic. All such details shall be made part of the traffic control plan to be submitted to the county traffic engineer for approval.

During evening hours and periods of inactivity all construction equipment, material and other obstructions shall be removed from all travel ways and shoulders, and properly secured from traffic. Two lanes of traffic with appropriate striping and all applicable warning signs shall be provided.

Before beginning work on any phase of the project, the contractor shall furnish and install all specified warning signs, temporary pavement markings, barricades, flashing lights, and other devices necessary, as directed by the county traffic engineer, to protect the public during each phase of operations.

The contractor shall notify the county in writing, as well as local Fire and Police Departments, First Aid Squads, and Boards of Education at least 7 days in advance of beginning construction. Such notification shall include the duration of project and a description of the methods to be employed to maintain traffic throughout the work site.

All traffic warning signs shall be furnished, erected, and maintained in a suitable manner as determined by the county traffic engineer and shall be maintained so as to provide maximum visibility and legibility.

Signs, lights, barricades and all other warning and protective devices shall be

established, repaired, replaced, relocated and removed by the contractor at the locations and times and in the manner directed by the county traffic engineer.

The contractor shall notify the owners of all adjacent properties at least 24 hours prior to the time any work is to commence which would interfere with normal passage of the residents into and out of these properties. Pavement areas shall be periodically cleaned of construction materials.

Except as necessary during actual working hours, and then only with the specific approval of the county, the Contractor shall not occupy with his equipment, materials, or personnel any roadway or sidewalk area within or adjacent to the project that is open for traffic.

No work which will interfere with traffic, or restrict the width of pavement available for traffic, shall be performed on Saturdays, Sunday, or legal holidays, without prior approval by the Engineer.

5.7-11 Detours

Written approval of the county traffic engineer and consent of Local Authorities having jurisdiction shall first be obtained for rerouting traffic over detours, whether such detours are shown or not on the contract plans or in the specifications. All necessary arrangements shall be made with such authorities regarding the establishment, maintenance, and repair of such detours, the regulation and direction of traffic thereon, and signing. Adequate directional and detour signs acceptable to the local authorities and approved by the county traffic engineer, shall be furnished and erected at the location where such authorities may direct.

Any detours used exclusively for hauling materials and equipment shall be constructed and maintained at no cost to the county.

Wherever and whenever a detour may be established, the contractor shall obtain approval from the county traffic engineer at least two weeks in advance and shall provide construction warning signs as necessary in accordance with the current edition of the Manual of Uniform Traffic Control Devices. The contractor will be responsible for signing and maintaining the detour and will assume all costs thereof.

5.8 COUNTY BRIDGE OR CULVERT CONSTRUCTION/RECONSTRUCTION DESIGN CRITERIA DESIGN STANDARDS

5.8-1 Bridge and Culvert Hydraulic Design

County bridges and culverts must be designed to convey the peak runoff from a 25-year storm under full flow conditions. One (1) foot of freeboard (1' above the water surface elevation of the 25-year storm to the bottom of the bridge deck structure or bottom side of the top of the culvert) is to be provided in determining the ultimate design of the county bridge or culvert. Minimum design velocity at flowing full

conditions shall be three feet per second. Maximum design velocity shall not exceed fifteen feet per second.

The hydraulic design of bridges and culverts shall be based on current New Jersey Department of Environmental Protection permit requirements. Therefore, all designs shall be sufficient to obtain all necessary permits.

5.8-2 Water Surface Profiles (HEC II)

At the discretion of the county engineer, any bridge or culvert replacement along a waterway must be accompanied by a HECII analysis of the upstream and downstream water surface elevation.

5.8-3 Standards and Specifications

Design specifications shall be the current edition of the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges as modified by the appropriate sections of the most current edition of the New Jersey Department of Transportation Design Manual for Bridges and Structures. Concrete classes shall conform to current Monmouth County standards.

- All structures shall be designed for current AASHTO HS20-44 truck plus 25% overload or tandem 24 kip axles at 4' centers whichever governs or as revised by most current AASHTO standards.
- Dead load shall include 25 pounds per square foot for future overlay on bridge deck.
- All structural design shall be performed using the **Working Stress method**.
- All reinforcing steel shall be hot dip galvanized after fabrication except mild reinforcing steel in pre-stressed concrete planks or beams shall not be hot dip galvanized. Exposed composite action stirrups and all cuts in galvanized reinforcing steel shall be coated with two coats of Galvanox or approved equal.
- The substructure shall consist of either cast-in-place concrete or timber bulkhead as determined by the Monmouth County Engineer. If a timber substructure is used, the bridge shall have cast-in-place concrete caps.
- The superstructure shall consist of cast-in-place concrete or prestressed concrete depending on the design span. Steel shall only be used upon the approval by the Monmouth County Engineer.
- The deck, sidewalks, safety walks and parapets shall consist of cast-in-place concrete. A minimum of one five-foot wide sidewalk shall be provided on the structures. Two sidewalks may be required depending upon site conditions.

- Railings shall conform to current New Jersey Department of Transportation approved details or Federal Highway Administration (FHWA) approved details subject to review and approval by the Monmouth County Engineer.
- Soil borings or other geotechnical services may be required as necessary for the design of the proposed structure.
- If site conditions permit the use of precast concrete box culvert sections, every attempt shall be made to design the structure as a single span. The use of more than one box culvert will be subject to review and approval of the Monmouth County Engineer and the applicant is advised that Monmouth County reserves the right to require the use of a bridge if more than one box culvert section is required.
- The design of bridge railings, parapets and other architectural treatments shall be compatible with the surrounding area. The use of special details, including textured concrete may be required. All architectural treatments shall be approved by the Monmouth County Engineer prior to incorporation into the design.
- Approach slabs shall be used for structures with concrete substructures and shall be designed in accordance with appropriate geotechnical parameters.
- Approach roadway transitions shall be designed to obtain the best achievable horizontal and vertical alignments. The minimum cross slope shall be 2.5%. The minimum centerline and gutter grades shall be 0.5%. Careful consideration shall be given to the impacts on existing intersections, driveways and sidewalks.
- Minimum cast in place, composite deck slab thickness for pre-stressed box beams or voided slabs shall be 6”.
- Minimum cover from the top of pavement (bituminous) to the top of the box culvert shall be two (2) feet. A reinforced concrete deck slab shall be used if the cover is less than two (2) feet. Minimum slab thickness shall be 6”.
- Curbface on the proposed structure shall be 8”.
- The specified compressive strength of concrete (non-prestressed) used in design shall be 3,000 psi. The extreme fiber compression used in design shall be 1,200 psi.

5.8-4 SCENIC ROADWAY CONSIDERATIONS

Where a bridge that is to be reconstructed by a developer is located on a scenic county road or if the existing structure possesses unique esthetically pleasing characteristics or is historically significant, the developer may be required to incorporate construction techniques and use materials that retains the structures characteristics

and is in harmony with the surrounding viewshed.

5.9 AS-BUILT PLANS

At the discretion of the county engineer, as-built plans of road, drainage and traffic control devices may be required.

As-built plans of all traffic signal installations shall be provided within seven (7) days of the activation of the traffic signal.

6.0 NEW BRIDGES, CULVERTS AND OTHER DRAINAGE STRUCTURES TO BE CONSIDERED FOR MAINTENANCE BY THE COUNTY

6.1 COUNTY RESPONSIBILITY FOR BRIDGES

The Board of Chosen Freeholders may by resolution, assume responsibility for the future maintenance of new culverts and bridges on new public roads within developments subject to the following conditions:

(a) Drainage Area

The drainage basin upstream of proposed bridge or culvert exceeds one-half (1/2) square mile (320 acres) in areas and the bridge or culvert has a span greater than 20 feet.

(b) New Jersey Department of Environmental Protection Permit Application has been made and a permit issued by the New Jersey Department of Environmental Protection for the proposed structure.

(c) Structure Loading

The structure is designed to carry A.A.S.H.T.O. H2O-44 + 25% loading. See Section 5.8.

Deck width meets the following requirements:

- (1) Culverts - Full width of road right-of-way.
- (ii) Bridges - Planned pavement width plus 2 - 5' wide sidewalks.

(d) The construction plans and specifications for the structure have been approved by the county engineer prior to construction.

(e) Construction Supervision Notification of commencement of construction is given so that periodic inspections can be made by county.

(f) Final inspection and certification of county engineer stating that the new structure was constructed in accordance with the approved plans and specifications.

(g) The municipal governing body has adopted a resolution requesting that the county assume maintenance responsibility of the new structure.

County of Monmouth

DEVELOPMENT REGULATIONS

Volume II

DESIGN STANDARDS

Figures

REVERSE FRONTAGE

COUNTY ROAD

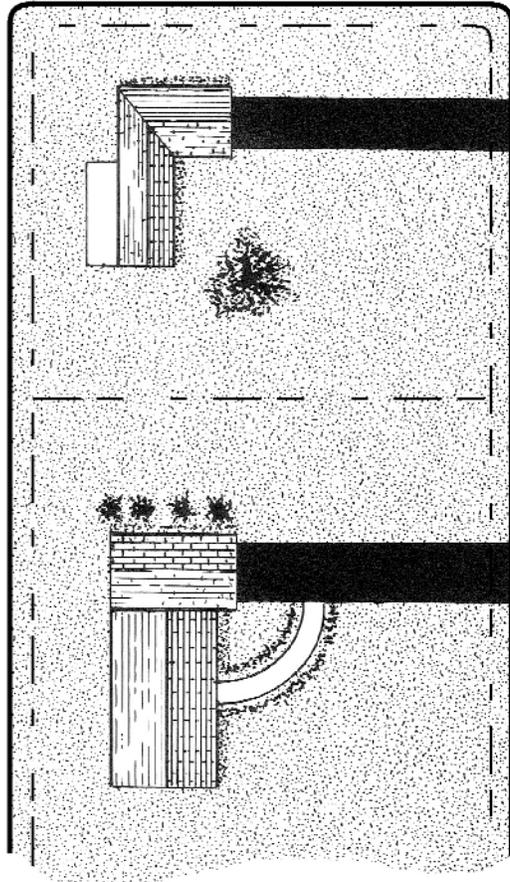
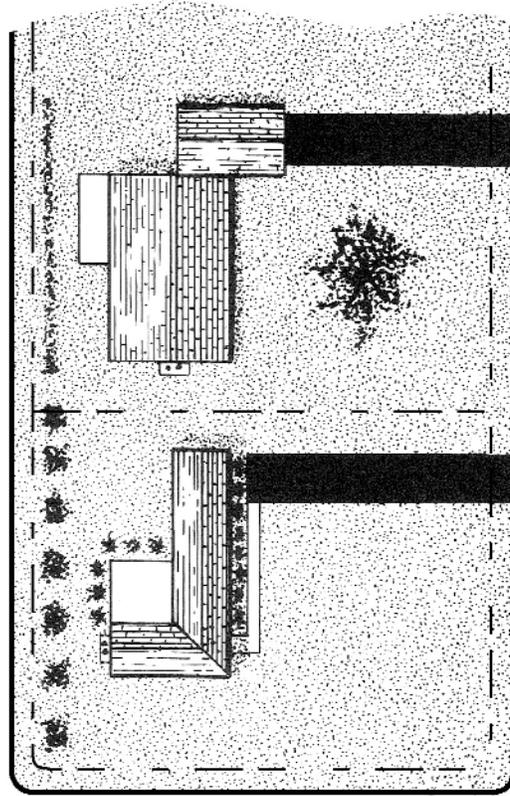


ILLUSTRATION
NOT TO SCALE

FIGURE 1

DRIVEWAY TURNAROUNDS (K-TURN DRIVEWAYS)

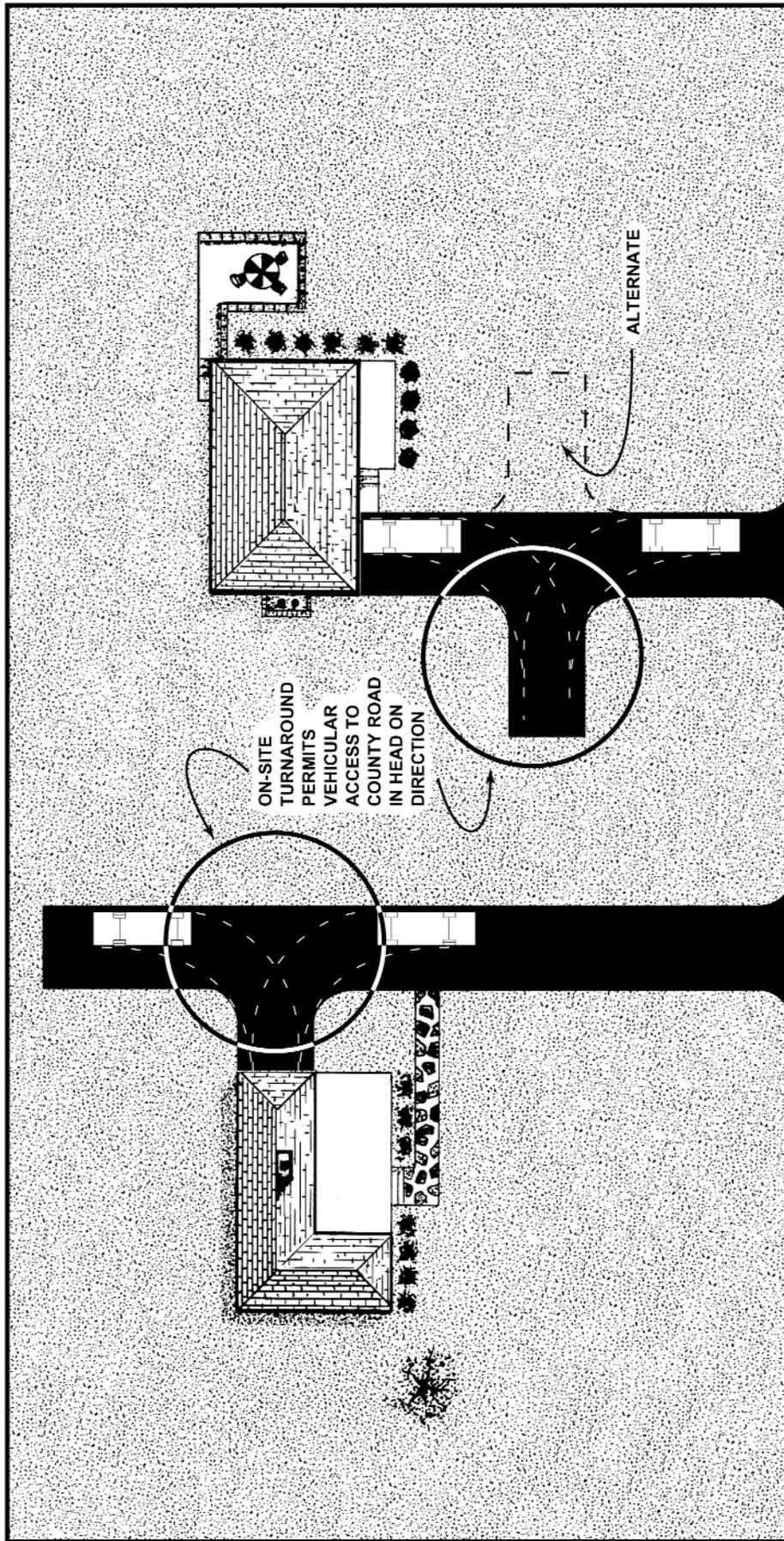


ILLUSTRATION
NOT TO SCALE

FIGURE 2

TYPICAL COUNTY ROAD SECTION

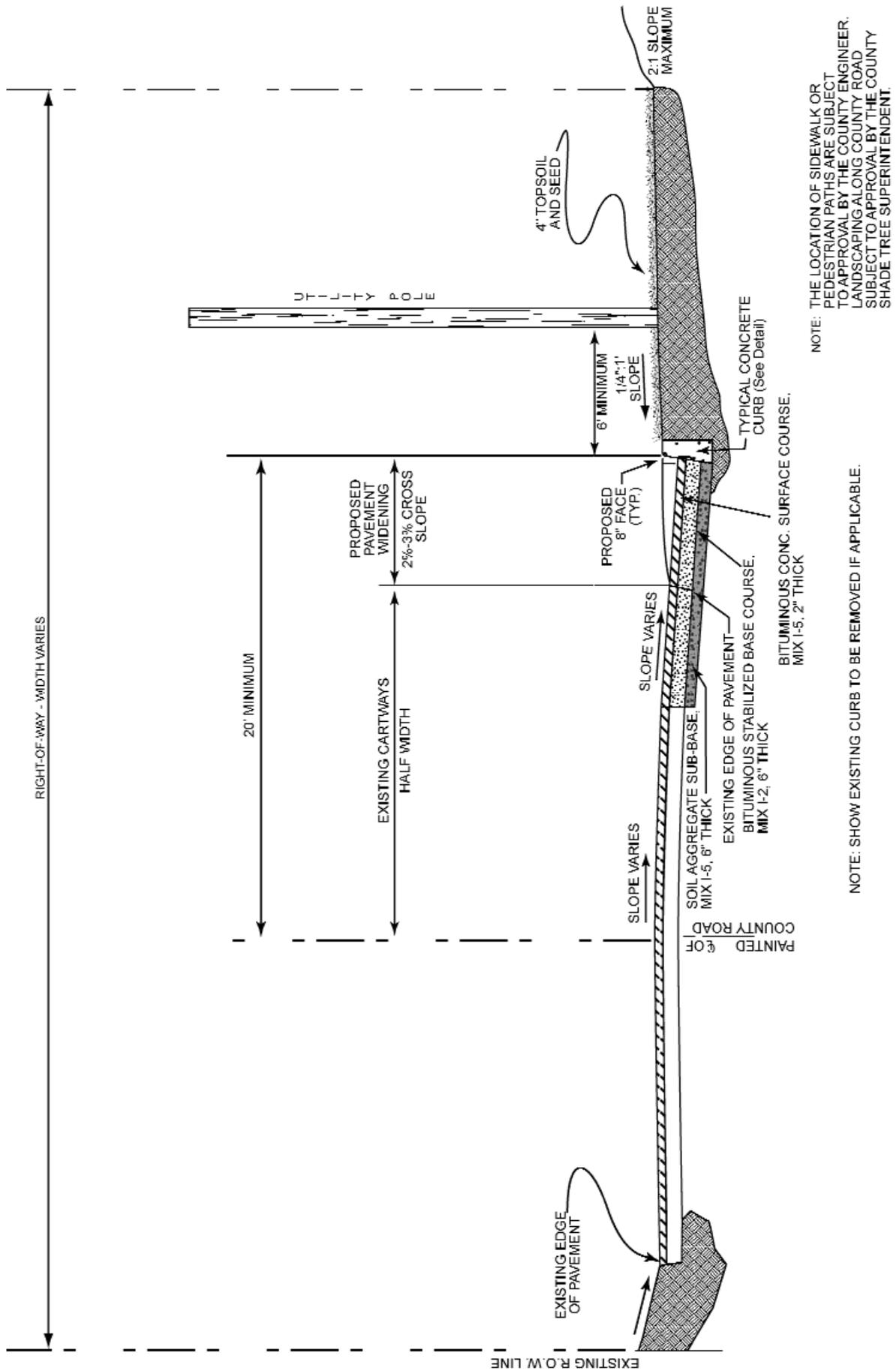
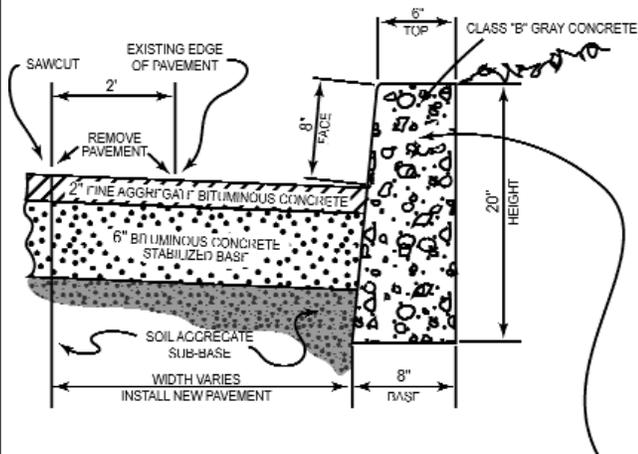


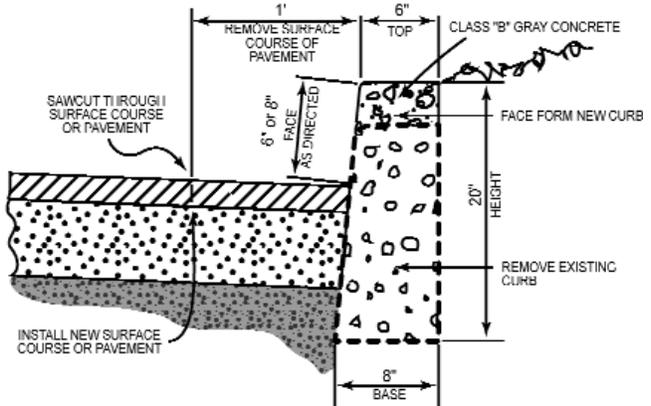
FIGURE 3

TYPICAL COUNTY CURB AND PAVEMENT SECTION DETAILS

TYPICAL COUNTY CURB & PAVEMENT SECTION (WITHOUT EXISTING CURB)

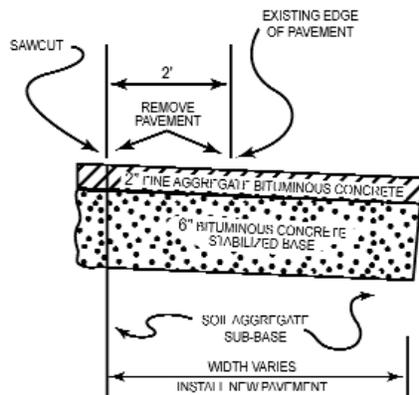


TYPICAL COUNTY CURB & PAVEMENT SECTION (REPLACE CURB IN PLACE - NO ROAD WIDENING)

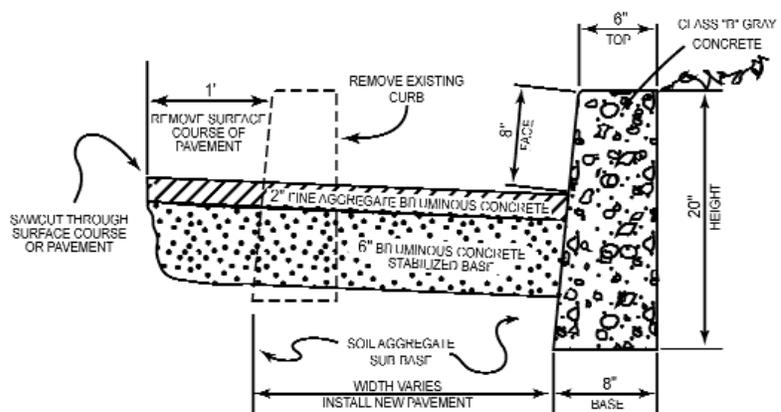


Note: Detail with curb required. Filminate curb section if curb is waived.

TYPICAL COUNTY PAVEMENT SECTION (WITHOUT NEW CURB)



TYPICAL COUNTY CURB & PAVEMENT SECTION (WITH EXISTING CURB)

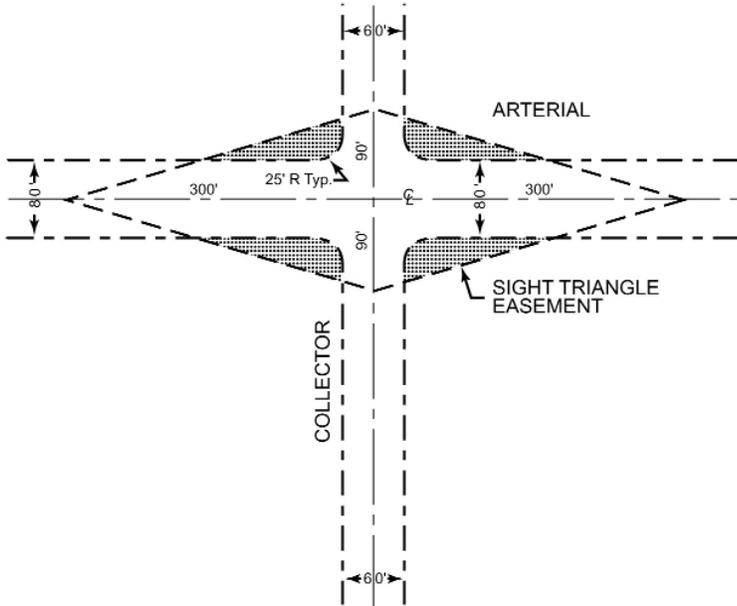


NOTE: CONSULT WITH MONMOUTH COUNTY ROAD INSPECTOR (MONMOUTH COUNTY ROAD DEPARTMENT) PRIOR TO CONSTRUCTION

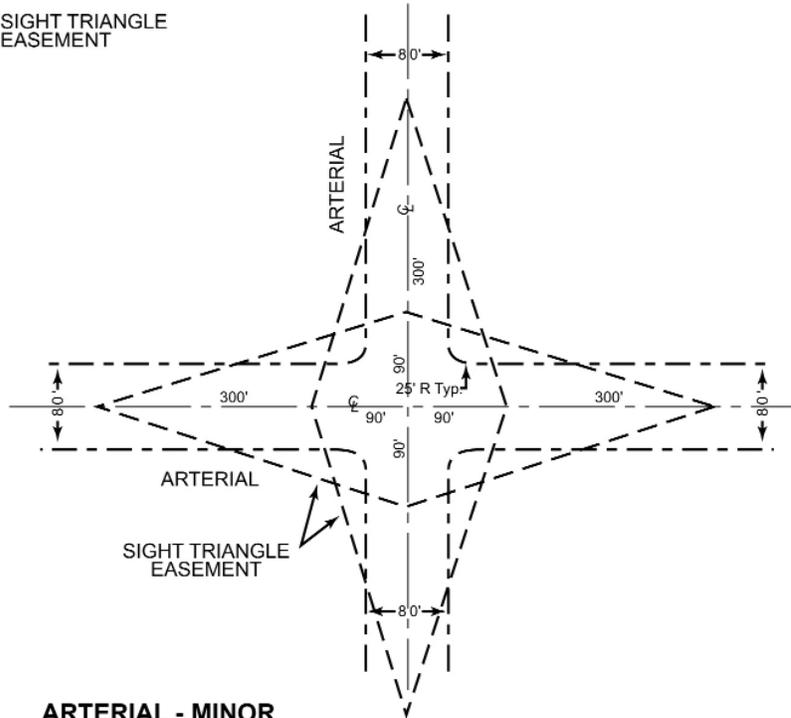
FIGURE 4

STANDARD SIGHT TRIANGLE EASEMENT AREA

ARTERIAL - COLLECTOR



ARTERIAL - ARTERIAL



ARTERIAL - MINOR

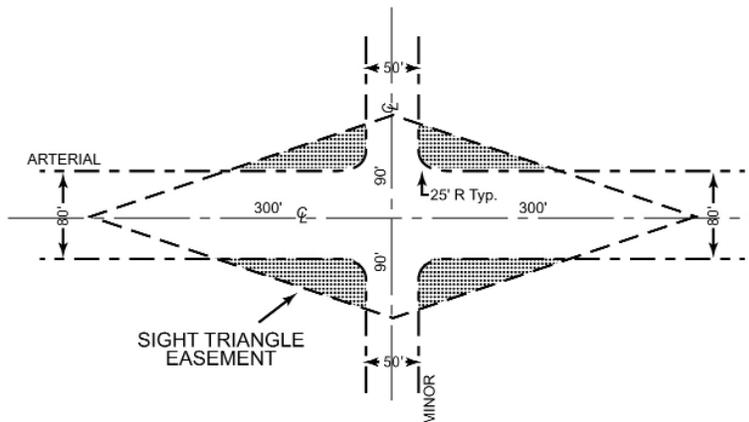


FIGURE 5

CRITICAL SIGHT AREA AT INTERSECTION

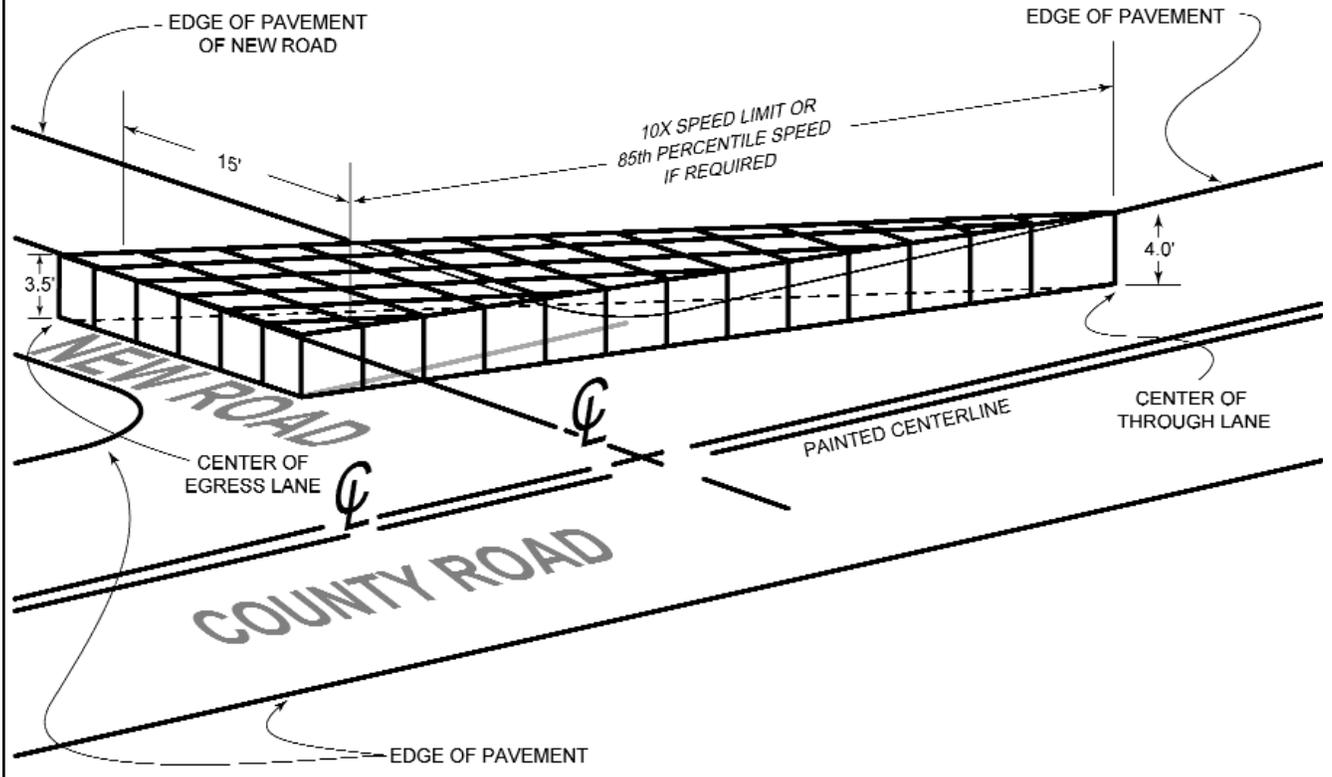


FIGURE 6

BYPASS AREA

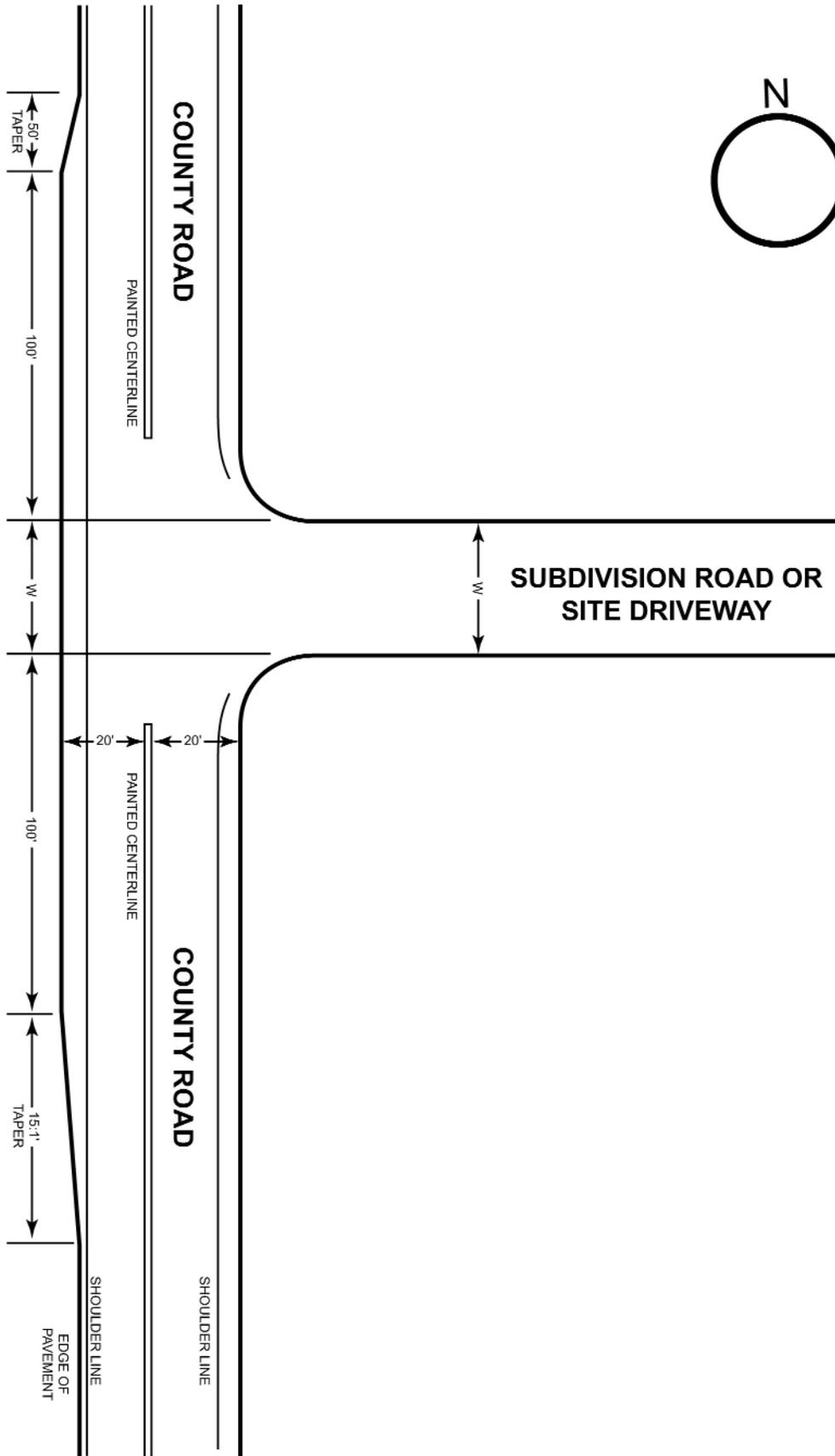
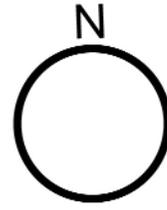
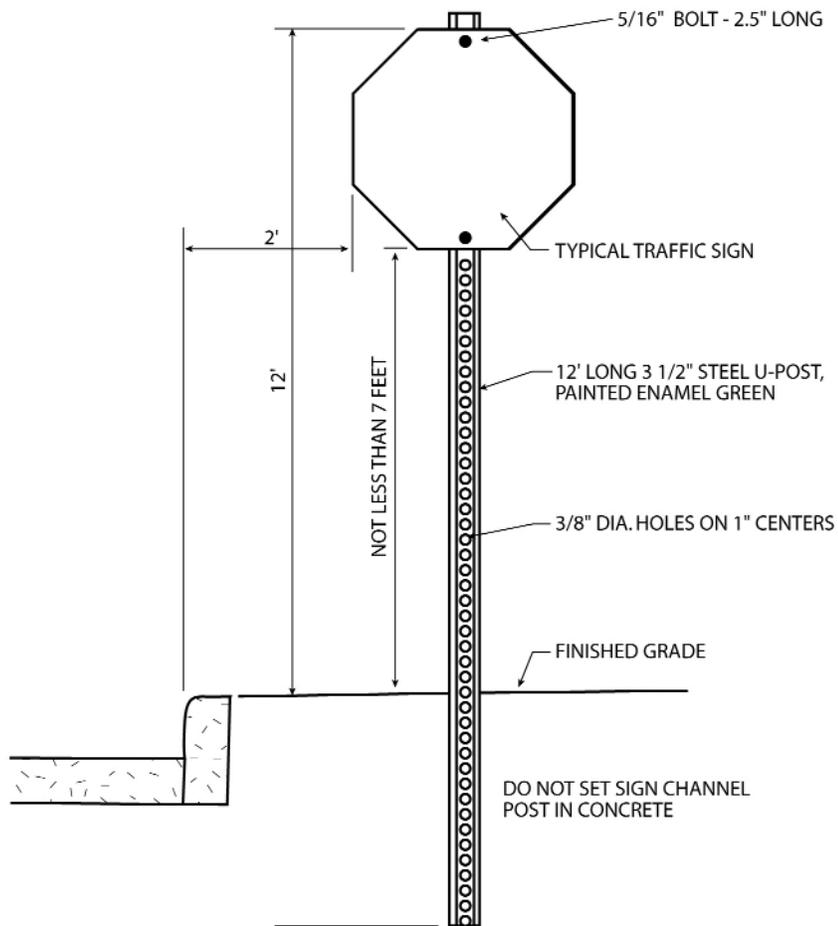


FIGURE 7

TYPICAL SIGN POST DETAIL

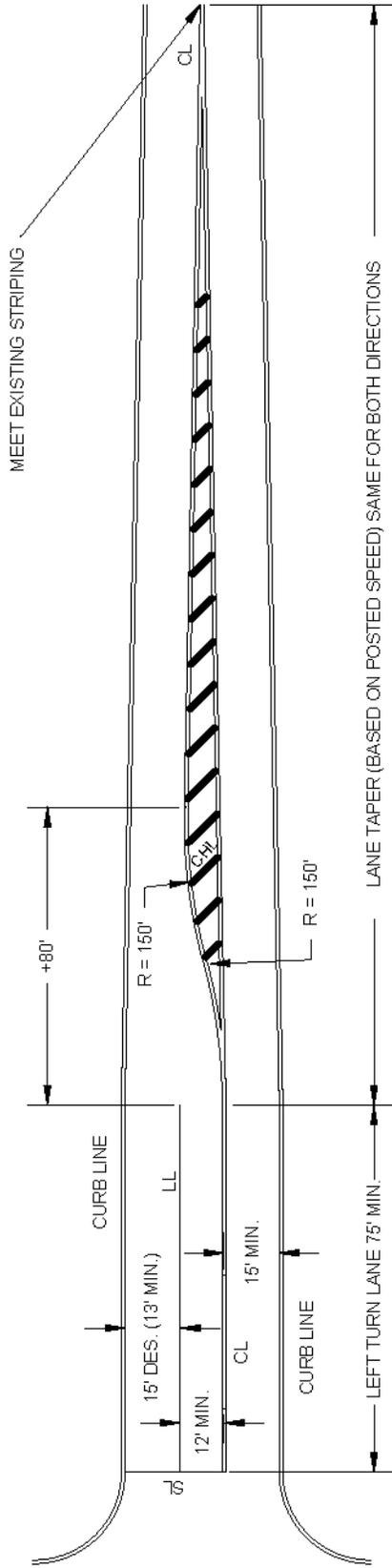


NOTES:

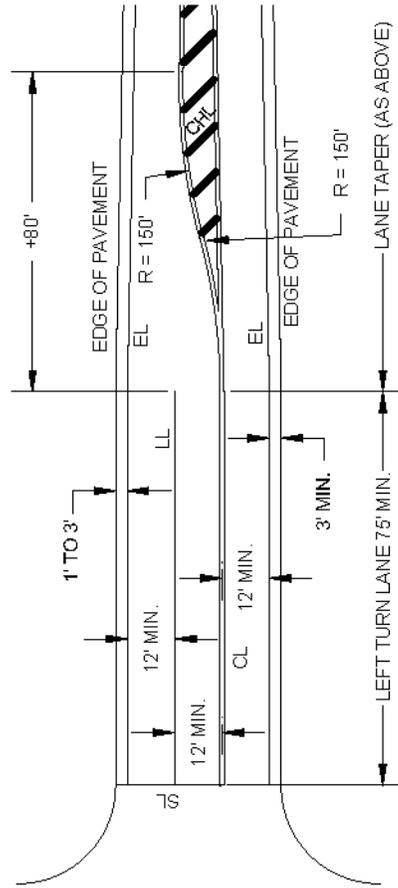
1. ALL REGULATORY AND WARNING SIGNS SHALL BE HIGH INTENSITY REFLECTIVE SHEETING
 2. ALL OTHER SIGNS SHALL BE ENGINEER GRADE SHEETING
 3. ALL SIGNS AFFECTING COUNTY ROAD TRAFFIC SHALL CONFORM TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION
 4. SIGN POSTS SHALL BE 3lbs./ft.
- * ILLUSTRATION NOT TO SCALE

FIGURE 8

LEFT TURN LANE AND TRANSITION DETAIL



STRIPING PLAN WITH CURB

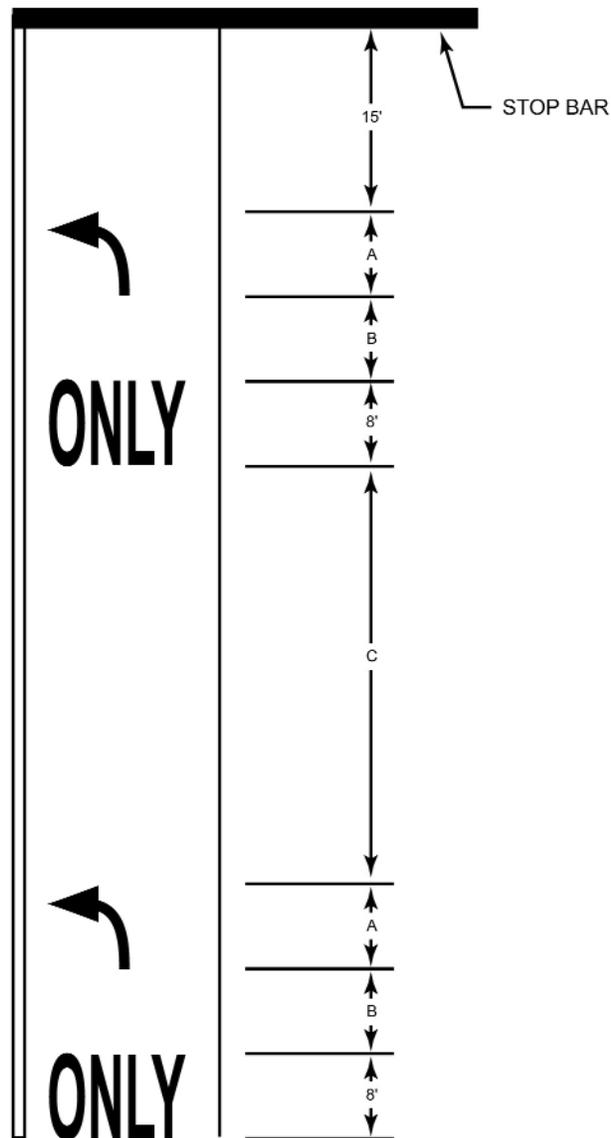


STRIPING PLAN WITHOUT CURB

PAVEMENT MARKING LEGEND			
PAVEMENT MARKING	MATERIAL	DESCRIPTION	LEGEND
STOP LINE	EXTRUDED THERMOPLASTIC	24" WIDE SOLID WHITE	SL
CENTER LINE	EXTRUDED THERMOPLASTIC	2-4" WIDE SOLID YELLOW	CL
DASHED LANE LINE	EXTRUDED THERMOPLASTIC	4" WIDE WHITE, 10' LONG SPACED AT 30' INTERVALS	DLL
EDGE LINE	EXTRUDED THERMOPLASTIC	4" WIDE SOLID WHITE	EL
CROSS HATCH LINES	EXTRUDED THERMOPLASTIC	24" WIDE YELLOW SPACED 12" O.C. AT 45°	CHL
LANE LINE	EXTRUDED THERMOPLASTIC	8" WIDE SOLID WHITE	LL

FIGURE 10

ARROW & TEXT SPACING CRITERIA



ARROW HEIGHT

ARROW HEIGHT	LEFT/RIGHT	THRU ONLY	THRU + L OR R
A (FEET)	8	9.5	12.75

SPACING BETWEEN SYMBOL & TEXT

POSTED SPEED (MPH)	25	30	35	40	45	50	55
B (FEET)	12	14	16	18	20	22	24

SPACING BETWEEN MARKING GROUPS

POSTED SPEED (MPH)	25	30	35	40	45	50	55
C (FEET)	32	40	48	56	64	72	80

FIGURE 11

NEW TYPE "C" CROSSWALK

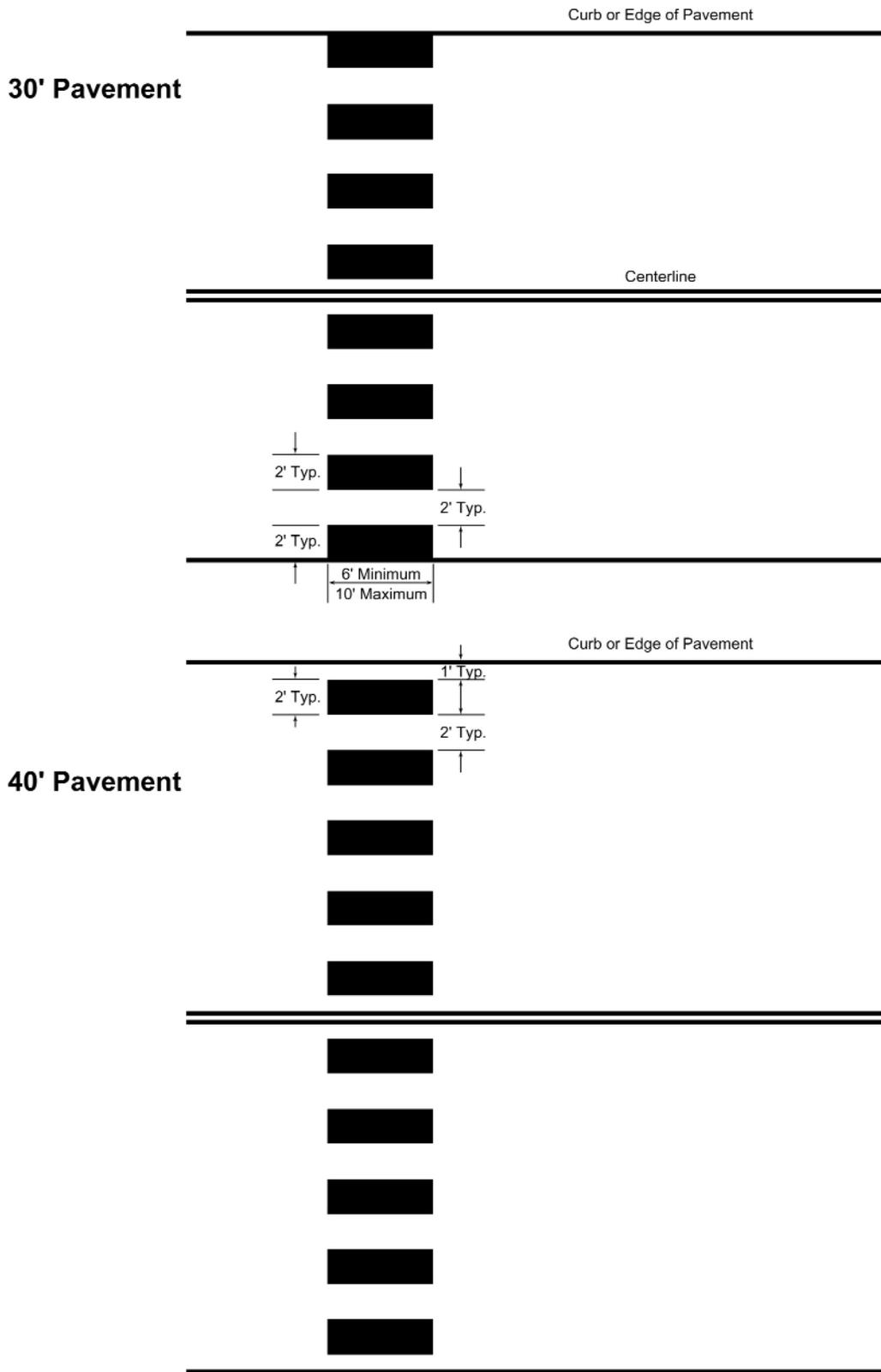
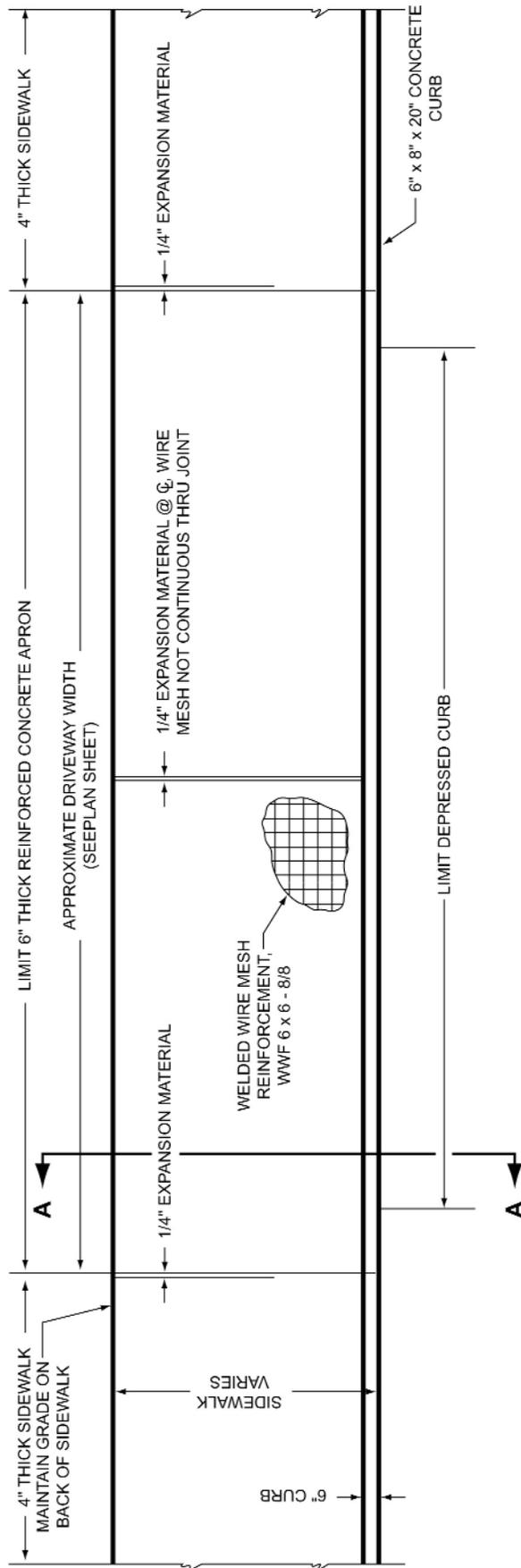


FIGURE 12

CONCRETE APRON DETAIL



SECTION A-A

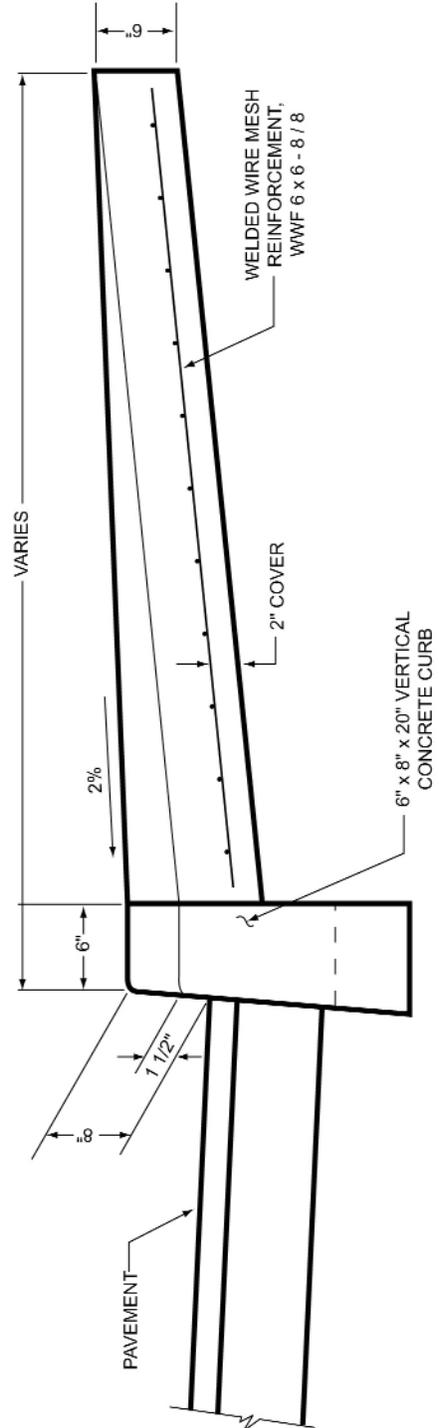
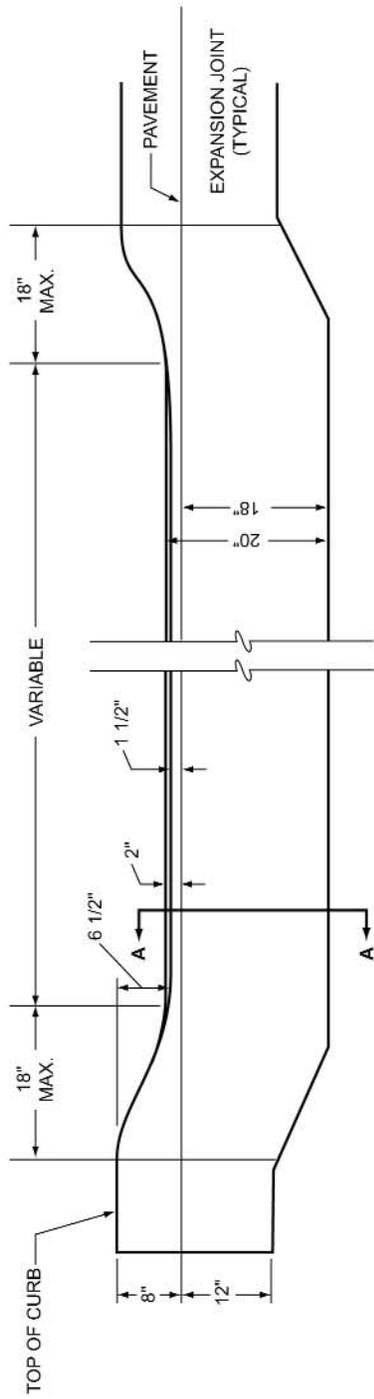


FIGURE 13

DEPRESSED CURB DETAIL



SECTION A-A

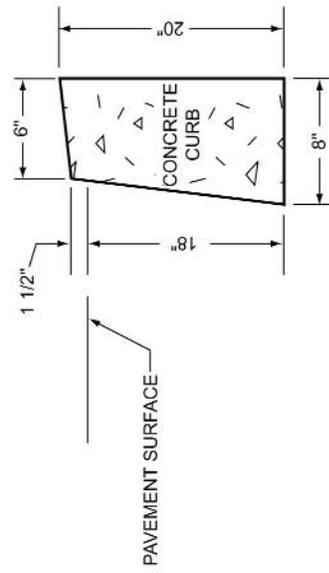


FIGURE 14

VERTICAL CURB TAPER DETAIL

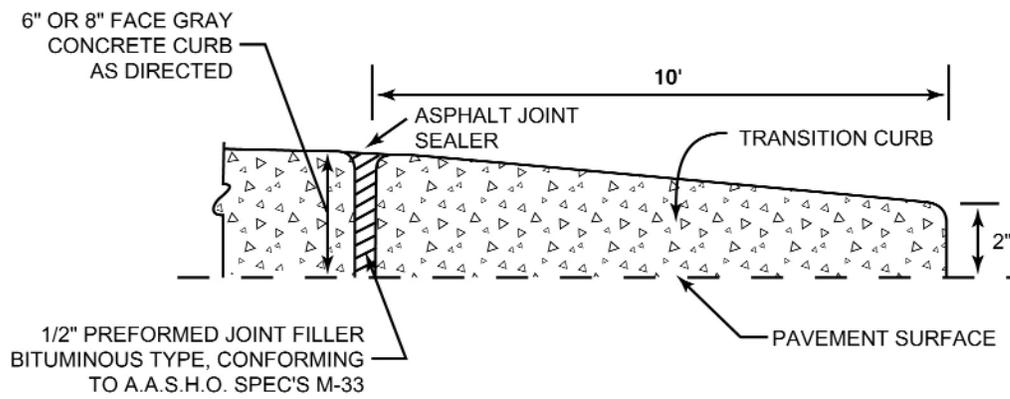


FIGURE 15

MOUNTABLE TRAFFIC ISLAND CROSS-SECTION

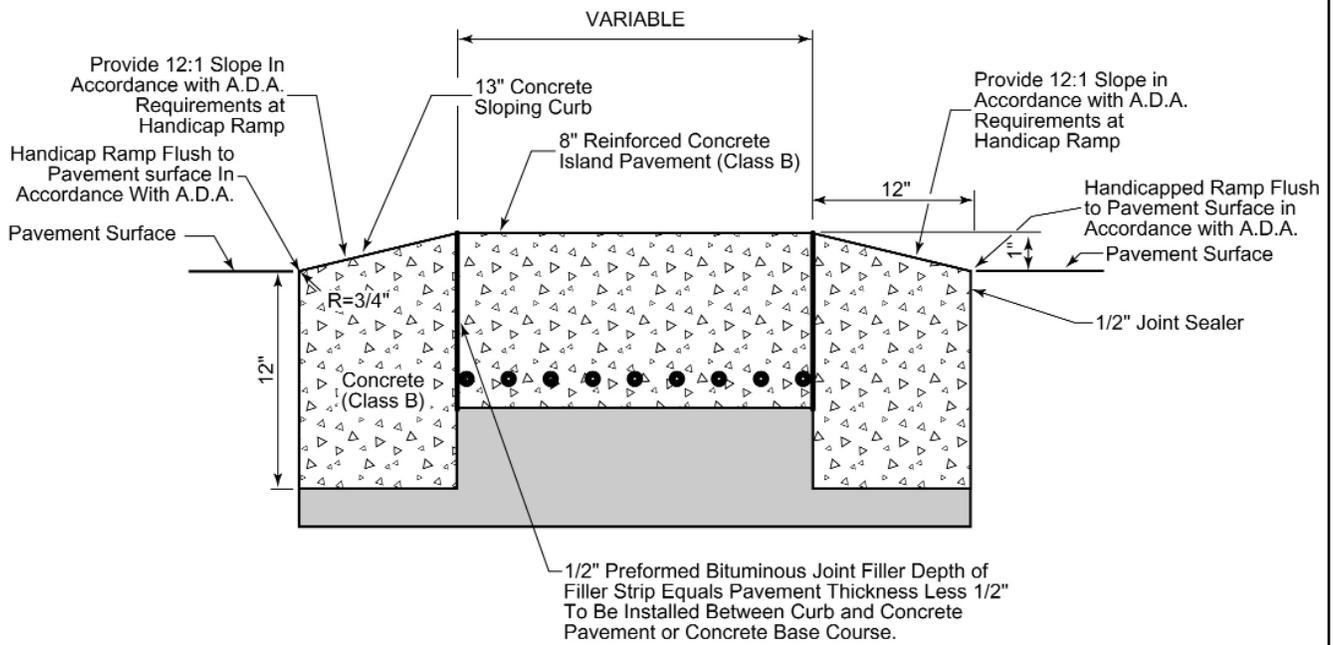
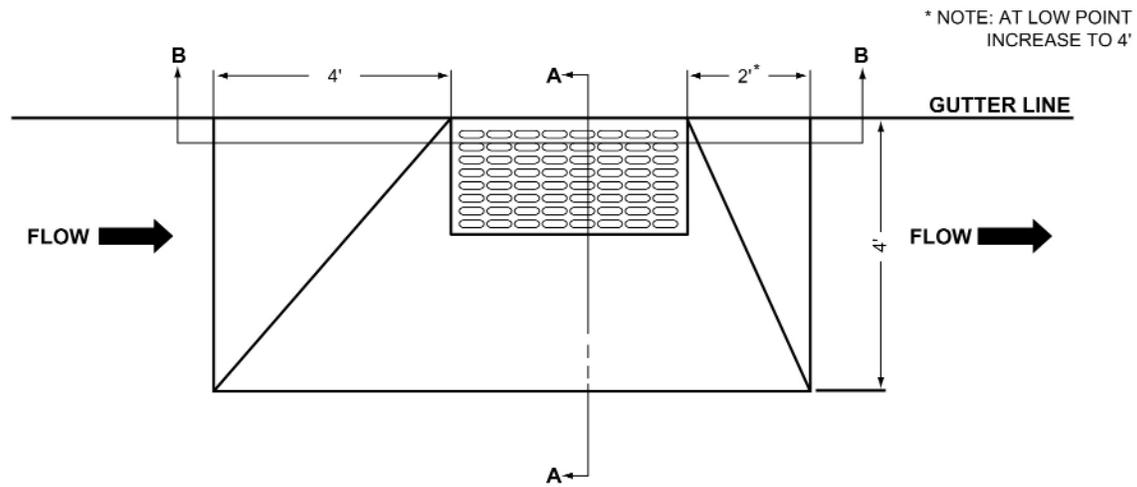


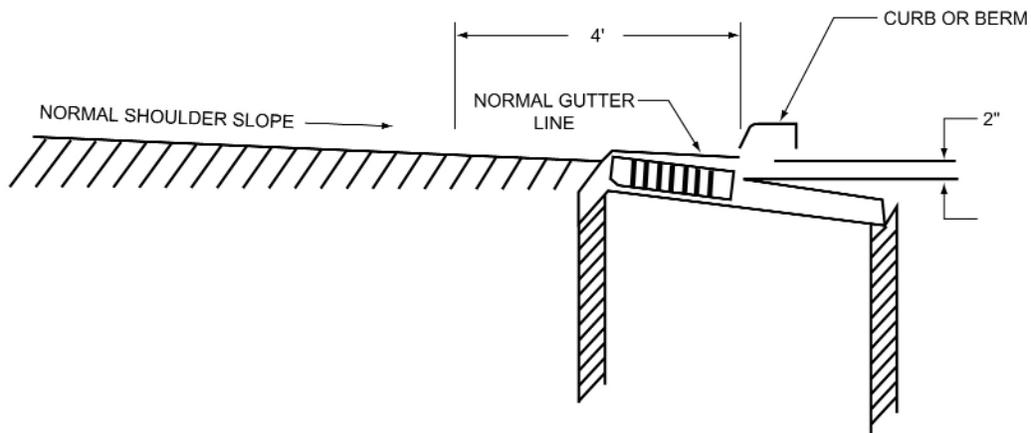
FIGURE 16

DEPRESSING INLETS IN SHOULDER

PLAN



SECTION A-A



SECTION B-B

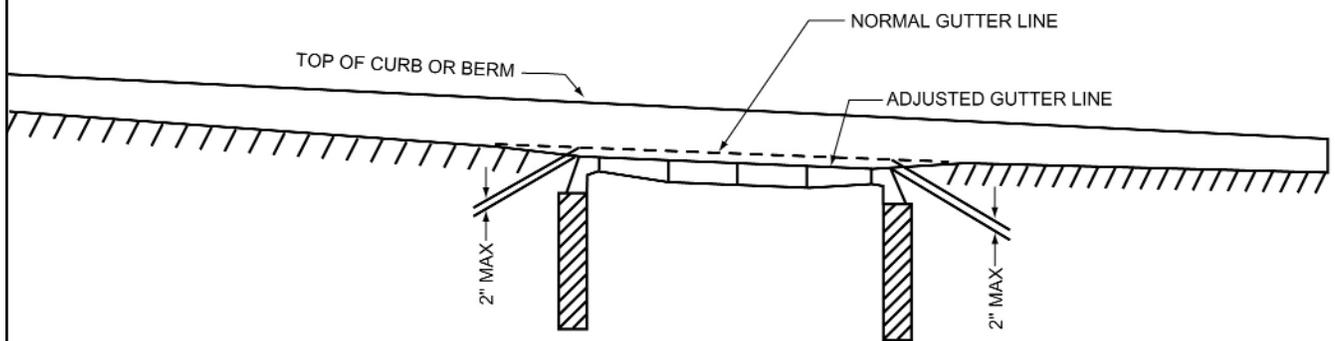
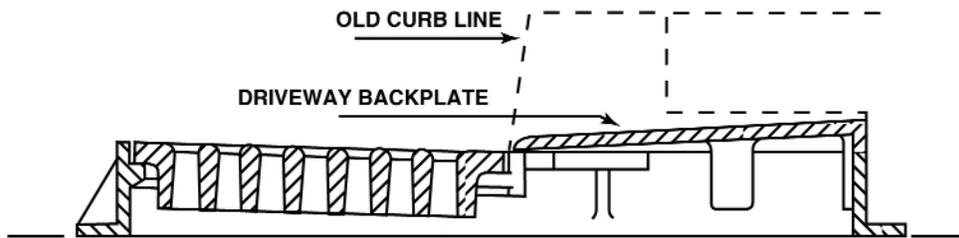


FIGURE 18

DRIVEWAY ACCESS BACKPLATE DETAIL

The Driveway Access Backplate is for use only where an existing Curb Type Inlet Frame and Grate must be altered to allow driveway traffic through the curb line.

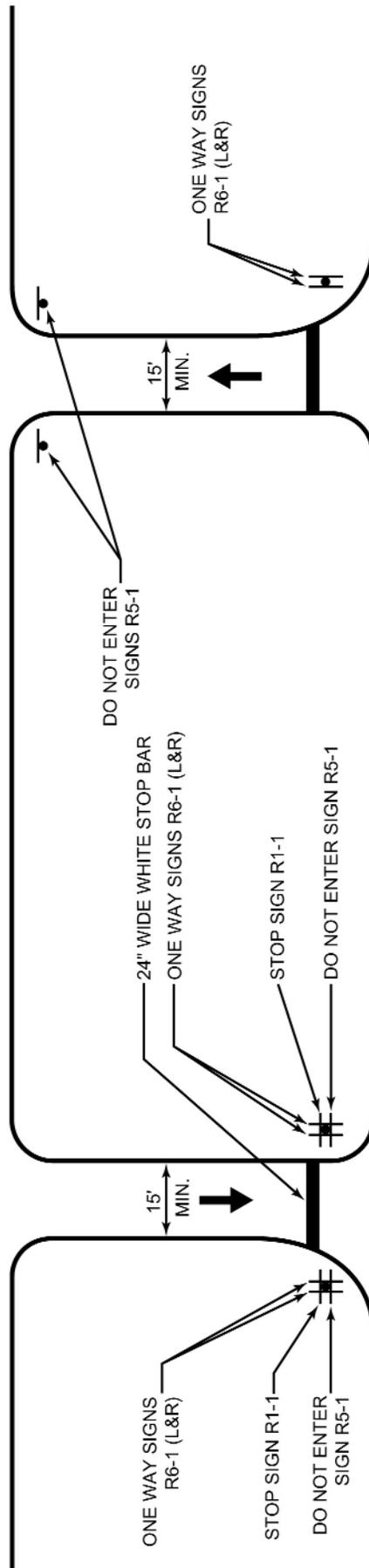


Driveway Access Backplates are to be Campbell Foundary specifications or equivalent:

FIGURE 20

ONE-WAY DRIVEWAYS DESIGN AND SIGNAGE

DEVELOPMENT SITE



COUNTY ROAD

- W1-7
- STOP SIGNS - 30" X 30"
- DO NOT ENTER SIGNS - 30" X 30"
- ONE WAY SIGNS - 36" X 12"

FIGURE 21

RAINFALL CURVES

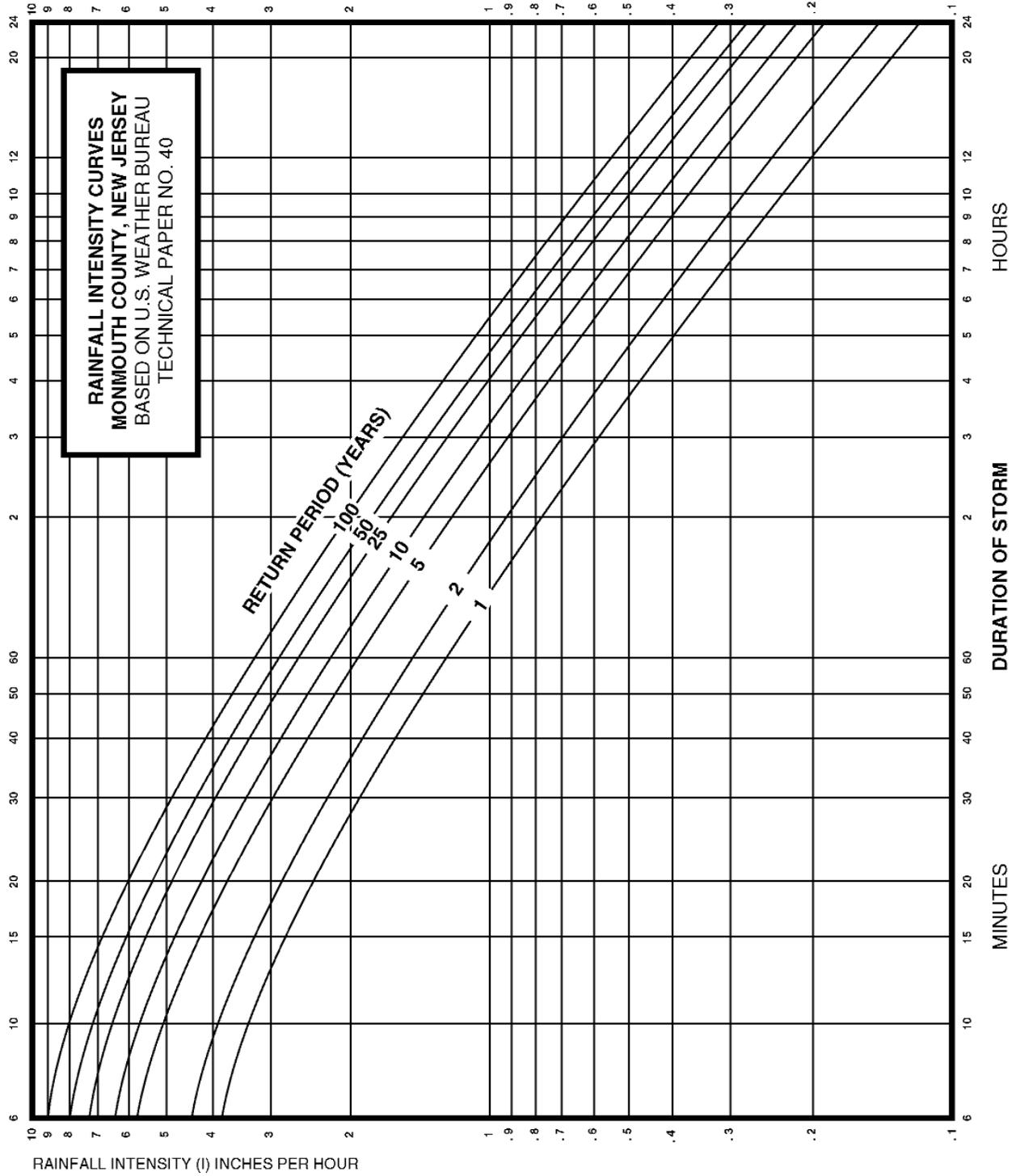


FIGURE 23

NOMOGRAPH FOR THE DETERMINATION OF TIME OF CONCENTRATION

EXAMPLE:
700' of Pavement On a
1.0% Slope = 9.8 minutes

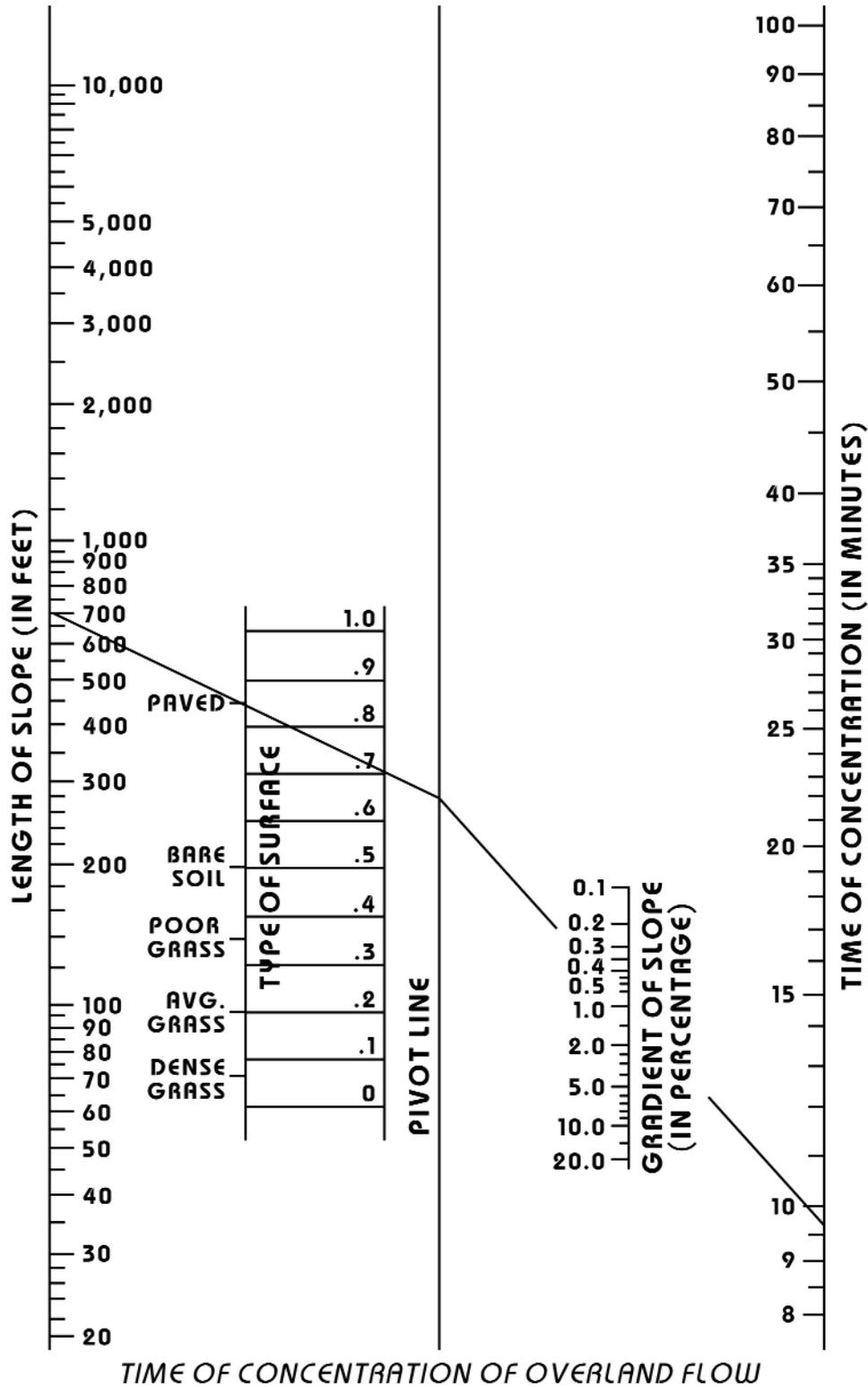


FIGURE 24

TYPICAL RUNOFF COEFFICIENTS FOR VARIOUS TYPES OF LAND USE AND SURFACE CONDITIONS

LAND USE	RUNOFF COEFFICIENTS (C)
Business:	
Downtown areas	0.90
Neighborhood areas	0.70
Residential:	
Single-Family areas	0.40
Multi-Units, detached	0.50
Multi units, attached	0.70
Residential: (Suburban)	0.30
Apartment dwelling areas	0.60
Industrial:	
Light areas	0.70
Heavy areas	0.80
Parks, Cemeteries	0.25
Playgrounds	0.30
Railroad yard areas	0.30
Unimproved areas	0.20

SURFACE CONDITIONS

a) Impervious

Streets:	
Asphalt	0.90
Concrete	0.90
Brick	0.80
Drives and Walks	0.80
Roofs	0.90

b) Pervious

Flat, 0 to 2%
Average, 2 to 6%
Steep, 6 to 10%
Hilly, more than 10%

HYDROLOGICAL SOIL GROUP

A	B	C	D
0.10	0.15	0.20	0.25
0.12	0.17	0.22	0.27
0.15	0.20	0.35	0.45
0.25	0.35	0.50	0.60

FIGURE 25

VALUES OF THE ROUGHNESS COEFFICIENT "n"

TYPE OF CHANNEL	Min.	Normal	Max
A. CLOSED CONDUITS FLOWING PARTLY FULL			
A-1 Metal			
a. Brass, smooth	0.009	0.010	0.013
b. Steel			
1. Lockbar and welded	0.010	0.012	0.014
2. Riveted and spiral	0.013	0.016	0.017
c. Castiron			
1. Coated	0.010	0.013	0.014
2. Uncoated	0.011	0.014	0.016
d. Wrought iron			
1. Black	0.012	0.014	0.015
2. Galvanized	0.013	0.016	0.017
e. Corrugated metal			
1. Subdrain	0.017	0.019	0.021
2. Storm drain	0.021	0.024	0.030
A-2 Non-metal			
a. Lucite	0.008	0.009	0.010
b. Glass	0.009	0.010	0.013
c. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
d. Concrete			
1. Culvert, straight and free of debris	0.010	0.011	0.013
2. Culvert, with bends, connections and some debris	0.011	0.013	0.014
3. Finished	0.011	0.012	0.014
4. Sewer with manholes, inlet, etc. straight	0.013	0.015	0.017
5. Unfinished, steel form	0.012	0.013	0.014
6. Unfinished, smooth wood form	0.012	0.014	0.016
7. Unfinished, rough wood form	0.015	0.017	0.020
e. Wood			
1. Stave	0.010	0.012	0.014
2. Laminated, treated	0.015	0.017	0.020
f. Clay			
1. Common drainage tile	0.011	0.013	0.017
2. Vitrified sewer	0.011	0.014	0.017
3. Vitrified sewer with manholes, inlet, etc.	0.013	0.015	0.017
4. Vitrified subdrain with open joint	0.014	0.016	0.018
g. Brickwork			
1. Glazed	0.011	0.013	0.015
2. Lined with cement mortar	0.012	0.015	0.017
h. Sanitary sewers coated with sewage slimes, with bends and connections	0.012	0.013	0.016
i. Paved invert, sewer smooth bottom	0.016	0.019	0.020
j. Rubble masonry, cemented	0.018	0.025	0.030

FIGURE 26

VALUES OF THE ROUGHNESS COEFFICIENT "n"

TYPE OF CHANNEL	Min.	Normal	Max
B. LINED OR BUILT-UP CHANNELS			
B-1 Metal			
a. Smooth steel surface			
1. Unpainted	0.011	0.012	0.014
2. Painted	0.012	0.013	0.017
b. Corrugated	0.021	0.025	0.030
B-2 Non-metal			
a. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.012	0.013	0.017
b. Wood			
1. Planed, untreated	0.010	0.012	0.014
2. Planed, creosoted	0.011	0.012	0.015
3. Unplaned	0.011	0.013	0.015
4. Plank with battens	0.012	0.015	0.018
5. Lined with roofing paper	0.010	0.014	0.017
c. Concrete			
1. Trowel finish	0.011	0.013	0.015
2. Float finish	0.013	0.015	0.016
3. Finished with gravel on bottom	0.015	0.017	0.020
4. Unfinished	0.014	0.017	0.020
5. Gunite, good section	0.016	0.019	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	
8. on irregular excavated rock	0.022	0.027	
d. Concrete bottom float finished with sides of:			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
e. Gravel bottom with sides of:			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
2. Dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. Glazed	0.011	0.013	0.015
2. In Cement mortar	0.012	0.015	0.018
g. Masonry			
1. Cement rubble	0.017	0.025	0.030
2. Dry rubble	0.023	0.032	0.035
h. Dressed ashlar	0.013	0.015	0.017
i. Asphalt			
1. Smooth	0.013	0.013	
2. Rough	0.016	0.016	
j. Vegetal lining	0.030		0.500

VALUES OF THE ROUGHNESS COEFFICIENT "n"

TYPE OF CHANNEL	Min.	Normal	Max
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline - excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.050	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage, 100ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rift or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070

VALUES OF THE ROUGHNESS COEFFICIENT "n"

TYPE OF CHANNEL	Min.	Normal	Max
D-2. Flood Plains			
a. Pasture, no Brush			
1. Short Grass	0.025	0.030	0.035
2. High Grass	0.030	0.035	0.050
b. Cultivated areas			
1. No Crop	0.020	0.030	0.040
2. Mature Row Crops	0.025	0.035	0.045
3. Mature Field Crops	0.030	0.040	0.050
c. Brush			
1. Scattered Brush, heavy weeds	0.035	0.050	0.070
2. Light Brush and Trees in winter	0.035	0.050	0.060
3. Light Brush and Trees in summer	0.040	0.060	0.080
4. Medium to dense Brush in winter	0.045	0.070	0.110
5. Medium to dense Brush in summer	0.070	0.100	0.160
d. Trees			
1. Dense Willows, summer, straight	0.110	0.150	0.200
2. Cleared Land with Tree Stumps, no Sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of Sprouts	0.050	0.060	0.080
4. Heavy stand of Timber, a few down Trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major Streams (top width at flood stage, 100ft). Then value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	----	0.060
b. Irregular and rough section	0.035	----	0.100

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Thomas J. Powers, Deputy Director
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Amy H. Handlin
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