## PARKING LOTS SUPPLEMENTAL SPECIFICATIONS

These specifications are supplemental to Chapter 202, Parking Lots, Surface, of the Code of the City of Lancaster and establishes minimum standards and guidelines for the design and construction of surface parking lots so as to improve the community aesthetically, economically and environmentally.

The purpose of these supplemental specifications is to provide minimum construction standards and guidelines for the construction of new accessory and commercial surface parking lots, and the improvement, including but not limited to reconstruction and resurfacing, of existing off-street surface parking areas. These supplemental specifications are not all inclusive, but provide examples of details and specifications acceptable to the City for meeting the minimum requirements of the Surface Parking Lots Ordinance.

The following standards and specifications should be used as guidance for the construction, reconstruction, resurfacing and other applicable improvements to all surface parking lots. In addition to the standards set forth herein, all surface parking lots shall be designed and constructed, reconstructed, resurfaced or otherwise improved in accordance with all applicable City and state codes and regulations, including but not limited to, Chapter 202 (Parking Lots), Chapter 260 (Stormwater Management), Chapter 262 (Streets and Sidewalks), Chapter 265 (Subdivision and Land Development), Chapter 273 (Trees) and Chapter 300 (Zoning Ordinance) of the City of Lancaster Code of Ordinances.

Innovation and best practices are encouraged. Where it can be shown that an alternative standard will provide equal or better results, that standard may be used in lieu of the standards and specifications provided herein; provided, however, that those alternative standards and specifications are acceptable to the City Engineer, and that such alternative will not have the effect of nullifying the intent and purpose of Chapter 202.

Prior to construction, enlargement or improvement of a surface parking lot or conversion of land for use as a surface parking lot, the owner, tenant or other party in interest who proposes such construction or conversion shall first submit a Parking Lot Permit application and construction documents to the City Engineer. See Appendix A for the permit application and instructions.

## MINIMUM STANDARDS AND APPLICABILITY.

All newly constructed surface parking lots or existing surface parking lots which are enlarged or improved shall conform to the following minimum standards, in addition to all applicable construction standards in the City of Lancaster Code of Ordinances, AASHTO or similar, and applicable manufacturer standards, as approved by the City.

A. All surface parking lots shall be designed in accordance with the dimensional and other parking requirements in the City Zoning Ordinance and Subdivision and Land Development Ordinance, as applicable.

B. All surface parking lots shall meet the following minimum construction standards:

    1. Paved Surfaces. All surface parking lots, except Temporary Surface Parking Lots, shall be paved with a durable material including but not limited to concrete, asphalt and

pavers. The construction specifications and typical cross section details of any parking compound shall be prepared to meet the minimum standards set forth herein. See Appendix B for construction details, drawings and diagrams.

(a) Non Permeable Pavement

Crushed aggregate based course with a minimum thickness of six (6) inches, as specified in the Pennsylvania Department of Transportation Specifications, Form 408, and its latest revisions, or other Pennsylvania Department of Transportation approved equivalent. Pavement should consist of a minimum of two (2) inches of binder courses and one and one-half (1-1/2) inch wearing surface. Material should be equal or superior to Pennsylvania Department of Transportation Specifications for Superpave and should be applied in accordance with the Pennsylvania Department of Transportation Specifications, Form 408, and its latest revisions, or other Pennsylvania Department of Transportation approved equivalent.

It is recommended that when parking lot and drive aisles will be used by heavy vehicles, base course thickness should be increased accordingly.

(b) Permeable or Porous Pavement

Permeable pavement is encouraged but not required. Permeable pavement should not be located on heavy industrial sites, fueling stations, sites with expansive soils or shallow depth to bedrock, areas draining to the permeable pavement greater than one (1) acre, and areas with the water table less than two feet below the bottom of the pavement base. Permeable pavement includes, pavers, porous asphalt, porous concrete and grid paver systems. Permeable pavement shall consider the infiltration rate of the soil subgrade under the base. Constant supervision during construction is encouraged as sediment must be kept from the aggregate base. See Appendix C for an example of porous pavement specifications.

(c) Pavers, Paver Systems

(1) Standard non-permeable pavers installed pursuant manufacturer specifications.

(2) Concrete Block Pavers including Permeable Interlocking Concrete Pavers- Manufactured concrete units intended to reduce stormwater runoff volume, rate, and pollutants. The impervious units are designed with small openings between permeable joints. The openings typically comprise 5% to 15% of the paver surface area and are filled with highly permeable, small-sized aggregates. The joints allow stormwater to enter a crushed stone aggregate bedding layer and base that supports the pavers while providing storage and runoff treatment. PICPs are highly attractive, durable, easily repaired, require low maintenance, and can withstand heavy vehicle loads.

(3) Concrete or plastic grid paver systems - A porous paving system using manufactured structural grids for containing and stabilizing either gravel, soil and other permeable materials.

(d) Other surface materials and paving techniques may be permitted subject to approval by the City Engineer.

(e) Access drives and driveways shall be designed and constructed in accordance with the City SALDO and Specifications Manual. Driveway aprons are recommended where sidewalk, ADA ramps and other improvements would be a required part of the development of the parking lot.

(f) Temporary surface parking lots should not be paved or surfaced with non-permeable materials.

2. Anticipated loading, soil characteristics and other load-bearing stresses should be considered for parking lot design in accordance with applicable PennDOT specifications or other paving specifications approved by the City Engineer, and should be incorporated into parking lot design.

3. Access aisle drives, parking stall angles, stall sizes, and additional landscaping requirements should be incorporated as per the City Zoning Ordinance.

4. All new accessory and commercial surface parking lots shall be designed and constructed to be consistent with the City's Stormwater Management Ordinance, Chapter 260 of the Code of the City of Lancaster and Chapter 202, Parking Lots, Surface, § 202-4, Adequate drainage.

    (a) Stormwater management facilities shall be installed and maintained in accordance with all applicable governmental and manufacturer’s standards.

    (b) Any combination of SWM facilities may be incorporated for the control and management of stormwater runoff, including green infrastructure/low impact development best management practices in accordance with the PA BMP Manual or equivalent standards.

    (c) All surface parking lots shall be properly graded and maintained to prevent conditions which may lead water flowing over public sidewalks, standing water, ice or other conditions deemed to pose a threat to the public health, safety and welfare.

        (1) Paved surfaces, including but not limited to parking spaces and drive aisles, shall be graded and sloped in such a way for directing stormwater into landscaped areas or other stormwater management facilities.

        (2) Stormwater flows onto adjacent property shall in conformance with the performance standards in the City of Lancaster Stormwater Management Ordinance.

    (d) Permeable paving materials

        (1) Permeable paving materials should not be applied to the most frequently used parking spaces.

        (2) Permeable paving is not recommended for drive aisles, travel lanes and access drives/driveways.

    (e) Construction specifications for green infrastructure techniques, including but not limited to permeable or porous pavement materials, infiltration beds and bioretention rain gardens are provided in Appendix C.

C. Handicapped-accessible spaces shall be provided and designed in accordance with the ICC/ANSI A117.1 or its successor, and the City Zoning Ordinance, as applicable.

D. Adequate lighting. In addition to the lighting standards in Chapter 202, lighting provided in all surface parking lots shall be in accordance with the following minimum standards:

1. All lighting shall be properly shielded in accordance with International Dark-Sky Association guidelines so as to eliminate glare and light spillage beyond the property line and onto adjacent property. All luminaires shall be fully shielded so that no light is emitted above the horizontal plane.
2. If required, photometric lighting design plans shall indicate fixture location and height and light intensity measured in foot-candles at grade.
3. In commercial areas, parking surfaces should have a target illumination of 0.6 to 0.9 foot-candles average with a uniformity ratio of 4:1, or better. All other areas parking surfaces should have a target illumination of 0.2 to 0.5 foot-candle average with a uniformity ratio of 4:1, or better.
   (a) Irrespective of the above standards, all lighting shall have intensities and uniformity ratios in accordance with the current recommended practices of the Illuminating Engineering Society of North America (IESNA) as contained in the IESNA Lighting Handbook.
4. When designing lighting for new parking lots, existing lighting from adjoining light sources shall be considered in order to avoid excess illumination. Lighting shall be placed to avoid conflict with overhead utilities, trees and structures. Wall packs and similar fixtures may be used for small accessory parking lots.
5. Light poles and standards in parking lots with street frontage greater than 50 feet, and/or frontage on a street with a cartway width greater than 30 feet and/or within the Heritage Conservation District, and/or within the Streetscape District shall be**,** to the maximum extent practicable, in compliance with the Streetscape Guidelines in the Streetscape District Ordinance, Chapter 262, Article VII.
6. The use of motion sensors for dimming and extinguishing lights after dark is encouraged.
7. Irrespective of the provisions for adequate lighting herein, and when approved by the City, a surface parking lot not used between dusk and dawn shall not be required to install lighting.

E. Landscaping and Screening. All surface parking lots should be designed and effectively landscaped and screened in accordance with the following standards and guidelines.

1. General landscaping standards and guidelines.
   (a) Landscaping should be provided in inverted perimeter landscape strips, interior planting islands and divider strips, as applicable, to minimize noise, glare and other nuisances as well as to enhance the environment and ecology of the site and surrounding area.
   (b) To the maximum extent practicable, landscape areas should be designed and constructed to provide stormwater management and accept stormwater runoff from the parking lot surface.

(1) Landscape areas should incorporate green infrastructure (stormwater management) in order to comply with stormwater drainage requirements in the Parking Lots Ordinance, §202-4.

(2) Acceptable designs include but are not limited to bio-swales, rain gardens, planter boxes, and tree trenches. Specifications and details can be found in the Appendices of this supplement.

(c) All landscape areas should include a combination of trees, shrubs and ground covers.

(d) To the maximum extent possible, trees and other plant materials should be native species. Appropriate tree species can be found in the City of Lancaster Tree Manual: Standards for Arborculture Work.

(e) All trees shall be sited and planted in accordance with Ch. 273, Trees.

(f) Shrubs, ground covers and perennials used below shade trees within parking lots should be of species able to withstand the harsh conditions and runoff of a parking lot. Plant selection should take into consideration tree growth and canopy cover and should be partially shade tolerant species.

(g) To prevent conflicts with the opening and closing of automobile doors and to reduce damage from automobile overhang, all shrub plantings in parking lot islands and divider strips located adjacent to or abutting parking stalls should be set back a minimum of two (2) feet from the curb or edge of pavement.

(h) Trees should be placed in order to avoid conflict with light standards and the effectiveness of light fixtures.

(i) Plantings required within the parking areas are exclusive of other planting requirements such as street trees and buffers.

(j) All damaged and dead landscape plantings, including trees, shall be replaced within six (6) months of notice by the City.

(k) Continuous curbing including but not limited to formed concrete and rolled asphalt shall not be installed as to impede the flow of stormwater into landscaped areas. The use of depressed concrete curbs is permitted.

(l) Replacement of Trees. Where one or more shade trees that were required are proposed to be removed, they shall be replaced by new shade trees meeting City requirements, and the new locations and species shall be approved by the City. The Zoning Officer may require that the City Shade Tree Commission and/or the City Arborist be provided with an opportunity for a review. This provision does not apply to required street trees.

(m) Raised landscape and planting beds may be allowed upon permission of the City Engineer when used for accenting vehicle and pedestrian access points and is not required for stormwater management.

(n) Invasive plant species shall not be used. To learn more about invasive plants in Pennsylvania and how they can be controlled, visit www.dcnr.state.pa.us/forestry/plants/invasiveplants/index.htm.

2. Perimeter landscape strips are required for all surface parking with frontage upon a public street and/or adjacent to residential dwellings and shall be designed in accordance with the following standards:

   (a) Perimeter landscape strips shall be a no less than five (5) feet in width and planted with a variety of medium and tall trees, shrubs and ground cover, as appropriate.

   (b) When adjacent to a street right-of-way or residential dwellings, perimeter landscape strips should contain a continuously intermittent row of low shrubs with a maximum height at maturity of three (3) feet interspersed between required trees. No gap in the spacing of individual shrubs at maturity shall be greater than one (1) foot. The height of landscaping shall be measured from the finish grade of the adjacent parking spaces.

      (1) For the purpose of this ordinance, adjacent residential dwellings include those properties abutting the parking lot or separated by a streets or other public right-of-way.

      (2) A three (3) foot tall masonry wall erected at the outer edge of the perimeter landscape strip may be substituted for the continuous row of shrubs.

      (3) Irrespective of (2) above, all perimeter landscape strips, except as provided in (e) below, should include trees, shrubs and groundcover.

   (c) Perimeter landscape strips greater than one hundred (100) feet in total length should be planted with a variety of small, medium and tall trees spaced in accordance with accepted standards of the American Association of Nurserymen, or equivalent.

   (d) Perimeter landscape strips should be located between all surface parking lots and buildings and structures on the same lot unless the parking lot is accessory to the adjoining building or structure. A variety of columnar trees and tall shrubs should be planted in the perimeter strip located between the parking lot and a building.

   (e) When the perimeter landscape strip is adjacent to a building not located on the same lot as the parking lot, and to which the parking is not accessory, additional taller shrubs may be substituted for trees if there is insufficient space for unobstructed growth.

3. Planting islands should be required for all surface parking lots containing forty (40) or more parking spaces and should be designed and distributed throughout the parking lot as follows:

   (a) One planting island, a minimum of ten (10) feet wide by twenty (20) feet long, should be located at the end of each parking space row and at intervals of no greater than eighty-five (85) feet apart, or every ten (10) parking stalls, in single or double bays.

   (b) Islands should be placed opposite each other in adjacent rows of parking, to reduce the number of islands, and to increase the area available for tree roots.

   (c) Each planting island should contain at least one (1) shade tree plus shrubs, ground cover, perennials and/or mulch to cover the entire area at maturity.

4. Divider strips. When incorporated into a surface parking lot divider strips should conform to the following standards:

(a) Divider strips may be utilized in surface parking lots with one hundred (100) or more spaces in lieu of planting islands.

(b) Divider strips may be used in all surface parking lots with double-loaded parking rows that exceed forty (40) spaces.

(c) When used, divider strips should be placed between double loaded rows of parking running the entire length of the rows and landscaped with plantings of shade, ornamental and/or flowering trees, plus shrubs, ground cover and/or mulch to cover the entire area at maturity.

(d) Divider strips should be a minimum of five (5) feet wide unless a sidewalk is proposed within the divider strip.

(1) If a sidewalk is proposed within the strip, the sidewalk may be placed in the center of the strip or to one side. The divider strip should be increased in width by no less than four (4) feet to accommodate the sidewalk.

(2) Divider strips should be sized to provide adequate space for landscaping and meet the minimum stormwater management requirements, if applicable.

(e) All divider strips should be planted with shade trees in accordance with Chapter 273. Two (2) ornamental and/or flowering trees may be substituted for each shade tree. The trees need not be spaced evenly apart; however, a minimum of three (3) shade trees should be planted for each one hundred (100) feet of divider strip.

(f) A variety of large and small shrubs should be planted in areas of the divider strip between trees. Gaps may be placed between the shrub plantings to provide areas for ground covers, decorative mulch beds, artwork, crosswalks or flowering plants. Shrubs near the ends of divider islands should not exceed three (3) feet in height so as not to block visibility. This should not preclude the use of taller shrubs elsewhere within the divider strip.

F. Curb stops or other means shall be used to ensure that parked vehicles do not overhang onto walking areas, sidewalks, or landscape areas.

G. Maintenance. The parking lot owner and lessee or operator is responsible for properly maintaining the pavement surface per the applicable manufacturer's recommendations. The surface grade shall be maintained as installed, and ruts and potholes shall be repaired immediately or upon notice by the City. All vegetation must be properly maintained and replaced as necessary per applicable City codes and regulations.

H. Safety. Parking lots shall be designed to allow for the safe flow of vehicular and pedestrian traffic and shall include design features to discourage through vehicular traffic between adjacent streets. Parking lot design shall consider vehicle speed in relation to pedestrian crossings and shall incorporate features such as designated pedestrian crosswalks when deemed necessary by the City. Appropriate sight distances, subject to approval by the City Engineer, at intersections of vehicle lanes shall be provided, and traffic control measures shall be installed where needed to facilitate public safety.

# APPENDIX A

## SURFACE PARKING LOTS PERMIT APPLICATION

**Permit application.** Prior to construction, enlargement or improvement of a surface parking lot or conversion of land for use as a surface parking lot, the owner, tenant or other party in interest who proposes such construction or conversion shall first submit a Parking Lot Permit application and construction documents to the City Engineer. The construction documents shall include the following:

A. For surface parking lots involving new or modified access drives to a public street or alley requiring Traffic Commission approval and/or where a highway occupancy permit would be required from the Pennsylvania Department of Transportation, the owner, tenant or other party in interest shall obtain prior to final permit approval the necessary approvals and submit evidence of same with the permit application to the City Engineer. An application for access to a public street or alley shall require that the applicant submit a written request to the City Traffic Commission. Applicants shall present to the Traffic Commission pertinent documentation concerning sight and safe stopping distances, safety for pedestrians and vehicles and impacts resulting from any loss of on-street parking. Proposed access drives and driveways shall be designed and constructed in accordance with the City SALDO.

B. For any parking lot requiring a special exception or variance from the Zoning Hearing Board, the applicant shall first present evidence to the City Engineer that required approvals have been granted and are in effect.

C. Site Plan. Three (3) copies of a site plan shall be submitted along with the permit application for all new surface parking lots and all surface parking lot improvement projects.
   1. All new and reconstructed surface parking lots shall also submit a stormwater management site plan in accordance with Article IV of the City Stormwater Management (SWM) Ordinance.
   2. If proposed parking lot project is part of an overall land development, then the SALDO plan submission procedure and plan requirements set forth in Ch. 265 of the Code of the City of Lancaster shall apply.
   3. The site plan shall include the width and angle of all parking spaces, aisle width and direction, access drives, landscaping, lighting, and signage, in accordance with all City of Lancaster codes and ordinances.
   4. For sealing, restriping, patching and similar minor repairs to paved areas of a lot solely for maintenance, a site plan or drawing is not required.

D. Material specifications, construction details, and cross-section profiles for the proposed pavement material shall be prepared in accordance with applicable industry, City or state standards.

E. Grading plan with contours and spot elevations, nearest sewers, method of connection and materials used in the system shall be submitted showing final proposed contours at intervals of no more than two (2) feet in areas of disturbance.

F. Details concerning excavation, reconstruction or installation of any curbs, streets, sidewalks and invert elevation of inlets and appurtenances which will be installed for the surface parking lot shall be shown on the site plan in accordance with applicable City specifications.

G. The site plan shall indicate the location of all proposed relocation of utilities, poles, fire hydrants, signage, parking meters or demolition of structures.

H. Erosion and sediment pollution control plan with sequencing narrative to address earthmoving activities, if applicable, shall be included with the site plan. All new, enlarged and reconstructed surface parking lots, regardless of size, shall indicate erosion and sediment pollution control methods on site plan.

Date Received _____

## APPLICATION FOR OFF-STREET PARKING LOT CONSTRUCTION / RECONSTRUCTION / RESURFACING PERMIT

Project Name _____

Address of Lot_____ Parcel ID #_____

Owner's Name _____

Owner's Mailing Address _____

Phone _____ Email _____

Name and Mailing Address of Individual/Firm that Prepared Plan: _____

_____

Phone _____ Email _____

Contractor Name: _____

Contractor Mailing Address: _____

Phone _____ Email_____

PLEASE CHECK ALL OF THE FOLLOWING THAT APPLY:

□ a. New Construction* □ b. Reconstruction* □ c. Resurfacing*

□ d. SWM/Landscaping/Lighting Improvements* □ e. Overlay/Minor Repair

Type of parking lot: □ Residential □ Nonresidential □ Accessory □ Temporary

* If required pursuant to City Code Chapter 202, Parking Lots, application shall include plans, specifications and reports as per the Permit Parking Submission Requirements.

PARKING LOT IMPROVEMENTS (Provide total areas in square feet)

a. New construction: _____ b. Reconstruction: _____ c. Resurfacing: _____

d. Pothole repair: _____ e. Base repair: _____

*I, _____, the undersigned, certify that the information I have provided for this Application for a Parking Lot Permit is true and correct. I understand that any false statements made herein are subject to the penalties of 18 Pa. C.S. §4904 relating to unsworn falsification to authorities.*

_____

Applicant/Authorized Agent Date

FOR OFFICIAL USE ONLY:

| City Engineer: | Stormwater Manager: | Zoning Officer: | Planning |
|---|---|---|---|
| _____ | _____ | _____ | _____ |
| Date: _____ | Date: _____ | Date: _____ | Date: _____ |



APPENDIX A

## Parking Lot Permit Application Submission Requirements

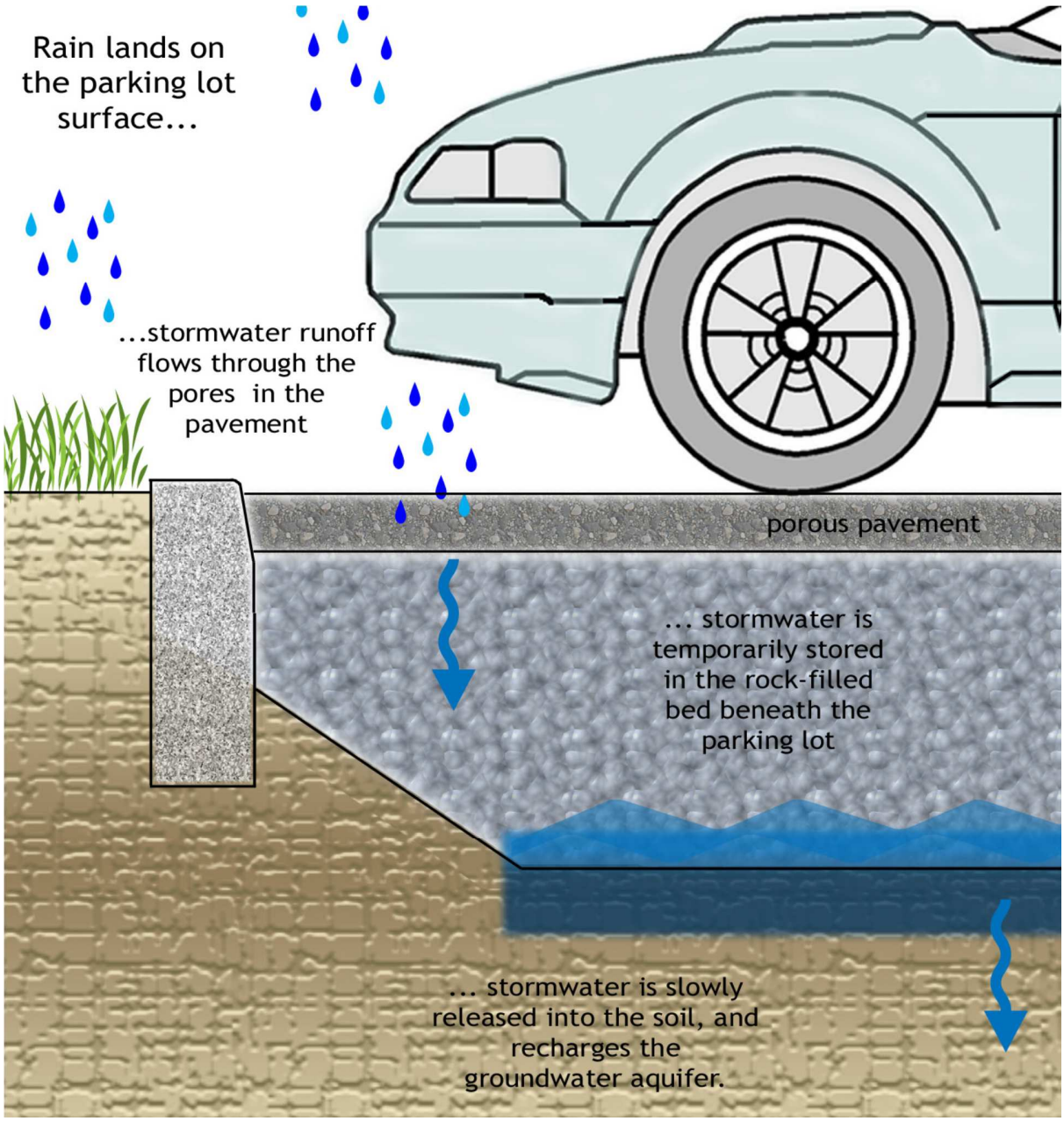
**Prior to construction, enlargement or improvement of a surface parking lot or conversion of land for use as a surface parking lot, three (3) copies of the application and plans, specifications and reports shall be submitted to the City Engineer. The plans and reports shall be prepared in accordance with § 202-5 of the Parking Lots Ordinance and contain the following minimum information:**

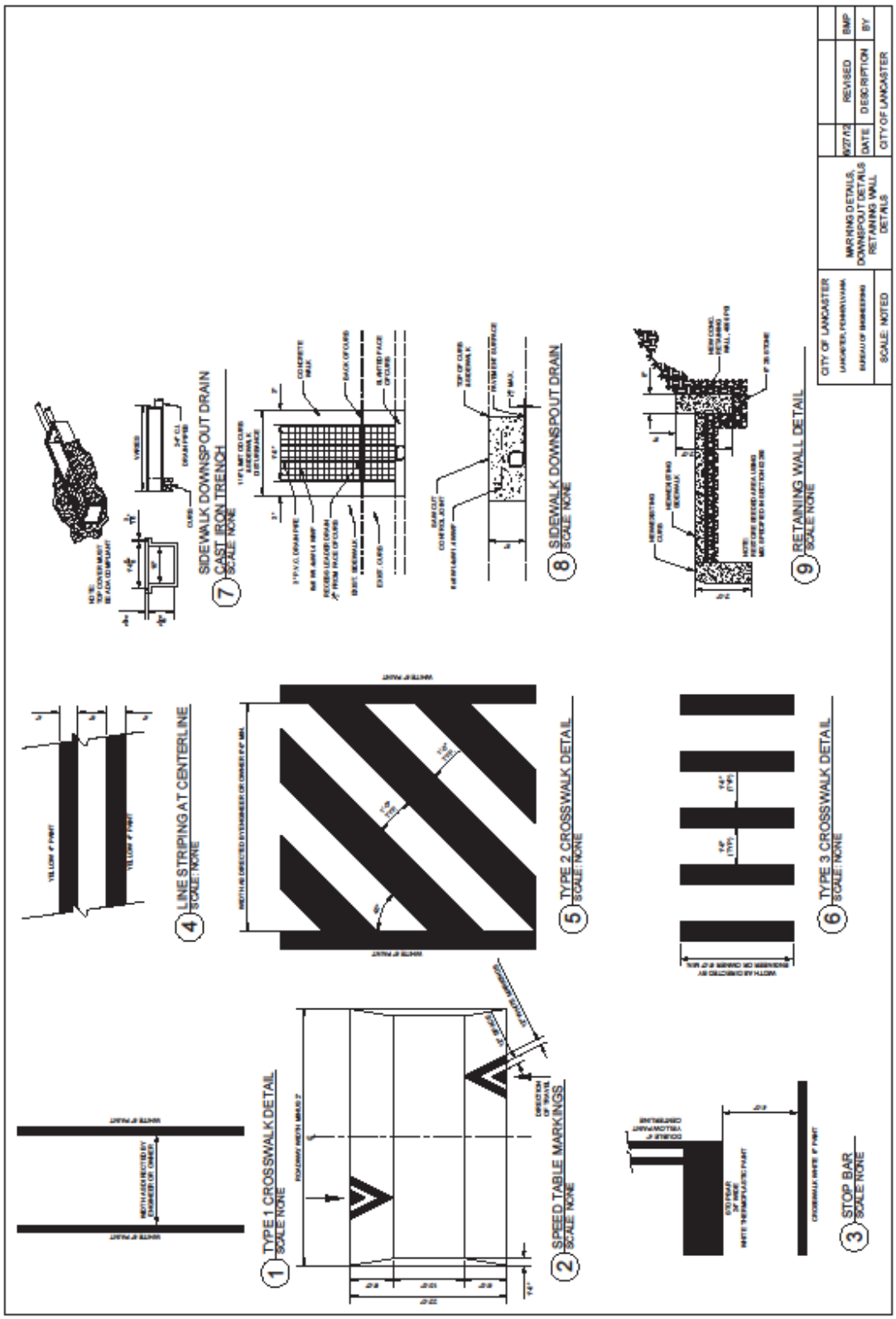
1. Date, north arrow, graphic scale and written scale.
2. Zoning site data including required number of parking spaces, any Zoning Hearing Board decision, existing and proposed number of stalls, and percent of existing and proposed lot coverage.
3. Existing and proposed buildings and other structures.
4. Location of any floodplain or flood-prone areas on the site.
5. Existing lot lines with dimensions to the nearest hundredths foot.
6. Existing and proposed public and private sidewalks, streets and alleys adjoining lot with dimensions to the nearest foot.
7. Existing and proposed driveway locations with distance to nearest edge of road of adjoining intersections.
8. Parking stall and aisle layout in accordance with the City of Lancaster Zoning Ordinance, Chapter 300 of the Code of the City of Lancaster.
9. Landscaping and screening design indicating size, species and number of plantings.
10. Sight triangles at all intersections.
11. Existing easements and utilities serving the lot.
12. Pedestrian pathways within parking lot from parked vehicles to and from destination buildings.
13. Bicycle parking facilities.
14. Handicapped-accessible spaces and required signage.
15. Location, height and type of any fencing or wall.
16. Location of regulatory signage, stop, one-way, etc.
17. Proposed curbing and wheel stops.
18. Lighting plan, if applicable. An electrical permit is required for any site lighting not included as part of any other permit for the project.
19. Paving specifications applicable to the paving material(s) to be used.
20. Stormwater Management Site Plan, in accordance with the Stormwater Management Ordinance, Chapter 260 of the Code of the City of Lancaster.
21. Grading Plan.
22. Soil Erosion and Sediment Control Plan.
23. Details and specifications of paving, driveway aprons, pipe slopes, storm water facilities, pipe connection to City mains, landscaping, signage, lighting, and associated improvements.

***Parking lots proposing new or modified access drives shall be required to file a separate application with the City Traffic Commission which should be done prior to submission of plans for a Parking Lot Permit. Applicants must be present at the Traffic Commission meeting to present their proposal and discuss impacts.***

APPENDIX B

CONSTRUCTION DETAILS, DRAWINGS AND DIAGRAMS

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5 TYPE 2 CROSSWALK DETAIL
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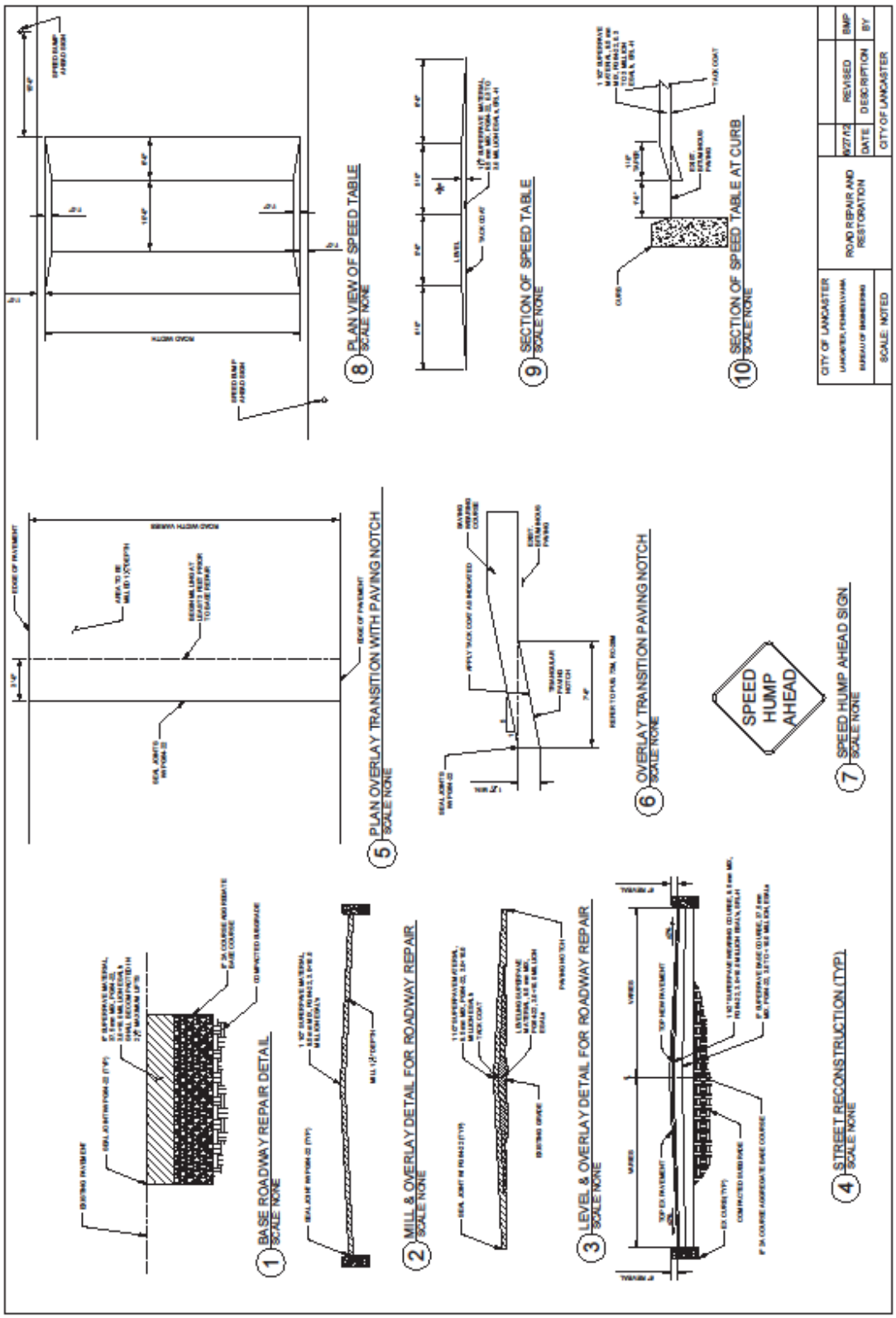
6 TYPE 3 CROSSWALK DETAIL
SCALE: NONE
7 SIDEWALK DOWNSPOUT DRAIN
CAST IRON TRENCH
SCALE: NONE
8 SIDEWALK DOWNSPOUT DRAIN
SCALE: NONE
9 RETAINING WALL DETAIL
SCALE: NONE
CITY OF LANCASTER
SCALE: NOTED
MARKING DETAILS, DOWNSPOUT DETAILS RETAINING WALL DETAILS
NO. REVISED BMP
DATE DESCRIPTION BY
CITY OF LANCASTER



APPENDIX B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3 LEVEL & OVERLAY DETAIL FOR ROADWAY REPAIR
SCALE: NONE
4 STREET RECONSTRUCTION (TYP.)
SCALE: NONE
5 PLAN OVERLAY TRANSITION WITH PAVING NOTCH
SCALE: NONE
6 OVERLAY TRANSITION PAVING NOTCH
SCALE: NONE
SPEED HUMP AHEAD
7 SPEED HUMP AHEAD SIGN
SCALE: NONE
8 PLAN VIEW OF SPEED TABLE
SCALE: NONE
9 SECTION OF SPEED TABLE
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10 SECTION OF SPEED TABLE AT CURB
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CITY OF LANCASTER
ROAD REPAIR AND RESTORATION
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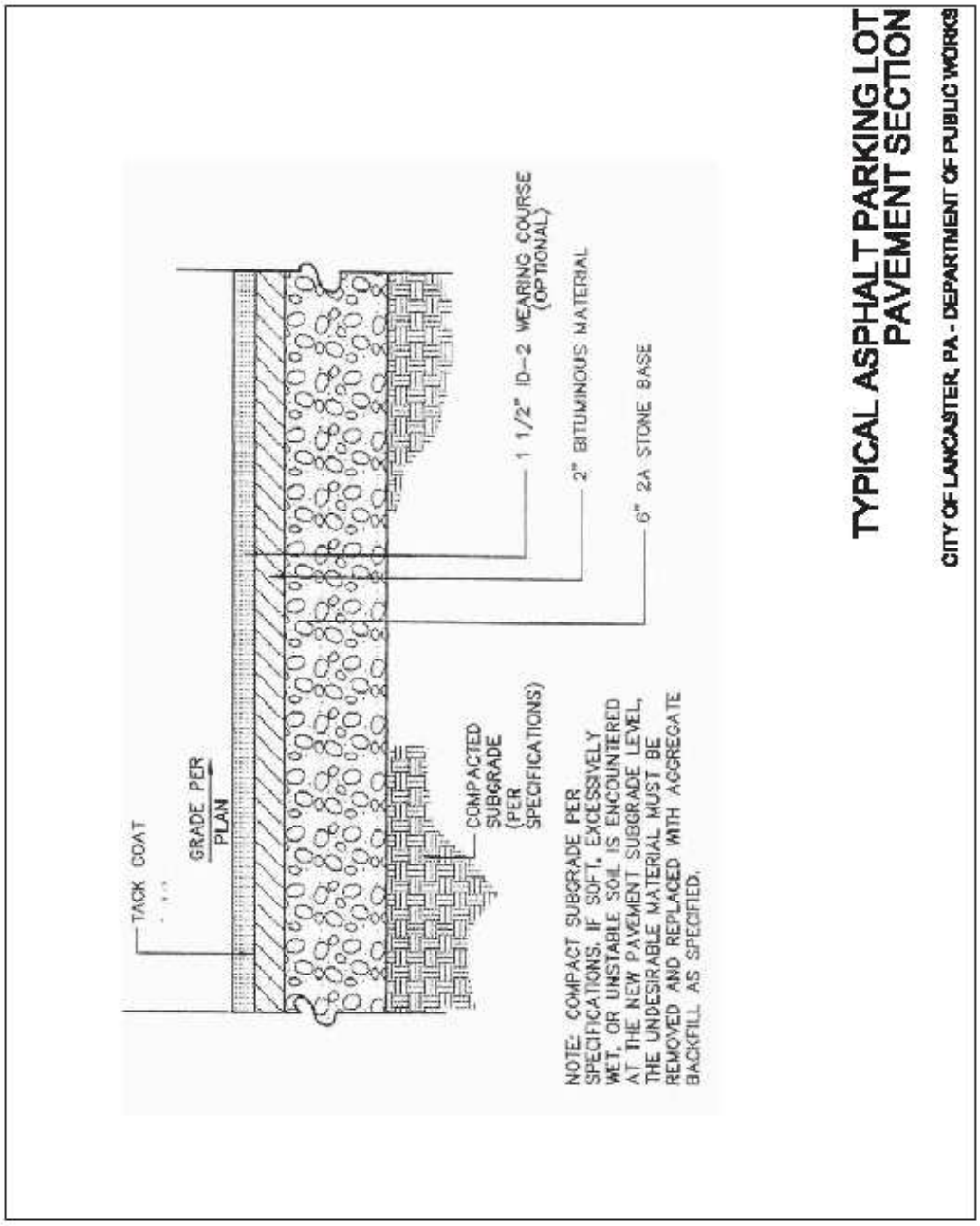
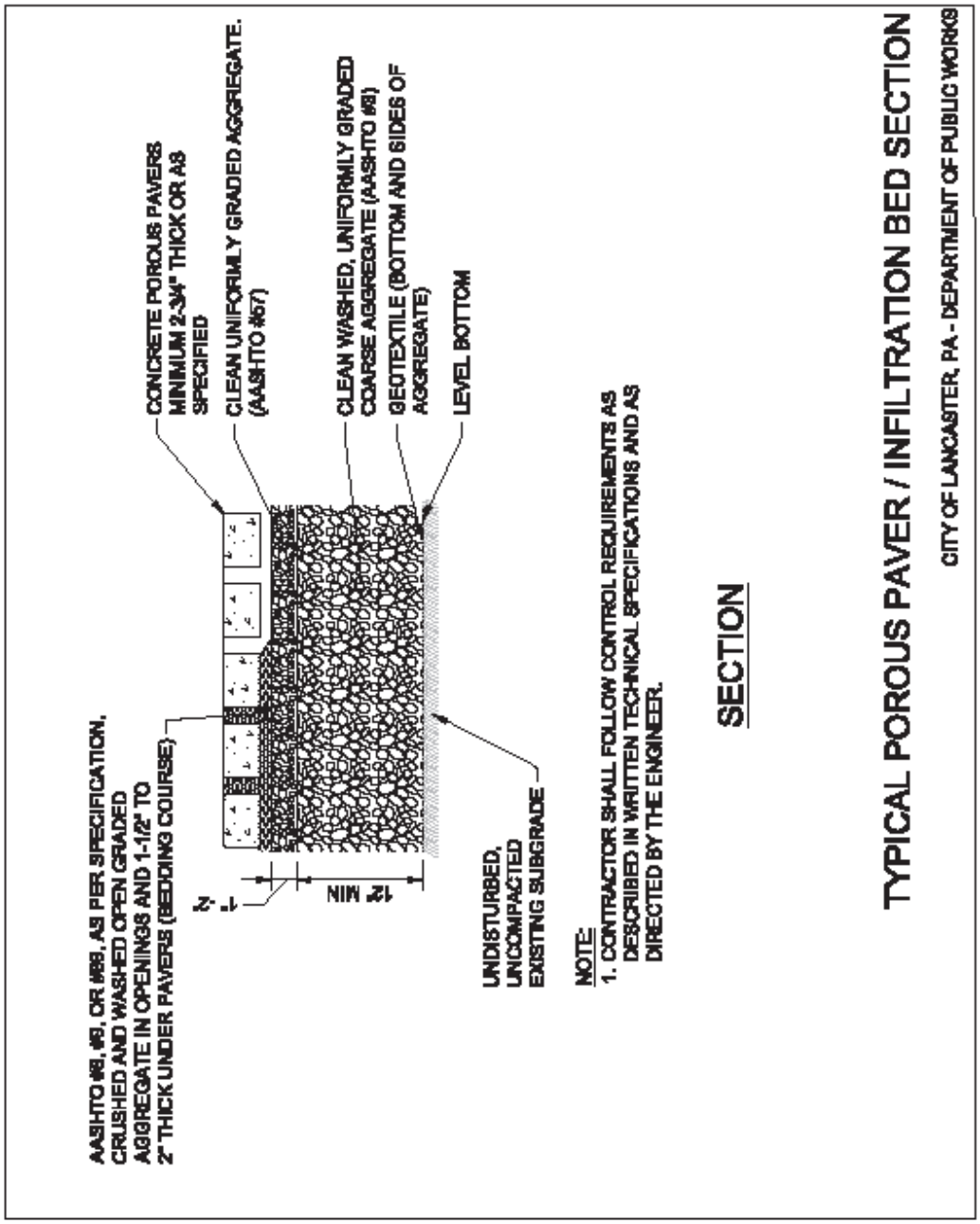
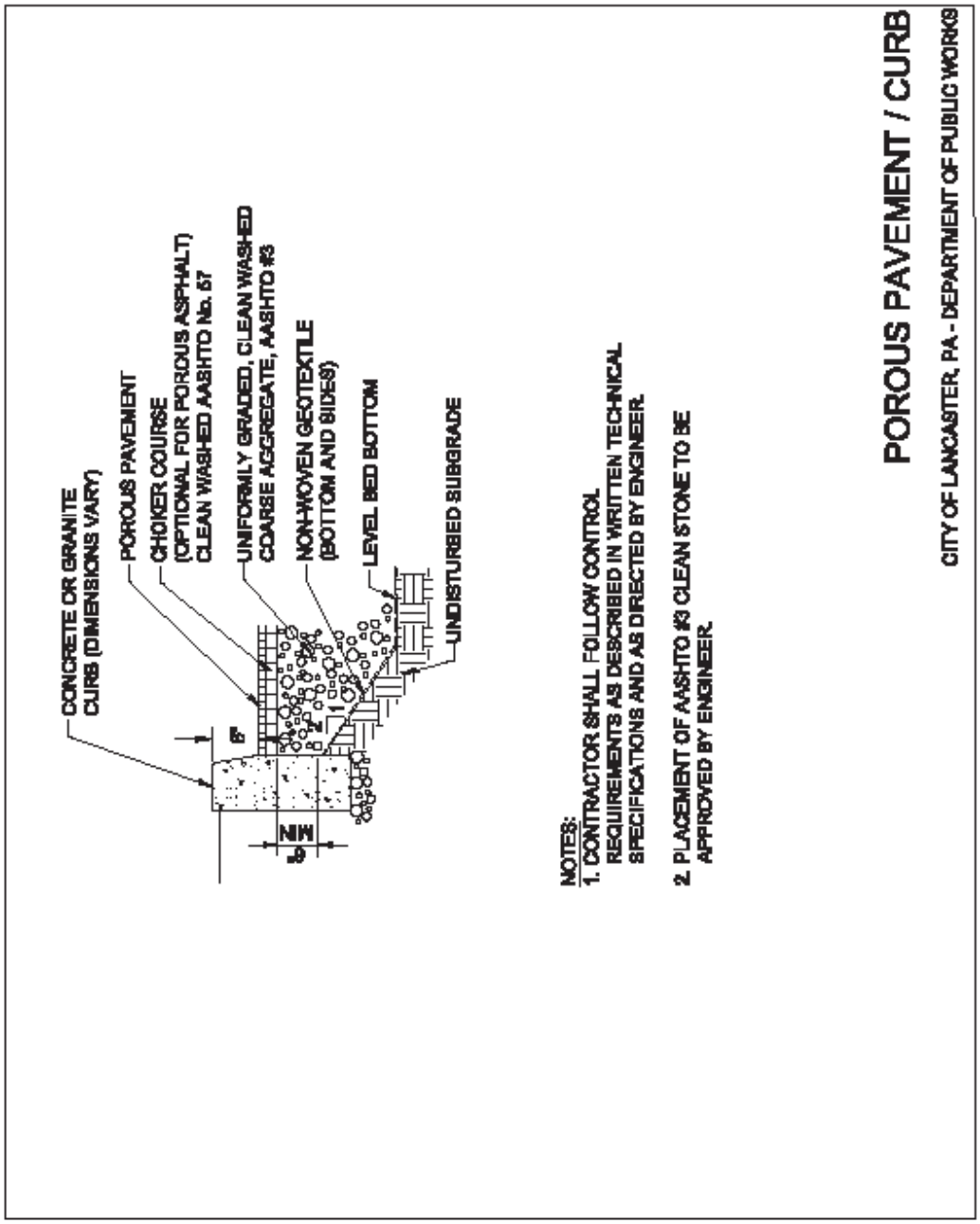
REVISED
DESCRIPTION
CITY OF LANCASTER

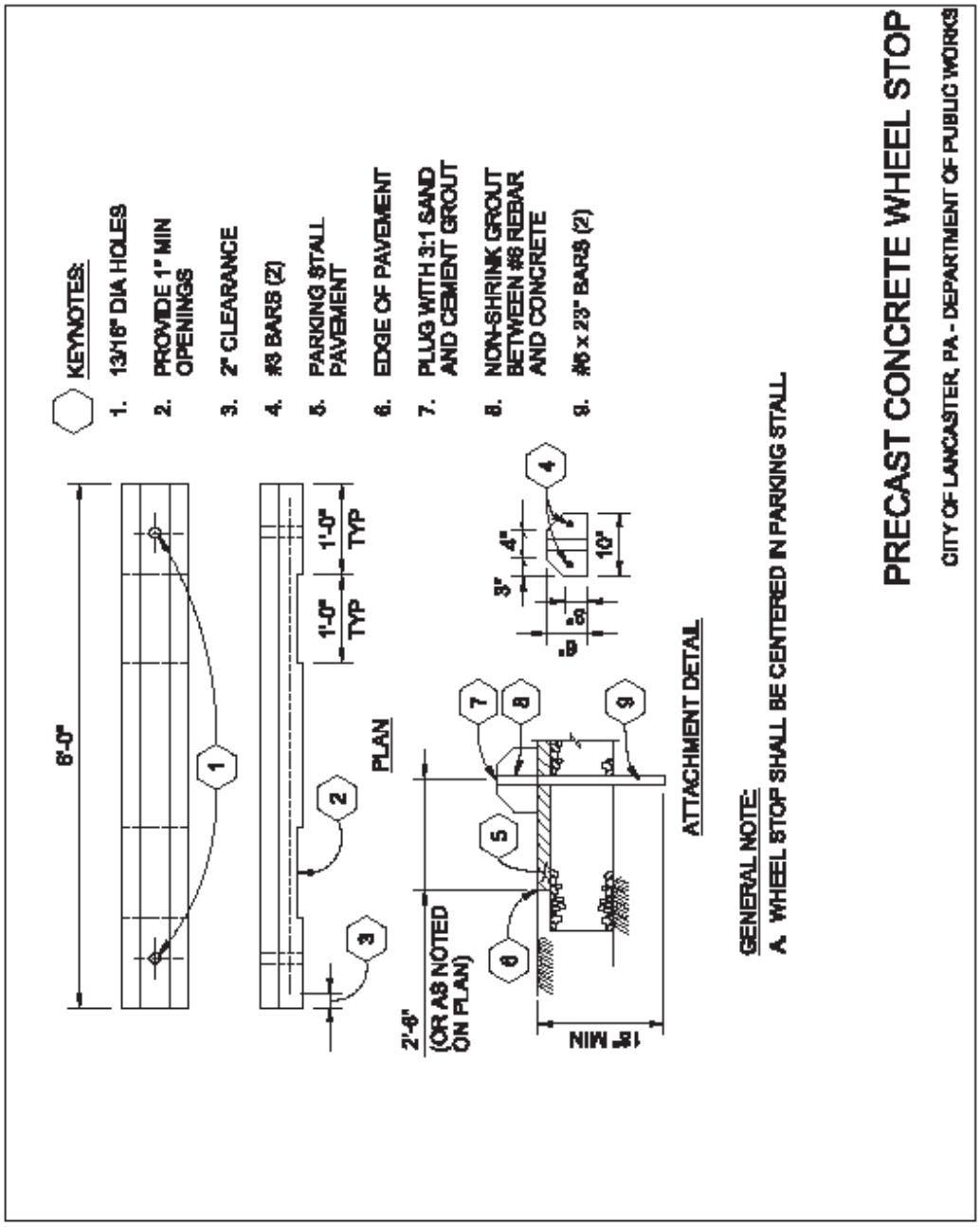


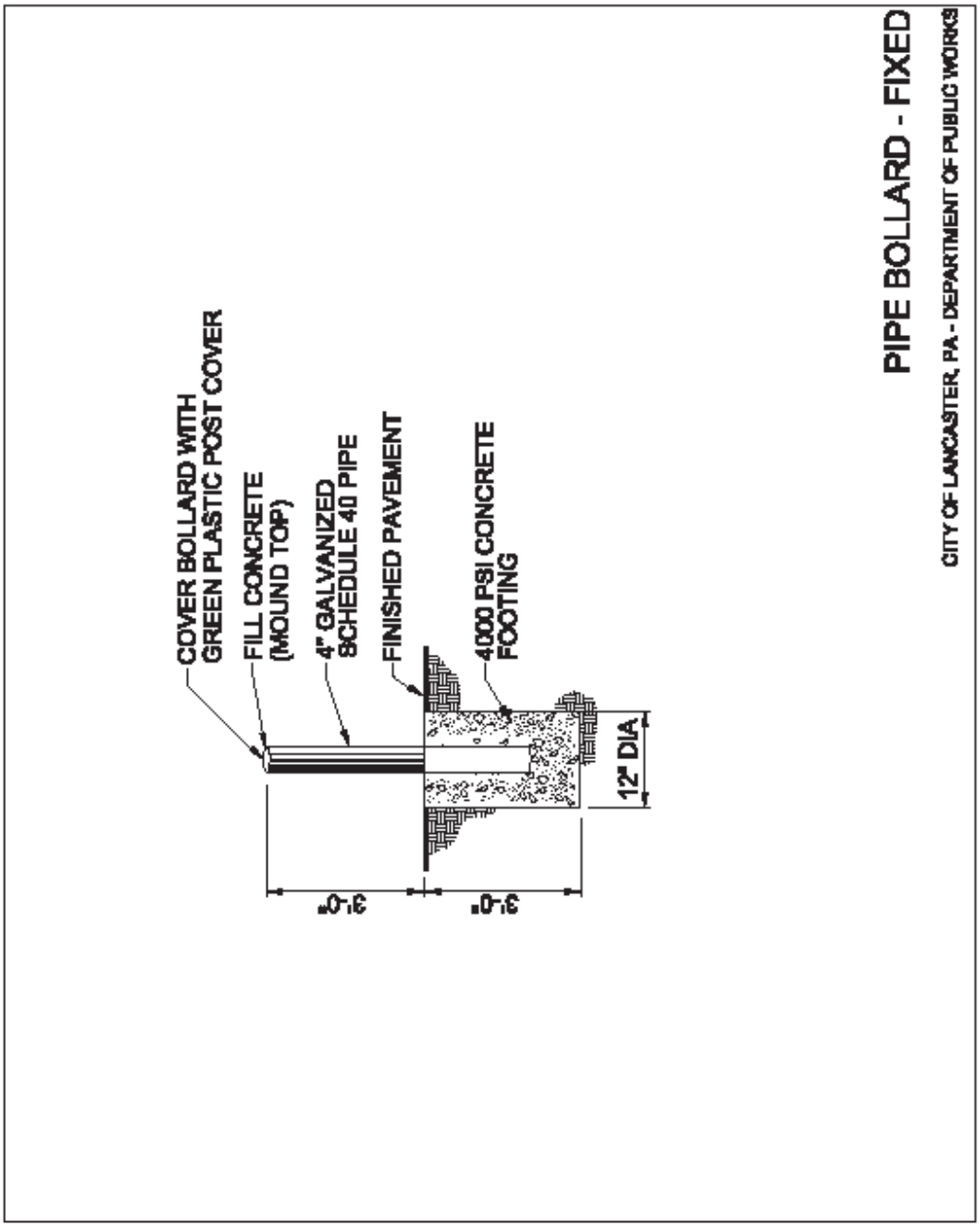
APPENDIX B

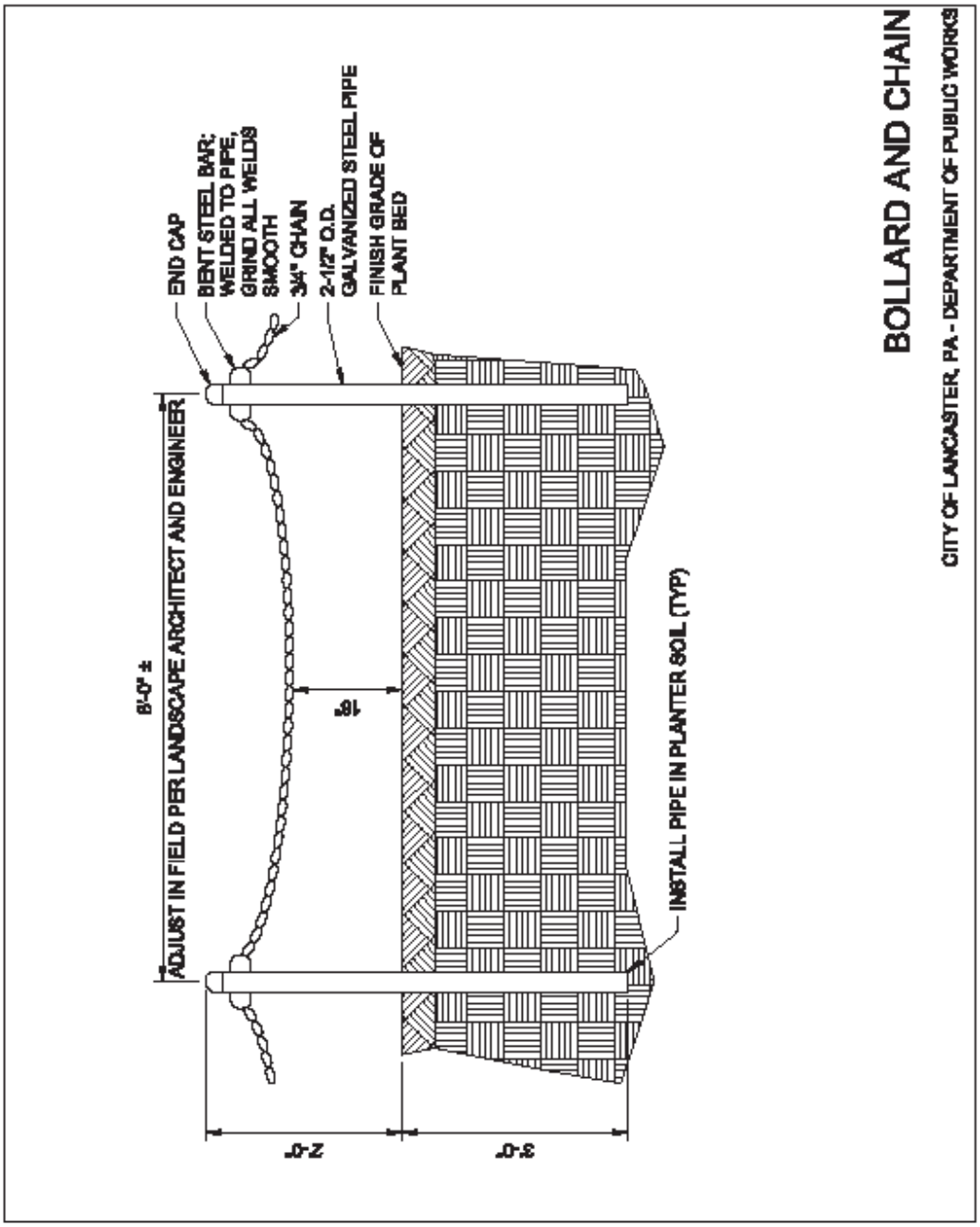

TYPICAL ASPHALT PARKING LOT
PAVEMENT SECTION
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
TACK COAT
GRADE PER PLAN
COMPACTED SUBGRADE (PER SPECIFICATIONS)
1 1/2" ID-2 WEARING COURSE (OPTIONAL)
2" BITUMINOUS MATERIAL
6" 2A STONE BASE
NOTE: COMPACT SUBGRADE PER SPECIFICATIONS. IF SOFT, EXCESSIVELY WET, OR UNSTABLE SOIL IS ENCOUNTERED AT THE NEW PAVEMENT SUBGRADE LEVEL, THE UNDESIRABLE MATERIAL MUST BE REMOVED AND REPLACED WITH AGGREGATE BACKFILL AS SPECIFIED.


CONCRETE POROUS PAVERS MINIMUM 2-3/4" THICK OR AS SPECIFIED
CLEAN UNIFORMLY GRADED AGGREGATE. (AASHTO #57)
CLEAN WASHED, UNIFORMLY GRADED COARSE AGGREGATE (AASHTO #8)
GEOTEXTILE (BOTTOM AND SIDES OF AGGREGATE)
LEVEL BOTTOM
AASHTO #8, #9, OR #89, AS PER SPECIFICATION, CRUSHED AND WASHED OPEN GRADED AGGREGATE IN OPENINGS AND 1-1/2" TO 2" THICK UNDER PAVERS (BEDDING COURSE)
1"
12" MIN
UNDISTURBED, UNCOMPACTED EXISTING SUBGRADE
NOTE:
1. CONTRACTOR SHALL FOLLOW CONTROL REQUIREMENTS AS DESCRIBED IN WRITTEN TECHNICAL SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER.
SECTION
TYPICAL POROUS PAVER / INFILTRATION BED SECTION
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS


CONCRETE OR GRANITE CURB (DIMENSIONS VARY)
POROUS PAVEMENT
CHOKER COURSE (OPTIONAL FOR POROUS ASPHALT) CLEAN WASHED AASHTO No. 57
UNIFORMLY GRADED, CLEAN WASHED COARSE AGGREGATE, AASHTO #3
NON-WOVEN GEOTEXTILE (BOTTOM AND SIDES)
LEVEL BED BOTTOM
UNDISTURBED SUBGRADE
6"
NTH
9"
NOTES:
1. CONTRACTOR SHALL FOLLOW CONTROL REQUIREMENTS AS DESCRIBED IN WRITTEN TECHNICAL SPECIFICATIONS AND AS DIRECTED BY ENGINEER.
2. PLACEMENT OF AASHTO #3 CLEAN STONE TO BE APPROVED BY ENGINEER.
POROUS PAVEMENT / CURB
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS

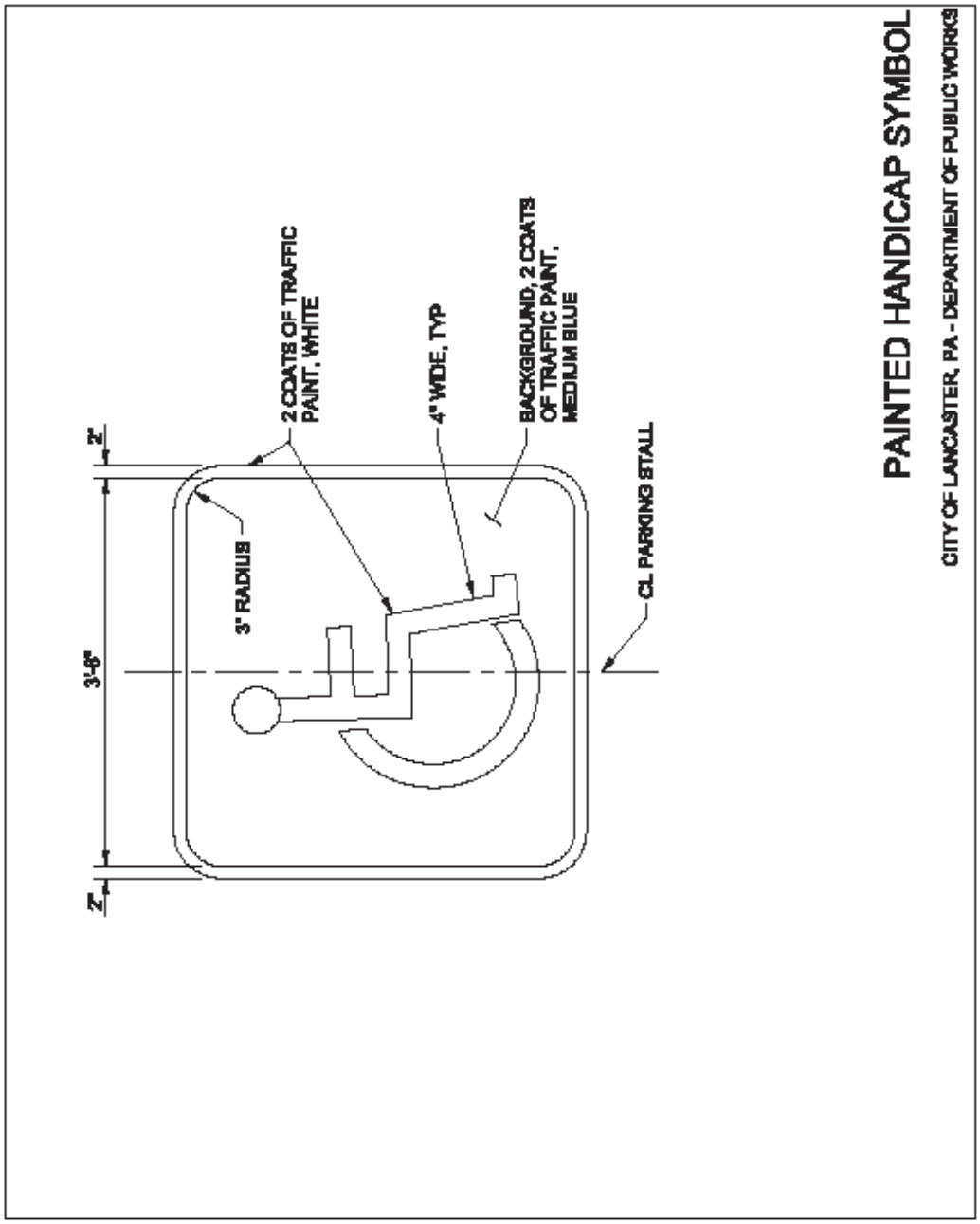

PRECAST CONCRETE WHEEL STOP
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
KEYNOTES:
1. 13/16" DIA HOLES
2. PROVIDE 1" MIN OPENINGS
3. 2" CLEARANCE
4. #3 BARS (2)
5. PARKING STALL PAVEMENT
6. EDGE OF PAVEMENT
7. PLUG WITH 3:1 SAND AND CEMENT GROUT
8. NON-SHRINK GROUT BETWEEN #8 REBAR AND CONCRETE
9. #5 x 23" BARS (2)
6'-0"
1'-0" TYP
1'-0" TYP
PLAN
2'-6" (OR AS NOTED ON PLAN)
15" MIN
3"
4"
10"
ATTACHMENT DETAIL
GENERAL NOTE:
A. WHEEL STOP SHALL BE CENTERED IN PARKING STALL

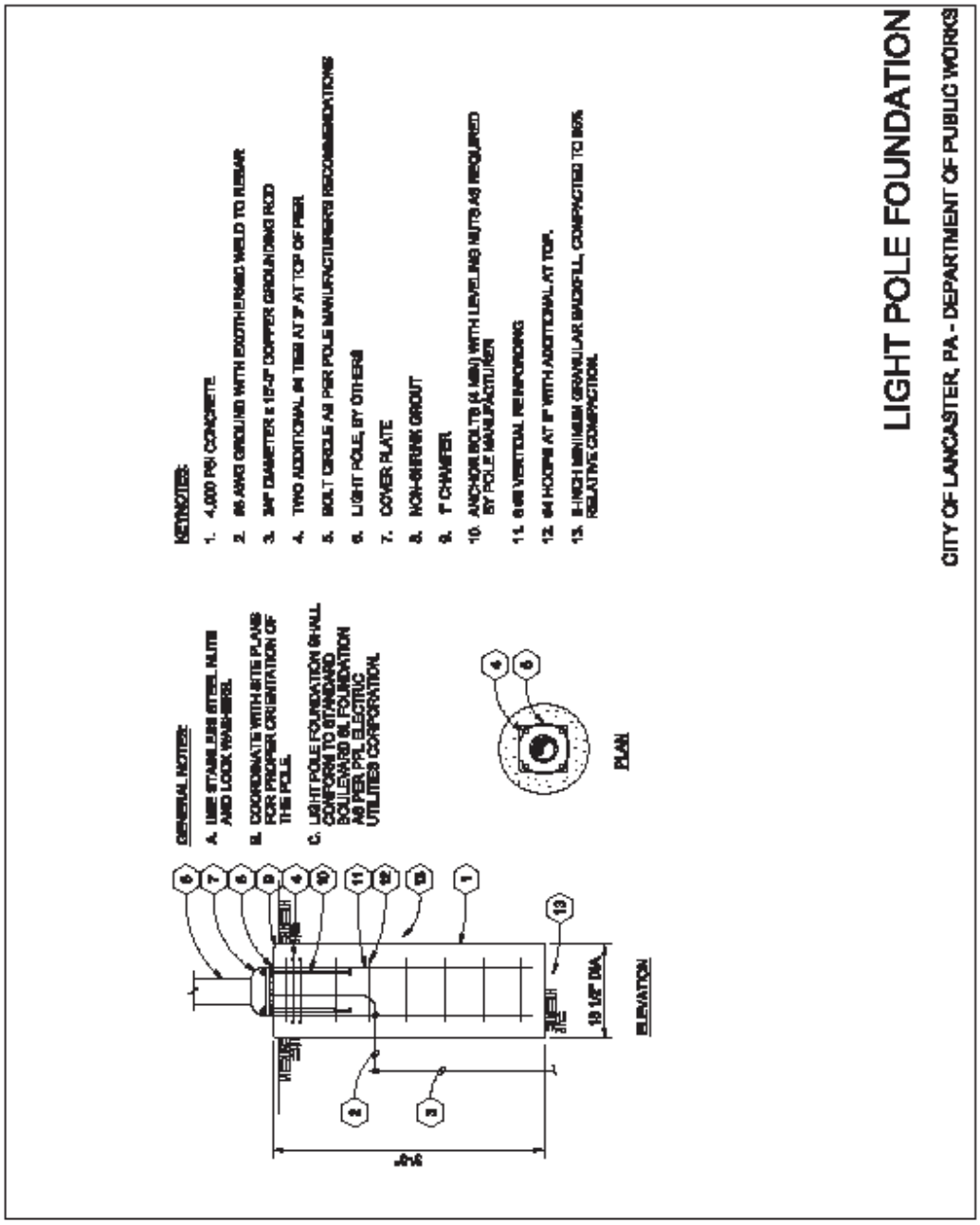

PIPE BOLLARD - FIXED
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
COVER BOLLARD WITH GREEN PLASTIC POST COVER
FILL CONCRETE (MOUND TOP)
4" GALVANIZED SCHEDULE 40 PIPE
FINISHED PAVEMENT
4000 PSI CONCRETE FOOTING
12" DIA
3'-0"
3'-0"

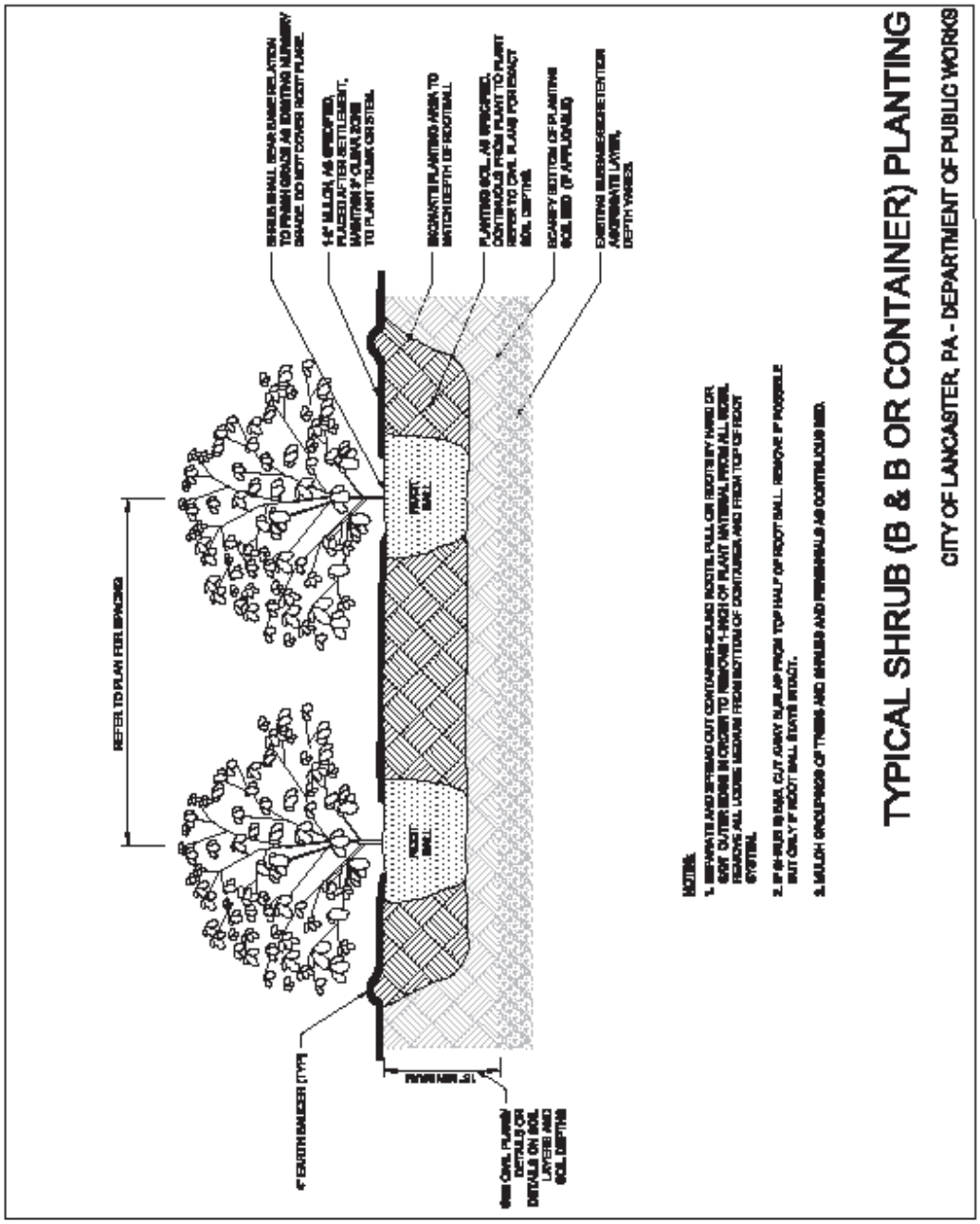

BOLLARD AND CHAIN
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
END CAP
BENT STEEL BAR; WELDED TO PIPE, GRIND ALL WELDS SMOOTH
3/4" CHAIN
2-1/2" O.D. GALVANIZED STEEL PIPE
FINISH GRADE OF PLANT BED
8'-0" ±
ADJUST IN FIELD PER LANDSCAPE ARCHITECT AND ENGINEER
18"
INSTALL PIPE IN PLANTER SOIL (TYP)
2'-0"
3'-0"

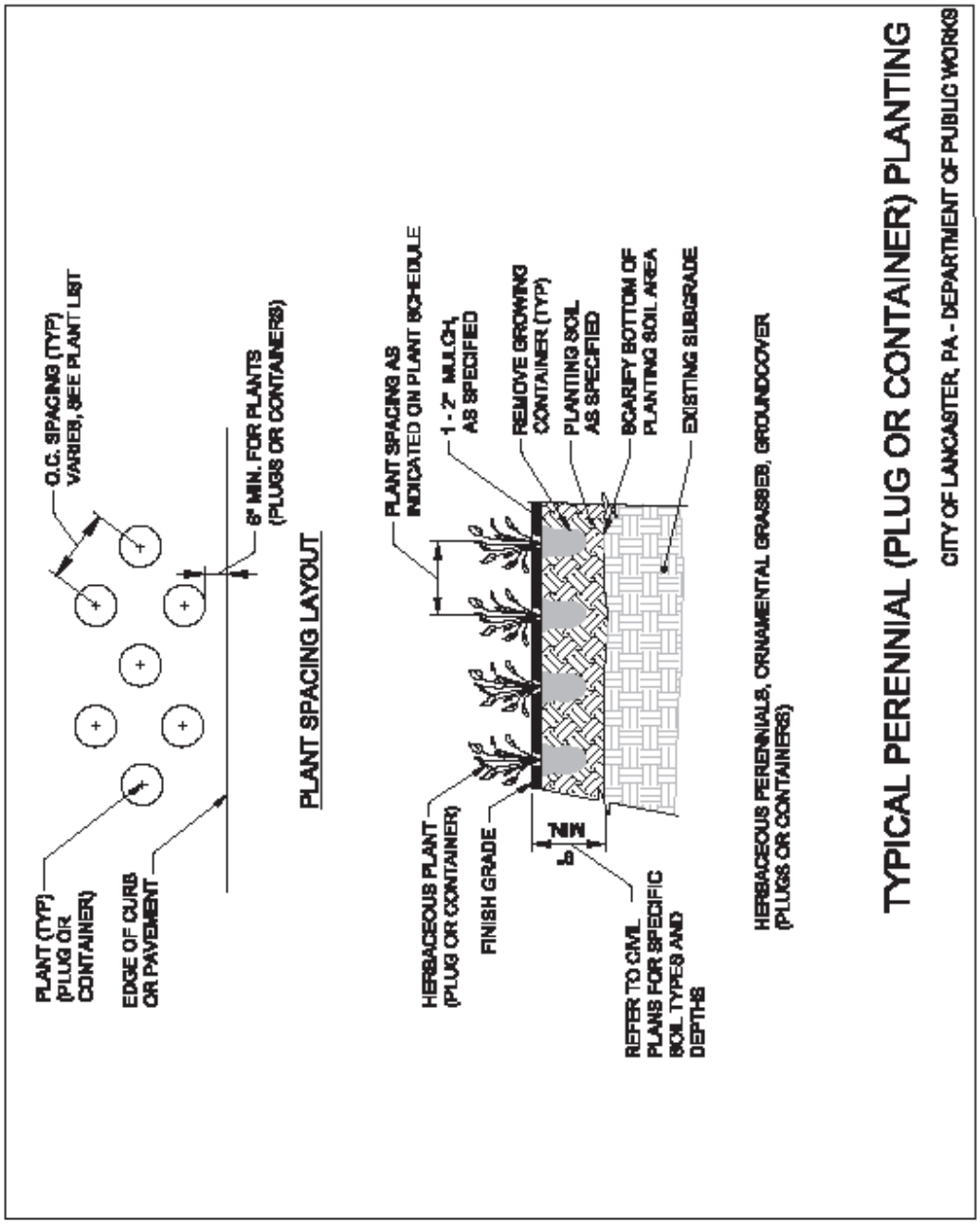


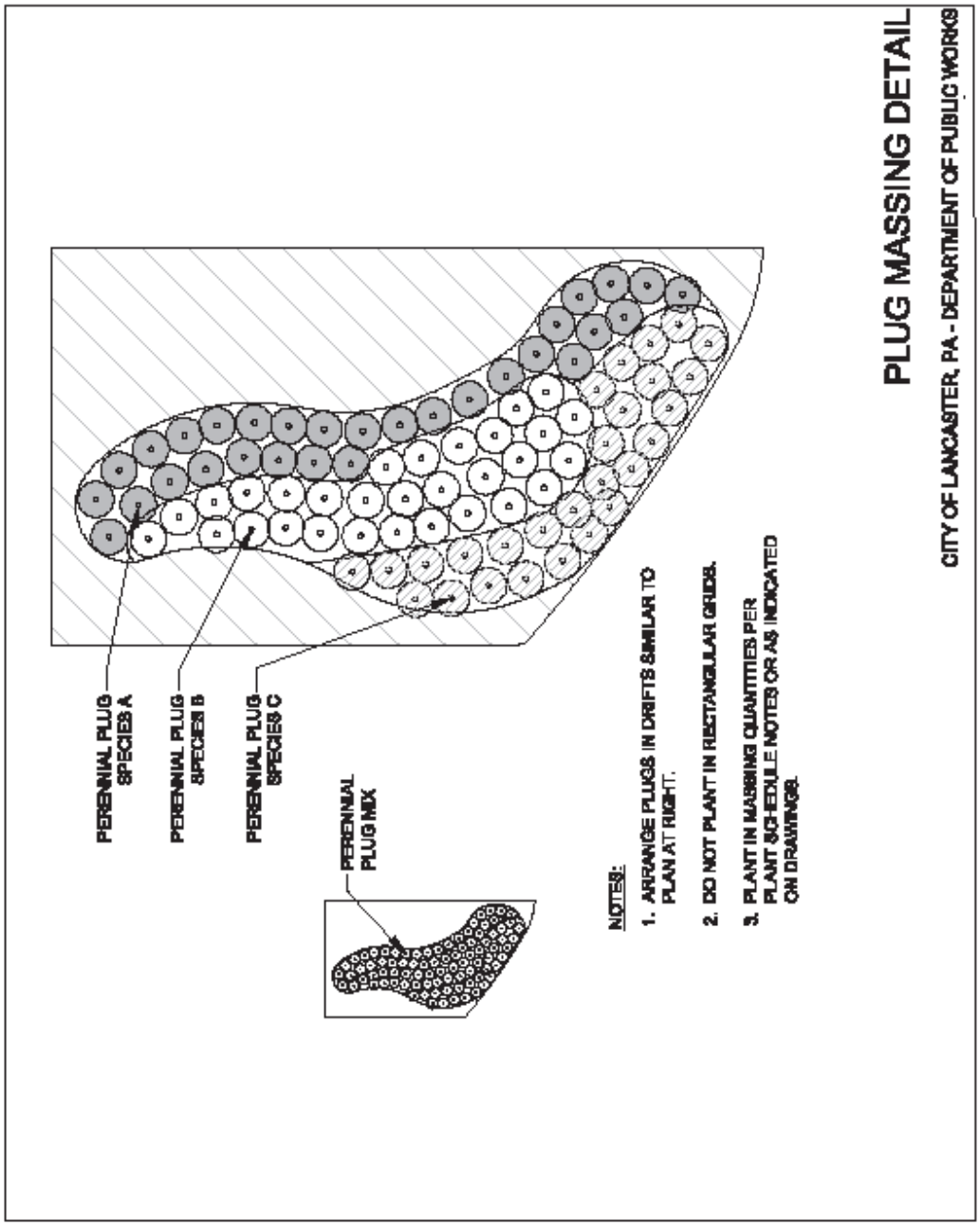
APPENDIX B


PAINTED HANDICAP SYMBOL
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
2" WIDE, TYP
2 COATS OF TRAFFIC PAINT, WHITE
BACKGROUND, 2 COATS OF TRAFFIC PAINT, MEDIUM BLUE
CL PARKING STALL
3' RADIUS
2"
3'-6"
2"


LIGHT POLE FOUNDATION
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
KEYNOTES:
1. 4,000 PSI CONCRETE
2. #6 AWG GROUND WITH EXOTHERMIC WELD TO REBAR
3. 3/4" DIAMETER x 10'-0" COPPER GROUNDING ROD
4. TWO ADDITIONAL #4 TIES AT 3" AT TOP OF PIER
5. BOLT CIRCLE AS PER POLE MANUFACTURER'S RECOMMENDATIONS
6. LIGHT POLE, BY OTHERS
7. COVER PLATE
8. NON-SHRINK GROUT
9. 1" CHAMFER
10. ANCHOR BOLTS (4 MIN) WITH LEVELING NUTS AS REQUIRED BY POLE MANUFACTURER
11. #4 VERTICAL REINFORCING
12. #4 HOOPS AT 9" WITH ADDITIONAL AT TOP.
13. 6-INCH MINIMUM GRANULAR BACKFILL, COMPACTED TO 95% RELATIVE COMPACTION.
GENERAL NOTES:
A. USE STAINLESS STEEL NUTS AND LOCK WASHERS.
B. COORDINATE WITH SITE PLANS FOR PROPER ORIENTATION OF THE POLE.
C. LIGHT POLE FOUNDATION SHALL CONFORM TO STANDARD BOULEVARD GL FOUNDATION AS PER PPL ELECTRIC UTILITIES CORPORATION.
PLAN
ELEVATION
19 1/4" DIA.
3'-6"


TYPICAL SHRUB (B & B OR CONTAINER) PLANTING
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
REFER TO PLAN FOR SPACING
NOTES:


TYPICAL PERENNIAL (PLUG OR CONTAINER) PLANTING
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
PLANT SPACING LAYOUT
O.C. SPACING (TYP)
VARIES, SEE PLANT LIST
6" MIN. FOR PLANTS
(PLUGS OR CONTAINERS)
PLANT (TYP)
(PLUG OR
CONTAINER)
EDGE OF CURB
OR PAVEMENT
PLANT SPACING AS
INDICATED ON PLANT SCHEDULE
1 - 2" MULCH,
AS SPECIFIED
REMOVE GROWING
CONTAINER (TYP)
PLANTING SOIL
AS SPECIFIED
SCARIFY BOTTOM OF
PLANTING SOIL AREA
EXISTING SUBGRADE
HERBACEOUS PLANT
(PLUG OR CONTAINER)
FINISH GRADE
MIN
b
REFER TO CIVIL
PLANS FOR SPECIFIC
SOIL TYPES AND
DEPTHS
HERBACEOUS PERENNIALS, ORNAMENTAL GRASSES, GROUNDCOVER
(PLUGS OR CONTAINERS)


PLUG MASSING DETAIL
CITY OF LANCASTER, PA - DEPARTMENT OF PUBLIC WORKS
PERENNIAL PLUG SPECIES A
PERENNIAL PLUG SPECIES B
PERENNIAL PLUG SPECIES C
PERENNIAL PLUG MIX
NOTES:
1. ARRANGE PLUGS IN DRIFTS SIMILAR TO PLAN AT RIGHT.
2. DO NOT PLANT IN RECTANGULAR GRIDS.
3. PLANT IN MASSING QUANTITIES PER PLANT SCHEDULE NOTES OR AS INDICATED ON DRAWINGS.

APPENDIX C

CONSTRUCTION SPECIFICATIONS

POROUS ASPHALT PAVEMENT & STORMWATER INFILTRATION BEDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related drawings, details, and specifications (e.g., stormwater structures, drainage, and grading)

1.2 SUMMARY

A. The work of this Section includes subgrade preparation, installation of infiltration beds, and porous asphalt base course and paving.

1.3 SUBMITTALS

A. All submittals and testing results shall be submitted to Engineer for review and approval a minimum of two weeks prior to pavement construction.

B. Submit a list of materials proposed for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

C. Submit certificates, signed by the materials producer and the paving subcontractor, stating that all materials meet or exceed the specified requirements.

D. Submit samples and/or properties of coarse aggregates for review and approval by the Engineer prior to installation.

E. The contractor shall provide results of all porous asphalt testing as required by this Section to Engineer, including, but not limited to:

1. Draindown Test (ASTM D6390)
2. Moisture Susceptibility Test using the modified Lottman Method (AASHTO T283) with the following:
    a. Compact using 50 gyrations of Superpave gyratory compactor
    b. Apply partial vacuum of 26 inches of Hg for 10 minutes to whatever saturation is achieved.
    c. Keep specimens submerged in water during freeze cycle.
    d. Required retained tensile strength (TSR) $\geq$ 80%
    e. If the moisture susceptibility test cannot be successfully run on the porous asphalt mix, a comparable dense-graded mix (with the same top size stone and the same material sources) can be tested in accordance with AASHTO T283.
3. Air Voids Test (AASHTO T269/ASTM D3203)

F. The contractor shall submit certification of all materials as required by this Section to Engineer, including:

1. Gradation of aggregate for stormwater storage beds/trenches.
2. Certification letter from polymer modified asphalt laboratory (if applicable).
3. Test data, mix design, and Performance Grade classification of the neat asphalt.
4. Certification and mixing recommendations for all asphalt additives including fibers, hydrated lime, and additives
5. Recommended mixing and compaction temperatures based on testing results.

1.4 QUALITY ASSURANCE

A. All testing results for the pervious asphalt mix should be certified by a laboratory meeting the requirements of AASHTO R18 that is certified by PENNDOT, regional equivalent (i.e., Mid-Atlantic Regional Training and Certification Program (MARTCP)), and/or qualified under ASTM D3666. Technicians should be certified by a local or regional certification agency in the area of asphalt.

B. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in their section.

C. Codes and Standards

1. Unless otherwise specified, all materials, methods of construction and workmanship shall conform to applicable requirements of the City of Lancaster and the Pennsylvania Department of Transportation (PENNDOT).

D. The owner reserves the right to require Third Party Testing.

1.5 PROJECT CONDITIONS

A. Protection of Existing Improvements

1. Protect adjacent work from splashing of paving materials. Remove all stains from exposed surfaces of paving, structures, and grounds. Remove all waste and spillage in accordance with local, State, and Federal Regulatory Requests.
2. Do not damage or disturb existing improvements or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Owner and the authority having jurisdiction at no additional cost.

B. Safety and Traffic Control

1. Notify and cooperate with local authorities and other organizations having jurisdiction when construction work will interfere with existing roads and traffic.

2. Provide temporary barriers, signs, warning lights, flaggers, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.

C. Weather Limitations

1. Do not place porous bituminous paving mixtures when surfaces are wet or when the ambient temperature is 55 degrees Fahrenheit or lower (measured in the shade and away from artificial sources of heat).

D. Erosion and Sediment Measures

1. All erosion and sediment measures must be installed prior to porous pavement/infiltration bed construction and maintained throughout project construction.
2. It is the contractor's responsibility to maintain job conditions to prevent the deposition of sediment on porous pavement and infiltration beds by wind-borne deposition, tracking, stormwater runoff, etc.
3. If job conditions arise that adversely affect porous pavement and/or infiltration beds, additional measures such as access control during construction, vacuuming of impervious and pervious surfaces, or additional site stabilization may be required.

1.6 REFERENCES

1. Annual Book of ASTM Standards, 2008 or latest edition; American Society for Testing and Materials, Philadelphia, PA.
2. Standard Specifications, latest edition; PENNDOT.
3. Standard Specifications for Transportation and Methods of Sampling and Testing of the American Association of State Highway and Transportation Officials (AASHTO), 2007 or latest edition.
4. Design, Construction, and Maintenance of Open-Graded Asphalt Friction Courses, Information Series 115; National Asphalt Pavement Association, Lanham, MD, 2002.
5. Porous Asphalt Pavements, Information Series 131; National Asphalt Pavement Association, Lanham, MD, Revised 2008.
6. ASTM Standard D7064, "Standard Practice for Open-Graded Friction Course (OGFC) Mix Design," ASTM International, West Conshohocken, PA, www.astm.org.
7. ASTM Standard WK15789 Practice for Design and Construction of Porous Asphalt Pavements for Stormwater Management; ASTM International, West Conshohocken, PA, www.astm.org.

PART 2 PRODUCT

2.1 MATERIALS

A. Infiltration Beds

1. All aggregates within infiltration beds shall be clean and thoroughly washed and shall meet the following:
   a. Maximum Wash Loss of 0.5% (ASTM C117)

b. Minimum Durability Index of 35 (ASTM D3744)
c. L.A. abrasion loss, 30% maximum. (ASTM C131 and C535)
d. Aggregate shall be 100% crushed material.
e. Fractured Faces, 1 side 95% minimum, 2 sides 90% minimum (ASTM D5821).

2. Unless otherwise approved by the Engineer, coarse aggregate for the infiltration beds/ trench shall be uniformly graded with the following gradation (AASHTO size no. 3)*:

| U.S. Standard Sieve Size | Percent Passing |
|---|---|
| 2 ½" (63mm) | 100 |
| 2" (50mm) | 90-100 |
| 1 ½" (37.5mm) | 35-70 |
| 1" (25mm) | 0-15 |
| ½" (12.5mm) | 0-5 |

* If the gradation (AASHTO size no. 3) for the infiltration bed coarse aggregate specified is not readily available, alternative gradations are acceptable if they meet the requirements set forth in 2.1.A.1., provide a minimum voids content of 40 percent by volume (tested according to ASTM C29 or equivalent), and provide a stable platform for paving. AASHTO size no. 5 may be used for the infiltration bed.

3. Choker base course aggregate for infiltration beds shall have the following gradation (AASHTO size number 57)**:

| U.S. Standard Sieve Size | Percent Passing |
|---|---|
| 1 ½" (37.5mm) | 100 |
| 1" (25mm) | 95-100 |
| ½" (12.5mm) | 25-60 |
| 4 (4.75mm) | 0-10 |
| 8 (2.36mm) | 0-5 |

** If an alternative gradation is used for the coarse aggregate, the gradation of the choker base course aggregate may also need to be adjusted accordingly, subject to the same requirements above.

Note: The choker base course is optional when using asphalt treated permeable base.

4. Non-woven geotextile (drainage filter fabric) shall conform to the following:

a. Minimum flow rate of 110 gal/min/ft$^2$ ASTM D-4491-99A
b. Grab tensile strength min 150 lb. ASTM D-4632-91
c. Mullen Burst strength min 300 psi ASTM D-3786-87
d. Puncture strength min 90 lb. ASTM D-4833-00
e. Apparent opening size 60-70 US Sieve ASTM D-4751-99A
f. Non-woven geotextile shall be Mirafi 160N, or approved equal.

5. Waterproof liner for "no infiltration areas" or the waterstop shall be Solmax 230 (30 mil minimum), or approved equal. Install per manufacturer's recommendations.

B. Edge Restraints

1. Edge restraints (Asphalt Edge or equivalent) shall be used where the porous asphalt meets landscaped areas to provide a clean, durable edge for the pavement. Install

according to manufacturer's installation guidelines to achieve a durable, clean pavement edge. Color: Black.

C. Asphalt Treated Permeable Base Course

1. Conform to PennDOT Specifications (Publication 408) Section 360: ASPHALT TREATED PERMEABLE BASE COURSE with the following clarifications:
   a. Use Type A coarse aggregate only
   b. The minimum bitumen content shall be 2.5%
2. Submit a full job mix formula to the Engineer for review and approval at least 2 weeks before paving is scheduled.

D. Porous Bituminous Asphalt

1. All aggregates in the porous bituminous asphalt mix shall meet the following:
   a. LA Abrasion loss, 30% maximum (ASTM C131).
   b. Fractured Faces, 2 sides - 90% minimum, 1 side - 95% minimum (ASTM D5821)
   c. Flat and Elongated Particles, 5:1 – 10% maximum, 3:1 – 20% maximum (ASTM D4791)
2. Aggregate in the porous asphalt mix shall be 100% crushed material with a gradation of:

| U.S. Standard Sieve Size | Percent Passing |
|---|---|
| ¾" (19.1mm) | 100 |
| ½" (12.7mm) | 85-100 |
| 3/8" (9.5mm) | 55-75 |
| 4 (4.75mm) | 15-25 |
| 8 (2.36mm) | 5-10 |
| 30 (600 µm) | 2-5 |
| 200 (75 µm) | 1-3 |

3. Fibers are recommended to minimize draindown, increase film thickness, and improve strength and durability. They shall consist of either cellulose fibers or mineral fibers which are to be treated with a cationic sizing agent to enhance dispersement of the fiber as well as increase cohesion of the fiber to the bitumen. Fiber is to be added at a dosage rate between 0.2% and 0.4% by weight of total mix. Depending on the absorption and dosage rate, the asphalt content of the mix may need to be increased slightly to account for the addition of fibers.
   a. Mineral fibers shall be from virgin, basalt, diabase, or slag with a maximum average fiber length of 6.35 mm and a maximum average fiber thickness of 0.005 mm.
   b. Cellulose fiber – Fiber length shall be 6.35 mm (max), Ash Content 18% non-volatiles (±5%), pH 7.5 (±1), Oil absorption (times fiber weight) 5.0 (±1), Moisture Content 5.0% (max).
4. Hydrated lime, if required as an anti-stripping agent, shall meet the requirements of AASHTO M 303 Type 1 and shall be blended with the damp aggregate at a rate of 1.0%

by weight of the total dry aggregate. The additive must be able to prevent the separation of the asphalt binder from the aggregate and achieve a required tensile strength ratio (TSR) of at least 80% on the asphalt mix. Other anti-stripping agents can also be used if approved in advance by the Engineer. Anti-strip is typically required if it would be used for conventional asphalt mixes using similar materials.

5. Asphalt binder shall meet the requirements of one of the following unless fibers are utilized in which case PG 64-22 is acceptable.
   a. Modified asphalt with an elastomeric polymer to produce a binder meeting the requirements of PG 76-22 as specified in AASHTO M320.
   b. Rubberized asphalt binder: The base asphalt for the binder material to be used for asphalt-rubber mix shall be PG 64-22 and shall be blended with ground tire rubber to meet the requirements of PG 76-22. Rubber shall be free of wire and other contaminants. Follow PENNDOT specification for asphalt rubber binder or ASTM D 6114, "Standard Specification for Asphalt-Rubber Binder."
6. The asphalt binder content shall be between 5.75% and 6.75% by total weight as determined by testing in Part 3.
7. The Contractor shall submit a certification letter for the asphalt or asphalt-rubber supplier to the Engineer before the mix is placed on the project. The certification letter from the supplier will include the following:
   a. Type and amount of modifiers.
   b. Information on the storage and stability of the asphalt binder.
   c. Manufacturer recommended mixing and compaction temperatures.

## PART 3 MIX PRODUCTION

### 3.1 ASPHALT MIX DESIGN

A. The asphalt content, use of fibers and/or anti-strip, and aggregate gradation should be adjusted within the ranges in this specification to produce a durable mix that meets the following criteria:
   1. 18 to 22 percent air voids for a compacted sample (a minimum of 16% is acceptable when using the CoreLok method)
   2. Binder draindown (ASTM D 6390) not to exceed 0.3 percent when tested at least 10 degrees above production temperatures.
   3. The retained tensile strength (TSR) of the compacted specimens in the modified Lottman method must be 80 percent minimum (using ASTM D 7064 w/ 1 freeze-thaw cycle or a surrogate dense-graded mix according to AASHTO T283).

PART 4 EXECUTION

4.1 INSTALLATION

A. Stormwater Storage/Infiltration Beds Underlying Porous Pavement

1. Owner shall be notified at least 48 hours prior to all infiltration bed and porous paving work.
2. Permeability of the subgrade shall be confirmed in accordance with the Pennsylvania Stormwater Manual. Owner reserves the right to perform additional permeability and compaction tests on the subgrade prior to installation of geotextile and aggregate.
3. Subgrade preparation
    a. Existing subgrade under bed/trench areas shall NOT be compacted or subject to construction equipment traffic prior to geotextile and stone bed placement. Excavators/backhoes should be used to excavate the bed area such that equipment is never running on exposed bed bottoms. Only very low ground pressure (4 PSI or less) equipment is acceptable in the bed areas when excavation is within 1 vertical foot of the final bed bottom elevation.
    b. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils loosened/scarified to a minimum depth of 8 inches. Overly dense or compacted soils should also be loosened/scarified to a minimum depth of 12 inches.
    c. Bring subgrade of stone infiltration bed/trench to line, grade, and elevations indicated. All bed bottoms are level grade, except where noted on the plan.
4. Infiltration Bed Installation
    a. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his/her discretion before contractor can proceed with infiltration bed/ trench installation.
    b. Geotextile and infiltration bed aggregate shall be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of geotextile at no extra cost to the Owner.
    c. Place geotextile in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile shall overlap a minimum of sixteen inches (16"). Secure geotextile at least four feet (4') outside of bed and take any steps necessary to prevent any runoff or sediment from entering the storage bed/trench.
    d. Install coarse aggregate in 8 to 12-inch lifts. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to an absolute minimum. Install aggregate to elevation necessary to achieve grades indicated on the drawings.
    e. Install choker base course (see Materials section) aggregate evenly over surface of stone bed, sufficient to allow placement of pavement, and notify Engineer for

approval. Choker base course shall be sufficient to allow for even placement of asphalt but no thicker than 1-inch in depth.

f. Following placement of bed aggregate, the geotextile shall be folded back along all bed edges to protect from sediment washout along bed edges. At least a four-foot edge strip shall be used to protect beds from adjacent bare soil. This edge strip shall remain in place until all bare soils contiguous to beds are stabilized and vegetated. In addition, take any other necessary steps to prevent sediment from washing into beds during site development. When the site is fully and permanently stabilized, temporary sediment control devices shall be removed.

B. Porous Bituminous Asphalt / Asphalt Treated Permeable Base

1. A full job mix formula with all applicable test results must be submitted to the Engineer for review and approval at least 2 weeks before paving is scheduled.
2. Transporting Material
   a. Transporting of mix to the site shall be in vehicles with smooth, clean dump beds that have been sprayed with a non-petroleum release agent. Truck beds should be raised after spraying to drain any puddles of release agent.
   b. The mix shall be covered during transport to control cooling.
   c. Haul distances shall be limited to 25 miles unless approved in advance.
3. Porous bituminous asphalt shall be placed within 90 minutes of being loaded to minimize cooling and asphalt draindown.
4. Asphalt treated permeable base
   a. Transport, place, and compact Asphalt Treated Permeable Base in accordance with PennDOT specifications
5. Asphalt Placement
   a. The porous bituminous surface course shall be laid with a track paver in one lift directly over the storage bed and stone base course to achieve the appropriate finished thickness (as shown on the drawings).
   b. The optimal laying temperature of the bituminous mix should be determined by the results of the Draindown Test (ASTM D6390) and the recommendations of the asphalt supplier. The typical range is between 275 degrees Fahrenheit and 290 degrees Fahrenheit.
   c. Installation shall take place when ambient temperatures are 55 degrees Fahrenheit or above, when measured in the shade away from artificial heat.
   d. The use of a remixing material transfer device between the trucks and the paver is recommended to eliminate cold lumps in the mix.
   e. Modified asphalt can be very difficult to rake and work by hand; a well-heated screed and other techniques should be used to minimize the need for hand work.
   f. Compaction of the surface course shall take place when the surface is cool enough to resist an 8 to 10-ton roller (typically between 200 and 260 degrees F). One to three

passes in static mode is all that is required for proper compaction (i.e., air voids of 18 to 22%). More rolling could cause aggregate breakdown and/or a reduction in the surface porosity which is unacceptable. Additional rolling with a small roller to smooth seams and remove marks is normally required. The roller should move slowly and uniformly to prevent displacement of the mix and rollers should not be stopped or parked on the freshly placed mat.

6. After final rolling, no vehicular traffic of any kind shall be permitted on the surface until cooling and hardening has taken place, and in no case within the first 72 hours (7 days is recommended). Provide barriers as necessary at no extra cost to the Owner to prevent vehicular use; remove at the discretion of the Owner. Construction equipment shall not be permitted on the porous pavement at any time.
7. Work shall be done expertly throughout, without staining or injury to other work. Transition to adjacent impervious bituminous paving shall be merged neatly with flush, clean line. Finished paving shall be even, without pockets, and graded to elevations shown on drawing.
8. Porous pavement beds shall not be used for equipment or materials storage during construction, and under no circumstances shall vehicles be allowed to deposit soil on paved porous surfaces.
9. Repair of Damaged Paving
    a. Any existing paving on or adjacent to the site that has been damaged as a result of construction work shall be repaired to the satisfaction of the Owner without additional cost to the Owner.
10. Quality Control
    a. QA/QC Testing Requirements during Porous Asphalt Production

<table>
<tr><th>Test</th><th>Minimum Frequency</th><th>Testing Method</th></tr>
<tr><td>Temperature in Truck at Plant</td><td>6 times per day</td><td>---</td></tr>
<tr><td>Gradation</td><td rowspan="3">Greatest of: 1 per 500 tons, 2 per day, or 3 per project</td><td>AASHTO T30</td></tr>
<tr><td>Binder Content</td><td>AASHTO T164</td></tr>
<tr><td>Air Void Content</td><td>ASTM D3203</td></tr>
<tr><td>Binder Draindown</td><td>Greatest of: 1 per 500 tons, 1 per day, or 1 per project</td><td>ASTM D6390</td></tr>
</table>

    b. The full permeability of the pavement surface shall be tested by application of clean water at the rate of at least 5 gpm, using a hose or other distribution devise. Water used for the test shall be clean, free of suspended solids and deleterious liquids and will be provided at no extra cost to the Owner. All applied water shall infiltrate directly without ponding or surface runoff, and shall be observed by the Engineer/Owner. At least 3 random locations shall be tested, with at least 1 additional test per 10,000 SF of porous asphalt.
    c. Testing and Inspection: Employ at Contractor's expense an inspection firm acceptable to the Engineer and Owner to perform soil inspection services, staking and layout control, and testing and inspection of site grading and pavement work.

Inspection and list of tests shall be reviewed and approved in writing by the Engineer prior to starting construction. All test reports must be signed by a licensed Engineer.

d. Test in-place base and surface course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable work as directed by the Owner.

e. Surface Smoothness: Test finished surface for smoothness and even drainage, using a ten-foot to centerline of paved area. Surface will not be accepted if gaps or ridges exceed 3/16 of an inch.

f. Contractor shall thoroughly vacuum-sweep porous asphalt pavement once site stabilization has occurred if materials have accumulated on the surface.

11. Grade Control

a. Establish and maintain required lines and elevations. The Engineer shall be notified for review and approval of final stake lines for the work before construction work is to begin. Finished surfaces shall be true to grade and even, free of roller marks and free of low spots to form puddles. All areas must drain.

b. If, in the opinion of the Owner, based upon testing results or observations, the quality of the work is below the standards which have been specified, additional work and testing will be required until satisfactory results are obtained.

SUBSURFACE INFILTRATION BED (BIORETENTION AREAS / VEGETATED CURB EXTENSIONS)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this Section includes subgrade preparation and installation of a subsurface infiltration bed under a bioretention area, vegetated curb extension, or other vegetated stormwater management facility.

1.2 SUBMITTALS

A. Submit a list of materials proposed to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

B. Submit certificates, signed by the materials producer, stating that materials meet or exceed the specified requirements.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

B. Codes and Standards

1. All materials, methods of construction and workmanship should conform to applicable requirements of PENNDOT Standard Specifications and AASHTO Standards, unless otherwise specified.

1.4 PROJECT CONDITIONS

A. Protection of Existing Site

1. Do not damage or disturb existing site features, utilities, or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
2. Restore damaged site features, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Owner, and authority having jurisdiction at no additional cost.

B. Safety and Traffic Control

1. Notify and cooperate with local authorities and other organizations having jurisdiction (such as PENNDOT and/or City of Lancaster) when construction work will interfere with existing roads and traffic.
2. Provide temporary barriers, signs, warning lights, flagmen, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.

C. Erosion and Sediment Control Measures

1. All erosion and sediment measures must be installed prior to infiltration bed construction and maintained throughout project construction.
2. It is the contractor's responsibility to maintain job conditions to prevent the deposition of sediment on infiltration beds by wind-borne deposition, tracking, stormwater runoff, etc.
3. If job conditions arise that adversely affect the infiltration bed, additional measures such as access control during construction, vacuuming of impervious and pervious surfaces, or additional site stabilization may be required.

D. REFERENCES

1. Annual Book of ASTM Standards, 2005, or latest edition; American Society for Testing and Materials, Philadelphia PA.
2. Pennsylvania Department of Transportation Specifications.
3. Standards of the American Association of State Highway and Transportation Officials (AASHTO), 19th edition 1998 or latest edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregates within infiltration bed should be clean and thoroughly washed and should meet the following:

1. Maximum Wash Loss of 0.5% (ASTM C117)
2. Minimum Durability Index of 35 (ASTM D3744)
3. L.A. abrasion loss, 30% maximum. (ASTM C131 and C535)
4. Aggregate should be 100% crushed material.
5. Fractured Faces, 1 side 95% minimum, 2 sides 90% minimum (ASTM D5821).

B. Unless otherwise approved by the Engineer, coarse aggregate for the infiltration beds/ trench should be uniformly graded with the following gradation (AASHTO size no. 7)* and provide a minimum voids content of 40 percent by volume (tested according to ASTM C29 or equivalent):

| U.S. Standard Sieve Size | Percent Passing |
|---|---|
| ¾" (19.0mm) | 100 |

| | |
|---|---|
| ½" (12.5mm) | 90-100 |
| 3/8" (9.5mm) | 40-70 |
| No. 4 (4.75mm) | 0-15 |
| No. 8 (2.36mm) | 0-5 |

* If the gradation (AASHTO size no. 7) for the infiltration bed coarse aggregate specified is not readily available, alternative gradations are acceptable if they meet the requirements set forth in 2.1.A.1 and provide a minimum voids content of 40 percent by volume (tested according to ASTM C29 or equivalent).

C. Non-woven geotextile (drainage filter fabric) should conform to the following:

1. Minimum flow rate of 110 gal/min/ft$^2$ ASTM D-4491-99A
2. Grab tensile strength min 150 lb. ASTM D-4632-91
3. Mullen Burst strength min 300 psi ASTM D-3786-87
4. Puncture strength min 90 lb. ASTM D-4833-00
5. Apparent opening size 60-70 US Sieve ASTM D-4751-99A
6. Non-woven geotextile should be Mirafi 160N, or approved equal.

D. Where noted on the plans, impervious liners and/or root barriers should be Solmax 230 (30 mil), or approved equal. Install per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Owner's Representative and Engineer should be notified at least 24 hours prior to all infiltration bed work.

B. Permeability of the subgrade should be confirmed in accordance with the Pennsylvania Stormwater Manual. Owner reserves the right to perform additional permeability and compaction tests on the subgrade prior to installation of geotextile and aggregate.

C. Subgrade preparation

a. Existing subgrade under bed areas should NOT be compacted or subject to construction equipment traffic prior to geotextile and stone bed placement. Excavators/backhoes should be used to excavate the bed area such that equipment is never running on exposed bed bottoms. Only very low ground pressure (4 PSI or less) equipment is acceptable in the bed areas when excavation is within 1 vertical foot of the final bed bottom elevation.

b. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material should be removed with light equipment and the underlying soils loosened/scarified to a minimum depth of 8 inches. Overly dense or compacted soils should also be loosened/scarified to a minimum depth of 12 inches.

c. Bring subgrade of stone infiltration bed/trench to line, grade, and elevations indicated. All bed bottoms are level grade, except where noted on the plan.

D. Infiltration Bed Installation

1. Upon completion of subgrade work, the Engineer should be notified and should inspect at his discretion before proceeding with infiltration bed installation.
2. Geotextile and bed media should be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place after approval of subgrade should be removed prior to installation of geotextile at no extra cost to the Owner.
3. Place geotextile in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile should overlap a minimum of sixteen inches (16''). Secure geotextile at least four feet (4') outside of bed and take steps necessary to prevent any runoff or sediment from entering the bed. This geotextile edge strip should remain in place until all bare soils contiguous to infiltration bed have been stabilized. When the site is fully stabilized, excess geotextile along bed edges can be cut back to gravel edge.
4. Install coarse aggregate in 8 to 12-inch lifts. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to an absolute minimum. Install aggregate to elevation necessary to achieve grades indicated on the drawings.
5. Install stormwater utilities as indicated in Section 02720 and where shown on plan.
6. Install planting soil system as indicated in Section 02941.