

**TECHNICAL PROVISIONS
FOR THE
AMTRAK STATION IMPROVEMENT PROJECT:
MIDDLETOWN STATION**

**VOLUME I OF III
MAINTENANCE MANUAL**

MASTER TABLE OF CONTENTS

VOLUME I - MAINTENANCE MANUAL

<u>CHAPTER</u>	<u>TITLE</u>
A.	ORGANIZATION AND GENERAL INFORMATION
B.	ROADWAY MAINTENANCE
C.	PAVEMENT DELINEATION MAINTENANCE
D.	DRAINAGE MAINTENANCE & EROSION & SEDIMENT CONTROL
E.	ROUTINE MAINTENANCE
F.	N/A
G.	STRUCTURE MAINTENANCE
H.	N/A
I.	N/A
J.	THIRD PARTY DAMAGES & EMERGENCY MAINTENANCE
K.	ROADWAY SAFETY FEATURES & SYSTEMS MAINTENANCE
L.	SIGNS AND SIGNAGE SYSTEMS MAINTENANCE
M.	LIGHTING AND ELECTRICAL SYSTEM MAINTENANCE
N.	PARKING FEE COLLECTION MAINTENANCE
O.	FACILITY MAINTENANCE

VOLUME II – OPERATIONS & PROCEDURES MANUAL

<u>CHAPTER</u>	<u>TITLE</u>
A.	ORGANIZATION AND GENERAL INFORMATION
B.	PROJECT MANAGEMENT PLAN
C.	QUALITY MANAGEMENT PLAN
D.	SAFETY PLAN
E.	EQUIPMENT PLAN
F.	PARKING FEE COLLECTION AND OPERATIONS PLAN
G.	SNOW & ICE CONTROL PLAN
H.	FACILITIES OPERATIONS PLAN
I.	TRAFFIC & TRAVEL MANAGEMENT PLAN
J.	CUSTOMER SERVICE PLAN
K.	EMERGENCY MANAGEMENT AND OPERATIONS PLAN
L.	DESIGN & CONSTRUCTION REQUIREMENTS
M.	ANNUAL STATE OF THE AMTRAK STATION IMPROVEMENT PROJECT REPORTS

VOLUME III – ENVIRONMENTAL MANAGEMENT MANUAL

<u>CHAPTER</u>	<u>TITLE</u>
A.	ORGANIZATION AND GENERAL INFORMATION
B.	ENVIRONMENTAL MANAGEMENT PLAN

TABLE OF CONTENTS

A. ORGANIZATION AND GENERAL INFORMATION

Section	Page
A.1. Purpose of Manual	2
A.2. Public-Private Transportation Partnership Agreement (PPA)	3
A.2.1. <i>PPA</i>	3
A.2.2. <i>General Terms and Conditions</i>	3
A.2.3. <i>Conflict of Terms</i>	3
A.3. Maintenance Objective	4
A.4. Review of Construction Projects & As-Built Drawings	5
A.5. Protection of Natural Resources	6
A.5.1. <i>Noise Control</i>	6
A.5.2. <i>Water Quality</i>	6
A.5.3. <i>Air Quality</i>	6
A.5.4. <i>Dust Control</i>	6
A.5.5. <i>Threatened and Endangered Species</i>	6
A.6. Pennsylvania Project Location Map	7
A.7. Abbreviations and Acronyms	8

A.1. Purpose of Manual

The Technical Provisions are comprised of three (3) separate and unique Volumes, as follows:

- Volume I – Maintenance Manual
- Volume II – Operations & Procedures Manual
- Volume III – Environmental Management Manual

In general, the Technical Provisions provide guidelines and criteria to the Development Entity regarding the standards, specifications, policies, procedures and processes that apply to the operation, maintenance, rehabilitation and improvements to the Project.

The purpose of this Manual is to provide the general terms and conditions for performing the required maintenance activities on and within the Project.

For purposes of the Technical Provisions, the term “Project” shall mean all of the features, elements, systems, etc., that are present within the boundaries established herein and in accordance with the Public-Private Transportation Partnership Agreement (PPA), without exception.

A.2. Public-Private Transportation Partnership Agreement

A.2.1. Public-Private Transportation Partnership Agreement

The Technical Provisions are governed by the terms and conditions of the Public-Private Transportation Partnership Agreement dated as of _____, 2018 by and between The Pennsylvania Department of Transportation (the “Department”) and _____(the "Development Entity") (the “PPA”).

A.2.2. General Terms and Conditions

The terms and conditions of the Technical Provisions are to be those provided for in the PPA, including but not limited to, those in Article 2 of the PPA.

A.2.3. Conflict of Terms

To the extent any term of the Technical Provisions conflicts with any term or provision as specified in the PPA, then such term or provision of the PPA shall govern and shall supersede any such conflicting term or provision. Capitalized terms not defined in the Technical Provisions but used herein have the meanings set forth in the PPA.

A.3. Maintenance Objective

The objective of maintenance work within the Project is to provide a safe and pleasant passage and occupancy throughout the Project for Patrons, while maintaining the Project as an asset. The major objectives of the Development Entity's maintenance program include, but are not limited to, the following:

- Maintaining all Project features, elements, components and systems in the best possible condition at all times.
- Improving features that do not meet the requirements of the Technical Provisions, with the ultimate goal to exceed the minimum stated within the Technical Provisions.
- Preserving the Right-Of-Way, and each type of roadway, structure, safety convenience or device, planting, illumination equipment and other facility, in a safe and usable condition to which it has been improved or constructed.
- Providing proper maintenance, safety and traffic devices for minimal disruptions and hazards to traffic.
- Identifying and improving safety features and situations.
- Establishing an inventory of maintenance features, including a method of locating and referencing those features.
- Establishing work procedures.
- Maintaining a regular program of maintenance for all aspects of Project maintenance.
- Providing immediate and proper response to emergency and third-party events.
- Performing routine, preventative, on-demand and emergency maintenance activities and work.
- Maintaining the Parking Fee Collection Systems, special safety conveniences and devices, and illumination equipment.

A.4. Review of Construction Projects & As-Built Drawings

Whenever maintenance work requires that a member, component, system or element, etc. be replaced or significantly repaired, the Development Entity must create a set of Original Construction Documents and Drawings, sealed by a Licensed Professional in the Commonwealth of Pennsylvania. Such construction drawings and documents are subject to review and Approval by the Commonwealth.

Upon completion of construction, the Development Entity must prepare and submit to the Commonwealth a complete set of original and As-Built Drawings in both hard copy and electronic format (in the platform predetermined and prescribed by the Commonwealth) for the work completed. In addition, the Development Entity will be responsible for creating a separate Original and As-Built set of drawings for the record. The As-Built drawings shall be stamped or marked "AS-BUILT", dated, and must be saved and placed with all other drawings that exist for the Project.

A.5. Protection of Natural Resources

The protection of natural resources is an essential and significant activity within the Project. The Development Entity must comply with all requirements in protecting the natural resources of the region, the environment and any threatened or endangered species.

If a project or activity may affect resources, such as wetlands, flood plains, Section 4(f) properties, or threatened and endangered species, an evaluation of alternatives appropriately addressing avoidance, minimization and mitigation options as required by regulations applicable to those resources must be prepared. In addition, if the preferred alternative will affect such resources, adequate justification must be provided to explain why avoidance alternatives were not selected.

A.5.1. Noise Control

Special efforts must be made in the development of a project or activity to comply with Federal, State and local requirements for noise control. Efforts must be made to consult with appropriate officials to obtain the views of the affected communities regarding noise impacts and abatement measures and to mitigate any construction-related noise impacts.

A.5.2. Water Quality

Water quality must be maintained within and around the Project. No construction improvement, maintenance activity, or daily activity may decrease the quality of surface waters, ground waters, or wetlands.

A.5.3. Air Quality

All improvements within the Project must conform to State, regional and Federal air implementation plans.

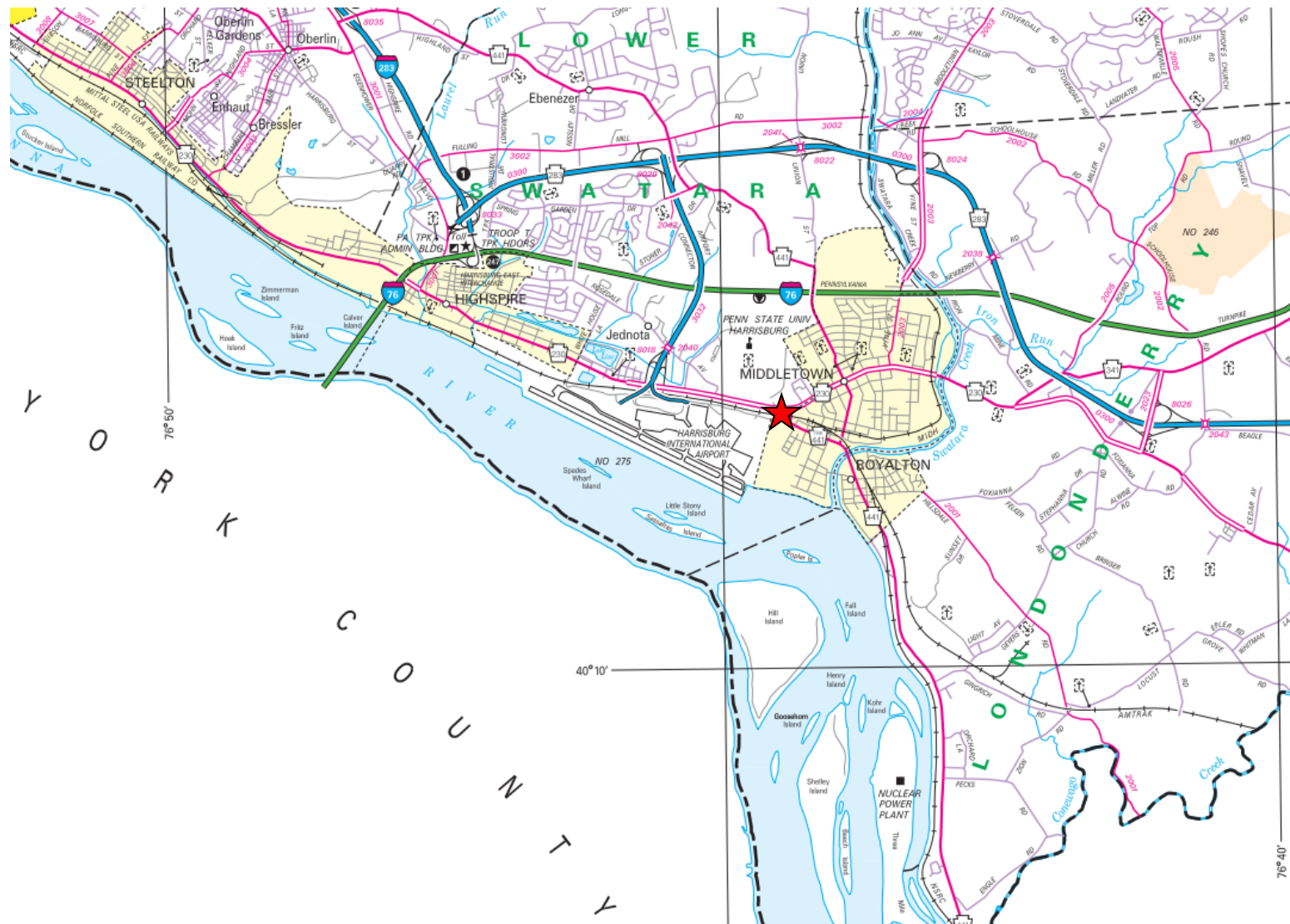
A.5.4. Dust Control

Dust control is essential in maintaining clean air and the prevention of airborne pollutants. Dust must be controlled within the Project by implementing best management practices for all construction and daily activities including land disturbance, demolition and material handling processes.

A.5.5. Threatened and Endangered Species

In the development of a project, an assessment must be made of the likely impacts on species of plants or animals listed at the Federal and State-level as threatened or endangered, and on State-designated natural areas. Every effort must be made to minimize the likelihood of jeopardizing the continued existence of listed threatened or endangered species or the destruction or adverse modification of a natural area or an area of habitat which has been designated as critical habitat or essential habitat.

A.6. Project Location Map



A.7. Abbreviations and Acronyms

The following abbreviations and acronyms are applicable for both Volume I – Maintenance Manual, and for Volume II – Operations and Procedures Manual.

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ABAS	PennDOT Automated Bridge Analysis System
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AIA	American Institute of Architects
ANSI	American National Standards Institute
APRAS	PennDOT Automated Permit Routing Analysis System
ASME	American Society of Mechanical Engineers
ASQ	American Society for Quality
ASTM	American Society for Testing and Materials
ATD	Automatic Traction Devices
AWWA	American Water Works Association
BA	Bachelor of Arts
BMS	PennDOT Bridge Management System BQAD PennDOT Bridge Quality Assurance Division
BS	Bachelor of Science
BSCE	Bachelor of Science – Civil Engineering
CCTV	Closed-Circuit Television
CFR	Code of Federal Regulations
CMA	Calcium Magnesium Acetate
CMS	Changeable Message Sign
COOP	Concept of Operations Plan

DHS	Department of Homeland Security
DMS	Dynamic Message Sign
EB	Eastbound
EIT	Engineer in Training
EMM	Emergency Management Manual
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
GVW	Gross Vehicle Weight
HAL	High Accident Location
HVAC	Heating, Ventilation and Air Conditioning
IBC	International Building Code
ICC	International Code Council
ICS	Incident Command System
ID	Identification
IESNA	Illuminating Engineering Society of North America
IEEE	Institute of Electrical and Electronic Engineers

IMC	International Mechanical Code
IRI	International Roughness Index
ISO	International Standardization Organization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LEED	Leadership in Energy and Environmental Design
LFD	Load Factor Design
LOS	Level of Service
LRFD	Load Resistance Factor Design
MEP	Mechanical, Electrical and Plumbing System
MIST	Management Information System for Transportation
M.P.	Mile Post
MPT	Maintenance and Protection of Traffic
MSDS	Material Safety Data Sheet
MSE	Mechanically Stabilized Earth
MTS	Maintenance Testing Specifications MUTCD Manual on Uniform Traffic Control Devices
NBIS	National Bridge Inspection Standards
NCHRP	National Cooperative Highway Research Program
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association NFPA National Fire Protection Association
NHI	National Highway Institute
NHS	National Highway System
NIMS	National Incident Management System
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic & Atmospheric Administration NOTAM Notice to Airmen

NPDES	National Pollutant Discharge Elimination System
NWR	NOAA Weather Radio
O & M	Operations and Maintenance
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
PA	Pennsylvania
PCC	Portland Cement Concrete
PCMS	Portable Changeable Message Sign
PDEM	Pennsylvania Department of Emergency Management PE Professional Engineer
PEMA	Pennsylvania Emergency Management Agency
PennDOT	Pennsylvania Department of Transportation
PennDEP	Pennsylvania Department of Environmental Protection
PERI	Public Entity Risk Institute
PSP	Pennsylvania State Police
PUC	Pennsylvania Utility Commission
QC	Quality Control
QA	Quality Assurance
QMS	Quality Management System
QMSPM	Quality Management System Policy Manual
QPM	Quality Procedures Manual
RPC	Regional Planning Commission
RWIS	Road Weather Information System

SHRP	Strategic Highway Research Program SE Structural Engineer
SEPTA	Southeastern Pennsylvania Transit Authority
SICP	Snow and Ice Control Plan
SOL	PennDOT “Strike-Off” Letter
SSPC	Society for Protective Coatings
SUV	Sport Utility Vehicle
PARKING FEE COLLECTION SYSTEM	Parking Fee Collection System
TFDS	Traffic Flow Detection System
TRB	Transportation Research Board
UL	Underwriters Laboratory
UPS	Uninterruptible Power Supply
USDA	United States Department of Agriculture
USGS	United States Geological Society
USEPA	United States Environmental Protection Agency
VE	Value Engineering
VHF	Very High Frequency
VMS	Variable Message Sign
VOC	Volatile Organic Compound
WAN	Wide Area Network
WB	Westbound
WBS	Work Breakdown Structure

TABLE OF CONTENTS

B. ROADWAY MAINTENANCE

Section	Page
B.1. Definitions	2
B.2. References	5
B.3. Policy for Performing Roadway Pavement & Shoulder Maintenance Work	6
B.3.1. <i>Objective</i>	6
B.3.2. <i>Responsibility of Development Entity</i>	6
B.3.3. <i>Performance Time Frames</i>	9
B.3.4. <i>Acceptance Criteria</i>	10
B.4. Additional Requirements	11
B.4.1. <i>Temporary Pavement Patching</i>	11
B.4.2. <i>Bituminous Surface Repairs</i>	11
B.4.3. <i>Pothole Repairs</i>	13
B.4.4. <i>Cracks & Joints</i>	13
B.4.5. <i>Spalled Pavements</i>	15
B.4.6. <i>Settled and Heaved Pavement</i>	15
B.4.7. <i>Pavement Base and Subbase</i>	17
B.4.8. <i>Grinding and Profiling</i>	19
B.4.9. <i>Access Roads</i>	19
B.4.10. <i>Roadway Sweeping and Cleaning</i>	19

B.1. Definitions

Access Roads: Those roadways located within the Project that are closed to the general public and are intended only for use by maintenance, inspection or utility traffic.

Asphalt: A bituminous substance, soluble in gasoline or naphtha; used in liquid form for roadway work in crack and joint sealing and to cement together and coat the surface of mineral aggregates.

Base Course: The layer or layers of a specified material of designed thickness placed on a subbase or a subgrade to support a surface course.

Bituminous Concrete: A designed combination of dense graded mineral aggregate filler and asphalt cement mixed in a central plant, laid and compacted while hot.

Bleeding: The accumulation of excess bituminous material on the roadway surface, caused by heat or the use of excessive quantities of bituminous material in construction, patching or resurfacing.

Blowup: Displacement of rigid-type pavement by a combination of vertical and horizontal stresses due to expansion. Generally, a blow-up is a heave in a concrete pavement caused by pavement expansion from excessive heat, sometimes resulting in shattering or displacement of the road surface.

Cold Patch: A mixture of bituminous material and aggregate used for general winter maintenance pavement patching and applied at below normal temperatures.

Concrete: A mixture usually composed of portland cement, an aggregate of hard, inert particles and water.

Composite Pavement: A pavement structure consisting of a Portland Cement Concrete base course overlaid with one or more courses of bituminous surface material.

Course: A layer of road material, separately compacted, used as a wearing surface or as a base for a wearing surface.

Crack: A fissure or open seam potentially extending through the entire depth of the pavement.

Emulsion: A suspension of extremely small droplets of asphalt coated with water in the presence of an agent, which is usually a type of detergent.

Erosion: A slow wearing away of the surface by natural action (weather) or by usage (traffic).

Flexible Pavement: A pavement structure which maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability.

Frost Heave: Displacement of pavement by an accumulation of ice crystals which builds up in the subgrade to the extent that the pavement is heaved up and badly distorted.

Hot Mix: A general term used for hot plant mixed bituminous concrete and sheet asphalt mixtures which are manufactured and laid at temperatures ranging from 250 degree F and above.

International Roughness Index (IRI): The accepted standard for measuring the roughness (ride quality) of a pavement surface. The IRI measures pavement roughness in terms of the number of inches per mile a laser-based device moves as it is driven along the pavement. The lower the number, the better the ride.

Joints: Designed or designated vertical planes of separation used in placing concrete pavement to aid in contraction, expansion or construction.

Median: The portion of a divided highway separating the traveled ways for traffic in opposite directions.

Mudjacking: An operation that raises a section of concrete pavement by hydraulic or pneumatic pressure applied by forcing an approved slurry mortar under the section to be raised.

Overlay: A layer of new bituminous concrete over an existing bituminous or concrete pavement.

Patching: Mending, repairing; especially, to repair a road surface.

Pavement Structure: The combination of subbase, base course and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Pothole: An area where a piece of pavement has broken free and been removed, leaving a hole.

Portland Cement: A hydraulic cement consisting of compounds of silica, lime and alumina; so called because of its resemblance in color, when set, to the Portland stone of England.

Project: As defined in Public-Private Transportation Partnership Agreement (PPA) (Background, Page 4, Section A).

Ramp: The portion of the traveled way that provides access between the mainline and the local street network, or connectivity of different mainlines or other ramp, that extends from shoulder line to shoulder line or from curb line to curb line.

Raveling: The progressive loosening and loss of the aggregate material in the surface course of a road as it separates from adjacent material.

Resurfacing: Placing of one or more new layers of material on an existing pavement surface.

Rigid Pavement: A pavement structure which distributes loads to the subgrade, and has one course typically constructed with Portland cement concrete, bounded by joints and edges.

Rocking or Pumping Pavement: Conditions in which one or more rigid or composite pavement sections move or rotate under wheel contact, with the slab itself remaining relatively sound.

Roadway: All portions of the Project mainline pavement, including shoulders and ramps, for vehicular Patrons.

Rutted and Shoved Pavement: Deformations in which the bituminous surface of the pavement has worn into longitudinal depressions or heaves due to repetitive passes of vehicle tires, or transverse corrugations due to vehicle deceleration and acceleration.

Shoulder: The portion of the roadway contiguous with the mainline or ramp traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Subbase: The layers of specified or selected material of designed thickness placed on a subgrade to support a base course.

Subgrade: The layer of a roadbed upon which the pavement structure and shoulders including curbs are constructed.

Surface Course: Layer of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion and the disintegrating effects of climate. This layer is sometimes called the "Wearing Course".

Patron: Any member of the travelling public or person(s) that is on or about the Commonwealth, Amtrak or Project Right-of-Way or is otherwise using the Infrastructure within the project limits for any purpose.

B.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- “Performance Standard 711-7147-01 Joint Sealing Concrete Roads”, PennDOT.
- Publication 8: “Construction Manual”, PennDOT.
- Publication 10: “Design Manual Part 1 – Transportation Project Development Process”, PennDOT.
- Publication 10A: “Design Manual Part 1A – Transportation Engineering Procedures”, PennDOT.
- Publication 13M: “Design Manual Part 2 – Highway Design”, PennDOT.
- Publication 14M: “Design Manual Part 3 – Plans Preparation”, PennDOT.
- Publication 15M: “Design Manual Part 4 – Structures”, PennDOT.
- Publication 16M: “Design Manual Part 5 – Utility Relocation”, PennDOT.
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 37: “Specifications - Bituminous Materials (Bul. 25)”, PennDOT.
- “Strike Off Letters”, PennDOT.
- Publication 72M: “Roadway Construction Standards”, PennDOT.
- Publication 113: “Highway Foremans Manual”, PennDOT
- Publication 242: “Pavement Policy Manual”, PennDOT.
- Publication 336: “Automated Pavement Condition Survey Field Manual”, PennDOT
- Publication 343: “CRC & Unpaved Roads Condition Surveying Field Manual”, PennDOT
- Publication 408: “Highway Specifications”, PennDOT.
- “Guide for Design of Pavement Structures, Volume I”, AASHTO.
- “A Policy on Geometric Design of Highways and Streets”, AASHTO.
- “Pavement Management Guide”, AASHTO.
- “SHRP-H-348: Asphalt Pavement Repair Manuals of Practice”, FHWA.
- “SHRP-H-349: Concrete Pavement Repair Manuals of Practice”, FHWA.

B.3. Policy for Performing Roadway Pavement & Shoulder Maintenance Work

B.3.1. Objective

The objective of Roadway Maintenance is to ensure that all pavements, including parking facilities, within the Project remain safe, smooth, durable, stable; and that work is conducted in a manner so as to prevent and repair deterioration of the roadway and shoulder pavement, thereby ensuring the safe and orderly movement of traffic.

Roadways require, without limitation, repairs to cracks, spalls, potholes, etc.; removal and replacement of pavement sections; reconstruction of the pavement structure; continual maintenance; and sweeping and cleaning of the roadway surfaces.

B.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices that limit and minimize the times and locations that roadway pavements are not completely open to traffic, to continually remain functional, carry the intended traffic, provide a safe means of passage to the Patrons, and meet all safety, aesthetic and economic benefits. This requires that the Development Entity carry out its obligations in accordance with this Chapter in a manner that maintains or improves the condition and functionality of the roadways.

The Development Entity must perform roadside maintenance, inspection and work activities at a frequency that ensures uniform and consistent compliance with all State and Federal regulations, and the requirements specified within this Chapter.

With the exception of Emaus St., all roadway pavements are to be maintained within the Project, including all: roadways; ramps; access roads, parking facilities, plazas; and shoulders within the Project.

All materials and construction requirements for roadway work performed by the Development Entity must conform to the appropriate and applicable requirements of the Referenced Documents noted in Section B.2 of this Chapter.

To the greatest extent possible, when performing roadway work the Development Entity must utilize the newest techniques implemented and approved by the Department for major highway contracts to provide longer pavement life, maximize the reuse of materials and to minimize motorist inconvenience.

During all work, the Development Entity must establish and continually maintain traffic control and protection as addressed by the requirements of Volume II – Operations and Procedures Manual, Chapter I, “Traffic and Travel Management Plan”.

Once a particular maintenance repair has been started, the work must continue during consecutive working days as weather permits until a thorough and workmanlike repair has been achieved. The objective of every repair is to cure all roadway deficiencies, to preserve the economic value of the Project as a capital asset, and to restore a riding quality satisfactory to the Patrons, in accordance with the requirements of this Chapter.

The Development Entity must make routine roadway maintenance inspections part of its daily activities and all Development Entity staff must be instructed to report any roadway maintenance needs observed.

Work on the roadway and pavements within the Project that must be performed by the Development Entity include the following:

- General:
 - Investigate, inspect, and rectify the underlying cause or the origin of the defect or damage before commencing repair work.
 - Ensure that all pavement repairs are of the required structural thicknesses; are constructed to a minimum depth equal to that of the distressed pavement; and provide a dense, smooth and level transition between the treated area and the adjacent undisturbed pavement surface.
 - Repair all pavement surfaces in a manner to match the profile, grades and cross slopes of the roadway; and ensure that all repair areas are free of depressions or humps, and there is no separation at the adjacent undisturbed pavement joints.
 - Ensure that temporary repairs and patching have been made with appropriate materials and workmanship to withstand traffic loading until a permanent repair can be made.
 - Remove and properly dispose of all debris and loose material, and leave the work site in a clean condition.

- Bituminous Surface Repairs:
 - Repair bituminous surfaces and pavement when defects, including, but not limited to the following, are present: Rutting, Raveling, Shoving, Bleeding, Depressions, Settlements, Frost Heave, Weathering, Fatigue, Loss of Traction, etc., in accordance with the requirements of the Technical Provisions, or good engineering and maintenance practices.
 - Ensure that all roadway bituminous surfaces are smooth, stable, durable and provide a safe condition for Patrons.
 - Repair shoulders that have been damaged by erosion, settlement or traffic use.
 - Pavement Surfaces that are considered or show indications that would be classified as slippery must be analyzed and corrected with a skid resistant pavement.

- Potholes:
 - All potholes must be repaired with temporary or permanent repairs within the Time Frames indicated in Table B.3.3.1.
 - All temporary pothole repairs must be monitored and failed areas re-treated until the permanent work can be completed.

- Joints & Cracks:
 - Repair all severe pavement cracks, as defined in Section B.4.4.1 of this Chapter.
 - Evaluate and repair all narrow pavement cracks, as defined in Section B.4.4.2 of this Chapter.
 - Repair all joint separations and joint failures in all pavements as they develop, within the Time Frames stated in Table B.3.3.1.
 - Monitor and, if required, reseal cracks and joints that do not withstand the impact of traffic or show signs of failure.

- Spalled Pavement:
 - Repair all pits, chips, pop-outs, scaling or other surface defects that can be identified or classified as spalls, and as defined in Section B.4.5 of this Chapter.

- Settled and Heaved Pavement:
 - Inspect, evaluate and perform the applicable repair to pavements that have settled or heaved, as defined in Section B.4.6 of this Chapter.

- Base and Subbase Repairs:
 - Remove unsuitable materials, complete backfill and compact materials in accordance with the requirements of the Reference Documents noted in Section B.2 of this Chapter.
 - When a cause is determined as to why a repair is required, install drainage appliances or materials that will prevent conditions from redeveloping.
 - Provide a suitable sub grade to ensure effective drainage of the road base in areas where surface damage and/or frost heaving is evident.
 - Provide adequate support for imposed vehicle loadings where surface damage has resulted from insufficient strength of the road base or subgrade.

- Grinding and Profiling:
 - When the situation dictates, and the requirements stated in Section B.4.8 of this Chapter require: grind and/or profile pavement to provide a smooth and safe driving surface for Patrons.

- Access Roads:
 - Maintain the integrity of the shape and driving surface of the access roadways to provide smooth and safe passage.
 - Repair all voids, potholes, erosion, ruts, etc. in a manner and time frame to permit safe and continual passage across the access roads.

- Roadway Sweeping & Cleaning:
 - Clean roadway surfaces by removing accumulations of dirt, debris, sand and/or gravel from the travel way, centerlines, shoulders, curbs, parking fee plazas, ramps, and along medians and/or roadside barriers to provide a safe, clean free-draining condition.
 - Ensure that all waste from the sweeping and cleaning operations are properly disposed of in accordance with applicable Law.

- Pavement Smoothness:

Pavement surface smoothness as determined by the International Roughness Index (IRI) must be measured annually on all traveled surfaces, and reported as an average IRI throughout the Project. The maximum overall system average shall not be greater than 95. IRI data submissions regarding pavement smoothness shall be provided on

an annual basis. All IRI data submissions must be in electronic format and must be capable of being aggregated.

- Pavement Surface Friction:

The Development Entity must periodically measure and monitor the pavement surface for its tire friction capabilities. Readings whereby the surface friction is below 30 will require investigation and possible remediation.

B.3.3. Performance Time Frames

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required maintenance, repair or replacement to the Roadway features (unless weather conditions limit material application):

TABLE B.3.3.1

Roadway Pavement Work to be Performed	Maximum Time Duration
Bituminous Surface Repairs	14 Days
<u>Pothole Repairs:</u>	
- Temporary	24 Hours
- Permanent	2 Months
Joint & Crack Repairs	3 Months
Spalled Pavement Repairs	6 Months
<u>Settled and Heaved Pavement Repairs:</u>	
- Temporary	24 Hours
- Permanent	1 Month
Base and Subbase Repairs	1 Month
Grinding and Profiling Repairs	3 Months
Access Roads	6 Months

- Walkways will be reviewed every three months for movement, settling and or wearing surface deficiencies. Areas of interest will be identified and arrangements made for remediation within 30 days from the date of identification.
- Every three (3) months the Project will be inspected for asphalt cracks (in excess of ¼” width), concrete cracking/shifting and/or misalignment. Areas where concrete pavement has shifted causing a hazard to the general public shall be repair as soon as possible. Cracks in concrete and asphalt that exceed ¼” in width shall be documented and properly sealed.

The following table establishes the minimum frequency that a particular maintenance operation is to be performed.

TABLE B.3.3.2

Maintenance to be Performed	Minimum Frequency of Occurrence
Pavement Condition Rating (Comprised of IRI, Rutting Survey, Surface Friction & Visual Inspection)	Once Annually (See Volume II, Chapter M)
<u>Roadway Sweeping & Cleaning:</u> - Sweeping - Large Debris Pickup	Once per month (May 1 st – October 31 st) Two times per week
<u>Parking Facility Sweeping & Cleaning:</u> - Sweeping - Large Debris Pickup	Once per month (May 1 st – October 31 st ; November 1 st – April 30 th if no snow cover) Three times per week

B.3.4. *Acceptance Criteria*

Pavement and shoulder maintenance work will be considered acceptable when completed in compliance with the PennDOT Maintenance Manual, PennDOT Highway Specifications (Publication 408) and the following criteria are met or exceeded:

- All repairs have been completed with the proper materials, methods and equipment in full compliance with the requirements stated in the Reference Documents.
- The underlying causes for the pavement defects have been thoroughly evaluated and examined, and the appropriate repairs and remedies taken.
- All repairs restore the integrity to the pavement so that it is safe and capable of supporting the applied loads.
- Repair work provides a continual smooth transition from new to existing pavements, free of all defects and deficiencies.
- Temporary repairs are replaced with the proper and correct permanent repairs in a timely manner, and such temporary repairs can withstand the loads applied for as long as the temporary repair is required.
- The work sites are left in a clean and tidy condition.
- All of the requirements stated and defined in the subsections of Section B.4 of this Chapter are upheld for the determination, removal and repair work required.
- The roadways and parking facilities remain free of dirt, debris, etc., and the roadways and parking facilities are swept at the frequency stated in Table B.3.3.2 of this Chapter.

B.4. Additional Requirements

B.4.1. Temporary Pavement Patching

Temporary patching material may be used in areas that demand immediate attention, and may occur during times of the year when hot mix asphalt plants are not open. Temporary pavement patching will be required when time, location (mainline or ramp), or material constraints dictate that temporary measures be taken immediately to adequately remedy the pavement failure for a short duration. Temporary pavement patching may be partial or full depth. The Development Entity must utilize methods of temporary pavement patching that will remain serviceable for the duration adequate to make the permanent repair, and the quality of workmanship must be sufficient to facilitate adequate drainage from the temporary repair. All Temporary Pavement Patching will be in accordance with the requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

B.4.2. Bituminous Surface Repairs

Bituminous surface repairs are categorized as repairs that are most effectively and commonly permanently corrected by milling and resurfacing of the pavement containing the defect. These defects include rutting, shoving, raveling and stripping, and slippery pavement surfaces. All milling and resurfacing repairs will be made in accordance with the requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

B.4.2.1. Wheel Track Ruts

Excessive wearing of the surface into ruts in the wheel tracks must be considered to be a safety issue because storm water may be trapped in the ruts, contributing to hydroplaning or icing.

Bituminous surfaces must be milled and replaced in sections adequate in length, and one full lane width when correcting this type of surface defect. Adjoining pavement sections must also be evaluated to determine if the repair area should be widened to include and connect other nearby repair areas.

Correction of wheel ruts is required when either:

- The maximum rut depth at any single point on a travel lane is 1-1/2-inches or greater.
- The average rut depth for any 200-foot long section of a single lane is 1-inch or more.

B.4.2.2. Transverse Ruts (Shoving)

Bituminous surfaces that have been shoved or deformed into transverse corrugations must be considered to be a safety issue, because trapped storm water may contribute to hydroplaning, may accelerate pavement deterioration, and may accelerate roadway icing during winter months. In addition, the corrugated surface could contribute to loss of vehicle control at higher speeds.

Bituminous surfaces must be milled and replaced in sections adequate in length, and by one full lane width when correcting this type of surface defect. Adjoining pavement sections must also be evaluated to determine if the repair area should be widened to include and connect other nearby repair areas.

Correction of transverse ruts is required when either:

- The maximum amplitude at any single point in a travel lane is 1-inch or greater.
- The average amplitude measured along any 50-foot long section of a single lane is 3/4-inch or more.

B.4.2.3. Raveling and Stripping

Once raveling has begun, this type of defect can develop rapidly. Stripping and raveling surface defects can become a safety issue due to loose aggregates, or surface depressions that may hold water and contribute to hydroplaning or icing conditions.

Bituminous surfaces must be milled and replaced in sections adequate in length, and by full one lane width when correcting this type of surface defect. Adjoining pavement sections must also be evaluated to determine if the repair area should be widened to include and connect to other nearby repair areas.

Correction of a surface that shows raveling or stripping is required when either:

- A rough or pebbly texture extends along a 100'-long section of a single lane or a 50'-long section of neighboring lanes.
- Two (2) locations are noted in a 150'-long section of a single lane in which a rough-textured surface shows heavy cracking or missing pieces of the surface.

B.4.2.4. Slippery Pavement Surfaces

Slippery pavement surfaces can contribute to a high wet-pavement accident rate at locations where vehicles must decelerate or turn, and create unsafe conditions for Patrons. The Development Entity must obtain and review the annual accident statistics compiled from accident records and compare the rates at specific locations and roadway segments. The Development Entity must identify wet-pavement High Accident Locations (HAL) on an annual basis. The Development Entity must arrange for a Pennsylvania Licensed Professional Engineer to review the accident reports and to conduct a field inspection of the HAL sites to examine slipperiness when the pavement is wet or dry, crash damage or skid marks at each scene, visibly polished pavement, and the like.

If the field inspection confirms that a site is a wet-pavement HAL, the site must be immediately scheduled for pavement repairs. The appropriate repair will involve milling the surface and replacing it with the recommended surface mix as defined in the PennDOT Publication 242 and the Reference Documents noted in Section B.2 of this Chapter. Any required milling and patching must cover the entire wet-pavement HAL site as revealed by accident data and field inspections.

B.4.3. *Pothole Repairs*

Potholes occur in pavements, and are most prevalent during the winter and spring months. Once a pothole is identified, the Development Entity must dispatch forces to make permanent and temporary repairs within the Time Frames stated in Table B.3.3.1 and in conformance with the requirements of PennDOT Publication 113.

Temporary repairs must be constructed in a workmanlike manner using appropriate material, so that the patch will have the best possible survivability under continuing traffic loadings.

Temporary repairs must be replaced with permanent bituminous concrete pavement patches, which must be in conformance with requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

B.4.4. *Cracks & Joints*

The following sections summarize the work that must be performed to correct crack and joint defects in the PCC and bituminous concrete pavements.

Cracking and joint defects that recur may be attributable to volume changes, temperature changes, or moisture content changes in the base support. The Development Entity must restore and stabilize base support when this has been identified as the cause of pavement surface cracking.

B.4.4.1. Large Pavement Cracks

Large pavement cracks are often large-scale defects that allow water and foreign material to enter the pavement structure, subbase, and subgrade, and which may contribute to poor rideability.

When the Development Entity is performing crack sealing work as preparation for the construction of a bituminous concrete overlay, the Development Entity must incorporate the appropriate reflective crack control treatment in the rehabilitation.

Crack sealing materials, methods and equipment must be in accordance with requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

Correction of large cracks in a bituminous or PCC pavement is required when either:

- The pavement surface contains visible cracks greater than 1/8”.
- One (1) location shows a vertical displacement 1/2 inch in any 50-foot long segment of a single lane.
- The length of the correction must extend a distance such that the entire defect has been addressed.

B.4.4.2. Narrow Pavement Cracks

Narrow cracking (crack widths less than 1/8") of flexible and rigid pavements is an inevitable consequence and may be hastened or worsened if not addressed and repaired.

Narrow cracks may be filled with emulsion, emulsion and rejuvenator mixture, or liquid asphalt. When using emulsion, light grade liquid asphalts or asphalt rejuvenators for crack repairs, fine sand should be mixed with the liquid or applied to the surface of the crack immediately after it has been filled.

Narrow pavement cracks need not be routed before being sealed, although the service life of any crack repair will be extended.

Small cracks that extend over a larger area, such as alligator-type cracking, may be repaired by tacking a blocked-out area and applying chips or other similar material, or a thin patch of hot plant mix so long as the repairs are in compliance with PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter. Such patches should be blocked out to give a uniform rectangular appearance.

B.4.4.3. Pavement Joint Separation

Joint separation in pavements or between adjacent sections of pavement is detrimental to the pavement structure. Individual joints in pavement or PCC base course that are separated by a 1/4-inch gap or wider must be repaired.

All joints repairs in pavements must conform to the repairs for cracks and joints in accordance with the requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

B.4.4.4. Pavement Joint Failure

Joint failure in rigid pavement or PCC base pavement is a severe joint breakdown resulting in raised joints caused by curling of the pavement slab, faulting at the joint or vertical displacement of concrete pavement slabs relative to each other or to the adjacent shoulder.

Joint failure may result in unexpected heaving or blowups at the joint. These failures must be addressed upon detection. Repairs may be made with temporary patching until permanent full depth pavement repairs can be made.

Repairs to failed joints must be made by the methods, materials and equipment for removal and replacement of the failed joint in accordance with the requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

B.4.5. *Spalled Pavements*

Spalls in PCC pavements are defects that leave a hole or gap in the roadway surface which may contribute to poor rideability as well as loss of vehicle control.

Spalled PCC pavement may be repaired using either plant mixed bituminous material or PCC materials, whether they occur in PCC pavements, or PCC base courses. When temperatures or inclement weather prohibit permanent repairs, temporary repairs are permitted, and shall be in accordance with all requirements for temporary repairs.

Repairs to spalled pavements must be in accordance to the requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter.

Correction of spalls in a PCC pavement is required when either:

- One (1) location shows a transverse spall that either exceeds 4-inches in length in the direction of travel, 6" in width or 1/2" in depth; or has cause to adversely affect driver safety.
- One (1) location shows a longitudinal spall that has been noted by maintenance staff or Patrons as adversely affecting riding quality.

B.4.6. *Settled and Heaved Pavement*

The following sections summarize the work that must be performed to correct settlement and heave in PCC and bituminous concrete pavements.

B.4.6.1. Tolerances for Abrupt Vertical Variations

Vertical variations may occur at the joint between two adjacent slabs of a rigid pavement; at a transverse crack or joint in the bituminous surface of a composite pavement; or at any crack or joint in a flexible pavement. Vertical variations may also occur between the pavement and adjoining construction such as concrete curb, shoulders, ramps, the center median, approach slabs, etc. Such vertical offsets can be caused by a number of factors, and may appear abruptly or more gradually.

Settlement and heave must be considered to be a safety concern due to the possible loss of vehicle control when a vehicle impacts these defects, and the excessive impact loading is imparted to structures and slabs. When this type of pavement distortion creates tears and cracks, the resulting penetration of water into underlying base courses, subbases or subgrades can rapidly escalate the problem until the pavement structure fails entirely.

Correction of a bituminous surface broken by settlement or heave is required when either:

- One (1) location shows a vertical or horizontal displacement of 3/4 inch in any 50-foot long segment of a single lane.
- Three (3) locations show vertical or horizontal displacements that exceed 1/2-inch in any 200-foot long segment of a single lane or a 100-foot long segment of one travel direction.

Correction of a rigid pavement showing settlement and heave of individual slabs is required when either:

- One (1) location shows a vertical or horizontal displacement of 1/2-inch between adjacent slabs in a single lane or between two lanes in one travel direction.

When an abrupt vertical differential is found between the traveled way and the adjacent paved shoulder, repairs to correct one or both of the surfaces will be required when:

- One (1) location shows a vertical or horizontal displacement of 1-inch.

B.4.6.2. Partial Depth Pavement Patching

If, after examining the settlement and heave in a flexible or composite pavement section, the Development Entity determines that a base course repair is not warranted, the Development Entity must mill and replace the bituminous surface course. The repair areas will be a minimum of 10' long by one full lane in width. The repair area must be carefully determined so that the constructed patch will provide a smooth transition as it eliminates the vertical displacement. In general, a patch should be a minimum 40' long for every one inch (1") of vertical displacement spanned by the patch, after the normal profile grade of the road has been taken into consideration.

Whenever settlement and heave has caused the difference in vertical elevation between the pavement and the adjacent shoulder, the Development Entity must mill and patch the shoulder in order to avoid affecting the mainline or ramp roadway profiles. However, the Development Entity must not pave against the center median barrier wall, and must restore the intended and acceptable cross slope of the shoulder.

B.4.6.3. Full Depth Pavement Patching

Full depth pavement patching will be required when settlement and heave has caused sufficient movements and stresses to physically break up the pavement section. Full depth pavement patching will also be required when the pavement must be removed in order to replace unsuitable subsurface soils, to undertake underground appurtenance repair or construction, or to address other defects beneath the pavement.

Repeated surface repairs will not be an acceptable substitute for a remedy involving full depth patching, when the causes or impacts of severe pavement heave or settlement can only be remedied by making a thorough reconstruction.

All work to construct full depth pavement patches must conform to the requirements of PennDOT Publication 408 and the Reference Documents listed in Section B.2 of this Chapter. The material quality and depth of repair must match or exceed those properties of the existing adjacent cross section.

B.4.6.4. Settlement of Approach Pavements

Settlement of approach pavements is most often detected at the expansion joint between a structure and the approach slab, and is commonly caused by consolidation of the structural backfill behind the structure and beneath the approach slab. A vertical variation between the approach slab and the structure is highly undesirable because, when the ability of the expansion joint to accommodate the variation is exceeded, water and de-icing salts will readily enter the expansion joint to the detriment of the structure. Such settlement is also undesirable because the vertical variation causes heavy vehicles to impact the end of the structure when crossing onto the structure or impact the approach slab when leaving the structure, which is detrimental to both structures and traffic.

The Development Entity must conduct geotechnical evaluations using a qualified Geotechnical Engineer to determine if the problem is attributable to settlement, and repair all voids that are discovered.

Correction of a settled PCC approach slab, whether or not it is currently overlaid with asphalt or concrete overlay, is required when any location shows a vertical displacement of 3/4-inch between the approach slab and the structure.

B.4.7. *Pavement Base and Subbase*

The following sections summarize the repairs that must be undertaken to address defects and deficiencies in pavement base courses and subbases.

B.4.7.1. Evaluation and Determination of Pavement Base Distress

Whenever surface cracks or pavement joints are accompanied by a severe vertical variation, the Development Entity must evaluate the site to determine if the underlying subbase or subgrade has failed.

When severe settlement or heave occurs at one or more slabs of a rigid pavement, the likeliest cause of the vertical dislocation will be a defect in the subbase or a deeper foundation layer. The Development Entity must evaluate all heaved or settled rigid pavement slabs to determine the manner in which underlying structural support has weakened or failed. The slab must be inspected under traffic to determine if it is rocking or pumping when loaded.

Whenever the base course failure is attributed to the cracking, crushing, or partial collapse of any utility conduit, sewer pipe, drainage structure, or similar appurtenance, the Development Entity must make a full repair of the appurtenance. The Development Entity must not repair the distressed pavement section until proper support has been restored, and the Development Entity can conclude that the subbase or subgrade can support the traffic loads.

If the geotechnical sampling, testing and studies conclude that sections of the pavement were caused to heave or settle due to improper supporting soils, the Development Entity must make a thorough reconstruction in the area to permanently repair the cause of the pavement movement.

If a broken base course is unexpectedly revealed during the milling of existing bituminous surface courses, the Development Entity must promptly evaluate the extent of the base failure, and select and implement an appropriate, permanent remedy. The Development Entity must not repeatedly patch or overlay the problem area as it recurs, but must repair the base course.

B.4.7.2. Investigation of Rocking or Pumping Rigid Pavement

Individual slabs of a PCC pavement or PCC base course that rock, move or pump subbase materials through joints and cracks when subjected to traffic loadings, must be analyzed to determine the cause of the reduced pavement structural support, and the extent of the damage done to the pavement structure.

The Development Entity must evaluate surface defects in bituminous overlaid composite pavement or flexible pavement to determine if the defect is attributable to base failure or subgrade problems. If a base failure is evident, the Development Entity then must perform the base repair as specified above.

Rigid pavement slabs that rock under wheel impacts may still be sound, but may have lost foundation support due to subbase consolidation, washout, settlement of embankment, or other causes. If the rocking pavement slabs are found to be sound and whole, but their underlying support is deficient, the Development Entity may attempt to repair such slabs by means of subbase or subgrade reinforcement techniques, or by removal and replacement of the pavement or base.

Pumping pavement slabs exhibit a type of base failure that will rarely be corrected by measures such as mudjacking or overlays. When the Development Entity's inspections furnish evidence that support soils are being pumped out from under PCC base course slabs, the Development Entity must schedule a removal and replacement of the failed base and pavement structure.

B.4.7.3. Pavement Subbase Reinforcement

Subbase reinforcement may be a suitable repair strategy when there is evidence of void or hollow space under rigid pavement slabs, or in cases when rigid pavement settlement is attributable to failure or compressibility of pavement support soils.

When a qualified Geotechnical Engineer concludes that a particular PCC base slab should be stabilized, reinforced or raised, the Development Entity may attempt these methods in order to re-establish the subbase without removing and reconstructing the slabs. Methods such as mudjacking, or pressure-injecting a PCC cement grout underneath the slab in order to replace lost or sunken subbase material, etc., should be done by a qualified Contractor experienced in this specific type of roadway construction work.

Subsealing involving pumping a bituminous mixture under the slab to seal the subgrade from further water penetration is not allowed.

B.4.8. *Grinding and Profiling*

The Development Entity must not grind PCC approach pavements or any reinforced concrete pavement in such a way that the reinforcement is exposed, concrete cover over reinforcing bars is substantially reduced, or the structural thickness of the concrete section is so reduced. However, there may be occasions where minor pavement grinding can be effective in repairing small-scale surface irregularities, small vertical faults at joints, or concrete patches that have slightly faulted.

The grinding must not remove the finish from more than minor areas of the riding surface, so that the majority of the original roughened texture is maintained.

B.4.9. *Access Roads*

Access roadways located within the Project need not be maintained to the same standards as those roadways open to the general public. The requirements for access road maintenance are to ensure that access roads provide safe and convenient access to specific areas.

B.4.10. *Roadway Sweeping and Cleaning*

Regular and effective pavement and shoulder sweeping and cleaning is the responsibility of the Development Entity. The Development Entity must maintain the traveled ways in such a manner that the roadways are kept clear of litter, leaves, debris, wind-borne soil and trash, vegetation, droppings, scalings, and loose material that might pose a safety hazard to Patrons, and which has a negative impact on the aesthetics and appearances of the Project.

The Development Entity is responsible for all sweeping and cleaning work in accordance with the frequencies stated in Table B.3.3.2 of this Chapter, and in determining any other special needs as a reaction to different circumstances or events.

All debris and spoil must be legally disposed of in accordance with Federal, State and Municipal solid waste disposal laws and ordinances.

TABLE OF CONTENTS

C. PAVEMENT DELINEATION MAINTENANCE

Section	Page
C.1. Definitions	2
C.2. References	3
C.3. Policy for Performing Pavement Delineation Maintenance	4
C.3.1. <i>Objective</i>	4
C.3.2. <i>Responsibility of Development Entity</i>	4
C.3.3. <i>Performance Time Frames</i>	6
C.3.4. <i>Acceptance Criteria</i>	7
C.4. Additional Requirements	8
C.4.1. <i>Pavement Markings and Striping</i>	8
C.4.2. <i>Raised Pavement Markers</i>	8
C.4.3. <i>Roadside Delineators</i>	8
C.4.4. <i>Prismatic Reflectors</i>	8
C.4.5. <i>Pavement Delineation Layout</i>	9
C.4.6. <i>Pavement Delineation Removal</i>	9
C.4.7. <i>Surface Preparation</i>	9
C.4.8. <i>Construction</i>	9
C.4.9. <i>Materials</i>	9

C.1. Definitions

Pavement Delineation: Devices designed and installed to assist in guiding motorists, or which express, by symbolism, certain traffic laws and use prohibitions. Delineation includes, but is not limited to, pavement striping, pavement markings, raised pavement markers and prismatic reflectors.

Pavement Markings: Materials applied to the roadway surface, such as pavement striping, letters or symbols. Markings consist of paint, plastic tape and films, epoxy, or thermoplastic materials serving as a binder and substrate for reflective glass beading.

Pavement Striping: Materials applied to a roadway surface in a linear manner as a means to delineate, guide and control the movement of traffic.

Prismatic Reflectors: Products consisting of molded housings and reflective elements, applied to parapets, metal posts (roadside delineators), barrier walls and temporary concrete barrier to improve the nighttime visibility of devices by reflecting light back toward the light source (i.e. vehicle headlamps).

Raised Pavement Markers: Products consisting of metal or plastic castings and raised elements set into the roadway surface as a lane delineation that work by reflecting a light pattern back toward the light source (i.e. vehicle headlamps).

C.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 10: ”Design Manual, Part 1: Transportation Project Development Process”, PennDOT.
- Publication 10A: ”Design Manual, Part 1A: Transportation Engineering Procedures”, PennDOT.
- Publication 13M: “Design Manual Part 2 – Highway Design”, PennDOT.
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 35: “Approved Construction Materials”, PennDOT.
- Publication 46: “Traffic Engineering and Operations Manual”, PennDOT.
- Publication 72M: “Roadway Construction Standards (Dual Unit)”, PennDOT.
- Publication 108: “Sign Foreman’s Manual”, PennDOT.
- Publication 111M: “Signing and Marking Standards”, PennDOT.
- Publication 148: ”Traffic Standards (TC-7800 Series) – Signals, PennDOT.
- Publication 149: ”Traffic Signal Design Handbook, PennDOT.
- Publication 212: “Official Traffic Control Devices”, PennDOT.
- Publication 213: “Work Zone Traffic Control Guidelines” PennDOT.
- Publication 234: “Flagging Handbook”, PennDOT.
- Publication 236M: “Handbook of Approved Signs”, PennDOT.
- Publication 383: “PA Traffic Calming Handbook”, PennDOT.
- Publication 408: “Highway Specifications”, PennDOT.
- “Strike-Off Letters”, PennDOT.
- “Manual on Uniform Traffic Control Devices (MUTCD)”, FHWA.
- “A Policy on Geometric Design of Highways and Streets”, AASHTO.

C.3. Policy for Performing Pavement Delineation Maintenance

C.3.1. Objective

The objective of Pavement Delineation maintenance is to ensure that all pavement markings, pavement striping, prismatic reflectors and pavement markers are properly maintained so as to facilitate the safe and orderly movement of traffic.

Pavement Delineation requires: repairs due to wear, snowplow damage, construction, sunlight degradation, etc.; maintenance; removal; and replacement.

C.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices and inspection survey intervals to ensure that all Pavement Delineation functions properly, is clearly displayed to ensure the safe and orderly movement of traffic, and meets other safety, aesthetic and economic benefits. This requires that the Development Entity carry out its obligations in a manner that maintains and/or improves the condition and functionality of the Pavement Delineation.

Each delineation must be kept visible, legible, and properly functioning under both day and nighttime conditions. It should be noted that all Pavement Delineation will gradually deteriorate to a point where the delineation must be repaired or replaced. The Development Entity is responsible for all repair and replacement determinations, required resources, work assignments and oversight for all work associated with or described for Pavement Delineation.

The Development Entity must make routine Pavement Delineation inspections part of its daily activities and should be watchful for missing, damaged and worn Pavement Delineation. In particular, extra attention must be placed during winter months when damage from snow plowing can be substantial.

Once work on Pavement Delineation has been started, the work must continue until a thorough, complete and workmanlike product has been achieved. All work that affects Pavement Delineation must conclude with a restoration of all delineation to a like-new condition.

All materials and construction requirements for Pavement Delineation work performed by the Development Entity must conform to the appropriate and applicable requirements of PennDOT Specifications, and the Reference Documents noted in Section C.2 of this Chapter.

Work on Pavement Delineation within the Project that must be performed by the Development Entity includes the following:

- Ensure that all pavement striping and markings are well-defined, clear, legible, distinct and in full accordance with the requirements of this Chapter and the Reference Documents.
- Replace all faded, worn, debonded, damaged, non-reflective and/or missing pavement striping and markings.

- Repair and replace all damaged, non-functioning, broken, missing or obstructed raised pavement markers, prismatic reflectors, and roadside delineators.
- Ensure that all pavement markings are reapplied or replaced when the required levels of retro-reflectivity are not in accordance with State and Federal guidelines.
- Remove and replace all Pavement Delineation as required by State or Federal regulations.
- Replace all pavement striping and markings that require alteration due to changing needs or conditions.
- Maintain the Pavement Delineation for all parking stall lines, handicap stall markings, and related pavement markings within the Project Service Plaza Facility, or other adjacent to the parking or travel areas.
- Ensure that all replaced Pavement Delineation matches the existing Pavement Delineation unless otherwise dictated by updates in the Reference Documents noted in Chapter C.2 of this Chapter, or requested by the Commonwealth.
- Install all new Pavement Delineation in full compliance with the Reference Documents, or as requested by the Commonwealth.
- Dispose of all removed materials in full compliance with all Municipal, State and Federal disposal and environmental requirements.
- Remove and completely eradicate all pavement markings which are superfluous or obsolete, or as requested by the Commonwealth.
- Ensure that pavement and other surfaces are not damaged as a result of grinding or other eradication techniques, and that the work is in compliance with the Reference Documents.
- Replace all pavement markings and striping that are covered, obliterated or removed due to construction or maintenance work with temporary Pavement Delineation prior to reopening to traffic, and maintain the temporary delineation until permanent Pavement Delineation is installed.
- Ensure that all temporary Pavement Delineation is in full compliance with the Reference Documents.
- Install temporary pavement markings and striping to delineate traffic at locations where the absence of or deficiencies in the Pavement Delineations create unsafe conditions, or have the potential to become unsafe conditions for Patrons.

C.3.3. Performance Time Frames

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required maintenance, repair, replacement, and or relocation work to the Pavement Delineation (unless weather conditions limit material application):

Pavement Delineation Item	Maximum Time Duration
Raised Pavement Markers	14 Days
Roadside Delineators	30 Days
<u>Prismatic Reflectors:</u> – Attached to barriers, guardrail, etc.	60 Days
<u>Pavement Markings:</u> – Letters or symbols – Striping	45 Days (Weather Permitting) 30 Days (Weather Permitting)

The Development Entity must, from the time a deficiency is detected by discovery or report:

- Install temporary markings and striping within eight (8) hours.

The Development Entity must also:

- Ensure that temporary pavement markings and striping be clear, legible and bonded to the surface upon which they are placed for the length of time that they are required.
- Remove and properly dispose of all waste materials from Pavement Delineation removal at the end of each day.
- Remove and replace temporary pavement markings and striping with permanent delineation within seven (7) days after it was installed or is no longer required; unless temporary delineation is for a pre-planned construction work period which, when concluded, the above stated requirement applies.

C.3.4. *Acceptance Criteria*

Pavement Delineation will be considered acceptable when the following criteria are met or exceeded:

- Prismatic Reflectors and Raised Pavement Markers:
 - The pavement marker bases are flush with the pavement surface and securely set into the pavement.
 - The reflector and markers are unbroken and clearly visible to traffic.
 - The markers are at the correct interval and are at the correct alignment.

- Pavement Markings and Striping:
 - Markings and striping have been properly applied at the correct application rates, location, color, size, alignment, and symbol, are free of distortion or damage, and have the correct reflectivity.
 - Incorrectly applied or placed markings and striping are not present.
 - Glass beads for reflectivity are applied at the specified amounts and meet the requirements of the Reference Documents as noted in Section C.2 of this Chapter.
 - Pavement and other surfaces are not damaged by installation or eradication.
 - Temporary markings and striping are present where the absence of or deficiencies of markings create unsafe conditions.
 - All pavement markings achieve full bond, with no separation from the applied surface.
 - Materials do not deteriorate when in contact with sodium chloride, calcium chloride, or traffic residues.
 - Pavement markings indicate no appreciable deformation or discoloration under exposed traffic and road temperatures between -40°C and 40°C.
 - Pavement markings maintain their original dimension and placement without chipping, peeling or cracking.

- Roadside Delineation:
 - Supports are plumb and level.
 - Intervals and locations are in accordance with the requirements of the Reference Documents.
 - Reflectors are unbroken, reflective and clearly visible to traffic.

C.4. Additional Requirements

C.4.1. Pavement Markings and Striping

Pavement markings and striping are critical for motorist guidance and public safety, and must be maintained and/or replaced in accordance with the requirements of Section C.3. of this Chapter. Pavement markings that are missing or have lost their effectiveness would constitute a safety hazard if not replaced.

Temporary replacement striping is permitted provided that there is no substitution of colors or substandard marking dimensions. Temporary or permanent replacement delineation must conform to the layout, patterns, lengths and spacing found in the Reference Documents of Section C.2 of this Chapter. All delineation constructed under a closure must be inspected by the Development Entity and approved before being reopened to parking or traffic.

The use of paint on curbs solely for the purpose of supplementing or replacing signing is prohibited. The Development Entity is authorized and encouraged to delineate for warning purposes (curbs, roadside hazards, access roads, etc.).

C.4.2. Raised Pavement Markers

Missing or deficient raised pavement markers must be replaced when pavement striping alone will not ensure that critical Pavement Delineation is visible at night and during inclement weather.

Temporary raised pavement markers must not be used as substitutes for traffic control and protection during maintenance or construction operations.

C.4.3. Roadside Delineators

Roadside delineators exist at various locations, including at the tops of embankments where guide rail is not warranted due to height and grading criteria.

Replacement of roadside delineators must be located and spaced in accordance with the requirements of the Reference Documents of Section C-2 of this Chapter.

C.4.4. Prismatic Reflectors

Prismatic reflectors have been installed at various locations which must be maintained by the Development Entity. These reflectors vary in location including, on barriers, walls, bridge railings, parapets, or retaining walls. In addition, certain reflectors exist along access roads, to assist in preventing the accidental intrusion of vehicles into neighboring properties.

C.4.5. *Pavement Delineation Layout*

For short lengths (less than 200 feet) of pavement striping replacement, the new markings must be placed in the same location as the removed markings. The Development Entity may place up to 200 feet of edge line without formal layout.

Longer lengths of striping, delineation in areas where lanes are diverging or converging with the mainline, and areas where lane widths are tapering, must be laid out in conformance with the Reference Documents noted in Section C.2 of this Chapter for both temporary and permanent markings.

No reference marks made to guide the installation of Pavement Delineation may be used as a temporary Pavement Delineation.

C.4.6. *Pavement Delineation Removal*

Paint or asphalt emulsion must not be used to cover Pavement Delineation except as a temporary measure until the proper removal can be made.

Leaving scars or damage to the pavement surface shaped like the former markings is not acceptable and can cause unsafe conditions.

C.4.7. *Surface Preparation*

Surface preparation for all Pavement Delineation must conform to the requirements of the Reference Documents noted in Section C.2 of this Chapter.

Before applying any pavement marking material, the Development Entity must sweep the pavement and must ensure that no loose material, water or debris is present that would reduce the adhesion of the markings to the pavement.

C.4.8. *Construction*

When construction activities alter or cause Pavement Delineation to be removed, the Development Entity must reinstall properly functioning delineation prior to opening the work zone to traffic. Temporary delineation must be installed only if permanent delineation cannot be installed immediately, but is required for a duration not to exceed that specified in Section C.3.3 of this Chapter.

C.4.9. *Materials*

The materials, production, transportation and storage of all Pavement Delineation must fully comply with the requirements of the Reference Documents noted in Section C.2 of this Chapter. In particular, the photo-reflectivity requirements must be met for all materials furnished by the Development Entity for installation on the Project.

The Development Entity must log and maintain all manufacturers' certifications for material delivered and installed for Pavement Delineation.

Specific additional material requirements, above those stated within the Reference Documents, follow:

C.4.9.1. Hot Melt Thermoplastic

Acceptable types of thermoplastic are supplied in granular or block form for spray, ribbon, or extruded application. The Development Entity is responsible for selecting the delivered form of the material and for ensuring the manufacturer's storage, handling and application requirements are met.

Hot melt thermoplastic is typically applied only to bituminous concrete (asphalt) surfaces but may be applicable to PCC pavements, slabs and bridge decks, when used in accordance with the Reference Documents and the manufacturer's recommendations.

C.4.9.2. Cold Preformed Plastic Tape

Preformed plastic tape markings must form a complete stripe or pavement marking legend, ready to be applied to the pavement. Such markings must be applied to the pavement by being rolled into the surface by means of a pressure sensitive precoated adhesive, or liquid contact cement.

Preformed plastic pavement markings are typically applied to P.C.C. pavements, slabs and bridge decks. The Development Entity must replace existing preformed plastic tape with similar material, and must not substitute preformed thermoplastic, paint or other pavement marking materials for preformed plastic without the Approval of the Department.

C.4.9.3. Preformed Thermoplastic

This material must be capable of being installed on either bituminous or P.C.C. surfaces by using a heating element. The use of this material is limited to emergency repair locations where reducing traffic delays and inconvenience is of primary importance.

C.4.9.4. Traffic Paint

The Development Entity is permitted to use paint as temporary delineation only, which must be replaced with permanent markings as soon as practical and possible, consistent with the requirements stated in Section C.3.3 of this Chapter.

C.4.9.5. Environmental Concerns

Solvent-borne traffic paint and marking materials can pose an environmental hazard unless handled in full accordance with the manufacturer's requirements. The residue of paint from color changes or cleaning tasks must be properly disposed of in conformance with State or Federal EPA requirements for liquid hazardous wastes. Paint guns may not be purged on shoulders or earth surfaces, and no residues may be tipped or flushed into the drainage system.

TABLE OF CONTENTS

D. DRAINAGE MAINTENANCE & EROSION & SEDIMENT CONTROL

Section	Page
D.1. Definitions	2
D.2. References	4
D.3. Policy for Performing Drainage Maintenance and Erosion & Sediment Control Work	5
D.3.1. <i>Objective</i>	5
D.3.2. <i>Responsibility of Development Entity</i>	5
D.3.3. <i>Performance Time Frames</i>	9
D.3.4. <i>Acceptance Criteria</i>	10
D.4. Additional Requirements	12
D.4.1. <i>Drainage Frames and Grates</i>	12
D.4.2. <i>Drainage Structures</i>	12
D.4.3. <i>Drainage Pipes and Conduits</i>	13
D.4.4. <i>Drainage Culverts</i>	13
D.4.5. <i>Bridge Drainage Systems and Downspouts</i>	14
D.4.6. <i>Stormwater Management Basins</i>	14
D.4.7. <i>Roadway and Roadside Ditches and Other BMPs</i>	15
D.4.8. <i>Curb</i>	16
D.4.9. <i>Pavement and Bridge Base-Drain Systems</i>	16
D.4.10. <i>Permanent Erosion & Sediment Control Systems</i>	16
D.4.11. <i>Temporary Erosion & Sediment Control Systems</i>	17
D.4.12. <i>Creek and Stream Requirements</i>	18
D.4.13. <i>Emergency Inspections</i>	18

D.1. Definitions

BMP: Best Management Practices (BMPs) are structural, vegetative, or managerial practices used to treat, prevent, or reduce water pollution, runoff, and erosion.

Curb: A concrete or bituminous device with a given cross section, constructed along the edges of pavements or shoulders that collects storm water runoff from the traveled way and conveys it to an intended discharge point.

Culvert: A structure made of steel, concrete, aluminum, natural stone, High Density Polyethylene or other material, covered by embankment material that allows a creek, stream or roadway to pass under a roadway or fill. Culverts are typically box or arch in shape, and may or may not have slabs under the creek or stream flow-line. Culverts may be of any size up to 20 feet in span length.

Debris: Litter, rubbish, vegetation, rocks, dead animals, spilled materials, brush or other items which are not part of or which impede drainage.

Ditch: A trough-shaped excavation made to collect and transport water; includes unpaved and paved ditches. Unpaved ditches are protected from erosion by turf, grasses or rock. Paved ditches are protected from erosion by concrete or asphalt.

Downspout: A pipe or conduit attached to a bridge to direct water away from a collection feature.

Drain: An aperture through a wall, curb or bridge deck to provide egress for water that would otherwise be trapped on the roadway.

Drainage System: An appurtenance that is intended to collect, convey, store or discharge storm water runoff. Drainage systems include structures in or under the roadway, such as curb, manholes, inlets and catch basins, storm sewers, and pipe basedrains; systems through the embankments such as culverts, and systems parallel to the embankments such as ditches, swales, berms, erosion control devices and outlet channels.

Embankment: An unpaved slope leading either to or from the earth supported traveled way that is covered by turf or natural plant life.

Erosion Control: A device or material used to limit the erosion of earth away from the site.

Flow-Line: The bed or lowest point of a pipe, conduit, ditch, stream or culvert. **Headwall:**

A vertical wall at the end of a pipe that retains earth.

Pavement Base-Drain: A system built under pavements or with bridge approach slabs that collects storm or ground waters that penetrate the roadway subbase or that percolate through the ground, and collects and discharges the water.

Pipes: Circular, arched or elliptical shaped conduits varying in size that are utilized to convey water from point to point. Most drainage pipes are made of steel, concrete, aluminum or high density poly ethylene.

Ponding: An undesirable condition in which standing or slow draining water is trapped on the roadway surface or in ditches.

Re-shaping: Re-grading of the earth from ditch line to ditch line in order to reestablish the proper shape and profile of the ditch.

Scour: Erosive action of flowing water that removes soil and can undermine foundations, create void space behind walls or under slabs, lower river beds, and destabilize embankments.

Scupper: A drainage structure associated with bridges, present in the deck, also referred to as floor drains. Scuppers provide a means for rain or other water to drain off the bridge roadway surface and lead to downspouts and enclosed drainage systems.

Storm Sewer: An underground conduit, pipe or tunnel constructed to receive storm water from pavement and bridge drains and convey such water to a distinct outlet point.

D.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 13M: “Design Manual Part 2 – Highway Design”, PennDOT.
- Publication 15M: “Design Manual Part 4 – Bridge Design”, PennDOT.
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 37: “Specifications – Bituminous Materials (Bul. 25)”, PennDOT.
- Publication 72M: “Roadway Construction Standards”, PennDOT.
- Publication 73: “Drainage Condition Survey Field Manual”, PennDOT.
- Publication 145: “Inspection – Concrete Pipe and Precast Concrete”, PennDOT.
- Publication 219M: “Bridge Construction Standards”, PennDOT.
- Publication 238: “Bridge Safety Inspection Manual”, PennDOT.
- Publication 280: “Manufacturer Specifications for Concrete Pipe”, PennDOT.
- Publication 325: “Wetland Resources Handbook”, PennDOT.
- Publication 408: “Specifications”, PennDOT.
- Publication 464: “Maintenance Field Resource for Erosion and Sediment Control”, PennDOT.
- Publication 584: “Drainage Manual”, PennDOT.
- “Strike Off Letters”, PennDOT.
- “Pennsylvania Code Title 25 Chapter 102 Erosion and Sediment Control”, PennDEP.
- “Pennsylvania Code Title 25 Chapter 105 Dam Safety and Waterway Management”, PennDEP.
- “Pennsylvania Code Act 167 – Watershed Plan”, PennDEP
- Culvert Inspection Manual, Report NO. FHWA-IP-86-2
- “General National Pollutant Discharge Elimination System (NPDES)”, USEPA

D.3. Policy for Performing Drainage Maintenance and Erosion Control Work

D.3.1. Objective

The objective of drainage maintenance and erosion & sediment control is to ensure that all elements of the drainage system (curb, inlets, catch basins, manholes, sewers, scuppers, downspouts, ditches, outlet structures, stormwater management basins, and miscellaneous drainage devices, as well as erosion control features) are properly maintained so as to eliminate ponding, flooding, scour and erosion as potential hazards to the safe and orderly movement of traffic; and all Project roadway and structure surfaces are efficiently, properly and continually drained.

Drainage Systems require: repairs due to age, corrosion, soil loading, traffic weight or impact, flood damage, etc.; maintenance; cleaning to remove blockage caused by debris, litter or sediment; and replacement.

Erosion control devices are classified as permanent installations, or temporary measures erected during construction to limit erosion from disturbed and stripped surfaces. These devices require maintenance to: remove trapped sediment; clean; and for final removal or replacement.

Drainage pipes and culverts are permanent structures conveying runoff water and, creeks and streams within and around the Project roadways and fills. Such structures must handle all flow conditions including flood conditions.

D.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices to ensure that all roadway and structure drainage devices, and erosion control systems remain functional, operate to direct and convey the flow of storm waters, and meet other requirements.

The Development Entity is responsible for any work required to alleviate flooding, repair flood damage, or to solve any drainage problems that may arise.

To the greatest extent possible, when performing drainage maintenance and erosion control work the Development Entity must utilize the newest techniques and materials that have been approved and implemented by the Department so as to minimize the environmental impact of the Project on the neighboring lands and waters while optimizing: cost, recycling and public convenience.

The Development Entity must recognize drainage pipes and culverts have finite lives and deteriorate as a result of abrasion, chemical attack, and aging of materials. Maintenance of drainage pipes and culverts involves both maintenance of hydraulic capacity and structural integrity. Constant vigilance is required for pipes and culverts as deterioration can occur on the soil side of such structures and non-destructive testing is limited in determining remaining life of such structures.

All materials and construction requirements for Drainage System and erosion control maintenance work performed by the Development Entity must conform to the appropriate and applicable requirements of the Reference Documents noted in Section D.2 of this Chapter.

Work on Drainage Systems, and Erosion Control Systems within the Project that must be performed by the Development Entity includes, but is not limited to, the following:

- Roadway Drainage System:
 - Ensure that frames and grates are properly and securely fastened, set and anchored.
 - Clear, repair or replace all frames, grates, structures and pipes that are clogged, damaged or missing.
 - Clear catchment areas that have become clogged.
 - Remove trapped or ponding water to prevent damage to the roadway pavement structure.
 - Repair and replace the Roadway Drainage System components that have deteriorated to a condition that is unsafe or has the potential to become unsafe for Patrons; and to prevent further deterioration of the pavement and the pavement structure.

- Structure/Parking Facility Drainage System:
 - Ensure that frames and grates are properly and securely fastened, set and anchored.
 - Clear, repair or replace all frames, grates, downspouts, pipes reducers, etc. that are clogged, rusted, damaged, separated or missing.
 - Clear catchment areas that have become clogged.
 - Remove trapped or ponding water to prevent damage to all structures.
 - Repair and replace structure components that have deteriorated to a condition that is unsafe or has the potential to become unsafe for Patrons; and to prevent further deterioration of the structure.

- Ditches:
 - Remove and clean debris, dams and all other obstructions from the ditches.
 - Restore, repair and stabilize ditches that have eroded, scoured and/or slumped, or have the potential to do so if not remedied.
 - Restore and maintain the full capacity and/or profile of the ditches within the Project.
 - Inspect ditches during periods of heavy rainfall and/or rapid melting to ensure the ditch shape is maintained, and the flow-lines are not undergoing scour or erosion.
 - Dispose of waste materials from ditching operations in a manner and location that is in full compliance with all, Local and State Laws and regulations.

- Curb:
 - Ensure that all curb remains unobstructed and is free to provide drainage as designed and intended.
 - Repair and replace all broken, settled, damaged, cracked, spalled and deteriorated sections of curb with “in-kind” materials and configurations as the intent of the original design.
 - Replace curb sections to conform to PennDOT standards for the type of curbing; and ensure that the section type matches the adjacent curb and gutter.

- Base-Drain System:
 - Ensure that the roadway and structure base-drain system is free from silt deposits, clogs and other defects that would impede the system from functioning as designed.

- Erosion Control Systems:
 - Maintain, clean, repair, restore, replace and monitor all of the temporary and permanent erosion control features and systems within the Project.

- Stormwater Management Basins:
 - Remove and clean debris, dams and all other obstructions from the outlet structures.
 - Restore, repair and stabilize basin embankments that have eroded, scoured and/or slumped, or have the potential to do so if not remedied.
 - Restore and maintain the full storage capacity of the stormwater management basins within the Project.
 - Dispose of waste materials from cleaning operations in a manner and location that is in full compliance with all Local and State Laws and regulations.

- Pipe Drainage Systems
 - Ensure that pipes are clean and functioning to full capacity.
 - Evaluate abrasion in pipes to determine the need for liners or replacement.
 - Inspect visually, or by camera, all pipe and pipe connections to determine that infiltration is not occurring or flows are diverting out of the pipe at joints.

- Insure that inlets and outlets have adequate velocity protection and grates are provided to prevent debris from entering the pipe and causing clogging.

- Culvert Systems
 - Ensure that culverts function in accordance with approved drainage studies, and plans.
 - Evaluate exposed culvert walls and roofs to determine if adequate cover remains for reinforcement or coatings on metal are adequate for corrosion or abrasion protection.
 - Inspect joints to determine if sections are shifting, infiltration of solids is occurring, or diversions of flows outside of the culvert barrel exist.
 - Insure inlets and outlets have adequate velocity protection to prevent debris from entering the culvert and causing clogging.
 - Evaluate upstream and downstream conditions for free flow. Be especially aware of fences which may impede flows.
 - Be aware of cracks and patterns of cracks which may be indicators of serious structural deficiencies.
 - Evaluate and maintain roadway protection devices to comply with Federal and State Safety standards, and insure errant vehicles do not end up in creeks and streams passing through culverts.

D.3.3. *Performance Time Frames*

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, to the time when the Development Entity must have completed the required cleaning, adjustment, repair or replacement of the deficient element or component to full operation (unless weather conditions limit material application):

Item	Maximum Time Duration
<u>Roadway Drainage System:</u>	
- Frames & Grates	48 Hours
- Structures	30 Days
- Pipes & Conduits	30 Days
<u>Structure/Parking Facility Drainage System</u>	48 Hours
Curb	60 Days
Concrete Median	Damage to structural integrity integrity or stability 24 hours; non-structural damage 30 days.
Ditches	60 Days
Storm, Side and Cross Drain Cleaning	2 times per year
<u>Base-Drain System:</u>	
- Roadway	45 Days
- Bridge	30 Days
<u>Erosion Control System:</u>	
- Temporary	24 Hours
- Permanent	60 Days
Stormwater Management Basins	24 Hours (Temporary); 60 Days (Permanent)
<u>Drainage Pipes</u>	
- Blockage	12 Hours
- Inlet or Outlet Failure	48 Hours
- Functional Failure	30 Days
<u>Culverts</u>	
- Blockage	12 Hours
- Inlet or Outlet Failure	48 Hours
- Functional Failure	30 Days

D.3.4. *Acceptance Criteria*

All roadway and structure drainage systems, ditches, curb, base-drain, and erosion control systems will be considered acceptable when the following criteria are met or exceeded:

- All Roadway and Structure Drainage Systems including base-drains are maintained unblocked and function as designed to keep roadway and structure surfaces free of standing water.
- Missing, broken or unsecured grates and frames and other castings are promptly repaired and/or replaced.
- Curb is maintained free of litter and debris; all damaged and deteriorated curb has been repaired or replaced; and all work conforms to the requirements of this Chapter and the Reference Documents.
- Design, construction, backfill, repair and replacement of drainage structures and system components in conformance with the requirements of the applicable Reference Documents.
- Roadside ditches are maintained free of debris, litter and excess vegetation, and function as designed to collect and transport storm water runoff to designated outfalls.
- Permanent erosion control systems are maintained in order to function as designed and any repair, replacement, and cleaning of trapped sediment from system components is performed when required.
- Permanent and temporary erosion control systems are adequately designed, properly installed, serviced, and removed as appropriate in order to fulfill their design intent; and to meet all applicable requirements of the Commonwealth and the NPDES.
- All Stormwater Management Basins are maintained unblocked, free of debris, and function as designed to manage storm water runoff as designed.
- Drainage pipes are free of debris such that under headwall control, the pipe can flow full.
- Drainage pipes that are partially filled in due to upstream and downstream sedimentation need not be cleaned below the upstream bed elevation. Downstream evaluations must be made to determine if pipe extensions are necessary or removal of fallen trees is required to allow normal exit flows.
- Drain pipes must be free of infiltration that would cause subsidence of roadway or embankments. Drain pipe joints are to be tight and aligned to create laminar water flows and reduce trapping of solid objects that might flow through the pipe.
- Drain pipes are to have intact bottoms and functioning inlet and outlet aprons or devices that direct flows through the pipe as opposed to under the pipe.
- Culverts must be maintained considering needs for both low flow and storm flow. The primary opening of a culvert is to be maintained free of debris such that under headwall control, the culvert can flow full.
- Multiple cell culverts are to be maintained open in accordance with FEMA and "Pennsylvania Act 167 Watershed Studies".

- Culvert joints are to be maintained such that infiltration does not occur that would cause subsidence of the roadway above or undermining of the culvert below.
- Upstream and downstream aprons, wingwalls and scour control measures are to be maintained such that headwall and endwalls are not undermined, stream flows are directed to established channels, and joints in culvert segments do not “open up”.
- Culverts over 8 foot in span must be maintained adequately to carry both flood flows and support roadway and fill above. Adequate maintenance requires a Licensed Professional Engineer in the Commonwealth of Pennsylvania will state the culverts structural capacity is adequate.

D.4. Additional Requirements

D.4.1. Drainage Frames and Grates

Missing, broken or fractured frames, rims and grates on drainage structures must be replaced promptly when detected by or reported to the Development Entity. Rims and grates must be replaced with devices having the appropriate size and thickness, and made of appropriate materials. The Development Entity should order in advance and have on hand a sufficient number of replacement parts to make repairs when required. To the greatest extent possible, the Development Entity must use iron castings that are legibly stamped to identify ownership and identification of the utility.

D.4.2. Drainage Structures

The Development Entity must inspect all drainage structures such as inlets, manholes and catch basins, and repair all defective components. Particular attention must be given to the following:

- Inlets, manholes or catch basins that are blocked due to cracking, an infall or collapse of their adjusting rings, masonry units, or precast barrel sections.
- Failed or subsided roadway or shoulder pavement at drainage structures, attributable to a partial failure or collapse of the drainage structure. This deficiency must be promptly repaired to avoid safety hazards, prevent growth of the localized pavement failure due to impact pounding, stop water infiltration, and avoid loss of the pavement subbase and subgrade.

When these above conditions arise, the Development Entity must not patch or repair the failed pavement or shoulder without first making a thorough inspection of the condition of the drainage structure.

After the drainage structure has been repaired, rehabilitated or reconstructed, the damaged pavement and/or shoulder must be replaced with a full-depth patch. Pavement patches must be constructed in accordance with the requirements of Volume I, Chapter B, "Roadway Maintenance". In addition, pavements, shoulders and berms must be correctly sloped after the repairs, and must properly drain storm water runoff away from the pavement and into the intended inlet structure without ponding.

Whenever a full depth patch is constructed at a drainage structure, the work must be done in accordance with the PennDOT Publication 72M: "Roadway Construction Standards".

D.4.3. *Drainage Pipes and Conduits*

The Development Entity must inspect all drainage pipes and conduits within the Project such as storm sewers, cross pipes, and culverts, and must perform the necessary maintenance work or repairs. Particular attention must be given to the following:

- Whenever pavement flooding, icing, washout of underlying soil layers, frost heave, or other situations indicate that there is a collapse or blockage of drainage pipe or conduit.

Blocked or collapsed pipes and conduits must not be allowed to cause local area flooding, embankment undermining, movement of structural foundations, or other failures. The Development Entity must evaluate all pavement defects where underlying slabs have apparently heaved or settled, all instances of heavily fractured or subsided pavement, all off-roadway sinkholes or areas of sudden subsidence, and all rotated or shifted structural walls and foundations in order to determine if a collapsed underground conduit is responsible.

When replacing any failed pipe or conduit, the Development Entity must maintain and restore all connections, outlets, taps, and the like during the work.

When the collapse, blockage or failure of any drainage pipe or conduit results in incidental damage to any other element of the Project infrastructure, the Development Entity is responsible for repairing those elements within the timeframe noted in Section D.3.3 of this Chapter.

- The Development Entity must inspect all culverts, pipe ends, outfalls, headwalls, end-sections and associated devices and perform the necessary maintenance repairs.

Headwalls end-sections and end-grates that have suffered damage, either due to traffic impact, corrosion, excessive loading, settlement, etc. must be repaired to restore full functionality or must be replaced if repair would be impracticable.

D.4.4. *Drainage Culverts*

The Development Entity must inspect all culverts conveying water or with the potential to convey water in accordance with requirements of Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports” Adequate inspection and documentation must be provided to maintain PennDOT BMS and FHWA data bases. Particular attention must be given to the following:

- Culverts requiring inspection are more than 8 foot in span and may be single cell or multiple cells.
- Culverts are to be numbered in accordance with the Project Structure element and milepost naming convention.
- Inspection requirements can be found in PennDOT Publication 238 Bridge Safety Inspection Manual, “Chapter 2.5 and 2.6”; and in Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports.”

- If inspection should reveal collapse, or near term expectation of collapse, creating a significant impact to the patrons, the Development Entity is to notify the Department in accordance with the requirements stated in Volume I, Chapter J, “Third Party Damages and Emergency Maintenance”.
- Culverts inlets and outlets, along with culverts with open bottoms, must be evaluated for scour.
- Culverts which are near the roadway surface or directly support the roadway pavement must be evaluated relative to safety features such as Guide Rail, Barrier or Parapet. Such safety devices must be anchored properly to deflect vehicles away from creeks and streams. Such devices must have proper transitions along the roadway for safe vehicular operation.

D.4.5. *Structure Drainage Systems and Downspouts*

The Development Entity must inspect Structure Drainage Systems including scuppers, deck drains, and downspouts, and must clean these components; repair damaged components; and replace missing or broken elements of the systems. The Development Entity must pay particular attention to the following deficiencies:

- Broken, missing, fractured and leaking scuppers and grates; broken grout around scuppers; defective or leaking pipe connections; and similar deficiencies.
- Blocked or clogged bridge downspouts, particularly following construction or maintenance activities that may have caused debris to accumulate.
- Loose, unattached or severely leaking bridge downspouts that can cause erosion, flooding, or a falling debris hazard.

Replacement parts for Structure Drainage Systems must be equivalent to the existing drain size or diameter, material type, wall thickness, and material strength, and/or must be painted to match the rest of the system as appropriate. The paint system must conform to the Reference Documents noted in Section D.2 of this Chapter. Whenever practicable, cleanouts must be installed on older downspouts to aid future maintenance efforts.

- When the Bridge Drainage System outlets onto the ground, the Development Entity must examine the condition of the outlet and perform all required repairs. Defects to examine include loss of riprap protection, soil erosion and water accumulations, etc.

D.4.6. *Stormwater Management Basins*

The Development Entity must inspect all Project stormwater management basins, and must pay Particular attention to the following deficiencies:

- Stormwater management basin embankment slopes that show erosion or undercutting at inflow or outflow points. Severely eroded or undercut slopes must be repaired to avoid potential failure or movement of the slope and possible undermining of the Project roadway.

Correction of eroded or undercut embankment slopes is required when the slope is measured to be 25% steeper than the undisturbed slope, or steeper. Undercut slopes must be evaluated and calculated based upon a professional survey.

The placing of embankment material to build up undercut slopes is to be done in accordance with the requirements of the Reference Documents noted in Section D.2 of this Chapter. The Development Entity must protect the newly constructed embankment from erosion by placing erosion control blanket, temporary seed and mulch, sod, or other measures.

The embankment repair must not restrict the stormwater management basin cross section as designed, alter the low flow profile, or block existing legal discharges into the Project from neighboring lands.

- The integrity of the basin structures must be maintained to ensure the basins function as designed. The Development Entity must restore, reset, and stabilize concrete riser structures or standpipes as designed when shifting or undermining of the structures has occurred.
- Sediment and debris that collects within stormwater management basins reduce the storage volume available for storm water runoff. The Development Entity must remove trash and debris periodically to prevent clogging of the outlet structures. Sediment must be removed a minimum of every 5 years, or as needed to ensure the basins design storage operates as designed and retains its intended capacity.

D.4.7. *Roadway and Roadside Ditches*

The Development Entity must inspect all open drainage channels including ditches and swales, as well as their associated erosion control devices, and must pay particular attention to the following deficiencies:

- Earth ditches that cannot convey design storm water flows due to soil settlement, erosion, embankment sloughing, sediment accumulation, etc. must be evaluated. Ditch re-grading may be required in order to restore a constant and uniform slope in accordance with the original design intent. Re-grading to eliminate channel pinch points or flat sloped sections may be required to reduce flooding, ponding and deposited sediments while enhancing free flow.

Bare soil must be reseeded to re-establish vegetative cover and prevent erosion. When appropriate, temporary erosion control measures such as mulch or erosion control blankets must be used while the grass seed is being established.

D.4.8. *Curb*

The Development Entity must maintain bituminous and concrete curb as an important part of the overall Drainage System, since they collect storm water runoff, convey runoff to sewer inlets or designed outfall points, and protect embankments from erosion. Curb also serves as a structural support for the shoulder, provides delineation of the edge of the traveled way, and can help redirect errant vehicles.

The Development Entity is responsible for making repairs and replacement of segments of bituminous and concrete curb that are deficient due to excessive break up, settlement or heave. The Development Entity must remove and replace, or otherwise repair segments of bituminous and concrete curb that show extensive cracking, open transverse cracks, missing expansion joint filler, or spalls. All broken bituminous and concrete must be properly disposed of in conformance with all laws and regulations.

Replacement of curb must conform to PennDOT standard details and the neighboring sections of curb. The gutter elevation and grades of the replacement curb must be flush with the adjoining pavement or shoulder, and must be set to convey flows to drainage structures without ponding.

The Development Entity must restore and stabilize base support when this has been identified as the cause of bituminous and concrete curb cracking. The Development Entity must regrade the earth berm behind the curb when erosion or settlement results in the earth surface settling three (3) inches below the top of curb at any location.

Missing expansion joint filler must be replaced with new preformed joint filler conforming to the material requirements of the Reference Documents noted in Section D.2 of this Chapter.

D.4.9. *Pavement and Structure Base-Drain Systems*

All base-drains and their associated outlet pipes must be in accordance with the requirements of the Reference Documents noted in Section D.2 of this Chapter. Structure base-drains including abutment back wall pipes and outlets or weep holes must be inspected to ensure that discharge is free-flowing, and that no outlet is clogged or crushed.

Pavement base-drains must be inspected to assure that they are functioning, and to verify free-flow and unobstructed discharge.

New installations of pavement base-drain must be considered in areas where pavement surface distress, surface blowups, excessive potholing, or other signs indicate that subsurface drainage would tend to reduce pavement maintenance needs. All new base-drain must conform to the requirements of the Reference Documents noted in Section D.2 of this Chapter.

D.4.10. *Permanent Erosion Control Systems*

The purpose of permanent erosion control measures and systems is to minimize or eliminate the erosion of soil into ditches, drainage systems and Waters of the Commonwealth. The objective of permanent erosion control repairs and maintenance is to prevent topsoil loss, maintain turf cover to anchor the soil and prevent erosion, and to ensure conformance with all applicable laws and regulations.

When a new permanent erosion control system is required, the Development Entity must perform all design, agency coordination and construction in order to obtain the necessary permits and approvals.

The Development Entity's Pennsylvania Licensed Professional Engineer should perform a thorough review of available permanent erosion control systems and their correct application given the anticipated water flow volumes and velocities, prevailing wind patterns and other specific field conditions.

Erosion and sediment control measures to be considered include new roadside ditches, riprap, ditch checks and settling basins.

D.4.11. Temporary Erosion Control Systems

The purpose of temporary erosion control measures and systems is to minimize or eliminate the loss of topsoil during construction and maintenance projects.

The Development Entity must implement the appropriate level of erosion control throughout all construction and maintenance activities. The Development Entity's erosion control for construction and maintenance operations must comply with all applicable State and Federal laws and regulations, and municipal ordinances. In order to so comply, the Development Entity must plan to control the amount, location and quality of discharges from its work sites into sewers, culverts, wetlands, streams, channels, and public waters or onto adjacent properties. When required for compliance with agency requirements, the Development Entity must perform studies, submit permit applications, create detail drawings, prepare specifications, attend meetings, etc.

To ensure that temporary erosion control measures are furnished when needed, the Development Entity must screen all construction or maintenance projects for erosion impacts. The screening must identify if the following potential impacts may occur:

- The operations will temporarily or permanently alter the manner of discharge of any waters outside the Project.
- The operations have the potential to convey topsoil from the Project into any drainage system, stream or channel.

Whenever the above potential impacts are identified, the preparation and filing of a written "Erosion and Sediment Control Plan" may be required for agency compliance.

Temporary erosion control measures and systems that may be considered for implementation include filter fabric fence, silt socks, inlet protection, erosion control blankets, rock filters, temporary seeding, mulching, sediment traps, sediment basins, sediment filter bags, rock construction entrances, outlet protection, etc.

D.4.12. *Creek and Stream Requirements*

The Development Entity is responsible for the wellbeing of waters flowing along or across the Project. In the operation of the Project both manmade and natural occurrences relative to creeks and streams can occur that require proactive measures by the Development Entity. Natural erosion can be detrimental to the Project. Emergency situations and Accidents on the Project roadways can severely impact creeks and streams. The Development Entity may be required to do the following as part of maintenance for creeks and streams within Projects:

- Evaluate toe of slope adjacent to creeks and streams to determine if mitigation measures are necessary to prevent loss of slope supporting roadways.
- In limestone prone areas determine if counter measures are necessary to prevent sinkholes from forming under the roadway. Countermeasures may take the form of impervious linings for streams or creeks. Such linings presently exist in local areas and require periodic review and maintenance.
- Periodically evaluate streams and creeks to determine if diversion ditches or stone lined swales are necessary to divert drainage which has migrated to the top of slopes above roadways.
- In mountainous areas, maintain drains at natural springs and seeps that can cause slope erosion or ice formation which can be hazardous to the roadway below.
- Develop emergency plans for containment of spills of solids or liquids carried over or under Project roadways. Such emergency plans should utilize storm water management basins, pipes and culverts as much as possible to contain contaminants in a confined area until they can be collected and disposed of properly. Emergency plans for spills should focus on containment in as small of an area as practical with due consideration to the safety of first responders.

D.4.13. *Emergency Inspections*

Emergency inspections are required following rainfall or snow events in which rapid runoff may occur that can be detrimental to either the Project or adjacent property owners. Such events should be focused relative to watersheds and drainage courses that are parts of said watersheds. The Development Entity must maintain an awareness of public and private agencies which historically provide the most accurate information relative to rainfall intensity, snow melt, and other meteorological measures that can indicate creeks and streams are rising above their banks. During such events Development Entity must safely view pipes and culverts to determine that they are functioning properly, or determine that either corrective action are necessary which may involve the pipe or culvert or temporary closure of a road segment or direction.

Following major storm events, Project areas where rainfall or snow melt exceeds the equivalent of 2 inches per hour, inspections of creeks and streams are to be performed when they pass parallel to or under the Project. These inspections must be undertaken to determine if any elements of the Project operation should be adjusted by examining the following:

- Determine if any creeks or streams have changed course resulting in erosion of embankments.
- Determine if any failures of storm water detention ponds have occurred.
- Determine if debris has clogged the opening of a drainage pipe or culvert causing backwater build up that could cause significant property damage to upstream properties, or impound a significant body of water that could cause a downstream wash out.
- Determine if creeks or streams are flowing around as opposed to through pipes or culverts intended to convey water alongside or under the Project.
- Determine if debris in the form of trees, tree limbs, ice or other solid objects are significantly blocking inlets to pipes or culverts creating high velocities that can cause failure from scour action.
- Head walls and end walls must be viewed to determine if they are submerged, and if velocities are bypassing scour protection devices.
- For culverts make similar determinations as to pipes when only one barrel is associated with the culvert. For multi-cell culverts determine if primary flows are through the intended barrel. In addition, determine if the other barrels are taking water according to expected water surface elevations.

TABLE OF CONTENTS

E. ROUTINE MAINTENANCE

Section	Page
E.1. Definitions	2
E.2. References	3
E.3. Policy for Performing Routine Maintenance	4
E.3.1. <i>Objective</i>	4
E.3.2. <i>Responsibility of Development Entity</i>	4
E.3.3. <i>Performance Time Frames</i>	6
E.3.4. <i>Acceptance Criteria</i>	7
E.4. Additional Requirements	12
E.4.1. <i>Roadside Litter Collection & Removal</i>	12
E.4.2. <i>Litter Receptacles</i>	12
E.4.3. <i>Reporting Illegal Dumping</i>	13
E.4.4. <i>Weed Control</i>	13
E.4.5. <i>Nuisance Vegetation Control</i>	13
E.4.6. <i>Required Measures for Using General Use Chemicals</i>	13
E.4.7. <i>Required Measures for Using Restricted-Use Landscape Chemicals</i>	14
E.4.8. <i>Burning</i>	14
E.4.9. <i>New and Replacement Plantings</i>	14
E.4.10. <i>Turf</i>	14
E.4.11. <i>Trees and Shrubs</i>	14
E.4.12. <i>Fences</i>	16

E.1. Definitions

Bagged & Burlapped Stock: A plant transplanted with the root ball secured in burlap. Balled Stock: A plant transplanted with its roots in a ball of earth.

Deciduous: Trees or woody shrubs which lose their leaves after each growing season.

Debris: Litter, rubbish, nuisance or dead vegetation, rocks, dead animals, spilled (nonhazardous) materials, brush, or other such items.

Defect: A deficiency in design, workmanship, and/or in the materials or systems used on a project that results in a failure of a component part of a building or structure and causes financial or physical damage to person or property.

Erosion: A wearing away of the surface by natural action of wind and water.

Fencing: Fabric, posts, gates, guy wires and braces configured to create a boundary or provide access control.

General Use Chemicals: Agents used to destroy pests and plant growth that will not cause unreasonable effects to the Patron or the environment when used in accordance with their registered labeling instructions. These products are generally available to the public without restrictions other than those specified on the labeling.

Herbicide: An agent used to destroy or inhibit plant growth.

Landscaping: All vegetation, including turf and grasses, trees, intentional plantings, as well as incidental items including block walls, planter boxes, planting beds, lawn edging, street furniture and irrigation sprinkler systems.

Litter: Trash, debris, waste, refuse, accident and construction residue, etc.

Noxious Weeds: Uncultivated plant growth that is harmful or destructive to other plant growth.

Nuisance Vegetation: Large types of weeds, and vegetation not desirable to the Landscape. Examples include medium height shrubs, vines and brush such as buckthorn, honeysuckle, kudzu, purple loosestrife, multiflora rose and leafy spurge.

Pesticides: Agents used to destroy insects, rodents and other pests.

Restricted Use Chemicals: Agents used to destroy pests and plant growth governed by Local, State and Federal regulations that require special training and/or licensing.

Systemic: Passing through and affecting the whole body of the plant system.

Turf: Surface earth ground cover containing a dense growth of grass and matted roots. Weeds: Uncultivated plant growth. Examples include crabgrass, dandelions, etc.

E.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 13M: “Design Manual Part 2 - Highway Design”, PennDOT.
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 72M: “Roadway Construction Standards”, PennDOT.
- Publication 324: “Agricultural Resource Handbook”, PennDOT.
- Publication 325: “Wetland Resource Handbook”, PennDOT.
- Publication 408: “Specifications”, PennDOT.
- Publication 461: “Roadside Planting Guidebook”, PennDOT.
- Publication 581: “Highway Beautification Manual”, PennDOT.
- “Strike Off Letters”, PennDOT.
- “A Policy on Geometric Design of Highways and Streets”, AASHTO.
- “Illegal Dumping Prevention Guidebook, EPA905-B-97-001”, USEPA.
- Pennsylvania Department of Agriculture Website, “www.agriculture.state.pa.us”.
- “ANSI A300 - Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance: Standard Practices”, ANSI.
- “American Standard of Nursery Stock”, AAN.

E.3. Policy for Performing Routine Maintenance

E.3.1. Objective

The objective of Routine Maintenance is to provide a safe, clean, welcoming and acceptable environment for patrons to access the Project.

E.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices to ensure that Routine Maintenance is completed in a regular, systematic and timely manner to ensure the safe and orderly movement of traffic and to meet the safety and aesthetic of the Project. This requires that the Development Entity carry out its obligations in a manner that maintains and/or improves the overall Project.

All materials and construction requirements for Routine Maintenance work performed by the Development Entity must conform to the appropriate and applicable requirements of the Department, and the Reference Documents noted in Section E.2 of this Chapter.

The Development Entity must make routine inspections part of its daily activities, and must be watchful for obstructions, locations of illegal dumping, damage to fencing, full and overflowing litter receptacles, and all other situations that detract from a neat and tidy appearance of the Project.

Work within the Project that must be performed by the Development Entity includes the following:

- Landscape:
 - Mow, trim and edge turf areas.
 - Repair and / or replace all damaged, diseased, dead and worn turf areas.
 - Aerate turf areas.
 - Water landscaped areas so that healthy plant life is maintained.
 - Control and remove weeds, insects, pests and diseases in plants, trees, shrubs and turf areas.
 - Keep all portions of the parking facilities, traveled lanes, shoulders, curbs, gutters, drainage structures, sidewalks, and bridges free of plant growth, and vegetation waste.
 - Fertilize plants, trees, shrubs and turf areas.
 - Mulch around plants, trees and shrubs.
 - Obtain, hold, and keep current all licenses required for the use of General Use and Restricted Use Chemicals.
 - Assure that all employees utilizing General Use and Restricted Use Chemicals are properly trained and licensed as required by Law.
 - Recognize, diagnose, and take measures to control all insects, rodents and other pests.
 - Apply General Use and Restricted Use Chemicals in a manner so as to prevent spray-drift and encroachment into non-target areas.
 - Properly remove and dispose of landscape control cuttings that represent a hazard, obstruct drainage or create a nuisance.

- Ensure that all trees and shrubs are pruned neatly and are maintained in a manner to minimize danger to Patrons, or which pose a threat to adjacent lands.
 - Remove vegetation that causes sight distance obstructions; obscures the visibility of signs, delineators, or other roadside features; constitutes noxious or nuisance weeds; or impedes drainage.
 - Remove all dead, damaged, overhanging and unstable trees and tree limbs.
 - Replace all dead and damaged plantings and trees.
 - Inspect health and growth of all plants, shrubs and plants.
 - Ensure that all equipment used for landscaping conforms and is operated in compliance with all applicable State and Federal requirements and Laws.

 - Litter & Debris Control:
 - Remove debris and litter from the entire Project
 - Empty litter receptacles.
 - Remove, dispose of and report all illegal dumping.

 - Fencing:
 - Repair or replace all damaged or deficient fencing or its components as a result of: motor vehicle collisions; rust, normal wear and weather damages; acts of vandalism; fallen trees; embankment shifts; fires and other occurrences.

 - Irrigation:
 - Repair or replace all damaged or deficient irrigation, sprinkler heads, controllers, pumps and their components.
 - Drain elements of the irrigation systems so as to prevent damage from freezing during the cold weather months. In addition, seasonal maintenance shall be performed pursuant to the requirements stated in the Irrigation System Operation and Maintenance Manuals.

 - Snow & Ice Removal:
 - Snow
 - Snow accumulation shall be removed from Station Platforms, walkways, roadways, and parking facilities before the accumulation is more than 1 inch, or within 4 hours of end of snow event for accumulation less than 1 inch. Development Entity shall implement and abide by the Borough regulations and approved cleaning plan when responding to severe weather conditions.
 - Ice
 - Ice buildup shall be prevented from Station Platforms, walkways, roadways, parking facilities and outside maintenance access points.
 - Development Entity shall prevent ice buildup and snow accumulation from the public roadways specified in Table E.3.3.2 of these Technical Provisions and per Borough regulations .

 - Inspections:
-

- Daily
 - Conduct all physical removal of dirt, soot, stains, marks, liquids and materials that come in contact with floors, walls, doors, windows, furniture and other Project components.
 - Repair any broken or malfunctioning floors, walls, doors, windows, furniture and other Project components.
 - Responsible for identifying the Defect and performing remedial actions in accordance with the Custodial Maintenance Standard and the timeframes established in the Performance Indicators. Notwithstanding, the Defect, timelines and remedial actions identified, prevailing legislation and City by-laws shall take precedence if they are more restrictive.
 - Immediately clean or repair any Station Defect that affects the Safety of the public or the employees of Development Entity in accordance with the Custodial Maintenance Standard.
- Weekly
 - All wayfinding and site signage shall be inspected for damage, graffiti, loose attachments and or replacement on a weekly basis for the Project.
 - Conduct weekly heavy cleaning of interior and frequented areas in accordance with the Custodial Maintenance Standard.
- Annually
 - Conduct bi-annual heavy cleaning in accordance with the Bi-Annual Custodial Maintenance Standard.

E.3.3. Performance Time Frames

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required maintenance, repair or replacement to the feature.

TABLE E.3.3.1

Feature	Maximum Time Duration
<u>Landscape:</u>	
- Sight Distance Obstruction	2 Hours
- Vegetative Waste	24 Hours
- Trees	7 Days
- Tree Trimming	Once per year
- Plants, Shrubs, Flowers, Turf	14 Days
- Seeding, Fertilizing, Mulching	Once per year
- Chemical Weed/Vegetation Control	Bi-monthly (April 1 st – October 31 st)

<u>Litter:</u> - Illegal Dumping - Roadway Litter Removal - Parking Lot Litter Removal	2 times per week 2 times per week 3 times per week
<u>Fencing:</u> - Temporary Repairs - Permanent Repairs	24 Hours 30 Days
<u>Irrigation System(s)</u>	7 Days

The following table establishes the minimum frequency that a particular maintenance operation is to be performed.

TABLE E.3.3.2.

Maintenance to be Performed	Minimum Frequency of Occurrence
<u>Landscape:</u> - Removal of Nuisance Vegetation/Pruning	Monthly (April 1 st – October 31 st)
<u>Mowing:</u> - Large Machine Mowing - Small Machine Mowing/Trimming - Retention Basin and Slope Mowing	Weekly (April 1 st to October 31 st) Weekly (April 1 st to October 31 st) Monthly (April 1 st to October 31 st)
<u>Litter Control:</u> - Project Litter Collection - Emptying of Litter Receptacles	3 times per week Every Day
<u>Ice and Snow:</u> - Snow Removal - Ice Removal	Within 4 hours of end of snow event or prior to reaching 1” of accumulation. Ice buildup shall be prevented

The Development Entity also must:

- Aerate all turf areas once yearly; recommended in the autumn.
- Establish a mowing frequency so that the criteria established in Table E.3.3.2 above is maintained.
- Cut and remove weeds and nuisance vegetation prior to reseeding.
- Trim trees and shrubs to ensure visibility, to prevent shading of signs and safety devices, and/or when less than seventeen (17) feet of vertical clearance above the traveled way and shoulder is not provided.
- Pressurize and test irrigation system(s) (recommended in spring), and winterize (recommended in fall) all lines once annually.
- All trash receptacles located within the boundaries of the Project will be kept clean of trash/garbage so that the criteria established in Table E.3.3.2 above is maintained. This will include a comprehensive site inspection and removal/disposal of all loose trash.
- The Project will be inspected on a weekly basis to determine, based on weather conditions, the need to maintain the lawn areas and onsite landscaping. This shall include cutting of lawns, weed control, maintaining of trees and shrubbery from pest invasion and overgrowth.
- Every three (3) months the Project will be inspected for painting upgrades and graffiti removal
- The Project will be cleared of snow and ice per Borough regulations and kept free and clear of any snow and ice during and after such events occur.
- Once a month all fixed site and facility lighting fixtures will be inspected and re-lamped (if required).
- Stations shall fail to meet the Custodial Maintenance Standard if:
 - Any condition exists that impacts Public Safety or the Safety of the employees of Development Entity and the City or fails to comply with the Safety Management System, including:
 - any accidental spills or bodily fluids;
 - floor treatments that represent a tripping hazard
 - free from any unsafe accumulation of ice and snow, and for clarity accumulation of ice and snow shall be deemed to be "unsafe" if not in compliance with the Snow and Ice Clearing Standards, including safe access to all areas of the buildings and facilities;
 - illumination and *I* or lighting levels are not in compliance with Schedule 15-2; or benchmarking levels as otherwise determined prior to Revenue Service; and
 - Any damage as a result of vandalism and/or graffiti has not been repaired as required and specified elsewhere.
 - Any of the subsequent time-dependent standards are violated
- Daily Custodial Maintenance Standard
 - Stations under Development Entity's responsibility shall meet the Custodial

Maintenance Standard if the following conditions exist after daily cleaning activities:

- All trash and debris has been removed and disposed of; and
- General cleaning of high Passenger frequented areas has occurred These general cleaning activities include washing floors and cleaning station furniture as needed
- Weekly Custodial Maintenance Standard
 - Stations under Development Entity's responsibility shall meet the Weekly Custodial Maintenance Standard if the following conditions exist after heavy cleaning activities have occurred weekly (or more frequently as required):
 - Station floors are washed;
 - all Station surfaces are dusted and cleaned; and
 - gum, scuff marks and other similar semi-permanent markings have been removed inside windows are clean.
- Bi-Annual Custodial Maintenance Standard
 - Buildings and facilities under Development Entity's responsibility shall meet the Bi-Annual Custodial Maintenance Standard if the following conditions exist after bi-annual cleaning activities have occurred:
 - Windows, floors and exterior surfaces are thoroughly cleaned; and
 - Damaged surface treatments have been painted, repaired, or replaced as needed
- Access Standard
 - The Station shall be open and in compliance with the Access Standard at least 15 minutes before the first scheduled Amtrak train, and closed within 15 minutes after the last scheduled Amtrak train or as otherwise directed.
 - The Station is considered to meet the Access Standard if:
 - All entrances to the Station are open and Passengers have access to the Passenger waiting areas in the Station;
 - The Station platform is accessible from each Station entrance, via: (i) elevator; or (ii) alternate means of vertical transportation within 100 ft. of the Station entrance;
 - The Station is free from any unsafe accumulation of ice and snow, and for clarity accumulation of ice and snow shall be deemed to be "unsafe" only if: (1) the Station is not in compliance with the Snow and Ice Clearing Standard and (2) safe access to Trains for all Passengers, including mobility impaired Passengers, is compromised;
 - The Station is free from any other hazard or event that results in Passengers, including mobility impaired Passengers, being unable to safely enter and leave the Station for purposes of accessing Trains, for example, failures with fire life safety systems; and
 - During any period of time when a Station does not meet the Access Standard due to non-compliance with one or more of the standards listed

above in subsections, The Development Entity shall make best efforts to mitigate the effects of such non-compliance and to provide, where possible, safe access to Trains for as many Passengers as possible.

E.3.4. *Acceptance Criteria*

The Routine Maintenance will be considered acceptable when the following criteria are met or exceeded:

- Landscape:
 - Turf height does not exceed that specified in PennDOT Publication 408.
 - Turf, flowers, shrubs and all plant life are trimmed, edged, pruned, disease and pest free, fertilized, watered and healthy.
 - Turf is free from brown-patches, missing-patches and damage.
 - No sight distance obstructions from trees and vegetation are present.
 - Trees are trimmed, and free from dangerous, damaged and overhanging limbs.
 - Landscape is free from weeds and nuisance vegetation.
 - All portions of the parking facilities, traveled lanes, shoulders, curbs, gutters, bridges, drainage structures, and sidewalks are free of plant growth and vegetation waste.
 - No areas outside the target areas show chemical damage.
- Litter:
 - Project is free from litter, and in a neat and tidy condition.
 - Litter receptacles are emptied at a rate that meets that stated in Table E.3.3.2.
 - Locations of illegal dumping are not present.
- Fencing:
 - Fence posts are plumb.
 - Top rails are level with no sags or deflections.
 - The fence fabric is taut and securely attached.
 - The fabric is free from holes, section loss, wear and vegetation.
 - The work site is left in a clean condition.
- Irrigation System:
 - All irrigation piping, sprinkler heads, controllers, pumps and their components must function properly, shall be unbroken and must not leak.
 - Water spray patterns must adequately cover the Specialty Landscape areas.
 - Winterizing and spring testing of system must be performed at the recommended times, in the prescribed manner.
- Custodial Maintenance:
 - The Development Entity shall immediately clean or repair any Defect that affects the Safety of the public or the employees of Development Entity and the Project Stakeholders in accordance with the Custodial Maintenance Standard

- The Development Entity shall conduct daily trash removal and general cleaning of frequented areas in accordance with the Daily Custodial Maintenance Standard.
- The Development Entity shall perform weekly heavy cleaning of interior and frequented areas in accordance with the Weekly Custodial Maintenance Standard
- The Development Entity shall conduct bi-annual heavy cleaning of floor surfaces in accordance with the Bi-Annual Custodial Maintenance Standard.
- The Development Entity shall maintain all Stations in a state of good repair and working order in accordance with the approved Corrective and Preventive Maintenance Plans.
- The Development Entity shall ensure Middletown Station is available as per the Access Standard
- Elevators shall be maintained in service and in accordance with Section E of these Technical Provisions

E.4. Additional Requirements

E.4.1. Litter Collection & Removal

The Development Entity must perform litter collection and removal within the Project at a frequency complying with that stated in Table E.3.3.2. For specific areas of the Project where litter is prone to collect, the frequency of litter collection should be increased so that the Project always remains in a clean and tidy condition.

The Development Entity's litter collection operations must be designed to minimize disturbance to patrons and to maximize safety for both patrons and maintenance crews at all times.

Litter must never be transferred to a spot outside Project for pickup.

Under no conditions will the Development Entity use water to flush litter onto adjacent property.

Litter bags should be carried in maintenance vehicles at all times, for use as needed.

All litter and refuse must be legally disposed of in accordance with all Federal, State and Local waste disposal laws and ordinances.

The requirements for pavement and shoulder sweeping are specified in Volume I, Chapter B, "Roadway Maintenance".

The Development Entity's response to accidental spills, release of hazardous materials, removal of large-scale debris, and similar situations are to be addressed as described in Volume II, Chapter K, "Emergency Management and Operations Plan".

The Development Entity's disposition of abandoned vehicles and breakdowns, animal removal, and repair of vandalism and graffiti is discussed in Volume I, Chapter J, "Third Party Damages & Emergency Maintenance".

E.4.2. Litter Receptacles

All receptacles located within the Project must be emptied at a frequency complying with that stated in Table E.3.3.2. Receptacles may be relocated and added only where adequate space is available and provisions have been made for safe entry and exit. In addition, new receptacles must closely match the color, type and size of existing receptacles in order to preserve a uniform appearance.

Emptying litter receptacles and trash/garbage collected from inside the facilities is addressed in Volume I, Chapter O, "Facility Maintenance".

E.4.3. *Reporting Illegal Dumping*

When incidents such as fly-dumping and unlawful trash disposal occur within the Project, the Development Entity must contact and file reports with the Borough and Pennsylvania State Police so that the location can be monitored.

E.4.4. *Weed Control*

Weeds must be eradicated within the Project. Updated lists of noxious plants recognized by Pennsylvania Noxious Weed Laws and other State legislation are available from the Pennsylvania Department of Agriculture's Bureau of Environmental Programs. The USDA Animal and Plant Health Inspection Service also publish a Federal Noxious Weed List.

E.4.5. *Nuisance Vegetation Control*

Nuisance vegetation that must be removed including vegetation which has taken root at locations such as turf areas, at the base of retaining walls, in shoulders, in clogged drainage grates, or along the fence lines. The Development Entity must completely remove all nuisance vegetation to the greatest extent possible, which shall include the root systems.

Nuisance vegetation must be removed so that it does not interfere with drainage, or the establishment of slope stabilizing turf and such vegetation does not lower the aesthetic appeal of the Project.

E.4.6. *Required Measures for Using General Use Chemicals*

The selection of General Use Chemicals used as herbicide types (contact, pre-emergent, systemic), specific manufacturer(s), application rates and times of day, variations for soil type and the time of year, etc. are the responsibility of the Development Entity and must be selected with regard to fulfilling the performance specifications.

Trees and shrubs that are killed or injured by over-application of herbicide must be replaced with similar plants.

The use of broad-spectrum herbicides on pavements, shoulders and sidewalks to control weeds growing through cracks and presenting an unsightly appearance is permitted.

The use of growth retardants or chemicals that reduce the growth rate in order to extend the periods between pruning, edging or mowing will not be permitted.

Weeds should be removed from turf areas where grass has been weakened by competition, but excessive use of weed killers on turf areas is discouraged.

The Development Entity is responsible for ensuring that all staff who apply General Use Chemicals within the Project are properly trained and licensed.

E.4.7. *Required Measures for Using Restricted-Use Landscape Chemicals*

The purchase, storage, transportation, disposal, application and conformance with all laws concerning Restricted-Use chemical compounds, including pesticides, herbicides, insecticides, fungicides and rodenticides is the Development Entity's responsibility.

The Development Entity is responsible for ensuring that all staff who apply Restricted-Use chemicals within the Project are properly trained and licensed as follows:

- All persons who apply Restricted-Use chemicals must be licensed as a Commercial Applicator by the Pennsylvania Department of Agriculture.
- The Pennsylvania Department of Public Health must certify and license any individual who applies pesticides in or on man-made structures for purposes including but not limited to bird control, rodent control, wood treatment and insect control.

E.4.8. *Burning*

Burning of select areas to control or eliminate weeds or nuisance vegetation is strictly prohibited. In addition, the Development Entity is prohibited from burning trash, refuse, litter, landscape waste, oil, grease, unused paint, or any other waste or chemical product.

E.4.9. *New and Replacement Plantings*

The Development Entity is responsible for ensuring that only healthy stock is used for new and replacement planting.

All plants must be healthy, shapely, and well rooted. Roots must show no evidence of having been stressed, restricted or deformed at any time. The stems or trunks of trees must show no signs of having been cut, broken, mutilated or restricted by plant ties or supports.

The Development Entity is prohibited from eliminating or choosing not to replace plantings without documented cause, or as a means to reduce the maintenance workload.

E.4.10. *Turf*

The Development Entity is responsible for maintaining all turf within the Project and must perform the necessary work to preserve its health and appearance, including but not limited to mowing, edging, applying landscaping chemicals and replacing all lost, diseased or dead turf and eroded topsoil in order to maintain proper grades and vegetative cover.

The Development Entity must evaluate the need for seeding, over-seeding or sodding in locations of disturbed, thin or weakened turf.

E.4.11. *Trees and Shrubs*

The Development Entity must perform maintenance to promote the growth of trees and shrubs. This work includes pruning, mulching, watering, fertilizing, removing and disposing, and replacing trees and shrubs with new plantings.

E.4.11.1. Inspections

The Development Entity must keep aware of damaged trees and limbs that may be a hazard to traffic, patrons, pedestrians, roadway appurtenances, electric utility lines, or adjacent property. Trees and limbs subject to such conditions must be inspected frequently to ensure they do not compromise safety.

The Development Entity must evaluate the shrubs along fence lines in order to provide a neat appearance.

E.4.11.2. Pruning

The Development Entity must prune growing trees and shrubs in order to maintain their structure and health, to maintain sight lines of visibility to prevent traffic and pedestrian hazards, to prevent damage to property, and to preserve the aesthetics of the landscaping.

Trees and shrubs too close to the Right-of-Way fence should be constrained. Such plantings must be thinned or removed if the plant spreads.

All tree and shrub pruning must be consistent with ANSI Standard A300, which includes guidelines for distances from trees to electrical and utility wires.

E.4.11.3. Mulching

Mulching around trees and shrubs with wood chips, green waste material, bark, straw or sheets of landscape fabric is required in order to conserve soil moisture, preserve a neat appearance to the landscaping, simplify mowing, and prevent weeds. Care must be taken to avoid excessive amounts of mulch, which may rot plant stems, and to use local products whenever possible to lower the chances of importing pests.

E.4.11.4. Fertilizing

The Development Entity must fertilize young trees to promote proper growth, and must apply fertilizer to trees and shrubs in order to maintain steady growth.

The Development Entity must not apply fertilizer in order to stimulate plant growth when underlying causes for lack of color or slow growth may be present. The Development Entity must inspect distressed plants for evidence of such underlying problems and take all necessary steps to cure the plant.

All fertilizer application methods and rates must be consistent with the current ANSI Standard A300.

E.4.12. *Fences*

The Development Entity is responsible for inspecting, maintaining and promptly repairing all fencing and its components.

Owners of private property fences bordering the Project must be promptly notified when their fences are in need of repair.

Fencing that has been damaged as a result of Third Party damages, must be repaired or replaced as required in Volume I, Chapter J, “Third Party Damages & Emergency Maintenance”. Fencing that has been vandalized must be repaired, reported to the Borough and Pennsylvania State Police and monitored.

TABLE OF CONTENTS

F. N/A

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

G. STRUCTURE MAINTENANCE

Section	Page
G.1. Definitions	2
G.2. References	6
G.3. Policy for Structure Maintenance	8
G.3.1. <i>Objective</i>	8
G.3.2. <i>Responsibility of Development Entity</i>	9
G.3.3. <i>Performance Time Frames</i>	14
G.3.4. <i>Acceptance Criteria</i>	16
G.4. Additional Requirements	23
G.4.1. <i>Clearance Requirements</i>	23
G.4.2. <i>Maintenance Inspections</i>	24
G.4.3. <i>Emergency Inspections</i>	24
G.4.4. <i>Mandated Structure Inspections & Reports</i>	24
G.4.5. <i>Decks and Wearing Surfaces</i>	26
G.4.6. <i>Railings and Parapets</i>	27
G.4.7. <i>Structure Joints</i>	27
G.4.8. <i>Superstructure and Substructure Elements</i>	28
G.4.9. <i>Minimum Design Life Requirements</i>	29
G.4.10. <i>Bearings</i>	29
G.4.11. <i>Painting</i>	29
G.4.12. <i>Structure Cleaning</i>	29
G.4.13. <i>Structure Accessories</i>	30

G.1. Definitions

Abutment: Earth retaining structures which support the superstructure at the beginning and end of a bridge.

Admixture: A substance added to a concrete mixture to produce a specific result.

Allowable Stress Design: A design method which computes stresses based on un-factored loads and compares such stresses to reduced allowable loads associated with structural materials. This method of design follows a “factor of safety” methodology.

Anchor Bolt: A threaded rod, including hardware, used for holding a mechanism or structure in place.

Approach Slab: A rigid pavement that resides on the roadway side of the structure joint that provides a transition element from the roadway to bridge.

Armor: A metal fitting installed to protect the underlying joint material.

Backwall: The component of the abutment usually starting at the bearing seat elevation acting as a retaining structure and support for the approach pavement.

Bearings: A mechanical support system which transmits the vertical loads of the Superstructure to the Substructure. Bearings are composed of steel, rubber, Teflon, etc., and are separated into two general categories:

- Fixed: Permitting only rotational movements.
- Expansion: Permitting longitudinal as well as rotational movements.

Bent: A line of columns built as a structural unit, transverse to the bridge and supporting the load of the Superstructure.

Bridge Management System (BMS): A system designed to optimize the use of available resources for the inspection, maintenance rehabilitation, and replacement of bridges in the State of Pennsylvania. BMS2 is a new Bridge Management system instituted in Pennsylvania in July of 2007. BMS2 uses CoRe data and is compatible with the PONTIS bridge management program.

Bridge: A structure consisting of single or multiple spans more than 20 feet in length that provides a means of transit for vehicles and/or pedestrians above the land, water surface, roadway, railroad or other obstruction.

Camber: The upward curvature built into the longitudinal profile of a beam to accommodate the application of the load.

Cast-in-Place (CIP) Concrete: Concrete which is placed in the field.

Culvert: A structure made of steel, concrete, aluminum, natural stone, High Density Polyethylene or other material, covered by embankment material and allowing a creek, stream or roadway to pass under a roadway or fill. Culverts are typically box or arch in shape and may or may not have slabs under the creek or stream flow-line. Culverts may be of any size up to 20 feet in span length.

CoRe Element: Commonly Recognized Bridge Structure Elements. A nationwide system developed by AASHTO to provide a uniform basis for data collection on bridge structure elements.

Cross Girders: Deep structural members in steel or concrete with an “I” or “Box” section that support stringers or girders over a roadway or railroad. Cross girders usually have only two supports, and have bearings that transmit vertical loads to columns. Cross girders may also be part of steel framing that has bearings at groundlevel.

Deck: The portion of a bridge that supports the highway, from the top of the major structural members to the Wearing Surface, and is designed to distribute loads evenly across the bridge.

Floor Beam: Transverse members which support the stringers and transmit the loads to the main load carrying members of a structure.

Fracture Critical: A tension member, reversal member or component (with a tension element) the failure of which will result in the collapse of the structure.

Girder: An “I” or “Box” section providing primary support for the bridge deck or floorbeams. Girders are oriented in the direction of the roadway, with the exception of Cross-girders.

Grade Separation: Crossing of a highway over another highway, street, railroad, channel or other facility, at different elevations.

Grout: A fluid mixture of mortar composed of sand, cement and water that can be poured or pumped easily.

Gusset: A plate serving to connect the elements of a member(s) of a structure, and to hold them in the correct alignment and/or position at a joint.

iForms: A self-contained software program that allows inspectors to record bridge safety inspection data in the field. iForms uploads that information to BMS2 from a remote location via the internet. iForms replaces paper inspection forms and PennDOT's previous data collection system.

Load Factor Design (LFD): A design methodology in which factors are applied to various loads on a structure and the resulting computed stress are compared to the ultimate strength of a material.

Load and Resistance Factor Design (LRFD): A probabilistic design methodology in which factors are applied to loads, and ultimate strength of materials. The factors applied are based on the degree to which the designer can predict both the loads and the ultimate strength of steel or concrete. The factors are established by AASHTO, and modified by PennDOT in Publication 15M, according to empirical and test data that correlates to bridge behavior in the State of Pennsylvania.

Load Rating: An analysis of a structure to compute the maximum allowable loads that can be carried across a bridge; the guidelines are set forth by AASHTO.

Overpass: The single or multi span bridge that cross over the Project.

Parapet: A wall-like member integrally connected to the fascia edge of a bridge deck to serve as a protective barrier for vehicular or pedestrian traffic.

Parking Facility: Developing, designing, constructing, financing, operating and maintaining parking facilities, by the Development Entity, that provide a minimum of 400 parking spaces specific for transportation use, including the administration, collection, and accounting for all parking fees.

Piers: Substructure elements which support the Superstructure at intermediate points between the abutments.

PONTIS: An AASHTOware product providing a comprehensive, rigorous and flexible Bridge Management System.

Precast Concrete: a plain reinforced or prestressed concrete element cast in other than its final position in the structure; can be architectural or structural.

Retaining Wall Structures: An engineered structure designed to resist horizontal earth pressures of a fill or cut, and/or a structure designed to prevent material from spilling onto another surface. Within the Project, retaining walls are made of reinforced concrete, Mechanically Stabilized Earth (MSE), Soldier Piles with Concrete Lagging, Crib Wall structures with rubble fill, and masonry or stone.

Rigid Frame Bridge: A reinforced concrete structure comprised of an integrated abutment and deck slab that has an inverted “U” shape. Rigid Frame bridges may rely on soil structure interaction as part of the load carrying process. Such structures typically have significant moment demand at the joint between the vertical abutment and the horizontal deck slab.

Roadway Arch Culvert: A concrete (cast in place or precast), or metal arch structure supporting fill or roadway with soil separation between the top surface and the underside of the arch. Arch culverts are considered either rigid or flexible and for the passage of roadways would span from 12 to 40 feet.

Rock Fall Fences: A system of steel posts and/or anchored fencing to prevent or slow the movement of rock from slopes above the Project down on to the roadway.

Scour: The lowering of the streambed by the erosive action of water as a result of a local obstruction or natural phenomena, typically occurring at piers and abutments in waterways.

Segmental Concrete Bridge: A concrete bridge typically with a “box” cross section that is either cast in place or precast and post tensioned together forming the span from pier to pier.

Spall: Circular or other shaped depression in a concrete surface resulting from the separation of a portion of the surface from its substrate.

Stringers: Longitudinal beams supporting the bridge deck, and in some bridges framed into or upon the floor beams.

Structure Joint: Designated horizontal and vertical separation that forms a determined gap at the end of a structure deck. Joints include expansion joints and fixed joints of various systems and materials.

Substructure: The pier and abutment elements required to support the Superstructure.

Superstructure: The entire bridge structure resting on the piers and abutments, consisting of

stringers, girders, decks, floor beams, trusses, wearing surfaces, railings, etc.

Truss: A jointed bridge structure having open built web construction so arranged that the frame is divided into a series of triangular shaped figures.

Wearing Surface: The portion of a bridge deck cross section which resists traffic wear.

Wingwall: A side wall to the abutment backwall or stem designed to assist in confining earth behind the abutment.

G.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 13M: “Design Manual Part 2 – Highway Design”, PennDOT.
- Publication 15M: “Design Manual Part 4 – Structures”, PennDOT
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 55: “Bridge Preventative Maintenance Standards”, PennDOT.
- Publication 72M: “Roadway Construction Standards”, PennDOT.
- Publication 100A: “Bridge Management System 2 (BMS2) Coding Manual”, PennDOT.
- Publication 135: “Fabricated Structural Steel Inspection”, PennDOT.
- Publication 218M: “Standards for Bridge Design BD-600”, PennDOT.
- Publication 219M: “Standards for Bridge Construction BC-700”, PennDOT.
- Publication 238: “Bridge Safety Inspection Manual”, PennDOT.
- Publication 293: “Geotechnical Engineering Manual”, PennDOT.
- Publication 302: “Bridge Design Training Manual”, PennDOT.
- Publication 408: “Highway Specifications”, PennDOT.
- Publication 590: “PA CoRe Element Coding Guide”, PennDOT.
- “LRFD Bridge Design Specifications,” AASHTO.
- “Maintenance and Management of Roadways and Bridges”, AASHTO.
- “Guide Specifications for Fatigue Evaluation of Existing Steel Bridges”, AASHTO.
- “Guide Specifications and Commentary for Vessel Collision Design of Highway Bridges”, AASHTO.
- Title 23 Code of Federal Regulation, Section 650, “National Bridge Inspection Standards (NBIS)”, FHWA.
- “Bridge Inspector's Training Manual," FHWA.
- “Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges," FHWA.
- “NCHRP Report 299: Fatigue Evaluation”, NCHRP/FHWA.
- “SSPC Painting Manual”, 2-Volume Set. SSPC.
- “Lead-Based Paint Removal for Steel Highway Bridges”, SSPC.

- “SSPC-VIS1 – Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning”, SSPC.
- “SSPC-VIS2 – Standard Method for Evaluating Degree of Rusting on Painted Steel Surfaces”, SSPC.
- “SSPC-VIS3 – Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning”, SSPC.
- “SSPC-VIS4 – Guide and Reference Photographs for Steel Cleaned by Water Jetting”, SSPC.
- “SSPC-VIS5 – Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning”, SSPC.
- NFPA 88A Standards for Parking Structures, National Fire Protection Association
- Green Parking Council Green Garage Certification Standard, Green Business Certification Incorporated (GBCI)
- ASTM C979-99, Standard Specification for Pigments for Integrally Colored Concrete, ASTM International
- Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products, PCI MNL-116.
- PCI Design Handbook
- ACI 318 for the Building Code Requirements for Reinforced Concrete

G.3. Policy for Structure Maintenance

G.3.1. Objective

The objective of Structure maintenance is to ensure that the stability, safety, durability, strength, and structural integrity of the Project is continually and properly maintained so as to maximize the functional life of the structures.

Structures require repairs due to wear, vehicular impacts, chloride infiltration, etc.; maintenance; inspections; and replacement in part and in whole.

Maintenance objectives for individual structure elements of a structure are further identified by the following:

- Decks and Wearing Surfaces: To provide a safe, uniform, smooth, stable and durable surface.
- Railings and Parapets: To provide a structurally sound and safe barrier for and between pedestrians, vehicles and hazards. This includes structure mounted fences.
- Joints: To provide a safe, smooth and stable condition across planned openings.
- Superstructure and Substructure Elements: To provide and maintain the structural integrity, durability and load carrying capacity of concrete and steel Superstructure and Substructure elements.
- Bearings: To ensure that Superstructure loads are properly transmitted and distributed to the Substructure, and that the Superstructure is free to undergo necessary movements without damage.
- Painting: To prevent corrosion in steel elements of Superstructures and Substructures, and to present a neat and tidy appearance on both steel and concrete.
- Structure Cleaning: To preserve the structures; and to remove dirt, debris, and deleterious materials.
- Structure Accessories: To provide functionality and maintenance to ancillary structure items including, but not limited to, inspection walkways, sidewalks, slopewalls, etc.
- Inspections: To provide current and accurate information on the condition and the structural adequacy of the structure in accordance with the applicable requirements of the Local, State and Federal governments.

G.3.2. *Responsibility of Development Entity*

In order to meet the requirements of this Chapter, the Development Entity must engage in practices to ensure that all Structures function properly as designed; to ensure that the stability, strength, durability and structural integrity of the Structures are not compromised; and to provide a continuous safe and orderly movement of traffic. This requires that the Development Entity carry out its obligations in accordance with this Chapter and the requirements of Volume I, Chapters D and L in a manner that minimizes the overall deterioration and/or improves the condition of the Structures.

The Development Entity is responsible for all management associated with the Structures including; conducting Maintenance, Emergency and Mandatory inspections; filing inspection documents and reports with PennDOT; assisting in independent inspections; and replying to questions or comments that might arise. The Development Entity is also responsible for determining repair needs; creating repair alternatives and procedures; scheduling work; and overseeing all work to ensure compliance with all of the Reference Documents noted in Section G.2 of this Chapter.

The Development Entity is responsible for initiating, designing, determining, establishing and maintaining all required Traffic Control for the duration of the work as addressed by the requirements of Volume II, Chapter I, “Traffic & Travel Management Plan”.

The Development Entity must ensure that all repair drawings are prepared and sealed by a Professional Engineer Licensed in the Commonwealth of Pennsylvania. In addition, all repair work resulting in an alteration of a structural element must be recorded with an “As-Built” document, which must also be filed with PennDOT.

All materials and construction for Structure work performed by the Development Entity must conform to the appropriate and applicable requirements of the Reference Documents noted in Section G.2 of this Chapter.

Once work on a Structure has been started, the work must continue during consecutive working days until a thorough, complete and structurally adequate product has been achieved. All work performed on Structures must correct all safety deficiencies, preserve the Project as an asset, and restore a quality riding surface.

Structures include Parking Facility, Bridges, Culverts, Retaining Walls, Rock Fall Fences, and noise walls. Sign structures, which include truss and single tube bridges and cantilever structures, are also included. For clarity this Chapter mainly addresses parking decks and parking-related structures. Refer to the following Volume I Chapters for other structures types:

- Chapter D: Drainage Maintenance & Erosion Control
- Chapter L: Signs and Signage Systems Maintenance

Refer to the corresponding Volume I “Maintenance Manual” Chapters for the following elements associated with Bridges:

- Structure Approach Pavement Chapter B: Roadway Maintenance
- Structure Approach Guide Rail Chapter K: Roadway Safety Features & System Maintenance
- Structure Drainage Chapter D: Drainage Maintenance & Erosion Control
- Structure Mounted Signs Chapter L: Signs and Signage Systems Maintenance
- Structure Mounted Lights Chapter M: Lighting and Electrical Systems Maintenance

Work on Structures within the Project that must be performed by the Development Entity includes, but is not limited to, the following:

- Decks and Wearing Surfaces:
 - Make repairs to deteriorated, delaminated and unsound portions of Decks & Wearing Surfaces including but not limited to full and partial depth repairs; concrete crack sealing; and replacement of the Decks and Wearing Surfaces in part or in whole.
 - Ensure that Decks and Wearing Surfaces are securely attached to their support elements, so that a safe, durable, and structurally adequate condition is continually provided.
 - Ensure that all Decks and Wearing Surfaces are structurally adequate to support vehicular and other design loads.
 - Ensure that all repairs or replacement work provides the following:
 - A smooth and safe wearing and riding surface.
 - The repaired areas encompass all surrounding unsound and deficient areas.
 - Repairs are sound, durable and well bonded to the substrate surface or support element.
 - The repaired area is finished in accordance to the requirements of the Reference Documents.
 - Cracks are sealed and prevent the infiltration of water and chlorides.
 - The repaired areas match the concrete color and the profile of the surrounding areas.
- Railings, Parapets and Fences:
 - Maintain, repair or replace Railings and Parapets that are unsafe or have the potential to become unsafe to Patrons.
 - Install temporary barriers or railings where and when required, ensuring the continual safety of Project Patrons.
 - Maintain, repair and replace Railings, Parapets and Protective Fence to the original design, unless entire segments or lengths are replaced in which case the Development Entity must conform to the most current requirements stated in the Reference Documents.
 - Repair or replace all rusted, bent, loose, missing, unsafe and/or damaged steel railings, parapets or fence supports.
 - Repair or replace all cracked (greater than 1/8"), unsound, delaminated, missing, unsafe and/or damaged concrete railings or parapets.
 - Modify or provide parapets and barriers in accordance with PennDOT standards to prevent vehicular vaulting.
- Structure Joints:
 - Replace full or sectional lengths of Joints, seals and joint armor that are unsafe or have the potential to become unsafe, or that would accelerate the deterioration of other bridge and structure elements.
 - Replace all Joint seal material that becomes damaged, missing, worn, torn, leaky, misaligned, or no longer function as intended by the original design.

- Repair or replace all Joint armor and its components that become loose, bent, gouged, separated from its substrate, damaged, broken, cracked, experience section loss or missing.
- Properly maintaining a parking structure necessitates regular inspections and cleaning of the precast joints as part of the structure cleaning referenced in this chapter.
- Superstructure and Substructure Elements:
 - Ensure that all bolts are present, properly torqued, tight, and contain the proper nuts and washers.
 - Replace all loose, damaged, deteriorated, cracked, missing and non- functioning rivets with an appropriate high strength bolt of the same or larger diameter as the original rivet.
 - Repair or replace bent, corroded, cracked, fatigued, damaged or structurally deficient steel Superstructure and Substructure elements.
 - Repair or replace unsound, delaminated, spalled, cracked and structurally deficient concrete Superstructure and Substructure elements.
 - Inspect and investigate all truss elements as well as all Superstructure and Substructure elements that appear loose, damaged and/or resonate when load is applied.
 - Perform all steel repairs so that each individual element, as well as the structure as a whole, is structurally adequate to support vehicular and other design loads.
 - Perform all concrete repairs in a manner that removes all deficient concrete and ensures a sound, durable, well-bonded repair that is structurally adequate to support vehicular and other design loads. In addition, the repaired concrete work must match the finish and color of the adjacent concrete surfaces.
 - Repair all concrete pedestals and bearing seat areas that become cracked, damaged, deteriorated, or unsound.
- Bearings:
 - Replace non-working or structurally unstable Bearings and associated components with replacement bearings that adequately support all of the design loads and combinations that it might experience, in conformance with the requirements of the Reference Documents.
 - Employ a Licensed Professional Engineer in the Commonwealth of Pennsylvania to prepare jacking, removal and installation procedures and documents for all Bearing removal, replacement and resetting work.
 - Replace Bearings and associated components in part or in whole that are unsafe or have the potential to be unsafe, or have deteriorated to the condition where maintenance and repair will not restore the intent of the original design function.
 - Clean, lubricate, realign and repair Bearings in accordance with the manufacturer's specifications or the original design specifications.
 - Clean all bridge bearings and associated components that are rusted or become covered with winter abrasives, dirt, pigeon dung or debris.
 - Repair or replace all pads that are damaged, warped, distressed, bulging, crushed, cracked, split, torn, etc.

- Repair or replace all anchor bolts, and associated components, that become damaged or are missing.

- Painting:
 - Clean, prepare and coat all steel surfaces of structures and railings in accordance with the requirements of the The Society for Protective Coatings (SSPC) and the PennDOT Standard Specifications, where the coating system is found to be deteriorated, broken, peeling, cracking, damaged, and/or the steel shows signs of corrosion or rust.
 - Test, remove and properly contain all existing paint that has or is thought to have lead present within its composition, in compliance with the requirements of the Reference Documents.
 - Apply paint to all new steel bridge members or elements in accordance with the requirements of the SSPC and the requirements of the Reference Documents noted in Section G.2 of this Chapter.

- Structure Cleaning:
 - Ensure that the following surfaces and elements are cleaned of all dirt, debris and deleterious material, and washed to remove chemicals and winter abrasives at the frequency stated in Table G.3.3.2 of this Chapter:
 - Decks, shoulders, curbs, railings, joints and parapets and gutter lines.
 - Truss members to a minimum height of 10 feet above the deck surface, including the bottom chord.
 - Members that are located below the deck. Include members at deck joints, nesting locations for pigeons, members experiencing splash from deck drain pipes or scuppers.
 - All drainage structures, including scuppers, deck drains, expansion joint troughs, abutment seat troughs, and drain piping.
 - Approaches and all associated elements for a distance of not less than 30 feet, as measured from the abutment joints, including the wingwalls, parapets, guard rail, etc.
 - Pier and abutment seats and caps, especially those beneath deck expansion joints.
 - Abutment stemwalls and backwalls.
 - Schedule structure cleaning at times when the temperatures are known to be above 40 degrees Fahrenheit for a minimum of 24 hours.
 - Remove all fire hazards beneath structures.
 - Ensure that all cleaning work is performed without damage to property, or injury to Project Patrons.

- Structure Accessories:
 - Repair or replace bent, corroded, cracked, fatigued, damaged or structurally deficient steel Inspection walkways and their components.
 - Repair and replace all damaged, settled or deficient slope protection.

- Repair and replace all unsound, deteriorated or damaged structure sidewalks, curbs, or safety walkways.
- Repair and replace all damaged, non-functioning or deficient structure underpass lighting, if that lighting is fed from an electrical source from the Project.
- Structure Mounted Utilities:
 - The Development Entity must clean pipe, conduits or other appurtenances in accordance with regular Structure cleaning requirements. Also, scheduled Structure inspections must include condition assessment of utilities. Establish a system to report deficiencies or emergency conditions to the appropriate authority.
- Inspections:
 - Ensure that all inspections required by Title 23 Code of Federal Regulations, as well as those required by PennDOT occur at the frequencies no greater than those stated in Table G.3.3.2, and the requirements of Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”.
 - Employ qualified, experienced and trained Professional Engineers Licensed in the Commonwealth of Pennsylvania to perform all of the required inspections, condition assessments, repair recommendations and required reports and filings with the appropriate State and Federal entities.
 - Ensure that all inspections methods and procedures are in conformance with the requirements of the National Bridge Inspection Standards (NBIS).
 - Provide inspection and tests for all precast concrete work in conformance with PCI Plant Certification requirements. Use certified inspectors and equipment to conform to the appropriate and applicable requirements of the Reference Documents noted in Section G.2 of this Chapter.
 - Develop, update and maintain a Structure management, inspection and condition database which shall include photographs, test results, field notes, etc., which will also identify and prioritize all required repairs.
 - Perform structure capacity and load analyses as required when deficient members and elements are discovered.
 - Ensure that all structures are properly inventoried with PennDOT and that biannual updated Inventory Inspection Forms and Reports are correctly coded into the Commonwealth’s inventory system.
 - Ensure scheduling, organization and compensation for all required inspections, including but not limited to, vehicle rental, testing equipment, outside testing services, lane closures, and securing rights-of-entry from property owners, and utilities.
 - Notify the Commonwealth immediately when inspections determine that a structure or one of its major components is at the risk of a localized or large scale structural failure.

G.3.3. Performance Time Frames

The following Table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must assess the condition and complete the required maintenance, repair or replacement work to Structures, and their components (unless weather conditions limit material application):

TABLE G.3.3.1.

Bridge or Structure Feature	Maximum Time Duration
<u>Decks & Wearing Surfaces:</u> - Traveled Lanes - Remainder of Deck Area	8 Hours 5 Days
<u>Railings and Parapets:</u> - Defect which compromises public safety - Other defects	4 Hours 1 Month
<u>Joints:</u> - Defect which compromises public safety - Other repairs	4 Hours 5 Days
<u>Superstructure and Substructure Elements:</u> - Defect critical to structure stability - Non-Structural Deterioration	4 Hours 2 Months
<u>Bearings:</u> - Defect critical to structure stability - Other defects	8 Hour 5 Days
<u>Painting:</u> - Directly Exposed to Weather - Protected from Direct Weather	3 Weeks 3 Months
<u>Structure Cleaning:</u> - Typical Cleaning - Protected from Direct Weather	(See Table G.3.3.2) (See Volume I, Chapter J)
<u>Structure Accessories:</u> - Defects which compromise public safety - Return to as designed condition	8 Hours 14 Days

The following table establishes the minimum frequency that a particular maintenance operation is to be performed.

TABLE G.3.3.2.

Activity to be Performed	Minimum Frequency of Occurrence
Structure Cleaning	Once Yearly
<u>Bearings:</u> Lubricate all required bearings in accordance with the original design and manufacturer’s specifications.	Once Yearly
<u>Inspections & Reports:</u> <ul style="list-style-type: none"> • All Structures • Filing of PennDOT Inventory/Appraisal Forms • Fracture Critical Structures & Members 	During Fabrication and Once Yearly Once Every 2 Years Once Yearly

The Development Entity must, from the time a deficiency is detected by discovery or report:

- Immediately dispatch a Licensed Professional Engineer in the Commonwealth of Pennsylvania to inspect, conduct testing, analyze, prepare condition reports and prepare repair/replacement recommendations.
- Notify the Commonwealth immediately when inspections by the Professional Engineer determine that the structure or its components are at risk of a localized or large scale structural failure.
- When such times occur that a structure or its components are at risk of failure:
 - Commence repairs immediately as instructed by the Professional Engineer, except where the damage will require complete reconstruction.
 - Complete repairs within three (3) months or within a time frame that is appropriate to the nature and urgency of the repair as determined by the Professional Engineer.
- Immediately establish and provide traffic control whenever a Structure is unsafe or has the potential to become unsafe for Project Patrons.
- Ensure that all temporary work is properly disposed of and replaced with permanent work commencing no later than one (1) month after it was installed, or is no longer required.

G.3.4. *Acceptance Criteria*

Structure maintenance work will be considered acceptable when the following criteria are met or exceeded:

- Performance Criteria:

Structures within the Project are critical to the asset, safety of the Patrons and overall performance of the Project and therefore cannot be compromised by the Development Entity. For a Structure to be deemed acceptable by the Commonwealth, the following criteria, in addition to all other criteria in the Technical Provisions, must be met for each structure on an annual basis:

TABLE G.3.4

Performance Item	Minimum Criteria
<u>Weight (Load) Restriction:</u> - General - Structural Capacity	No Weight Restriction 1.2 times the Legal Load (minimum)
<u>Rating:</u> - Overall - Major Element (Deck, Superstructure, or Substructure)	Sufficiency Rating 50 or greater (i.e. Structure cannot be deemed Structurally Deficient) No Major Element (as listed) can be rated by the Professional Engineering Firm at or below 4.

If a structure is found during the annual inspections and reports required by this Chapter or by Volume II, Chapter M “Annual State of the Amtrak Station Improvement Project Reports”, as not conforming to the minimum criteria stated in Table G.3.4, that structure must be listed and included in the 10-year Capital Improvement Program for major improvement. In addition, during the 10-year timeframe, the Development Entity must continually maintain all listed structures in a manner such that the conditions of the Major Elements (Deck, Superstructure, or Substructure), as well as other safety related elements, never reach a rating of 3 or less at any time.

- Decks and Wearing Surfaces:
 - The concrete finish of the decks and/or wearing surfaces provides a safe driving surface and is in accordance with the requirements of the Reference Documents.
 - Repair areas match the existing Deck profile, cross-slope, color and finish.
 - Repair areas and adjacent areas encompass all deterioration and are structurally sound, uniform in shape, durable and bonded to the supporting elements and substrate.
 - Repair and replacement materials are compatible to the remaining materials, and new materials are in full compliance with the requirements of this Chapter and the Reference Documents.
 - Repair and replacement areas are structurally adequate and maintain the structural integrity of the deck.
 - All cracks 1/16" or larger are sealed to a minimum depth of 1/2".
 - The decks and wearing surfaces are clean and free of all dirt, debris and foreign materials that may reduce the safety of Project Patrons and impede drainage.
 - The decks or wearing surfaces are replaced in whole when the existing combined areas with the required and proposed repair areas, account for more than 30% of the entire deck area.

- Railings, Parapets, and Fence:
 - The railings and parapets are properly attached and meet all of the requirements of the Reference Documents so that the system provides a safe barrier for Project Patrons.
 - The railings and parapets are properly aligned, and free of all damage, defects and deterioration.
 - Temporary barriers or railings have been installed only for the duration required to complete the permanent repair or replacement.
 - Fence fabric is fully supported by pipe frames properly connected according to current standards.

- Joints:
 - The joints have been properly installed and function as designed to withstand the movements of the structure.
 - The joints are free of leaks and defects that can create damage or deterioration to the structure.
 - The joints provide a smooth and safe transition for Project Patrons.
 - The joint armor plates are securely attached to the substrate, are not misaligned, and are not damaged or deteriorated.

- Superstructure and Substructure Elements:

- Existing and repaired or replaced elements are structurally adequate and maintain the structural integrity of the structure.
- Repair areas match the adjacent surface color and finish.
- All waste materials have been removed from the work site and the areas are left in a clean and tidy condition.
- Repair areas and adjacent areas encompass all deterioration and are structurally sound, uniform in shape, durable and bonded to the supporting elements and substrate.
- All structural cracks are filled and sealed with the appropriate materials and methods as determined by the Professional Engineer and in conformance with the Reference Documents.
- Backwalls at approach slabs should provide adequate vertical support without longitudinal movements. All joint materials must be adequately fastened and attached to the Backwalls and deck.
- The concrete pedestals and bearing seats are clean and free of all deterioration, damage and deficiencies that might compromise the bearings.

- Bearings:

- All bearings constructed with elastomeric or other pads are properly aligned and free of all bulging, warping, cracks, splits, tears and distress.
- All bearings function as designed, and are capable of supporting the applied loads in a manner that does not cause the bearing to compromise its structural integrity or that of the structure as a whole.
- All bearings are clean, properly aligned and free of all damage, deterioration deficiencies, and missing components.
- Bearings that require lubrication are maintained as required by the original specifications and the manufacturer's recommendations.

- Painting:

- All steel and metal surfaces of the structure, or its components that require paint (exposed to weather) are prepared and coated in accordance with the Reference Documents.
- All structures and their components are free from deficiencies in the paint surface that can cause corrosion or rust.
- Existing paint that is thought or is known to contain lead is tested and handled in a manner that conforms to all Commonwealth and Federal laws and regulations.

- Structure Cleaning:
 - All structure surfaces are free from dirt, debris, foreign materials and winter abrasives.
 - All fire hazards beneath or adjacent to structures have been removed, the area cleaned, and the site left in a neat and tidy manner.

- Structure Accessories:
 - The inspection or service walkways, access platforms, ladders and other similar accessories are free from damage, deficiencies, deterioration and missing components.
 - The slopewalls are stable, free from damage, deterioration, settlement and other deficiencies.
 - All underpass lighting is functioning as designed, no burn-out lamps are present and the lighting system illuminates at the original design level.

- Inspections:
 - Structure inspections have been performed in accordance with the requirements of Table G.3.3.2 of this Chapter, Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”, and all required documentation and reports have been filed with the appropriate agency.
 - The qualifications of the Engineers conducting the inspections conform to the requirements of this Chapter, Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”, and the Reference Documents, whichever is more stringent.

G.4. Additional Requirements

G.4.1. Clearance Requirements

G.4.1.1 Horizontal Clearance

The required horizontal clearances which structures must meet are defined in the PennDOT Publication 13M, as well as the Reference Documents stated in Section G.2 of this Chapter, whichever is greater.

Roadway and shoulder widths must be maintained at the existing dimensions or may be increased as the result of construction. In no instance may a lane width be increased at the expense of a current shoulder width, nor may the median and parapet walls be increased in size to accommodate new features at the expense of existing lane or shoulder widths.

Local surface streets, railroads, navigable channels, and other traveled ways that pass beneath or over the Project must be maintained at the existing dimensions or may be increased as the result of construction. Existing horizontal clearance dimensions may be decreased only if the Development Entity provides written documentation, and the State or Local jurisdiction accepts and approves such proposals. In addition to any required approvals from PennDOT, the Development Entity will be responsible for obtaining all required permits, exemptions, waivers, etc.

G.4.1.2. Vertical Clearance

The required vertical clearances which structures must meet are defined in the PennDOT Publication 13M, as well as the Reference Documents stated in Section G.2 of this Chapter, whichever is greater.

Vertical clearances at surface streets, railroads, the Navigable River channel, and all other traveled ways crossing under the Project structures, should be maintained at the current clearance or may be increased as the result of construction. In addition, vertical clearance between the paved Project surface and all overhead features of the Project must be maintained at the current clearance or increased, as required to meet current PennDOT criteria when the structure is subjected to a major rehabilitation or reconstruction.

When work on the Project occurs that results in an increase in the current roadway surface elevations, the Development Entity must evaluate and study the impact of the change on the existing vertical clearances to the overhead features so that the provided clearance is in full conformance to the requirements stated in the Reference Documents. Existing vertical clearance dimensions may be decreased only if the clearance exceeds the requirements stated in the Reference Documents, and the Development Entity provides written documentation, and PennDOT accepts and approves such proposals. In addition to any required approvals from PennDOT, the Development Entity will be responsible for obtaining all required permits, exemptions, waivers, etc.

G.4.2. *Maintenance Inspections*

The Development Entity is responsible for establishing, scheduling and performing routine maintenance inspections of all Structures within the Project. The Development Entity's inspectors must be under the direct supervision of a qualified and experience Licensed Professional Engineer in the Commonwealth of Pennsylvania. The purpose of these inspections is to identify and note defects that may go unnoticed during daily patrols, to monitor known problems, and to monitor the performance of new construction and recent repairs.

G.4.3. *Emergency Inspections*

The Development Entity is responsible for responding to all incidents within the Project that are known to have or are suspected to have caused damage and investigate the effects to the structures and their components. These types of incidents include vehicle collisions, major storms, flooding, vandalism, and earthquakes; and are described in greater detail in Volume I, Chapter J, "Third Party Damages and Emergency Maintenance", and in Volume II, Chapter K, "Emergency Management and Operations Plan".

The Development Entity must immediately inspect all known and suspected damage by employing qualified and experienced Professional Engineers Licensed in the Commonwealth of Pennsylvania. As required by the particular circumstances, the Development Entity must also mobilize all required inspection and testing equipment to assist in the determination of the structural integrity and condition of the structure and its components. The Development Entity will need to develop conclusions in order to make judgments on the required remedial actions such as whether to keep the structure open, limit the use of one or more lanes, close the shoulder, impose a weight restriction, or take other measures to protect the public and Project Patrons.

The conclusions, decisions and judgments reached by the Development Entity and its Professional Engineer must be implemented immediately. In addition, the Development Entity is responsible for notifying all police, fire, governmental, utility, news and other organizations as appropriate.

When damage is discovered to a structure or property owned by others, the Development Entity must immediately notify that owner or agency.

G.4.4. *Mandated Structure Inspections & Reports*

The inspections included in this section are intended to address required Federal, and State inspections and reports. In addition to the inspections and reports required by this Chapter, the requirements of Volume II, Chapter M, "Annual State of the Amtrak Station Improvement Project Reports", must also be fulfilled.

G.4.4.1. General Requirements

All inspections and reports must be performed by an independent Consulting Engineering firm, not associated or partnered with the Development Entity.

The inspection type, filing requirements, and frequency of the work as stated in Table G.3.3.2 of this Chapter must be fulfilled.

The qualifications of the personnel that will be performing the inspection work are stated in Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”.

All inspection procedures and inspectors qualifications must be in accordance with NBIS from Title 23 CFR, as required by PennDOT, or as amended within this Chapter, whichever is more stringent.

The Development Entity is responsible for testing, equipment, staff and supervision for all inspections.

G.4.4.2. In-Depth Inspection Requirements

An In-Depth Inspection is a close-up, hands-on inspection of one or more members above or below the water level to identify any deficiency not readily detectable using Routine Inspection procedures. In-Depth Inspections can be conducted alone or as part of a Routine or other type of inspection. Schedule in-depth Inspections, on a 10 year cycle (in addition to the annual inspections) for all structures.

In-Depth Inspections do not reduce the level of intensity for Routine Inspections.

G.4.4.3. Report and Inventory Filings

The Development Entity’s Professional Engineer is responsible for filing all required documentation with the Pennsylvania Department of Transportation – Bureau of Design.

As required by ACT 44 of 1988, PennDOT has the duty of compiling and forwarding to FHWA Bridges greater than 20’ in length. Additionally, Pa-Code TITLE 67 provides regulations governing transportation issues. All safety inspections for Pennsylvania NBIS bridges must be performed using PennDOT's electronic data collection software called *iForms*.

iForms and BMS2 Web are available to all authorized owners and consultants.

In addition to the federally-required NBIS inspections, *iForms* provides the capability for Patrons to perform the other types of bridge inspections (e.g. PA CoRe Element Inspections, Fracture Critical Inspections, Underwater inspections) and safety inspections of other types of structures (e.g. overhead sign structures, walls).

In order to utilize *iForms* and BMS2 Web, consultants and bridge owners performing bridge inspections must be registered as Business Partners with PennDOT and submit the necessary forms as indicated in Strike Off Letter 430- 07-08.

The Department will maintain Forms at no cost to Patrons. The Bridge Quality Assurance Division (BQAD) will notify Patrons when updated versions of *iForms* are available and required for bridge inspections. BQAD will have updates for *iForms* available through PennDOT's website.

The Development Entity must report to PennDOT the load carrying capacity of Project bridges such that hauling permits under the “Automated Permit Routing Analysis System” APRAS, will be correct. For complex bridges the Development Entity must provide PennDOT with load capacity rating data that can be used in the “Automated Bridge Analysis System” ABAS. This data is to allow comparisons of permit loads with known vehicles which will not damage the bridge. Further discussion on loadings can be found in Section G.4.6 Weight Restrictions.

PennDOT forms that, in the sole judgment of the PennDOT, are incomplete, do not show sound analysis of the conditions, or do not contain sufficient detail to track problems, will be returned to the Development Entity for revision.

The requirements and procedures for reports and findings due to PennDOT are stated in Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”.

G.4.4.4. Bridge Load Ratings

The two main indicators of a bridge’s capacity are the Inventory and the Operating Ratings, which are detailed in the “Bridge Safety Inspection Manual, Publication 238”, Part IP: Policies and Procedures, and Part IE: Evaluations. When deficient members are identified during inspections or by reports, the Development Entity’s Licensed Pennsylvania Professional Engineer must perform a bridge rating on both the effected element and the structure as a whole, and update both the Operating and the Inventory Rating values. Load ratings and capacity must be calculated in accordance with the procedures and requirements stated in the “Manual for Condition Evaluation of Bridges”, AASHTO.

When the load ratings and capacity analysis of a bridge determines that part or all of the structure is structurally deficient (operating rating less than 100%), and incapable of supporting a design load safely, the Development Entity’s Professional Engineer must prepare a Bridge Safety Analysis, which outlines the operating restrictions, maximum capacity to be posted, the temporary support work that might be required, and an Action Plan that will restore the structure to its full capacity as soon as possible.

Whenever the rating values indicate a restriction of load, the Development Entity must send PennDOT a separate written notification of the location, condition, rating analysis, posting limit, and Action Plan immediately.

Following permanent repairs, the Development Entity’s Professional Engineer must perform a new bridge load rating and capacity analysis to ensure that no further operating restrictions or maximum gross vehicle weight restrictions remain, to the complete satisfaction of PennDOT.

G.4.5. Decks and Wearing Surfaces

The Decks and Wearing Surfaces of the structures of the Project are of extreme importance since their condition impacts the safe passage of Patrons through the System.

All construction and design of Decks and Wearing Surfaces shall be in accordance with the requirements of the Reference Documents, except as noted as follows:

- Minimum deck thickness on adjacent box beams is 5 inches. Adjacent box beams with asphalt overlays lacking full deck membrane protection require inspections and evaluation in accordance with SOL 431-06-03.
- Concrete for the deck must be in accordance with the most current PennDOT Special Provision for AAA Concrete.
- All deck must receive a minimum 1-¼ inch thick Latex Concrete Overlay, when rutting exceeds ½ inch or the engineer determines that cracks in the deck surface cannot be sealed by skid resistant concrete surface applications.

Requirements for deck and wearing surface repairs must be in accordance with the requirements of the Reference Documents, in addition to the following:

- When planning deck work, the entire area of the deck must be sounded to determine the extent of all unsound concrete, and to include it in the repair work.
- Repair areas must form square and rectangular shapes as much as possible.
- Saw cut the perimeter of the repair area to a depth so as to form a clean edge, to eliminate feathered edges, but to avoid cutting rebar. Perform repairs in accordance with PennDOT standards.
- The application of permanent bituminous overlays and/or chip seal coats on Project decks is prohibited.
- Additional overlays on Project decks without removing the existing overlays and additional overlays that would add dead load to the bridges are prohibited.
- Bituminous concrete patches are permitted as a temporary measure only, and must be replaced with permanent repairs as soon as possible.
- Bituminous overlays and chip seal coats are permitted on local roads over the Project provided the wearing surface is maintained free of potholes, has adequate skid resistance, and cracks in the bituminous are sealed yearly.

G.4.6. *Railings and Parapets*

The Railings, Parapets and Fence of the structures of the Project are of extreme importance since their condition directly affects the safety of Project Patrons.

All construction and design of Railings and Parapets must be in accordance with the requirements of the Reference Documents, except as noted as follows:

- Replace broken or damaged sections of the Parapets with a wall having the existing wall face shape and dimensions, or having a face shape and dimensions that comply with the current PennDOT Bridge Manual. All transitions of wall face shape and dimensions must be made gradually so that no corners or projections will be present that impair the function of the barrier.
- When it is necessary to install a temporary railing or barrier, the Development Entity must ensure that the temporary work is as effective a crash barrier as the original element.
- Maintain all fence and safety hardware to insure projectiles or ice does not fall on roadways below structures.

G.4.7. *Structure Joints*

Joint repairs must include all activities necessary to provide functional expansion joints that prevent water leakage onto the bearings, Superstructure and Substructure. This work will include, but is not limited to, rebuilding or patching the joint edges, installing/replacing joint seals, installing drainage troughs, and adjusting or re-securing the joint components.

All construction and design of Railings, Parapets and Joints must be in accordance with the requirements of the Reference Documents. To the greatest extent possible, when performing Joint work the Development Entity must utilize the newest techniques implemented and approved State-wide for major highway contracts to provide longer joint life.

G.4.8. *Superstructure and Substructure Elements*

The timely repair of Superstructure and Substructure components and elements is essential to the safety of Project Patrons.

The Development Entity must coordinate all repairs, reinforcements and replacements with a Pennsylvania Licensed Professional Engineer. This includes all actions to stringers, girders, beams, main truss members, etc. The Development Entity must employ the Professional Engineer when Plans and Construction Documents are required, and must prepare, review, and seal all plans, fabrication orders, and written field procedures.

To the greatest extent possible, when performing Superstructure and Substructure work the Development Entity must utilize the newest techniques implemented and approved by the Department to provide longer life, maximize the capacity of materials, and to minimize motorist inconvenience.

All construction and design of Superstructure and Substructure elements and components must be in accordance with the requirements of the Reference Documents, except as noted as follows:

- Concrete must be a High Performance Mix in accordance with the most current PennDOT Special Provision.
- All reinforcement must be epoxy coated.

Requirements for Superstructure and Substructure repairs must be in accordance with the requirements of the Reference Documents, in addition to the following:

- Every attempt must be made to eliminate Fracture Critical and fatigue prone connections and situations.
- When planning work to the Superstructure or Substructure the entire element or component must be inspected and repaired as required.
- Repair areas must form square and rectangular shapes as much as possible.
- Saw cut the perimeter of the repair area to a depth so as to form a clean edge, to eliminate feathered edges, but to avoid cutting rebar. Perform repairs in accordance with PennDOT standards.
- All emergency or temporary repair work must be planned to best meet the situation, protect the structure and protect Project Patrons.
- The color and finish of the repair area must match the adjacent surfaces.
- High strength bolts of the same diameter as the rivets removed must be used to replace rivets in re-assembly.
- Heat straightening of members must not be used without the approval of the Professional Engineer. When such approval is given, requirements that the member must be relieved of all loads before repairing must be discussed and have the approval of the structural engineer prior to heat application.

G.4.9. *Minimum Design Life Requirements*

For construction of Project structures the following requirements for usable life are to be attained. In general the design life for new superstructures and substructures is 100 years with appropriate maintenance. New concrete deck with epoxy-coated reinforcement should last 50 years.

The Targeted Service Life for rehabilitation of structures can be found in PennDOT Publication 15M, Chapter 5, Section 5.5.4

G.4.10. *Bearings*

Bearings within the Project consist of numerous types and materials dependent upon their age, function and location. Timely repair, inspection and maintenance to keep these components functioning are essential to the life and safety of structures.

The Development Entity must coordinate all repairs and replacements with a Pennsylvania Licensed Professional Engineer. This includes all jacking plans, bearing designs and replacements procedures. The Development Entity must employ the Professional Engineer when Plans and Construction Documents are required, and must prepare, review, and seal all plans, fabrication orders, and written field procedures.

All construction and design of Bearings must be in accordance with the requirements of the Reference Documents. To the greatest extent possible, when performing Bearing work the Development Entity must utilize the newest techniques implemented and approved by the Department to provide longer life, maximize the capacity of bearing materials, and to minimize motorist inconvenience.

G.4.11. *Painting*

Painting of structures within the Project is essential to the life of structures, and to prevent deterioration of structure components. In order to provide a long structure life, all steel and iron components must be painted at a frequency so as to protect the metal from rust and corrosion.

All materials and procedures for the painting of structures must be in accordance with the requirements of the Reference Documents. When performing structure painting work the Development Entity must utilize the newest materials implemented and approved by the Department to maximize the life capacity of the materials.

All structures that require the existing coatings to be stripped of existing paint layers must be inspected for the presence of lead, chromium or cadmium containments. In conformance to the governing regulations, all paint so contaminated must be removed, contained and disposed of in accordance with all EPA, PennDEP and OSHA guidelines and regulations. If the paint is in a condition that will permit an over-coating which will effectively contain the contaminate materials and protect the steel, this alternative should be implemented unless conditions demand otherwise. The Development Entity is responsible for having the existing paint tested and sampled at sufficient locations to ensure that all prior painting applications have been tested.

G.4.12. *Structure Cleaning*

Each structure must be given regular inspections for accumulations of dirt, debris and animal droppings including on the deck; in the drainage openings; on the Substructure seats; and on the Superstructure members. Checks must be conducted to eliminate all potential fire hazards

such as debris accumulating under the structure.

All structure components and elements including, but not limited to, decks, pier caps, abutment seats, bearings, expansion joints, drainage openings, headwalls, wingwalls, Superstructure members, Substructure faces, etc. must receive a thorough water flush at the frequency stated in Table G.3.3.2.

G.4.13. *Structure Accessories*

Activities performed under this category include all repairs and modifications to inspection catwalks, lighting platforms and ladders, sidewalks, slope paving, fill material, fill stabilization systems and all other similar items.

This activity must be addressed on a case by case basis dependent upon the system, damage, deterioration, function of the system, and usage of the system. The Development Entity must repair these systems as the need requires, and must not eliminate them to reduce maintenance and repair work.

In addition, if specialized features such as cathodic protection devices, ice detection and anti-icing devices, and specialized geotextile systems are introduced to the Project in later years they must be maintained and repaired as with every other element of the Project.

TABLE OF CONTENTS

H. N/A

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I **N/A**

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

J. THIRD PARTY DAMAGES & EMERGENCY MAINTENANCE

Section	Page
J.1. Definitions	2
J.2. References	4
J.3. Policy for Performing Third Party Damage and Emergency Maintenance	5
J.3.1. <i>Objective</i>	5
J.3.2. <i>Responsibility of the Development Entity</i>	5
J.3.3. <i>Performance Time Frames</i>	8
J.3.4. <i>Acceptance Criteria</i>	9
J.4. Additional Requirements	10
J.4.1. <i>Vehicle Incidents</i>	10
J.4.2. <i>Vandalism Incidents</i>	11
J.4.3. <i>Atmospheric Damage Repairs (Rain/Wind/Snow/Ice)</i>	12
J.4.4. <i>Animal Removal and Damages</i>	13
J.4.5. <i>Construction Activities</i>	13

J.1. Definitions

Animal Control Work: The efforts by the Development Entity to remove animal pests from the Project, and prevent additional damage by pests, including trapping, baiting, poisoning, fencing, or deterring animals.

Animal Damage: Damage done to any part of the Project by the actions of animal pests including squirrels, skunks, mice, rats, etc., as well as incidental damage resulting from vehicle interactions or collisions with animals.

Animal Removal Work: The work performed by the Development Entity to remove animals, including wildlife and stray pets, from the Project, as well as the removal of animal carcasses.

Atmospheric Damage: Damage done to any part of the Project by the action of the atmosphere or climate, including rain, wind, snow, ice, storms, lightning strikes, freeze/thaw temperature cycles, chemical or pollutant degradation, etc.

Collision: An incident involving the impact of a vehicle with another vehicle or with some component of the Project. Vehicles that can cause collision damage include highway traffic, aircraft, off-road vehicles, railroad cars and locomotives, utility or railroad service vehicles, construction equipment, and vessels within the channel of navigable rivers.

Earthquake: A seismological event or earth tremor described, reported or classified by the USGS as an earthquake.

Emergency Maintenance: Time-critical repair work performed on an unplanned basis and intended to restore operations and mitigate damage done to the Project by collision, vandalism, earthquake, an atmospheric event, etc. Emergency maintenance and repairs may be a temporary measure, using the staff and materials available immediately following the incident.

Graffiti: Painted vandalism of buildings, walls, signs, etc. that has been placed on a surface without the property owner's consent.

NOAA Weather Radio: Local broadcast radio which issues bulletins and alerts regarding severe weather conditions or forecasts. The Development Entity must subscribe to NOAA Weather Radio and monitor this station on a 24 hour-a-day basis.

Responsible Public Agencies: Government agencies that are empowered to take responsible charge of the operational and safety aspects of an emergency situation, including the Pennsylvania State Police, Local and State Fire Departments, the FBI, FEMA, the Department of Homeland Security, etc.

Soda Machine or Soda Truck: A truck or truck-mounted tank, pump and hose assembly that uses baking soda delivered under high water pressure to remove painted graffiti from mineral surfaces such as masonry, brick, and Portland cement concrete. Soda machine devices have been shown to cause no damage to building or viaduct surfaces, while being faster and more environmentally safe than sandblasters or chemical solvents.

Third Party Damage Repair: The repair work to restore any damaged feature located within the Project to undo or mitigate the effects of an intentional destructive human act (vandalism or graffiti marking), vehicle collision, animal pests, atmospheric event, etc.

Tornado: A severe weather event or wind gale described, reported, or classified by the National Weather Service as a tornado or funnel cloud.

Vandalism: An intentional, destructive human act that damages or weakens any part of the Project or causes harm, peril, or inconvenience to the Patrons. Acts of vandalism include arson, graffiti, breakage, theft, placing obstructions in the traveled way, fence cutting, etc.

J.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 213: “Work Zone Traffic Control Guidelines”, PennDOT.
- Publication 234: “Flagging Handbook”, PennDOT.
- Publication 383: “PA Traffic Calming Handbook”, PennDOT.
- Publication 408: “Highway Specifications”, PennDOT.
- “Strike-Off Letters”, PennDOT
- “Manual on Uniform Traffic Control Devices” (MUTCD), FHWA.
- “NOAA Weather Radio (NWR) Brochure”, NOAA.
- “Guide Design Specifications for Bridge Temporary Works”, AASHTO.

J.3. Policy for Performing Third Party Damage and Emergency Maintenance

J.3.1. Objective

The objective of Third Party Damage and Emergency Maintenance is to restore the elements of the Project that are damaged by unforeseen accidents, events or incidents to a safe, operable, useful condition and to maintain orderly traffic flows.

Any element of the Project is liable to suffer damage from storms, climate variations, animal pests, pollution, vandalism or other causes as discussed in this Chapter. Damaged portions of the Project will require: maintenance; temporary repairs; permanent repairs or replacement.

An effective response to incidents of third parties damages to the Project requires:

- Immediately attending to incidents that are potentially life threatening or pose a threat to the Project or Patrons.
- Cooperating with all responsible police, fire, emergency or, State and Federal officials.
- Performing damage assessments using qualified personnel and taking all necessary steps to safeguard life and property.

Information regarding the Development Entity's required response to emergency incidents is addressed by the requirements of Volume II, Chapter K, "Emergency Management and Operations Plan".

J.3.2. Responsibility of the Development Entity

J.3.2.1. Maintenance and Repair Requirements

Maintenance and repair of damage done by third parties to the Project, as well as maintenance and damage repair following severe weather, animal or emergency events are the responsibility of the Development Entity.

The Development Entity is responsible for assessing the damage to the Project by the incidents and for ranking the priority for repair of such damage in order to assure safe, continuous use by the Patrons.

The Development Entity is responsible for completing all of the necessary repair/replacement work within the Time Frames established in other Chapters for the particular elements damaged.

J.3.2.2. Incident Response Requirements

The Development Entity is responsible for responding to notifications of vehicle collision, vandalism, animal damages, natural disaster, severe weather, earthquake, etc. as addressed by the requirements of Volume II, Chapter K, "Emergency Management and Operations Plan", and must fully restore the damaged elements of the Project to their condition as they existed before the event.

The Development Entity's responsibilities will encompass many roles during an event and include, but are limited to, the following:

- Dispatching qualified staff and emergency response equipment to where a collision, natural disaster, fatality, personal injury, or property damage has been reported.
- Communicating and cooperating with the Pennsylvania State Police (PSP), PennDOT, Local and State Fire and Police agencies, Local emergency medical personnel, utilities, adjoining state agencies, and other agencies, etc., both with their offices and with their on-site crews.
- Facilitating access to the crash site by fire, police and emergency medical personnel and equipment, and assisting in moving involved vehicles.
- Establishing, maintaining, and providing all required Traffic Control as appropriate given the apparent blockage, visible structural damage, or similar hazards.
- Conducting immediate inspections, repair/replacement work and integrity assurances of any damaged structural members using qualified Professional Engineers Licensed in the Commonwealth of Pennsylvania, and mobilizing any inspection and testing equipment required for thorough inspections as quickly as possible.
- Maintaining and policing on-going restrictions based on the inspection findings.
- Responding to notifications by responsible authorities whenever an emergency incident occurs within or adjacent to the Project which might pose a hazard to Patrons of the Project.

J.3.2.3. Management and Coordination Requirements

The Development Entity is responsible for all management and coordination associated with the maintenance work of repairing damage caused by the incidents discussed in this Chapter. The Development Entity must conduct all required inspections, file documents with the Commonwealth as required, and assist any independent inspections conducted on behalf of the Commonwealth. The Development Entity is not required to block traffic, arrange special inspections, or otherwise hamper Project operations in order to accommodate third party insurance claims adjusters.

The Development Entity is responsible for all determinations of repair needs, performing Project element maintenance and/or repairs, as specified elsewhere in Volume I – “Maintenance Manual”, for those specific elements, and generally ensuring that the specified acceptance criteria are achieved.

The Development Entity is responsible for monitoring the local NOAA Weather Radio Station 24 hours a day, and acting upon all bulletins and alerts regarding severe weather conditions that are forecast.

The Development Entity must also communicate with the PennDOT Incident Command Center, as well as Pennsylvania Emergency Management Agency (PEMA), and coordinate all communications and coordination with those agencies.

J.3.2.4. Incident Report Documentation

The Development Entity must document, record and file a report in a separate log whenever third party damages occur within the Project. The reports must include the following minimum information, so that an accurate evaluation of the situation may be made whenever required:

Outline – Third Party Damage Report

- 1) General Discussion
 - a) Date of occurrence
 - b) Discussion of occurrence
 - c) Impact on travel and/or occupancy
 - d) Estimated cost of repairs
- 2) Supporting Information
 - a) Damaged element(s) or segment(s) of Project
 - b) Nature of damage
 - c) Condition of remaining elements(s)
 - d) Weather Conditions
 - e) Road conditions
 - f) Location of incident
 - g) Witness interviews
 - h) Photographs
- 3) Third Party Information (As Available)
 - a) Names and addresses
 - b) Insurance information
 - c) Copies of any reports filed

J.3.3. *Performance Time Frames*

The following table establishes the maximum duration from the time an incident or incident-related deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must respond and complete the required repair or replacement to restore the damaged Project component to its original condition or to a better condition:

Event	Maximum Time Duration
Vehicle Incidents	15 minutes (Response) (Repair/Replacement work per requirements of the applicable Chapter)
<u>Material Spills:</u> - Non-Hazardous - Hazardous	15 minutes (Response) 15 minutes (Response)
<u>Vandalism Incidents:</u> - Graffiti Removal - All other incidents which affect the operations	24 Hours 24 Hours
Atmospheric Damage	1 Hour (Response) (Repair/Replacement work per requirements of the applicable Chapter)
<u>Animal Incidents:</u> - Damage - Removal of carcasses	24 Hours 8 Hours

The Development Entity’s response time and the scale of mobilization in reaction to each detected or reported incident must be appropriate to the seriousness of the event and must be addressed and coordinated with the requirements of Volume II, Chapter K, “Emergency Management and Operations Plan”.

J.3.4. *Acceptance Criteria*

Third party damage repairs and emergency maintenance work will be considered acceptable when the following criteria are met or exceeded:

- The Development Entity is responsive to reported incidents within the Project in conformance within the Time Frames specified.
- The Development Entity performs all necessary inspections and evaluations following an event, and makes all repairs required to restore all affected components to a safe and functioning condition in conformance to the relevant Chapters of Volume I, “Maintenance Manual”.
- The Development Entity protects traffic and Patrons and the event site as deemed necessary, and maintains Traffic Control as appropriate during any incident site cleanup, inspection, repair, testing, shoring, etc.
- The Development Entity manages each incident as outlined herein, and maintains contact in order to coordinate forces and consult on work tasks with PSP, PennDOT, PEMA, the Commonwealth, and all other public agencies and authorities as appropriate or required.
- The Development Entity manages incidents of minor vandalism, graffiti, animal and pest control, and similar nuisances in the manner and within the Time Frames specified.

J.4. Additional Requirements

J.4.1. *Vehicle Incidents*

J.4.1.1. Initial Response and Towing

The Development Entity must respond to any notification that an inoperable vehicle has been located within the Project and must remove the vehicle. If the vehicle owner is present, the Development Entity must first move the vehicle out of the traveled way, and must offer to help the owner arrange for a commercial tow operator to remove the vehicle from the Project. If the vehicle owner is not present, cannot assist in arranging the commercial tow, has abandoned the vehicle, or is present but refuses to arrange for a commercial tow, the Development Entity must tow the vehicle to a pre-designated site. The pre-designated tow site selected by the Development Entity should be conveyed to PennDOT so that it remains on file.

The Development Entity must promptly notify the Pennsylvania State Police concerning all vehicles that have been towed and that are stored in the pre-designated site so that the owner can be informed.

When the Development Entity has good cause to believe that a wrecked or abandoned vehicle has been used in the commission of a crime, or if the incident involves a fatality or serious injury, the Development Entity should not move, tow or handle the vehicle until permitted by the Pennsylvania State Police. The Development Entity must cooperate with the Pennsylvania State Police and comply with requests to assist with emergency traffic control until such time as the vehicle is removed.

J.4.1.2. Incidental Repairs and Cleanup

The Development Entity is responsible for clearing debris, glass, firefighting foam, abandoned equipment, and any substances spilled from damaged vehicles such as liquids, chemicals, bulk (solid) material, or hazardous materials. All such cleanup work must be performed under emergency traffic control before the Development Entity allows normal traffic to resume. All such removed material must be properly handled and disposed of by the Development Entity.

Requirements for the containment, removal, transportation and disposal of hazardous material spills, flammable liquid spills, livestock, or potentially hazardous bulk materials must be done in accordance with all Local, State and Federal requirements and as addressed by the requirements of Volume II, Chapter K, "Emergency Management and Operations Plan".

J.4.1.3. Repair of Damage caused by Vehicles

The Development Entity is responsible for repairing all damage to the Project caused by vehicle incidents, regardless of the cause of the incident. Damage repair must be sufficiently thorough, complete, and competent to restore the affected elements of the Project to their condition as existed before the damage event.

The Development Entity must refer to the specific Chapters of Volume I “Maintenance Manual” pertaining to the damaged element for information and requirements concerning the repair of that element.

J.4.2. *Vandalism Incidents*

J.4.2.1. General Requirements

The Development Entity must maintain the Project by repairing any damage caused by vandalism, and must respond to any notification that intentional damage has been done to any element by a third party.

Third-party damage to any element that involves fire, explosion, obvious structural damage, or visible damage must be immediately inspected by the Development Entity and reported to the Borough and Pennsylvania State Police. Foreign materials or debris that are thrown upon or deposited in the Project that are likely to jeopardize safety must be immediately removed by the Development Entity.

J.4.2.2. Repair of Vandalism Damage

The Development Entity must act to restore all elements affected by vandalism to a safe and functioning condition, and must prioritize its repairs based on the severity of the act, as the situation demands, and according to the scale of the damage. The Development Entity must make repairs within the Time Frames stated in the appropriate Chapter of Volume I – Maintenance Manual.

Whenever the Development Entity is forced to postpone the permanent repair work, or is compelled to do so in order to schedule the necessary forces and receive replacement parts, the Development Entity must continually monitor the temporary repairs and the incident site to ensure that the damaged system or element does not continue to weaken or deteriorate, and endanger the public.

J.4.2.3. Removal of Graffiti & Postings

The Development Entity is responsible for removing graffiti within the Project, and must recognize graffiti as an issue that affects the Patrons’ perception of the Project, the Development Entity’s operations, and the Commonwealth of Pennsylvania as a whole. The Development Entity must engage in its own efforts to remove graffiti and maintain the aesthetics and value of the Project.

The Development Entity is responsible for immediately removing graffiti upon detection if the marks obscure lamps, sign information, traffic devices, or are otherwise a safety concern. Also, graffiti of an obscene or offensive nature must also be removed or covered immediately.

The Development Entity is required to contact the Pennsylvania State Police to report vandalism and graffiti-painting acts in progress, so that the offenders can be pursued and apprehended.

The Development Entity must use graffiti removal techniques wherever feasible, and may only use paint to cover graffiti on wood, traffic signal equipment, various painted surfaces or other areas unsuitable for the soda machines removal techniques.

Signs or posters that are placed within the Project without the knowledge or approval of the Development Entity, or in violation of Local or State Law or Ordinance, such as house and garage sale advertisements, political ads, protest signs, and similar materials must be promptly removed upon discovery.

J.4.3. *Atmospheric Damage Repairs (Rain/Wind/Snow/Ice)*

J.4.3.1. General Requirements

The Development Entity must maintain the Project by repairing any and all damage caused by high winds, gales, blizzards, hail storms, sleet, snow storms, lightning strikes and similar typical atmospheric disturbances. The Development Entity is required to respond to reports of damage caused by unusually severe weather such as tornadoes or funnel clouds, or seismological incidents such as earthquakes, as addressed by the requirements of Volume II, Chapter K, "Emergency Management and Operations Plan".

The Development Entity must respond to all notifications that severe weather has caused damage to a Project element, and must perform an immediate site inspection. Should the Development Entity's inspectors determine that the damage poses a hazardous situation, the Development Entity must act immediately to safeguard the public by taking steps such as immediately notifying the proper stakeholders, temporarily closing the affected areas, making emergency repairs, etc., so as to restore safe operations along the Project.

J.4.3.2. Repair of Atmospheric/Weather Damage

The Development Entity must restore all Project elements damaged by severe weather to a safe and functioning condition, and must prioritize and schedule repairs based on the damage. The Development Entity must refer to the specific Chapters of Volume I - Maintenance Manual that pertain to the damaged element for information and requirements concerning the repair for that element. If the Development Entity is forced to postpone the permanent repair work, all temporary repairs must be continually monitored.

J.4.4. *Animal Removal and Damages*

J.4.4.1. General Requirements

The Development Entity must repair the Project by correcting any damage caused by the actions of animal life. The Development Entity is also responsible for removing and properly disposing dead animals (carcasses) from the Project in accordance with all applicable Local and State Laws.

Removal of an animal carcass should be performed within the Time Frames stated within this Chapter. Whenever possible, the Development Entity should recover license tags, name badges, or other pet identification and the Development Entity should notify the pet owner prior to disposal.

J.4.4.2. Treatment of Live Animals

Live animals including wildlife must either be removed by the Development Entity, or be tolerated and protected by the Development Entity as part of the natural habitat. In the case of domesticated animals or pets that stray into the Project the Development Entity must not attempt to trap or remove the animal, but must call the Local or State Animal Control Officers for removal.

When there is evidence at a specific location that an animal is causing damage to the Project, the Development Entity is then authorized to use humane means to target and eradicate the specific pests. Traps or poison may be set by qualified personnel only for the specific pests at the specific location, and only until such time as the damage is stopped. Once the pest is removed, the Development Entity must remove and dispose of all traps and/or poison bait.

J.4.4.3. Maintenance Activities

The Development Entity must inspect and repair all damage done by animals to the Project. The Development Entity must evaluate the severity of all such damage and its effect on safety, and prioritize the repairs accordingly. Damage to electrical wiring, plumbing, signage, lighting and other similar elements that affects safety systems and which poses a hazard to the public must be repaired as a higher priority.

J.4.4.4. *Construction Activities*

Nothing herein shall be interpreted as granting the Department or its contractors permission to perform any construction activities related to the Project on (or affecting) Amtrak or NSR property. The Department will execute separate agreements with Amtrak and with NSR prior to the commencement of any construction activities. In addition, the Department will execute all real estate documents (e.g., lease or easement agreements, deeds) required by Amtrak for the construction of the New Station Facility prior to commencement of construction.

TABLE OF CONTENTS

K. ROADWAY SAFETY FEATURES & SYSTEMS MAINTENANCE

Section	Page
K.1. Definitions	2
K.2. References	3
K.3. Policy for Performing Roadway Safety Systems Maintenance	4
K.3.1. <i>Objective</i>	4
K.3.2. <i>Responsibilities of Development Entity</i>	4
K.3.3. <i>Performance Time Frames</i>	5
K.3.4. <i>Acceptance Criteria</i>	6
K.4. Additional Requirements	7
K.4.1. <i>Guide Rail Systems</i>	7
K.4.2. <i>Impact Attenuator Systems</i>	8
K.4.3. <i>Barrier Wall</i>	9

K.1. Definitions

Barrier Walls: All concrete wall elements used as a protective barrier for vehicular or pedestrian traffic. Examples include median barrier walls, permanent or temporary roadside concrete barrier (single for double faced), ground mounted barrier walls, and parapets and barriers attached to retaining walls and mechanically stabilized earth (MSE) retaining walls.

Guide Rail Systems: All plate-like beam rails, including all associated terminal sections and hardware, used to protect traffic from slopes or obstacles near the traveled way or to protect elements from traffic.

Impact Attenuators: Protective systems that prevent errant vehicles from impacting hazards by either decelerating the vehicle to a stop after a frontal impact or by redirecting it away from the hazard after a side impact, accomplished by the use of either energy absorbing or energy transferring devices.

Median: The portion of the highway forming the separation of the traveled ways for traffic in opposing directions.

Parapet: A wall-like element of reinforced concrete integrally and structurally connected to the deck portion of a bridge to serve as a protective barrier for vehicular or pedestrian traffic.

Clear Zone: The unobstructed, relatively flat, total roadside border area beyond the edge of the traveled way available for a driver to stop safely or regain control of a vehicle that leaves the traveled way.

K.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 13M: “Design Manual Part 2 Highway Design”, PennDOT.
- Publication 15M: “Design Manual Part 4 Structures”, PennDOT.
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 33: “Guide Rail Condition Survey Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 72M: “Roadway Construction Standards”, PennDOT.
- Publication 108: “Sign Foreman’s Manual”, PennDOT.
- Publication 212: “Official Traffic Control Devices”, PennDOT.
- Publication 213: “Work Zone Traffic Control Manual”, PennDOT.
- Publication 218M: “Bridge Design, BD-600M Series”, PennDOT.
- Publication 219M: “Bridge Construction, BC-600M Series”, PennDOT.
- Publication 408: “Highway Specifications”, PennDOT.
- “Strike-Off Letters”, PennDOT.
- “Roadside Design Guide”, AASHTO.
- “A Guide to Standardized Highway Barrier Hardware”, AASHTO.
- “A Policy on Geometric Design of Highways and Streets,” AASHTO.
- “Manual on Uniform Traffic Control Devices”, AASHTO.

K.3. Policy for Performing Roadway Safety Systems Maintenance

K.3.1. Objective

The objective of Roadway Safety Features and Systems is to preserve in working order or restore to working condition all features and systems installed to enhance the safety of motorists, pedestrians and or workers, should a vehicle leave the traveled way; and to protect the integrity of the Project from damage by vehicle collisions. These features and systems include: guide rail systems; impact attenuators; and barrier walls.

K.3.2. Responsibilities of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices to ensure that all Roadway Safety Features and Systems function properly to ensure the safety of the Patrons, traffic, pedestrians and workers while protecting the structural integrity of the Project from vehicle collision; and meet other safety, aesthetic, and economic benefits. The Development Entity must perform its obligations in accordance with this Chapter in a manner that maintains and/or improves the condition and functionality of the Roadway Safety Features and Systems.

Roadway Safety Features and Systems maintenance, inspection, and work activities must be performed at a frequency that ensures uniform and consistent compliance with all local agencies with authority, State and Federal regulations, and the requirements specified within this Chapter.

All materials and construction requirements for Roadway Safety Features and Systems work performed by the Development Entity must conform to the appropriate and applicable requirements and the Reference Documents noted in Section K.2 of this Chapter.

Once a particular maintenance repair has been started the work must continue during consecutive working days, as weather permits, until a thorough, complete and workmanlike repair has been achieved. The Development Entity must establish and maintain traffic control and protection during this time and must conform to the appropriate and applicable requirements and the reference Documents noted in Section K.2 of this Chapter.

Parapets, railings and other systems attached to structures are addressed in Volume I, Chapter G, "Bridge and Structure Maintenance".

Work on Roadway Safety Features and Systems within the Project that must be performed by the Development Entity includes the following:

- Repair or replace all damaged, deteriorated, or deficient portions of the guide rail systems, impact attenuators, and barrier wall that constitute or have the potential to create an unsafe condition for Patrons, personnel and the public.
- Ensure that all of the Roadway Safety Features and Systems are: functioning as intended and designed; are free from debris; securely fastened to their foundations; are structurally sound; and are clearly and highly visible.
- Ensure that all of the Roadway Safety Features and Systems are properly aligned and positioned as safety devices.
- Maintain all posts and vertical components in a plumb, aligned and straight position.

- Apply preservatives to all timber elements as required to maintain rot-free and structurally sound components.
- Replace all timber and steel components if elements are rotted, broken, settled, excessively corroded, or damaged.
- Repair or replace guide rail sections that are bent, broken, cracked, rusted or damaged with materials and finishes that meet or exceed the components that they replaced.
- Ensure that damaged, compromised, ineffective or non-functioning impact attenuators are repaired with parts and components in consultation with the original manufacturer, or successor.
- Alleviate any and all impediments to the drainage flow caused or created by the presence of the Roadside Safety Features and Systems, including cleaning drainage holes in the bases of the barrier walls.
- During repairs, construction, replacement of all Roadway Safety Features Systems, traffic control and protection as addressed in Volume II, Chapter I “Traffic and Travel Management Plan” must be implemented.

K.3.3. Performance Time Frames

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required repair or replacement work to the Roadway Safety Feature & Systems and their components (unless weather conditions limit material application):

Roadway Safety Feature or System	Maximum Time Duration
<u>Guide Rail System:</u>	
- Damage to Structural Integrity	24 Hours
- Non-Structural Damage or Deterioration	30 Days
<u>Barrier Wall:</u>	
- Damage to Structural Integrity or Stability	24 Hours
- Non-Structural Damage or Deterioration	45 Days
Impact Attenuators	24 Hours

The Development Entity must also:

- Clean all drainage holes in the barrier wall bases and inlets adjacent to the barrier walls at least two (2) times annually.
- Immediately establish and provide temporary barricades and traffic control whenever a Roadway Safety Feature or System is unsafe or has the potential to become unsafe for Patrons.
- Remove all litter and debris in and around the impact attenuators at least three (3) times annually, or at a greater frequency as conditions and locations dictate.

K.3.4. *Acceptance Criteria*

Roadway Safety Features and Systems will be considered acceptable when the following criteria are met or exceeded.

Guide Rail Systems:

- The guide rail has been installed in full compliance with the Reference Documents noted in Section K.2 of this Chapter, and the system is within $\frac{3}{4}$ -inch of plumb and grade.
- The surface materials are smooth, undamaged and free of defects.
- The rails and terminal elements are not warped or otherwise deformed.
- The posts are installed square to the rail.
- The work site is left in a clean condition.
- Impact Attenuators:
 - The system is free of obstructions and is fully capable of functioning as designed and intended.
 - The system components are free of damage which impairs the ability of the attenuator to serve its function or have been repaired with equal or comparable parts in consultation with the original manufacturer or its successor.
- Barrier Walls:
 - Barrier walls are properly aligned horizontally and vertically so as to conform to the roadway profiles, alignment and geometry.
 - The barrier wall is free from defects and damage which impair its ability to perform its function.
- Parking fee Plaza Crash Protection Systems:
 - Protection System is free from all damage and deficiencies, which affect the function of the System, and on which all cosmetic defects have been removed or repaired.
 - The protection system is structurally sound and is capable of functioning as designed.

K.4. Additional Requirements

K.4.1. Guide Rail Systems

K.4.1.1. General Requirements

The Development Entity required inspections must include a visual examination of the roadside guide rail to evaluate its functional integrity, height, and alignment.

Mixtures of old and new types of guide rail are not permitted.

K.4.1.2. Applicability of PennDOT Standards

Guide rail must be repaired and/or replaced in accordance with the most current PennDOT Standards and Reference Documents whichever is more stringent. Damaged guide rail sections, posts, block-outs and hardware must be replaced in kind or with superior shapes or materials. If replacement cannot be made in kind, an analysis by a Licensed Professional Engineer in the Commonwealth of Pennsylvania must be made to ensure that all protective devices, hardware and breakaway terminals are replaced with acceptable current standard devices.

K.4.1.3. Upgrading to Current Standards

The Development Entity must upgrade or retrofit older segments of the guide rail system to current standards when such segments of the system are damaged or in need of replacement. When a substantial portion (25% or greater) of a run of guide rail (defined as the length between the guide rail origin and end) is damaged the Development Entity must bring the entire run up to current standards or replace the guide rail with an equal or better safety feature.

K.4.1.4. Construction Requirements

The Development Entity must perform all guide rail work in such a manner that motorists are protected from an opening in the rail at all times. The Development Entity must make every effort to fully restore the system by the end of the working day once repairs have started. An unprotected gap in the guide rail must never be left overnight. Barricades or drums will not be considered sufficient protection.

Adjustments to line and grade of guide rail should be done in conjunction with other repair work whenever possible.

Surface irregularities such as berms or windrows must not be allowed on the traffic side of guide rail.

All work areas are to be left in a clean and neat condition after repair, replacement or routine maintenance.

K.4.2. *Impact Attenuator Systems*

K.4.2.1. *General Requirements*

The Development Entity is responsible for repairing and/or replacing impact damage to energy attenuation devices. An ample supply of replacement parts should be ordered in advance and kept on hand.

Impact attenuator replacement must be performed during a single working day, and the work site and the hazard itself must be properly shielded from traffic by temporary crash cushions, lane closures and similar approved methods.

Additionally, litter and debris that accumulates at the base of attenuators or between, in front of or around the cells must be removed. Debris must not be allowed to accumulate since such debris could hinder and impair the operation of the impact attenuator. Impact attenuator inspections must include checking for debris under or around the attenuators.

K.4.2.2. *Requirements for Replacement Parts & Assemblies*

Replacement of broken, missing or damaged elements of the impact attenuator systems must be exactly in kind and should be supplied by the manufacturer of the original device to ensure that the device's physical properties and impact responses continue to function as designed.

The entire replacement of damaged impact attenuator assemblies, unless otherwise designed and approved by a Licensed Professional Engineer in the Commonwealth of Pennsylvania, must be of the same type as the existing impact attenuator assemblies in terms of the module's length, width of protection, re-directive properties, debris retention features, support legs and ground pad, transition panels or struts to concrete barrier wall or guide rail and all other parameters pertaining to the module's performance at a particular location. If a different manufacturer's product is considered for use as a replacement, that product must meet the current requirements for impact attenuators.

K.4.2.3. *Upgrading to Current Standards*

These requirements are not intended to prevent the Development Entity from upgrading or retrofitting existing impact attenuators to higher performance standards or modifying existing Roadway Safety Features and Systems that possess little or no energy absorbing properties. Any time impact attenuators are replaced, they must be replaced with devices meeting the current highway standards.

K.4.2.4. *Assurance by Development Entity*

The Development Entity inspections, maintenance and work must be conducted with sufficient thoroughness so that the Development Entity can warrant that all attenuators components are in satisfactory and operable condition and that all necessary repairs and replacements have been completed.

K.4.3. *Barrier Wall*

K.4.3.1. *General Requirements*

It is the Development Entity's responsibility to maintain all barrier walls in a crashworthy, fully functional condition. Missing or damaged sections must be repaired or replaced.

The inspection and repair work for barrier walls mounted on bridge structures (parapets) is specified in Volume I, Chapter G, "Bridge and Structure Maintenance".

The Development Entity must replace broken or damaged sections of the barrier wall with a wall having the existing wall face shape, or having a face shape that complies with current Reference Documents. All transitions of wall face shape must be made gradually so that no corners or projections will be present that impair the function of the barrier.

K.4.3.2. *Requirements for Median Wall*

Median walls must not be retrofitted or replaced in such a manner that the clear zone available to motorists is reduced, or any inappropriate projections are created in the wall face.

The Development Entity is prohibited from cut openings in the median wall to facilitate movement around the Project.

The Development Entity must not erect cantilever sign supports, overhead sign truss supports, light fixtures, or any other appurtenance in the median wall that would rely on the barrier wall for a portion or all of its foundation support unless the Development Entity retrofits the median wall at that location to resist all of the applied loads it must withstand. In addition, the Development Entity must not retrofit or replace the barrier wall in such a manner that the clear zone available to motorists is reduced, or any dangerous projections are created in the wall face.

K.4.3.3. *Requirements for Impact Events*

When a vehicle impact creates a gap in the wall that could permit a vehicle to cross the median, expose a drop-off greater than two (2) feet, or expose a fixed object hazard to traffic, and permanent repairs cannot be made immediately, the Development Entity must protect the opening with temporary barrier to completely protect the hazard. Barricades, barrels, and the like must never be used as temporary means for a fully functional barrier wall.

All permanent repairs must be made of the same type as the existing barrier wall, precast concrete units may not be considered a permanent repair for existing cast-in-place barrier wall. All precast units and all replacement construction must be done in accordance with current PennDOT Standards for Barrier Wall.

TABLE OF CONTENTS

L. SIGNS AND SIGNAGE SYSTEMS MAINTENANCE

Section	Page
L.1. Definitions	2
L.2. References	4
L.3. Policy for Performing Signage Systems Maintenance	6
L.3.1. <i>Objective</i>	6
L.3.2. <i>Responsibilities of Development Entity</i>	6
L.3.3. <i>Performance Time Frames</i>	7
L.3.4. <i>Acceptance Criteria</i>	9
L.4. Additional Requirements	10
L.4.1. <i>Inventory and History Record</i>	10
L.4.2. <i>Sign Materials</i>	10
L.4.3. <i>Storage and Handling of Signage System Components</i>	11
L.4.4. <i>Installation Requirements</i>	11
L.4.5. <i>Inspection Requirements</i>	11
L.4.6. <i>Obstructed Signs</i>	13
L.4.7. <i>Obsolete Signs</i>	13
L.4.8. <i>Temporary Signs</i>	13
L.4.9. <i>Portable Changeable Message Signs (PCMS)</i>	13
L.4.10. <i>Sign Lights and Lighting</i>	14
L.4.11. <i>Work Zone Signage</i>	14
L.4.12. <i>Overhead and Bridge Mounted Signs</i>	15
L.4.13. <i>Sign System Supports</i>	16
L.4.14. <i>Sign System Foundations</i>	19

L.1. Definitions

Clear Zone: The unobstructed, relatively flat, total roadside border area beyond the edge of the traveled way available for a driver to stop safely or regain control of a vehicle that leaves the traveled way.

Damaged Sign:

- a) A sign that is not flat (planar) and properly oriented to the patrons or other intended audience.
- b) A sign that has either 4 square inches or 1% (whichever is greater) of the sign panel face area containing deficiencies.
- c) A sign that, in the opinion of the Commonwealth, is damaged or contains a message to the patrons or other audience that is unclear, improper or confusing.

Dynamic Message Signs (DMS): Overhead sign structure capable of displaying a visual message by means of light bulbs, plastic tabs, liquid crystal displays etc. (Referred to as Variable Message Signs – VMS or Changeable Message Signs – CMS in some publications)

Emergency Maintenance: Time-critical repair work performed on an unplanned basis and intended to restore operations and mitigate damage done to the Sign System by Collision, Vandalism, Earthquake or an atmospheric event. Emergency maintenance and repairs may be a temporary measure, using the staff and materials available immediately following the incident.

Flashing Light (or Flashing Lamp): A device on a sign or Signage System that consists of a lamp or series of lamps which are turned on and off repetitively.

Guide Sign: A sign that does not contain regulatory information, traffic laws, or warnings. Examples include signs that show route designations, destinations, distance to exits, services, or other geographical, recreational, or cultural information.

Portable Changeable Message Signs (PCMS): A portable, dynamic message sign usually mounted on a trailer or truck bed that can be deployed quickly for meeting temporary requirements found in work zones or accident areas.

Overhead Sign Structure: An overhead sign support structure, with the horizontal member either supported at both ends or cantilevered over the Traveled Lanes.

Regulatory Sign: A sign that gives notice to road Patrons of traffic laws or regulations. Examples include STOP, SPEED LIMIT 45 MPH and LOAD LIMIT signs.

Retro-reflectivity: A property of a sign panel surface which causes a specified portion of the light coming from a point source to be returned directly back to the origin.

Right-Of-Way Assignment: The process which uses a sign to give preference to vehicles to proceed in a lawful manner before other vehicles. An example is a YIELD sign.

Sign: A lettered board, message or other display which includes all regulatory, warning, guide or informational, advisory, construction and maintenance, route markers and all special or other messages/displays.

Sign Lighting: An engineered lighting system that makes a sign uniformly visible to road Patrons, whether by day or night. Signs on the Project have external illumination, in which a light pattern is cast upon the sign panel by lamps.

Sign Panel: The layer of the sign panel which contains the message, and which is applied to the aluminum, wood or steel sign.

Sign System: All Signs and Signage Systems components including regulatory, warning, guide or informational, advisory, construction and maintenance, overhead and bridge mounted signs.

Structure Mounted Sign: All Signs that are attached directly to bridge structure by frame work without foundation.

Warning Sign: A sign that gives notice to road Patrons of a potentially hazardous situation that might not be readily apparent. Examples include STOP AHEAD and LOW CLEARANCE signs.

Work Zone Sign: A sign that gives notice to road Patrons of construction and maintenance activities. Work zone signs are required in advance of the site and must be erected through the work zone. Examples include CONSTRUCTION SPEED LIMIT 30 MPH and FLAGGER signs.

L.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- Publication 8: “Construction Manual”, PennDOT.
- Publication 13M: “Design Manual Part 2 – Highway Design”, PennDOT.
- Publication 15M: Design Manual Part 4”, PennDOT.
- Publication 23: “Maintenance Manual”, PennDOT.
- Publication 35: “Approved Construction Materials (Bul. 15)”, PennDOT.
- Publication 72M: “Roadway Construction Standards (Dual Unit)”, PennDOT.
- Publication 100A: “Bridge Management System 2 (BMS2) Coding Manual”, PennDOT.
- Publication 108: “Sign Foreman’s Manual”, PennDOT.
- Publication 111M: Traffic Control – Pavement Markings and Signing Standards”, PennDOT.
- Publication 212: “Official Traffic Control Devices”, PennDOT.
- Publication 213: “Work Zone Traffic Control”, PennDOT.
- Publication 218M: “Bridge Standard Drawings for Bridge Design, BD-64.1M – 645M”, PennDOT.
- Publication 238: “Bridge Inspection Manual”, PennDOT.
- Publication 234: “Flagging Handbook”, PennDOT.
- Publication 236M: “Handbook of Approved Signs”, PennDOT.
- Publication 266: “Right-Of-Way Encroachment & Outdoor Advertising Sign Control”, PennDOT.
- Publication 408: “Highway Specifications”, PennDOT.
- Publication 590: “PA Core Element Coding Guide”, PennDOT.
- “Guidelines for Inventory and Inspection of Pennsylvania’s Sign Structures”, PennDOT.
- “Strike Off Letters”, PennDOT.
- “Manual for Inspection Bridge for Fatigue Damage Conditions, Research Project No. 85-02”, PennDOT.
- “Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals”, AASHTO.
- “Manual for Condition Evaluation of Bridges”, AASHTO.
- “Bridge Inspector’s Training Manual”, FHWA.
- “Manual on Uniform Traffic Control Devices (MUTCD)”, FHWA.

- “Inspection for Fracture Critical Bridge Members, Report No. FHWA-IP-86-26”, FHWA.
- National Bridge Inspection Standards (NBIS), FHWA.
- “Portable Changeable Message Sign Handbook (PCMS)”, FHWA.

L.3. Policy for Performing Signage Systems Maintenance

L.3.1. Objective

The objective of Sign and Signage System Maintenance is to ensure that all regulatory, warning, guide, informational, advisory and work zone (construction and maintenance) signage and their components are properly maintained so as to regulate and facilitate the safe and orderly movement of traffic.

Signs and Signage Systems require: repairs due to wind damage, vehicular impact, etc.; maintenance; relocation; and replacement in part and in whole.

Highway signs are grouped into four general classifications: Regulatory, Warning, Guide, and Work Zone (Maintenance and Construction). Designated shapes and colors are used to differentiate between the different sign classifications. All signs must be reflectorized and/or illuminated to show the same shape and color by day and night.

Effective Signs and Signage Systems require:

- Selection of the correct Signage System for a particular situation.
- Correct location of the Signage System.
- Ongoing maintenance to ensure that the sign and its supports are in good condition.

L.3.2. Responsibilities of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices and inspection survey intervals to ensure that all Signs and Signage Systems are clearly displaying the necessary messages to ensure the safe and orderly movement of traffic, and meet other safety, aesthetic and economic benefits. This requires that the Development Entity carry out its obligations in a manner that maintains and/or improves the condition and purpose of Signs and Signage Systems.

All materials and construction requirements for Sign and Signage System work performed by the Development Entity must conform to the appropriate and applicable requirements of the Reference Documents noted in Section L.2 of this Chapter.

Each sign face must be kept visible and legible under both day and nighttime conditions. It should be noted that all signs will gradually deteriorate to a point where the signs must be refurbished or replaced. The retro-reflective sheeting of signs deteriorates from the effects of sunlight, weather, airborne particles, and air pollution. Dirt from road spray, snow and ice removal from the roadway, and air pollution may collect on the sign sheeting, and, if unchecked, will severely affect the nighttime visibility of the sign.

The Development Entity must make routine sign inspections part of its daily activities, and all Development Entity staff who travel the Project for any reason must be instructed to report any damaged or obscured signs to the Development Entity.

Work on Signage Systems within the Project that must be performed by the Development Entity includes the following:

- Repairing Signs and Signage Systems and their components.
- Maintaining a stock of sign panels, supports and other sign system components for use when damage occurs.

- Clearing obstructed signs.
- Cleaning Sign Systems and their components.
- Inspecting the Sign Systems.
- Resetting/repairing Signs and Signage Systems that are accidentally knocked or blown down.
- Relocating Signs and Signage Systems that need to be removed and/or reinstalled due to changing needs or conditions.
- Replacing or installing new Signs and Signage Systems and their components.
- Replacing or relocating Signs and Signage Systems as required by local, state or federal regulations.
- Ensuring that all Signs and Signage Systems are legible, adequately reflectorized, erect and correctly located in accordance with the references stated in Section L.2 of this Chapter.
- Obtaining approval from the Commonwealth for all re-ordering and design of guide and information signs.
- Removing, storing and being responsible for all illegal or unauthorized signs within the Project, as discovered by the Development Entity, as directed by the Commonwealth, or as permitted by the Public-Private Transportation Partnership Agreement.

L.3.3. *Performance Time Frames*

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required cleaning, resetting, replacement of missing, repair, or relocation work to the Signs and Signage System and its components:

Table L.3.3.1

Sign & Signage System Classification/Type	Maximum Time Duration
Regulatory	2 Days
Warning	2 Days
Guide	3 Days
<u>Work Zone:</u>	
- Construction	4 Hours
- Maintenance	1 Hour
Dynamic Message Signs (DMS) or Portable Changeable Message Signs (PCMS)	4 Hours
All Other Signs	3 Days

Table L.3.3.2

The frequency of Sign Structure inspections shall conform to:

Structure Type	Inspection Type	
	Routine	In-Depth
Aluminum Overheads	---	2 Years
Galvanized Steel Overheads	3 Years	6 Years
Condition < 6	---	3 Years
Mounted on Bridges	---	2 Years
Galvanized Steel Cantilevers		
Ground Mounted	3 Years	6 Years
Mounted on Bridges	---	2 Years
Structure Mounted	2 Years	4 Years

The Development Entity must, from the time a deficiency is detected by discovery or report:

- Make temporary repairs to all regulatory or warning signs determined to be a “damaged sign” (see Definitions), or to replace missing signs; and to immediately initiate installation of temporary signage.
- Touch-up or re-paint all painted Sign System components when the surface is discolored or damaged within seven (7) days; and re-paint all components once every five (5) years.
- Relocate Signs and Signage Systems required to be removed and reinstalled due to changing needs or conditions within seven (7) days.
- Make all replacements and/or repairs to Signs and Signage System lighting, including burnt-out bulbs, within twelve (12) hours.

The Development Entity must also:

- Replace or install new regulatory or warning signs within forty-eight (48) hours from receiving direction from the Department.
- Perform detailed inspections on all overhead, cantilever and structure mounted sign structures, in accordance to the requirements of PennDOT, at an interval no greater than the frequencies stated and submit a written report to the Commonwealth. The inspection procedures shall be in conformance with the requirements of the National Bridge Inspection Standards (NBIS).
- Upon receipt of notification or when local, state or federal regulations mandate; the Development Entity must order, replace or install new Sign Systems as follows:
 - 1) Order within 48 hours.
 - 2) Install within 24 hours of delivery.

L.3.4. *Acceptance Criteria*

Signs and Signage Systems will be considered acceptable when the following criteria are met or exceeded:

- Supports are plumb and level.
- Design, type classification and installation are in accordance with the requirements of the applicable Reference Documents.
- Concrete bases and foundations are the proper and correct distance out of the ground.
- Steel supports are properly coated and protected by the galvanizing process, when required, as described in the PennDOT and ASTM Specifications.
- The site and area adjacent to the Signs and Sign System is left clean and tidy after all work is completed.
- Sign Panels contain the correct color, spelling or symbols required for its classification and application.
- Supports have a complete coverage of paint that is free of cracking, peeling and flaking, when the support requires paint to be present.
- Sheeting Material:
 - Lettering and symbols are of the correct size, clear and legible, and of the required retro-reflectivity in accordance with Local, State and Federal guidelines.
 - Sheeting has been applied free of blistering, delamination, peeling or chipping, with no discoloration or fading.
- Sign Panel Backing:
 - Wood Panels are straight and smooth with no warping, bending, twisting, or splitting, and are properly sealed to prevent swelling.
 - Aluminum Panels are straight with no warping, bending, or twisting, and are not torn or deformed at connections.

L.4. Additional Requirements

L.4.1. Inventory and History Record

The Development Entity must develop, maintain and keep current an inventory and history record of all Signs and Sign Systems within the Project. The inventory and history record must consist of the type, size, location, and age of each Sign and Signage System. Information that must be contained in the inventory and history record includes:

- Sign location
- Measured distance from edge of traveled way to nearest point of sign.
- Separation of sign post(s) from traveled way by: guiderail, barrier wall, or none.
- Sign type or name (e.g. STOP, NO PASSING, etc.).
- Sign panel color, size and/or shape (e.g. 18" x 18", 30" x 30").
- Sign and Signage System support material and type characteristics.
- Chronological history of all repairs/replacements including a brief note of what the change was (i.e. raised it 2 feet, pipe post to 4" x 4" wood post, etc.).

L.4.2. Sign Materials

The Development Entity must ensure the following:

- All Signs and Signage System materials must conform to the current requirements of the Reference Documents of Section L.2 of this Chapter.
- Sign panel base material must be a flat sheet aluminum to which a chemical conversion has been applied.
- Sign panels have a minimum thickness of 1/8 inch.
- Sign panels must be a flat continuous section of the length, width and shape as specified in the Standard Sign Design Criteria of the MUTCD with specific mounting holes and corner radii.
- Sign panels must conform to dimensions and colors specified in the MUTCD.
- Before reflective sheeting or paint is applied to the sign panel, the application surface must be cleaned and prepared according to the sheeting or paint manufacturer's recommendations. The sheeting must form a durable bond to resist corrosion, provide a weather-resistant surface, and adhere securely at temperatures ranging from -34°C to 71°C.
- Signs and Signage System posts must be straight and have a uniform finish. All holes must be free from burrs and ends must be cut square. Steel posts must be hot-dipped galvanized according to AASHTO requirements. If a weld process is performed after galvanizing, the weld must be zinc-coated after the scarifying operation.

L.4.3. *Storage and Handling of Signage System Components*

Improper storage or handling can damage Signage System materials. It is important that signs and sign supports be protected in storage and transporting, as well as during installation.

Certain types of sign supports, panels and components may require special storage techniques. An example of this is panel signs, which have small weep holes in the channel at the bottom edge. These holes allow moisture that enters the panel to drain. Therefore, these types of panels must be stored upright to help drain accumulated moisture.

The Development Entity must ensure that wood sign supports are properly stored in maintenance yards. Wooden sign posts must not be stored on the ground, as they can become warped.

The Development Entity must ensure that signs are stored properly in the vehicles during transportation. Any sign panels that have sustained damage to their surface or reflectivity during transportation must be replaced with new panels free of damage.

L.4.4. *Installation Requirements*

Prior to digging, the Development Entity must notify utility companies about the intended work through PA One Call System, and must furnish sufficient time for the utilities to locate their lines.

The Development Entity must install all Signs and Signage Systems and their components in accordance with the applicable Reference Documents noted in Section L.2 in this Chapter, as well as the manufacturer's recommendations.

Sign panels must be thoroughly inspected both before application to sign supports as well as after installation is complete. The Development Entity must clean all installed sign panels prior to the final field inspection.

L.4.5. *Inspection Requirements*

The Development Entity must incorporate the requirements outlined below into its sign inspection procedures, to ensure that a consistent method of inspecting the daytime and nighttime performance of Sign and Sign Systems is upheld. The daytime inspection must evaluate the condition, state of repair, security of sign attachment hardware, repair needs of support systems and local earth grading, etc. for all signs. The effects of age, weathering, vandalism, and visibility must be assessed during the night inspection. In addition, a nighttime inspection must be made immediately following a nearby fire, as heat can cause loss of reflectivity.

The Development Entity must remember that the signs are to be clearly legible to the patrons, and present a neat and balanced appearance free from defects. Signs not adequately visible because they are dirty, hidden by vegetation, or otherwise obscured must be noted as deficient.

L.4.5.1. *Daylight Visual Inspection*

Under daylight conditions the Development Entity must inspect the sign panels to detect non-uniform color, streaks, spots, abrasions or other defects in the panel surface. The inspection must include reviewing slight imperfections that may be visible only during daylight, and would not be visible during the nighttime inspection. The Development Entity must conduct these inspections as required, but at a frequency no less than four (4) times annually.

L.4.5.2. *Nighttime Visual Inspection*

The Development Entity must conduct nighttime inspections as required, but at a frequency no less than four (4) times annually.

The following requirements and guidelines pertain to performing Sign and Signage System inspections at night:

- The inspection must be performed with a vehicle that must be driven in the furthest lane from the median with the headlamps in the dimmed position. The lane location places the inspection team in a position where signs hidden by vegetation will be noted. It is important that the inspection vehicle headlamps be properly adjusted prior to the start of inspection.
- Signs must be observed at the "distance of driver need". This distance is subjective, but must include factors such as average speed and roadway alignment. Observations should be made 250 feet to 500 feet in advance of the sign.
- The inspection team must include one member who is considered a qualified sign maintenance employee.
- One team member must have good color vision for evaluating sign colors.
- Median mounted signs may be observed from the lane adjacent to the median if it is safe to do so.
- It may be necessary to make individual passes for sections where both median and shoulder mounted signs are to be inspected.
- Spotlights must not be used to evaluate night sign reflectively since they are several times brighter than vehicle headlamps, and can cause false observations of sign brightness.
- The Development Entity's nighttime sign inspection team must also inspect all sign panels with an inspection light. The inspection light shall be a 120-watt, 120 volt reflector flood lamp with an average rating of 1600 lumens. The inspection shall be performed while holding the light at eye level and looking directly over the top of the light.
- A sign face is considered to have lost its retro-reflectivity for nighttime display when the area of limited retro-reflectivity or blotchy reflectiveness exceeds 25% of the sign face area. A sign face is also considered to have lost its retro-reflectivity when the reduced retro-reflectivity overrides the ability of the sign text, color, or legend to be effectively presented to the patrons or other intended audience.

L.4.6. *Obstructed Signs*

Because landscape plantings grow along the Project, untrimmed plants, trees and vegetation may obscure signs. Signs and Signage Systems that are hidden by planted or natural vegetation must be cleared so that the sign is visible.

L.4.7. *Obsolete Signs*

Whenever the design requirements for new signs are changed by the Commonwealth, or when PennDOT adopts changes instituted by the FHWA, new requirements must be considered to immediately affect the Development Entity's operations, and any obsolete signs in inventory that have not yet been installed must not be installed on the Project.

Existing signs that have been rendered obsolete must be replaced in a timely manner acceptable to the Commonwealth, regardless of actual condition or estimated remaining service life.

L.4.8. *Temporary Signs*

Temporary signs must be continually maintained for as long as they are required, and must be replaced with permanent signs as soon as possible.

Temporary signs for nighttime use must have a reflectorized background and/or legend and border depending on the standards for that particular sign type. Temporary signs must conform to the color, size, material, and other requirements which apply to permanent signs of that type.

L.4.9. *Portable Changeable Message Signs (PCMS)*

Portable Changeable Message Signs (PCMS) must be mounted on a trailer designed to adequately support the message board in a level position. The PCMS must be aligned and positioned to provide optimal driver visibility. The Development Entity must program and adjust the message display cycle so that a minimum of two complete message cycles can be legibly displayed to a driver while approaching the sign at the posted speed.

Repairs due to failure, malfunction, or damage to a PCMS shall be completed within the requirements stated in Section L.3.3 of this Chapter. During the process of repair the Development Entity must furnish another PCMS.

The Development Entity must relocate the PCMS for the various stages of maintenance and construction work as needed to adequately inform the motorists. The Development Entity must provide an experienced operator for the PCMS during periods of operation to ensure that the messages displayed are correct and legible. In addition, the Development Entity must ensure that the message sign is illuminated properly to meet the current light conditions, and that all adjustments for operation of the sign are made as needed to properly guide motorists.

The Development Entity must perform all maintenance operations recommended by the manufacturer of the sign, including periodic cleaning of the sign face, and if present, the associated solar panels.

L.4.10. *Sign Lights and Lighting*

The Development Entity must inspect all Signs and Signage Systems lights, lighting units, fixtures and services, as required by the requirements of the Technical Provisions, and must pay particular attention to the following deficiencies:

- Burned out, broken, missing or damaged light fixtures or any elements thereof.
- Broken or missing cover plates on hand-holes or other access points.
- Broken latches on access hatches, hinged lens, etc.
- Defects in the electrical service, such as exposed wiring, open splice or junction boxes, loose or detached boxes, and loose, broken or missing sections of conduit or conduit hangars.

All electrical work must be performed by a duly certified and licensed Electrician who possesses adequate previous experience.

L.4.11. *Work Zone Signage*

L.4.11.1. *General Requirements*

The requirements for the Development Entity to provide movement of traffic through work zones for maintenance, construction, inspections, emergency repairs, etc. is to be addressed in Volume II, Chapter I, “Traffic & Travel Management Plan”. As it pertains to work zone signage, the responsibility of the Development Entity is to erect, maintain, adjust, modify, repair and remove as required, all temporary traffic control signage in compliance with all relevant PennDOT Criteria, and/or the detailed traffic control drawings for a particular project.

During the construction and maintenance work zone traffic restrictions, the Development Entity must continuously review and maintain all work zone signage to ensure the safety of Project Patrons, the workers and the general public. The Development Entity must repair or replace all work zone signage in accordance with the requirements stated in Section L.3.3 of this Chapter.

Specific work zone signage maintenance responsibilities of the Development Entity include, but are not limited to the following:

- Sign replacement due to loss of retro-reflectivity.
- Repair of defaced sign sheeting and legends.
- Replacement of broken supports.
- Repositioning of leaning signs.
- Cleaning of dirty devices.
- Replacement of stolen or vandalized devices or signs.

L.4.11.2. *Stationary Signs*

Work zone stationary signs must stand plumb in all directions, under all conditions. The signs must be securely anchored in a manner such that they resist all loadings similar to the requirements associated with permanent signs.

When required, the Development Entity must cover work zone signs with an opaque material that does not damage the sign panels, and that can prevent reading of the sign at night by a driver using high beam headlights.

L.4.11.3. *Portable Signs*

Portable work zone signs must stand plumb in all directions, under all conditions. The signs must be securely anchored in a manner such that they resist all loadings similar to the requirements associated with permanent signs.

When not in use for periods longer than 30 minutes, the Development Entity must lay the portable work zone sign flat on the ground and collapse the sign stand so it also lays flat on the ground. Prior to erecting the sign again, the Development Entity must thoroughly clean the sign face.

If the distance from the ground to the lowest point creates a sight problem to Patrons, the Development Entity must install adjustable sign stands so as to provide the best possible view of the portable signs.

L.4.11.4. *Arrow Panels*

The Development Entity must furnish, install, place, operate, maintain, relocate, and remove flashing arrow panels as needed based on maintenance or construction work. Only Arrow Panels that meet or exceed the requirements of the MUTCD, and that are also on PennDOT's Approved Construction Materials listing shall be used.

The Development Entity must use arrow panels that have the capability to display mode selections, but do not use the straight line caution display. Flashing arrow panels must be securely mounted on trucks, trailers, or other mobile units.

L.4.12. *Overhead and Structure Mounted Signs*

L.4.12.1. *General*

New types of overhead sign structures introduced by the Development Entity into the Project must be approved by the Commonwealth and must be warranted. In addition, calculations and drawings prepared by and sealed by a Professional Engineer Licensed in the Commonwealth of Pennsylvania must accompany all requests for Approval.

L.4.12.2. *Inspector Requirements*

It is the responsibility of the Development Entity to employ a qualified sign structure inspector to perform the inspection described above, and to prepare the report. The sign inspector must meet the following minimum requirements:

- The inspector must be a Certified Inspector who has successfully completed a comprehensive training course based on the FHWA “Bridge Inspector’s Training Manual”, and who has 5 years of bridge and/or sign structure inspection experience.
- The inspector must be a Pennsylvania Licensed Professional Engineer.
- All inspectors must be properly trained in the use of all required inspection equipment.

L.4.12.3. *Inspection Requirements*

The Development Entity must conduct a detailed inspection and provide a written report to PennDOT for all cantilevers, overhead, and structure mounted sign structures as described in Table L.3.3.2 of Section L.3.3 of this Chapter.

The inspection and report must include all components and elements of the sign structures, including mechanical and electrical equipment.

The Development Entity’s inspection of all overhead and bridge mounted sign structures shall pay special attention to the following:

- Condition and attachment of sign panels and assemblies.
- Bolted connections to ensure all bolts are tight, free from cracks or deformity, and performing as designed.
- Fracture critical details where the welds and weld material have a greater potential to fail.

L.4.13. *Sign System Supports*

L.4.13.1. *General*

When conditions dictate the replacement or repair of Signs and Signage System supports, the types and sizes of the supports must be evaluated and selected on the basis of the Reference Documents indicated in Section L.2 of this Chapter, and in consideration of the following:

- Breakaway properties increase safety in the event of a vehicle collision.
- The ability of the support to withstand wind and other loads.
- Conformance to the existing Project Signage System’s aesthetics and other such features.

New types of sign supports introduced by the Development Entity into the Project must gain the Approval of the Commonwealth and must be warranted. In addition, calculations and drawings prepared by and sealed by a Professional Engineer Licensed in the Commonwealth of Pennsylvania must accompany all requests for Approval.

L.4.13.2. *Inspection Requirements for Sign Supports*

Inspection of Signs and Signage System supports must include inspection for cracks, rust or corrosion, and any distress in the members. Welds at the member joints must be carefully examined for any signs of cracking or separation of the weld from the adjoining members. All nuts, bolts and washers on the structures must be checked for tightness. Of particular importance, the anchor bolts must be inspected to determine if any of the bolts have corroded, suffered section loss or are loose.

The Development Entity must inspect the paint system on all the sign supports and identify locations where the paint is peeling, cracking or curling.

The Development Entity must inspect the galvanization system on all the sign supports and identify locations where the galvanization has wear, chipping or damage.

Inspection of the sign support foundations must note the presence of any surface cracks, missing grout, exposed reinforcing steel, spalls, etc. If safety of the foundation is found to be compromised, the sign structure foundation must be replaced immediately.

Due to their exposure to repetitive wind loads, metal sign supports are susceptible to fatigue, and inspections must include this factor. Fatigue distress, if found or suspected, must be tested to quantify deflection, crack propagation, etc., and the appropriate and expeditious repairs must be immediately scheduled in order to restore the Signage System to full serviceability. The Development Entity must perform non-destructive testing as required.

L.4.13.3. *Bent and Damaged Sign Supports*

Whenever sign panels have been damaged or bent, the Development Entity must determine if the signs and supports are to be repaired or replaced. In deciding, the Development Entity must consider the physical condition of the panels and supporting members. All repairs or replacements must conform to the requirements of the Reference Documents noted in Section L.2 of this Chapter.

L.4.13.4. *Break-Away Wide Flange and Tubular Metal Sign Supports*

Existing and new break-away metal sign supports must meet all current FHWA requirements for supports that break-away. Break-away sign supports must reduce the change in momentum that occurs during vehicular impact to tolerable levels as defined by the FHWA, and must also conform to the applicable sections of the Reference Documents noted in Section L.2 of this Chapter. Correct alignment of post sections and placement of bolts in the slip base is critical to the proper functioning of the break-away feature.

When conditions necessitate the replacement of an existing support, the Development Entity must investigate the merits of installing break-away type metal sign supports within the Clear Zone as a replacement, subject to the following:

- The new sign support type meets all of the requirements of the Reference Documents.
- The history of vehicle impacts at the sign location.

L.4.13.5. *Wood Posts*

Wood posts may be utilized by the Development Entity if they conform to the requirements stated in the Reference Documents. Typically most applications of installing wood posts are limited to locations where they are protected from traffic (e.g., behind guide rail).

The Development Entity must never replace current sign supports that have break-away characteristics, with wood posts, timbers or other lumber.

Where directed by the requirements of the stated Reference Documents, holes must be drilled in larger-diameter wood posts to provide a weakened plane for breakage if the post should be impacted by a vehicle. It is important in this case to make sure the holes are drilled at the specified height above the ground. The holes are designed for the specified height to ensure that the broken end protruding above the ground will not snag the bottom of a car.

Combinations of timber poles with alternate sign support types will not be permitted in the same multi-post installation.

Wood sign posts must not be painted.

L.4.13.6. *Laminated Wood Posts*

Whenever conditions and requirements permit, existing sign posts can be replaced using laminated wood posts. The Development Entity must design the laminated posts to meet or exceed all applicable PennDOT requirements for such break-away devices as noted in the Reference Documents.

To ensure that laminated wood sign posts will break-away properly when hit and still not be damaged by high winds, posts must be designed and installed in conformance with the requirements of the stated Reference Documents.

Laminated posts must be stored and handled carefully.

L.4.14. *Sign System Foundations*

Sign System concrete foundations must be designed to conform to the requirements of the Reference Documents, and must be inspected for the following types of deterioration:

- Cracking, Scaling and spalling of the concrete.
- Delamination or hollow sounds when the surface of the concrete is impacted with a hammer.
- Exposed reinforcing steel.
- Collision impact damage.
- Foundation movement; including sliding with a shifting or eroding slope, rotation out of plumb due to soil movement or collision.
- Missing or severely cracked grout under base plates.
- Anchor bolts that are missing, loose, or bent.

TABLE OF CONTENTS

M. LIGHTING AND ELECTRICAL SYSTEM MAINTENANCE

Section	Page
M.1. Definitions	2
M.2. References	3
M.3. Policy for Maintenance of Lighting and Electrical Systems	4
M.3.1. <i>Objective</i>	4
M.3.2. <i>Responsibility of Development Entity</i>	4
M.3.3. <i>Performance Time Frames</i>	7
M.3.4. <i>Acceptance Criteria</i>	9
M.4. Additional Requirements	11
M.4.1. <i>Inventory and History Record</i>	11
M.4.2. <i>Roadway Lighting and Sign Illumination and Tunnel Lighting</i>	11
M.4.3. <i>Cables, Conduits and Unit Ducts</i>	15
M.4.4. <i>Closed Circuit Television (CCTV) Systems</i>	16
M.4.5. <i>Facility Electrical Systems and Supplies</i>	17
M.4.6. <i>Lighting, Signage and Operating Timetable</i>	17

M.1. Definitions

Conduit or Duct: An enclosed tubular way for protecting wires and cables.

Electrical Systems: Systems, elements and components that are contained in facilities, and which supply, distribute and function by the use of electricity. These systems include, but are not limited to: substations, meters, wiring, service panels, individual circuits, generators, transformers, interior lighting, exterior lighting, motor control units, back-up generators and systems, and emergency lighting.

Luminaire: A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

Permanent Repair Time: Amount of time from initial discovery or report to the Development Entity until the time permanent repairs are made.

Service Response Time: Amount of time from initial discovery or report to the Development Entity until personnel are present at the required location.

Service Restoration Time: Amount of time from initial discovery or report to the Development Entity until the time the system is fully operational again.

Uninterruptible Power Supplies (UPS): Power supplies that operate in parallel with the electric utility sources and supply their load without interruption when and if the utility source fails. Used to meet the operating needs of the computers and critical elements of the Parking Fee Collection System

M.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- “Roadway Lighting Handbook – Implementation Package 78-15”, FHWA.
- “An Informational Guide to Roadway Lighting”, AASHTO.
- DG - 4 - 03 “Design Guide for Roadway Lighting Maintenance”, Illuminating Engineering Society of North America (IESNA.)
- “National Electrical Code”, NFPA.
- “Standard for Parking Structures”, NFPA 88A
- “Standard for Smoke Control Systems”, NFPA 92
- “Title 33 Code of Federal Regulations – Part 118”, U.S. Government Printing Office.
- Publication 8: “Construction Manual”, PennDOT
- Publication 13M: “Design Manual Part 2 – Highway Design (Dual Unit)”, PennDOT
- Publication 72M: “Roadway Construction Standards / Dual Unit”, PennDOT
- Publication 35: “Approved Construction Materials (Bulletin 15)” PennDOT
- Publication 408: “Highway Specifications” , PennDOT
- “Strike-Off Letters”, PennDOT
- “Standard Drawings RC-80, RC-81, RC-83, RC-84”, PennDOT.
- “ANSI Catalog of American National Standards”, ANSI.
- “Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems”, IEEE.
- “Roadside Design Guide”, AASHTO
- “Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals”, AASHTO

M.3. Policy for Maintenance of Lighting and Electrical Systems

M.3.1. Objective

The objective of Lighting and Electrical Systems maintenance is to ensure that all elements and components of Lighting and Electrical Systems including, but not limited to, roadway luminaires, underpass lighting, sign lighting, site, grounds, illumination, etc.; as well as all electrical systems including power, communication, signaling wiring, and surveillance cameras and wiring, etc., are properly maintained and serviced so as to continuously function at superior reliability, and to reduce potential hazards to the safe and orderly movement of Patrons.

Lighting and Electrical Systems require maintenance, repairs due to age, lamp burnout, weather effects, corrosion, traffic impact, failure of soil support, etc.; cleaning of lenses and other elements; and replacement.

Effective and reliable lighting and electrical systems require:

- Frequent maintenance patrols to identify outages and damage.
- Timely repairs to ensure uniform and acceptable illumination in nighttime and low light level conditions.
- Seasonal maintenance and cleaning of lenses and fixtures

M.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices that ensure that all roadway, structure and underpass lighting, warning lights, and other critical illumination systems remain fully operational during low ambient light conditions, and all cameras, communications, power cabling, related electrical panels and wiring, and other critical electrical devices remain functional at all times in order to ensure the safe and orderly movement of traffic, and meet other safety, aesthetic and economic benefits.

The Development Entity is responsible for conducting nighttime patrols of all Lighting and Electrical Systems and must repair all defects or deficiencies. The patrols must evaluate all locations in the lighting system, including underpass fixtures that are the Development Entity's maintenance responsibility, temporary lighting installations, etc. The patrols must be arranged so that all locations are inspected in compliance with the required Performance Time Frames.

The Development Entity is responsible for maintaining a stock of replacement lamps, lenses, fixture heads, light standards, cameras, electrical conduit and cabling, and other lighting and electrical systems parts for ready use in case of damage.

The Development Entity must implement a cleaning and maintenance schedule for the luminaries and fixtures. In this schedule the luminaire lenses and housings shall be cleaned of dust and grime build-up as recommended by the IESNA, manufacturer's specifications, and as required by the conditions.

Temporary or permanent repairs performed on high voltage or high current systems, highly sensitive equipment, cameras, monitors, and other similar devices must only be done by trained, certified technicians and Licensed Electricians, as appropriate. The Development Entity is responsible for determining staffing needs in order to service broken or defective components within the time frames specified below.

General work on Lighting and Electrical Systems within the Project that must be performed by the Development Entity includes the following:

- Coordinating with all electrical utilities and equipment vendors to ensure prompt response and repair of electrical service, connections, outages, or other difficulties with lighting and electrical systems.
- Create and maintain an inventory and history record of all Lighting and Electrical Systems.
- Roadway Lighting and Sign Illumination:
 - Perform nighttime patrols and inspections for each lighting system to detect deficiencies or defects.
 - Inspect, maintain, and repair or replace defective, malfunctioning or deficient lighting controllers.
 - Ensure that all light pole units, mast arms and foundations are inspected and all damage or deficiencies repaired or replaced.
 - Ensure that all luminaires are inspected, and all damage or deficiencies are repaired or replaced.
 - Establish and conduct a re-lamping and cleaning program to maintain the efficiency and continual operation of the lighting systems.
 - Replace and/or repair all lighting systems components that are excessively corroded, repairing foundation cracks or spalls, replacing missing hardware and hand-hole covers, etc.
 - Rewire or relocate Lighting and Electrical Systems and components as required by changing needs, altered conditions, or as required by State or Federal regulations.

- Cables, Conduits, and Unit Ducts:
 - Ensure that all cables, conduits and unit ducts remain free of all defects and damage; that all breaks of these lines are repaired or replaced within the stated Time Frames; and that the lines remain operational and functional at all times.
 - Ensure all temporary cabling only be used to temporarily restore service until a permanent repair to the defects and deficiencies can be completed. Temporary aerial cabling must be installed and maintained at a minimum height of twenty-five (25) feet above ground level.
 - Ensure that all re-cabling and conduit or duct repair be performed for all permanent repairs of defects or deficiencies. Cables should be replaced with new copper cable meeting all applicable codes and requirements.
 - Ensure that all direct bury cable repairs be performed in accordance with all applicable codes and requirements.

- Closed Circuit Television (CCTV) Systems:
 - Ensure that all components are inspected at a frequency so as to repair and replace all noted damage or deficiencies within the Performance Time Frames specified.
 - Replace the CCTV cameras with new cameras every eight (8) years, or as required.

M.3.3. Performance Time Frames

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, to the time when the Development Entity must have completed the required maintenance, replacement or repair work to restore the functionality or operation of a deficient Lighting and Electrical Systems or component (unless weather conditions limit material application):

TABLE M.3.3.1

Lighting and Electrical System	Maximum Time Duration
Roadway/Parking Area Lighting & Sign Illumination: <ul style="list-style-type: none"> - Lighting Controller - Light Pole Units, Mast Arms, and Foundations - Luminaires - Sign Illumination 	24 Hours 7 Days 24 Hours 24 Hours
Cables, Conduits and Unit Ducts: <ul style="list-style-type: none"> - Temporary Cabling - Re-cabling and Conduit or Duct Repair - Direct Bury Cable Repair 	4 Hours 21 Days 21 Days
Closed Circuit Television (CCTV) Systems: <ul style="list-style-type: none"> - Control Cabinet damage repair/replacement - Control Cabinet power supply interruption - Camera non-operational 	24 Hours 4 Hours 24 Hours
Tunnel Lighting: <ul style="list-style-type: none"> - Lighting Controller - Luminaires 	1 Hour 4 Hours

The following table establishes the minimum frequency that a particular operation is to be performed:

TABLE M.3.3.2

Operation to be Performed	Minimum Frequency of Occurrence
Inventory of Lighting and Electrical Systems	Once per Year
Roadway Lighting and Sign Illumination Nighttime Patrol	Once per Month
Re-lamping (Group)	See Section M.4.2.5
CCTV Camera Replacement	Once every eight (8) Years
Tunnel Lighting Nighttime and / or Daytime Patrol	Once per week

The Development Entity must, from the time a deficiency is detected by discovery or report:

- Immediately initiate temporary repairs to all damaged or deficient lighting and electrical components in order to provide continual service.
- Immediately initiate temporary repairs to all damaged or deficient navigation or aircraft warning beacons in order to restore service in compliance with applicable regulations of the U.S. Coast Guard, Federal Aviation Administration, and all other governing authorities.
- Complete a permanent repair of deficient lighting, electrical or communication cabling mounted on or within bridge parapets, or beam fascias within twenty-one (21) days.
- Notify the electrical supply utility company of an outage or low-voltage complaint within fifteen (15) minutes of discovery, and re-contact the utility company every one (1) hour if service has not been restored.
- Provide and maintain back-up power supply for all essential electrical systems.

M.3.4. *Acceptance Criteria*

Project Lighting and Electrical Systems will be considered acceptable when the following criteria are met or exceeded:

- Inventory databases are maintained including performance history records for all Lighting and Electrical Systems.
- The work conforms to all Local, State and Federal requirements and the work is performed by certified and/or licensed professionals.
- Light standards, camera mounts and other supports are plumb and level.
- Design and installation of replacement components conform to the requirements of the applicable Reference Documents.
- Work sites are left clean and tidy after all repairs are completed.
- Roadway Lighting and Sign Illumination:
 - Nighttime Patrols and inspections for each lighting system and its controllers are completed within the Performance Time Frames specified.
 - Light pole unit, mast arm, fixture mount and foundation maintenance, repair work and replacement work has been completed within the Performance Time Frames specified; and the components are free of defects and deficiencies.
 - Replacement lamps are the correct type and wattage for the installation.
 - All luminaires are free of burnt-out bulbs, defects, damage and deficiencies; and all components are operating and functioning as intended.
 - A re-lamping and cleaning program has been established and implemented so as to maintain the efficiency and continual operation of the lighting systems.
 - Lighting systems and their components are free of foundation problems, missing hand-hole covers and all other deficiencies that are unsafe or have the potential to become unsafe.
 - Sites adjacent to outdoor controllers are maintained free of obstructions.

- Cables, Conduits, and Unit Ducts:
 - Temporary overhead cabling has been installed maintaining a minimum height of twenty-five (25) feet above ground level, and promptly removed as permanent repairs to cabling are complete.
 - All cables, conduits and unit ducts are free from all defects, damage and breaks; and service has been continually provided.
 - Permanent re-cabling and conduit or duct repairs have been completed and all work meets the requirements stated in the Reference Documents.
 - Direct bury cable repairs have been performed in accordance with all applicable codes and requirements, and the site has been restored and left clean.
 - Electrical conduit, signal cabling, unit duct, and other wiring systems are properly buried, secured to supports and bridge fascias, etc. as appropriate for the installation.

- Closed Circuit Television (CCTV) Systems:
 - CCTV components are fully operational, functioning as intended, and all maintenance and repairs have been completed.
 - CCTV cameras have been replaced within the Performance Time Frames specified.

M.4. Additional Requirements

M.4.1. Inventory and History Record

The Development Entity must develop, maintain, and keep current a complete and detailed inventory and history record of all Lighting and Electrical Systems within the Project. The inventory and history record must include the following at a minimum:

- Type, make, model, age, installation date and location of each and every Lighting and Electrical System and its components and appurtenance in the Project
- Measured distance from edge of traveled way to nearest point of appurtenance.
- Chronological history of all repairs/replacements including a brief note of what the change was (i.e. re-lamped, replaced ballast, painted standard, etc.).

M.4.2. Roadway Lighting and Sign Illumination and Tunnel Lighting

The Development Entity must incorporate the following requirements into its roadway lighting, tunnel lighting and sign installation work procedures in order to ensure that the highest reliability and most consistent performance are upheld.

The following must be included and performed for work with the roadway lighting, sign illumination, or electrical service components:

M.4.2.1. Nighttime Patrol

The Development Entity must patrol each roadway lighting, underpass lighting, and sign illumination system to assure consistently safe, functional, and operational conditions of equipment and materials; and to assure that all installations are performing at the level of service for which they were designed. Each lighting system must be inspected at the frequency stated in [Table M 3.3.1](#).

The nighttime patrol must record and document all lighting systems inspected, and the deficiencies and repair needs.

M.4.2.2. Lighting Controllers

The Development Entity must adhere to all procedures and special training in order to understand, operate, and repair the lighting controllers and their components. Repair and service logs must be recorded and maintained for any inspection, service or repair to the controller or components of the controller. If more than one service is required to a component of the controller within a one month period, that component should be considered defective, and the component replaced.

Additional controller requirements apply as follows:

- Clock – If the controller is equipped with a time clock, and if repeated controller malfunctions are required due to time clock malfunctions, the clock component of the controller must be replaced.

- Photoelectric Controls – If so equipped, photoelectric controls must be checked during routine lighting inspection, serviced periodically, or replaced as required.
- Attention must be given to coordinating controls to ensure that all highway lighting units turn off or on at approximately the same time within a given segment of the Project, regardless of the number of circuits in use. Circuits designed for early turn on of illuminated signs should have the early turn on type of photocells. When these photocells fail, it is important that they are replaced with the correct unit.
- Cabinet – The Development Entity must maintain the controller cabinet including all doors, hinges, hatches and locks to keep the cabinet functioning as originally intended.
- Warning Sign – The Development Entity must assure all lighting controller cabinets have a voltage warning label affixed and clearly legible.
- Foundation – The lighting controller foundations must be maintained to minimize any problems with the controller due to poor foundation conditions.
- Service Voltage – If there is a notification of low voltage or utility problems, the Development Entity must verify within one (1) hour. If voltage is not restored by sunset, the Development Entity must provide generator power for the lighting system.
- Vegetation – The Development Entity must clear all vegetation from within ten (10) feet of the controller.

M.4.2.3. Light Pole Units, Mast Arms, and Foundations

The Development Entity must inspect all light pole units, mast arms, and foundations to ensure safe, operational condition of equipment and materials; to ensure that all installations are performing at the level of service for which they were designed; and to ensure that all unsafe conditions have been addressed.

Standard light poles and mast arms must be replaced with galvanized steel equipment or aluminum equipment meeting the same strength, height and mast arm length requirements of the existing equipment. All replacement lighting equipment must meet or exceed all loading requirements.

Additional light pole unit, mast arm, and foundation requirements apply as follows:

- Ground Lugs – If existing ground lugs are damaged or non/functional, the pole must be drilled and the ground wire lugged onto the pole.
- Foundations – It is the Development Entity's responsibility to be knowledgeable of safety requirements for light pole foundations. Foundations must be maintained in a safe and functioning manner.
- Identification Labels - All lighting units shall be marked with identification labels. The identification labels must be maintained.

- Hardware – All hardware must be rust free and tightened according to original requirements. Any loose, defective, or missing hardware should be replaced immediately.
- Shrouds or Skirts – Base shrouds or skirts must be in place and rust free. Any missing or defective shrouds must be replaced.
- Hand-Hole Doors – All hand-hole doors or access covers must be in place and securely fastened. Any missing or defective doors or covers must be replaced or repaired immediately.
- Poles or Standards – Poles or Standards must be plumb to within 10-degrees and in good condition free of corrosion. Any misaligned or defective poles or standards must be repaired or replaced.
- Base Coupling – It is the Development Entity’s responsibility to be knowledgeable of safety requirements for light pole mounting and coupling. All reset or new installations must conform to the current requirements for base couplings.
- Slip Bases – Slip bases or slip base inserts must be inspected annually to ensure the slip bases or slip base inserts will function properly under the impact of collision.

M.4.2.4. Luminaires

The Development Entity must inspect all luminaires to ensure proper operational condition of equipment and materials, and to ensure that all installations are performing at the level of service for which they were designed. Inspection and service logs must be recorded and maintained for any inspection, service, repair, or replacement to the luminaires.

Luminaires must be thoroughly inspected at the time of lamp replacement. During inspections the following components must be checked:

- Gaskets – Inspect for loose or missing gaskets. Repair or replace as required.
- Glassware – Clean and inspect for cracked or broken lenses. Replace if necessary.
- Hardware – Inspect for loose or missing hardware, and replace or tighten as required.
- Terminal Block – Inspect for cracked or broken barriers on the block. Replace if necessary.
- Mounting – Inspect mounting to determine if luminaires are rigidly held in proper position. Make all adjustments necessary.
- Wiring – Inspect wiring for abrasions and loose connections, and repair as required.
- Reflectors – Clean, and inspect for tarnish or oxidization. Replace if necessary.

- Ballasts – Replacement luminaires must be installed with a new lamp and new ballast of the same type and wattage. Where primary lines of multiple ballasts are provided with fused splice connectors, fuse ratings must be maintained at the current values.
- Sign Lighting Fixtures - Sign lighting fixtures may be replaced with metal halide sign lighting fixtures and must meet the current specifications and requirements of PennDOT.

M.4.2.5. Re-lamping

In addition to burn-out replacement of lamps discussed above, all roadway, bridge, structure, signage and underpass luminaire lamps must be group replaced on a planned schedule based on the average rated lamp life, which must not exceed the following:

- High Pressure Sodium Group re-lamp every 4 years
- Low Pressure Sodium Group re-lamp every 3 years
- Fluorescent Group re-lamp every 2 years
- Other Per Approval of PennDOT

M.4.3. *Cables, Conduits and Unit Ducts*

The Development Entity must repair or replace all cable and associated equipment grounding cables, or cable-in-duct, which become damaged, displaced, defective, or broken. The Development Entity must take immediate action to make temporary repairs when cable deficiencies become suspect.

Temporary cable may be used as a trouble fix until a permanent replacement can be made. When temporary cable is used, it must be installed aerial so the lowest point is at least twenty-five (25) feet above ground level.

Cable used for permanent repairs must be new, and must be installed in accordance with all applicable ordinances and codes, and in compliance with the National Electrical Code (NEC). In addition, all new cables must be in compliance with current PennDOT electrical requirements.

Additional cable, conduit and unit duct requirements apply as follows:

- Cable in Duct or Conduit – When the damaged or faulty cable is located in duct or conduit, the cable must be completely removed, the duct or conduit repaired, and new cable installed.
- All new cable installations must include a green colored insulated equipment ground conductor properly sized in accordance with all applicable electric codes.
- Direct bury cable may be repaired, provided the defective area is completely removed and replaced with an additional length of repair at least three (3) feet on either side of the defective area. If the repair is within six (6) feet of a light pole, handhole, or a control cabinet, the entire six (6) foot section must be replaced.

M.4.4. *Closed Circuit Television (CCTV) Systems*

The effectiveness of the Closed-Circuit Television (CCTV) Camera system relies on the proper functioning of the cameras at their intended levels. The Development Entity is responsible for maintaining all components of the CCTV systems and repairing or replacing all components as defects or failures occur. The control cabinet, monitor stations, and all components must remain free of defects and operational at all times. In addition, the Development Entity must ensure that throughout the term of the Agreement the CCTV system shall be and remain compatible with the Commonwealth CCTV system requirements, as determined by the Commonwealth's sole and absolute discretion.

The Commonwealth retains the right to override and take control of a portion or the entire CCTV System as part of the Commonwealth's emergency and surveillance operations, at any time and for as long as the Commonwealth so desires, without notification. The Development Entity must surrender control of the CCTV System as directed by the Commonwealth, and must fully cooperate with the Commonwealth and its respective Departments at all times. In addition, the Development Entity must schedule all maintenance and repair activities to the CCTV System with the Commonwealth.

In order to maintain the efficiency and effectiveness of the CCTV System the Development Entity shall implement a CCTV system maintenance program as follows:

M.4.4.1. Camera Preventive Maintenance at Control Center & Monitor Stations

Using a waveform monitor, the Development Entity must perform the following measurements; ensure that the results recorded are within manufacturers' specifications; and document the results:

- Check raw video.
- Measure peak white.
- Measure color burst.
- Measures synch pulse.
- Check integrity of all connectors.
- Check all camera video at night (to determine which cameras need back focusing).

M.4.4.2. Camera Preventive Maintenance at Cabinet Level

- Check integrity of all cables, connectors, and surge protectors.
- Check raw video from the camera with a waveform monitor (raw video shall measure 1.00Vp/p). Adjust per manufacturers' specifications.
- Check all local functions (Pan, Tilt, Zoom, Focus, etc.).
- Check and ensure that all relays are firmly seated on the control board.
- Check operation of auto-iris and adjust for correct operation per the manufacturers' operational and maintenance manual.
- Check proper function of thermostat.

- Check fan and replace where applicable.
- Clean and vacuum inside of cabinet.
- Inspect and change filter where applicable.
- Check light bulb and replace where applicable.
- Check incoming power for proper voltage and correct if not within tolerances.
- Check cabinet door for proper closure.

M.4.4.3. Camera Preventive Maintenance at Pole Level

- Check camera housing pressure (typically 5psi +/- 1psi). Pressurize with dry nitrogen if not within limits.
- Visually inspect camera housing.
- Clean glass with suitable glass cleaning agent.
- Inspect pan and tilt mechanism and adjust limit switches where applicable.
- Inspect housing mounting for corrosion.
- Remove any nests around the camera housing.
- Check and inspect the integrity of all cable harness and connectors. Replace defective items as necessary.
- Check integrity of surge protector and replace as necessary.
- Replace filter in camera housing.
- Check operation of thermostat inside camera housing.
- Check for corrosion of terminal inside housing.
- Check circuit box at the base of the camera pole to ensure that the terminal strips are corrosion free.

M.4.5. *Facility Electrical Systems and Supplies*

Electrical system work associated and required for the operation of the Project must be addressed in the requirements for Volume II, Chapter H, "Facilities Operations Plan".

M.4.6. *Lighting, Signage and Operating Timetable*

Platform lighting and signage as may be requested by NSR or the Department shall be included in the plans submitted to Amtrak for its review and approval as part of the design review process for the New Station Facility. Amtrak will not unreasonably withhold approval of such lighting and signage plans, provided the design does not create interference with Amtrak's operations.

Amtrak will update its operating timetable as appropriate for train operations at the New Station Facility.

TABLE OF CONTENTS

N. PARKING FEE COLLECTION MAINTENANCE

Section	Page
N.1. Definitions	2
N.2. References	3
N.3. Policy for Parking Fee Collection Maintenance	4
N.3.1. <i>Objective</i>	4
N.3.2. <i>Responsibility of Development Entity</i>	4
N.3.3. <i>Performance Time Frames</i>	8
N.3.4. <i>Acceptance Criteria</i>	9
N.4. Additional Requirements for Parking Fee Plaza Maintenance	11
N.4.1. <i>Inventory and History Record</i>	11
N.4.2. <i>Parking Fee Collection Signage</i>	11
N.4.3. <i>Parking Fee Plaza Gates</i>	11
N.4.4. <i>Parking Fee Collection Lighting</i>	11
N.4.5. <i>Parking Fee Collection Equipment</i>	12
N.4.6. <i>Parking Fee Plaza Canopies</i>	12
N.4.7. <i>Parking Fee Booth Units</i>	12
N.4.8. <i>Parking Fee Collection System & UPS</i>	12

N.1. Definitions

Light Curtain: A device that emits a light field between two poles, that maps the shape of a vehicle as the light pattern is interrupted.

Parking fee Booths: The physical enclosure that includes protective cover and safe refuge for parking fee collectors; parking fee-lane payment and processing equipment; and communications and emergency response alarms; etc.

Parking fee Canopy: The physical structure covering the parking fee booths and collection lanes, which provides both a cover and facility, and indicates where Patrons must pay applicable parking fees.

Parking Fee Collection System: The electrical and electronic equipment and computer information management system utilized to record and verify the revenue and vehicle classification.

Parking Facilities: The facilities within which parking fee payments are collected from vehicles; including the parking fee canopies; the parking fee booths; vehicle lanes; etc.

Treadle: A device embedded into the pavement that registers the number of axles or wheels as a vehicle passes over it.

Uninterruptible Power Supply (UPS): Power supplies that operate in parallel with the electric utility sources and supply their load without interruption when and if the utility source fails. Such power supplies must be utilized to meet the operating needs of the computers and critical elements of the Parking Fee Collection System

N.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- “International Building Code”, IBC.
- “Manual on Uniform Traffic Control Devices (MUTCD)”, FHWA.
- “National Fire Codes”, NFPA.
- “National Electrical Code”, NFPA.
- “International Mechanical Code”, IMC.
- “National Plumbing Code, ANSI.
- “Uniform Plumbing Code”, WPOA.
- “Uniform Heating and Cooling Code”, WPOA.
- “Chimneys, Fireplaces and Vents Code”, NFPA.
- Americans with Disabilities Act”, U.S. Department of Justice.
- Publication 23: “Maintenance Manual”, PennDOT
- National Standards, Specifications and Regulations as applicable, from the following organizations:
 - National Electrical Manufacturers Association (NEMA).
 - American National Standards Institute (ANSI).
 - American Society for Testing and Materials (ASTM).
 - Federal Communications Commission (FCC).
 - American Society of Civil Engineers
 - Portland Cement Association
 - American Concrete Institute
- Original Equipment Manufacturers’ (OEM) specifications, Maintenance Manuals, Handbooks, Procedures Guides, etc. as applicable for all installed equipment, systems and components.
- LEED (Leadership in Energy and Environmental Design) Guidelines.

N.3. Policy for Parking Fee Collection Maintenance

N.3.1. Objective

The objective of Parking Fee Collection Maintenance is to ensure that all elements, components, and systems are maintained in such a manner that they remain safe, functional, and continually operational in support of the parking fee collection activities, without posing hazards or undue delays to Patrons.

The Parking Fee Collection Maintenance includes; repairs due to damage, wear, breakage, emergency maintenance, cleaning, retro-fittings, and replacement due to age and obsolescence.

N.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices to ensure that all Parking Fee Collection components, elements, systems, and appurtenances are continually operational, secure, clean, sound, and in all ways safe and suitable for use. This requires that the Development Entity carry out its obligations in accordance with this Chapter in a manner that maintains and/or improves the condition and functionality of these facilities.

All equipment and resources required in supporting the operation of the Parking Fee Collection must be provided without fail by the Development Entity. All repair and replacement work must be scheduled, staged and preplanned so as not to adversely impact traffic movement or safety or the accuracy and validity of the parking fee collection procedures, or cause undue exposure of Project employees to traffic.

The Development Entity must perform Parking Fee Collection Maintenance, inspection and work activities at a frequency that ensures uniform and consistent compliance with all State and Federal regulations and the requirements specified within this Chapter.

All materials and construction requirements for Parking Fee Collection work performed by the Development Entity must conform to the appropriate and applicable requirements of the Reference Documents noted in Section N.2 of this Chapter.

Once a particular maintenance repair has been started, the work must continue during consecutive working days as weather permits until a thorough, complete, and workmanlike repair has been achieved. The Development Entity must establish and maintain all required traffic control and protection.

Work on Parking Fee Collection elements, components, systems, and appurtenances within the Project that must be performed by the Development Entity includes the following:

- General:
 - Create and maintain an inventory and history record of all Parking Fee Collection equipment, elements, components, systems, and appurtenances.
 - Ensure that only qualified, certified, licensed and/or well trained personnel perform work to these items, especially to sensitive, proprietary, and complex equipment and systems.
 - The maintenance of the all roadways and parking facilities are considered to be included with the requirements stated within Volume I, Chapter B, “Roadway Maintenance”.

- Parking Fee Collection Signage:
 - The maintenance of the Parking Fee Collection Signage is considered to be included with the requirements stated in Volume I, Chapter L, “Sign and Signage System Maintenance”, with the exception of the following:
 - Ensure that all parking fee rate signage is current, updated with changes in rate schedules, and well placed to inform Patrons of the applicable parking fees.
 - Ensure that the parking fee payment message process signs are well illuminated, functioning properly, clean, legible, and free of all defects.

- Parking Gates:
 - Maintain all vehicle stop/go gates free of defects, damage and malfunctions that could create or have the potential to create an unsafe condition.
 - Maintain all lane open/closed gates free of damage and defects.

- Parking Fee Collection Lighting:
 - The maintenance of the Parking Fee Collection Lighting is considered to be included with the requirements stated in Volume I, Chapter M, “Lighting and Electrical System Maintenance”, with the exception of the following:
 - Ensure that all Parking Fee Collection Lighting provides the proper illumination; functions as intended; remains free of damage and defects; remains free of burnt-out bulbs; and does not create an unsafe condition for Project employees and Patrons.
 - Ensure that driver stop/go lights, applicable canopies, lane signs, and the lane opened/closed lighting are functioning properly and are free of defects, burnt-out bulbs and damage.
- Parking Fee Collection Equipment:
 - Ensure that all parking fee collection equipment is properly functioning; free of defects and damage; and regularly inspected for continual operational ability. These components, elements, and systems that either comprise or interact with the collection of parking fees include, but are not limited to, the following:
 - Treadles
 - Light Curtains
 - Detector Loops
 - Parking fee Payment Message Process Signs
 - Vehicle Stop/Go Lights
 - Cash Drawers
 - Parking Fee Collection System Connections & Equipment
 - UPS Connections
 - Intercoms, Phones and Communication Systems
 - Emergency Alarms
 - Weigh Station / Barrier Equipment
- Parking Fee Canopies:
 - Ensure that the applicable canopies are free of defective roofing, deficient drainage, loose, or missing bolts, cracked welds, corrosion, loss of paint, deformation, loss of section, eccentricity or rotation about an axis, or other indications of weakened support.
 - Ensure that the connection and support of all illuminated rooftop and structure mounted signs are secure, and free of loose connections, buckled members, excessive corrosion, and other damage.

- Parking Fee Booth Units:
 - Repair all windows that leak, have a poor wind seal, or are scratched and clouded offering poor visibility.
 - Repair or replace all booth doors that do not close properly, do not seat on the weather-seal, or that have broken locks.
 - Ensure that all booth floors that are unsound, that are missing the rubber mat flooring, that have defective floor hatches (which open directly over the access tunnels) or are otherwise unsafe, are repaired.
 - Ensure that all communications equipment, including the intercom and the emergency signal device(s) are maintained in continual working order, and if broken or malfunctioning, are repaired.
 - Ensure that all heating, ventilation and air conditioning equipment is properly operating.

- Parking Fee Collection System and Uninterruptible Power Supply (UPS):
 - Ensure that the Parking Fee Collection System and the UPS remain operational at times, with periods of “down-time” limited only to those necessary for repair or maintenance work.
 - Ensure that all repair and maintenance work is performed by qualified personnel familiar with the particular system.
 - Perform maintenance and “back-ups” of the Parking Fee Collection System.

N.3.3. *Performance Time Frames*

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required maintenance, repair or replacement work to Parking Fee Collection System, element, component or appurtenance:

TABLE N.3.3.1

Parking fee Booth and/or Plaza Component, Element or System	Maximum Time Duration
Parking Fee Collection Signage	8 Hours
Parking Fee Booth Gates	24 Hours
Parking Fee Collection Lighting	8 Hours
Parking Fee Plaza Collection Equipment	2 Hours
Parking Fee Plaza Canopies	7 Days
Parking Fee Booth Units	2 Days
Parking Fee Collection System and UPS	4 Hours

The following table establishes the minimum frequency that a particular maintenance operation is to be performed.

TABLE N.3.3.2

Maintenance to be Performed	Minimum Frequency of Occurrence
<u>Parking Fee Booth Cleaning:</u>	
- Cleaning Booth Signs and Windows	3 Times Per Week
- Emptying of Litter Receptacles	Once Daily

N.3.4. *Acceptance Criteria*

Parking Fee Collection maintenance work will be considered acceptable when the following criteria are met or exceeded:

- General:
 - The inventory and history record is current and complete.
 - The Parking fee Booths and the surrounding areas present a clean, tidy and neat appearance.

- Parking Fee Collection Signage:
 - The parking fee rate signage is current, updated with changes in rate schedule, and are well placed.
 - The parking fee payment message process signs are well illuminated, functioning properly, clean, legible, and free of all defects.

- Parking Fee Booth Gates:
 - The Parking fee Booth stop/go gates are functioning properly, are free of all defects and damage, and do not present an unsafe condition.
 - The Parking fee Booth lane open/closed gates are free of damage and defects.

- Parking Fee Collection Lighting:
 - Parking Fee Collection lighting is providing the proper illumination; functioning as intended; free of damage and defects; free of burnt-out bulbs; and does not create an unsafe condition.
 - The lane status, driver stop/go lights, and the lane opened/closed lighting are functioning properly, and are free of defects, burnt-out bulbs and damage.

- Parking Fee Collection Equipment:
 - All parking fee collection equipment, components, elements, and systems are properly functioning and free of defects and damage.

- Parking Fee Plaza Canopies:
 - The applicable canopies are free of defective roofing, deficient drainage, loose or missing bolts, cracked welds, loss of paint and section, deformation, eccentricity or rotation about an axis, and other indications of weakened support.

- The connection and support of the illuminated guidance signs are secure and free of loose connections, buckled members, excessive corrosion, and other damage.

- Parking Fee Booth Units:
 - All windows are free of leaks, poor wind seals, not scratched or clouded, and provide good visibility.
 - All booth doors close properly, seat on the weather-seal, and have properly functioning locks.
 - All booth floors are sound, have a rubber mat flooring present, have no defective floor hatches, and are otherwise safe.
 - All communications equipment, including the intercom and the emergency signal devices are in proper working order, and functioning as intended.
 - All heating, ventilation and air conditioning equipment is properly operating.

- Parking Fee Collection System and Uninterruptible Power Supply (UPS):
 - The Parking Fee Collection System and the UPS are fully operational.
 - Maintenance and “back-ups” of the Parking Fee Collection System are being performed on a regular basis.

N.4. Additional Requirements for Parking Fee Collection Maintenance

N.4.1. Inventory and History Record

The Development Entity must develop, maintain, and keep current a complete and detailed inventory and history record of all Parking Fee Collection equipment, components, systems and appurtenances, and must keep an ample supply of replacement parts available on-site. The inventory and history record must include the following at a minimum:

- Type, make, model, age, installation date and location of each and every parking fee booth component and element.
- Chronological history of all repairs/replacements including a brief note of what the change was (i.e. replaced treadle, repaired light curtain, replaced lighting, etc.).

N.4.2. Parking Fee Collection Signage

The requirements for inspecting, cleaning, repairing, relocating and replacing Project signage is discussed in detail in Volume I, Chapter L, “Sign and Signage System Maintenance”.

The Development Entity’s maintenance staff must make it a habit to regularly observe sign conditions and illumination while patrolling the Project, and any damage, non- functioning lights or impaired visibility must be reported for repair.

Any parking fee regulatory signs that are placed by the Development Entity to inform motorists of the penalties for parking fee evasion must be inspected, cleaned, replaced or modified as necessary, and maintained in the same manner as discussed herein and as specified in Volume I, Chapter L, “Signs and Signage System Maintenance”.

N.4.3. Parking Fee Plaza Gates

Malfunctioning gates must be reported by the parking fee attendants since they can pose a safety concern to Patrons. Parking fee Gates that continually malfunction or have impacted vehicles must be locked in the open/up position and disconnected/deactivated from operations until repaired.

N.4.4. Parking Fee Collection Lighting

The lighting maintenance and replacement requirements, including lamp replacement and requirements for electrical systems, are specified in Volume I, Chapter M, “Lighting & Electrical System Maintenance”.

Parking Fee Collection lighting must be maintained as discussed above. All lighting fixtures that present unsafe conditions, such as the presence of smoke or excessive heat, that flicker or are dark, or that demonstrate high current draw, must be repaired.

Parking fee attendants are to visually inspect all lighting within and around the Parking Facilities including parking fee payment process lights; driver stop-and-go lights; etc.; during each shift, and must report all defects for repair.

N.4.5. *Parking Fee Collection Equipment*

The accuracy, functionality and operation of parking fee collection equipment including, but not limited to, the treadles, vehicle light curtains, touch screen monitors, etc., must be verified by the Development Entity on a daily basis, by comparing traffic axle counts with the parking fee collection reports and vehicle classification device data. Malfunctioning parking fee collection equipment must be regarded as deficient components that affect productive services, and therefore must be repaired. If proper operation cannot be restored within this time frame, the affected parking fee plaza lane can remain closed, and traffic diverted to one of the remaining plaza lanes until such time as repairs are complete.

N.4.6. *Parking Fee Plaza Canopies*

The parking fee plaza canopies must be inspected annually in the same manner as any component of the Project, in accordance with Volume II, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”. The integrity of the roofing system and all architectural elements, the security of the cladding system, the functioning of the drainage system and downspouts, and the operation of the electrical and lighting systems must be inspected and repaired when found deficient.

The canopy frame and foundations will require an independent inspection and performance evaluation by the Development Entity’s Pennsylvania Licensed Professional Engineer.

N.4.7. *Parking Fee Booth Units*

All parking fee plaza booths must be inspected annually in accordance with Volume II – Operations and Procedures Manual, Chapter M, “Annual State of the Amtrak Station Improvement Project Reports”.

N.4.8. *Parking Fee Collection System & UPS*

The current Parking Fee Collection System is an integrated system developed for the Project, and is comprised of the following major elements:

- A dedicated UPS/intranet server room located next to the Parking fee Counting Room.
- Internal network (intranet) servers, data storage and backup devices, power supply (UPS), and peripheral devices such as monitors, printers, etc.
- Proprietary software to run the system, perform calculations and drive the timed- backup storage devices.
- A system of touch-screen (interactive) display monitors with terminals in each parking fee booth, the Control Tower, the Parking fee Counting Room, and other locations.
- A network of hard-wired data connections between all locations served by the Parking Fee Collection System and all traffic counting and detection devices.

The Parking Fee Collection System equipment must be maintained on a continuous basis. All Development Entity employees who make use of the system must immediately report difficulties with the Parking Fee Collection System for immediate repairs.

The UPS system must be continuously maintained and must effectively switch supplied power from the back-up generator whenever required, in order to eliminate the possibility of lost or corrupted data.

TABLE OF CONTENTS

O. FACILITY MAINTENANCE

Section	Page
O.1. Definitions	2
O.2. References	3
O.3. Policy for Performing Facility Maintenance Work	4
O.3.1. <i>Objective</i>	4
O.3.2. <i>Responsibility of Development Entity</i>	4
O.3.3. <i>Performance Time Frames</i>	11
O.3.4. <i>Acceptance Criteria</i>	12
O.4. Additional Requirements	16
O.4.1. <i>Inventory and History Record</i>	16
O.4.2. <i>Building Exteriors</i>	16
O.4.3. <i>Building Interiors</i>	16
O.4.4. <i>Mechanical Systems</i>	16
O.4.5. <i>Electrical Systems</i>	17
O.4.6. <i>Services</i>	17
O.4.7. <i>Life Safety & Security</i>	17

O.1. Definitions

Electrical Systems: Systems, elements and components that are contained in facilities, and which supply, distribute and function by the use of electricity. These systems include, but are not limited to: substations, meters, wiring, service panels, individual circuits, generators, transformers, lighting, motor control units, back-up generators and systems, emergency lighting, etc.

Facility: The “Project Facilities” (as defined in the PPA) and the equipment, components, elements and systems that are housed within in each.

Fire Protection Systems: Systems, elements and components that are intended to assist in the prevention and suppression of fire. These systems include, but are not limited to, fire extinguishers, exit signage, fire alarms, sprinkler systems, carbon monoxide detectors, heat sensors, smoke detectors, etc.

Life Safety Systems: Systems, elements and components that are contained in facilities, and which promote health, safety, and life preservation. These systems include, but are not limited to, communication systems; security systems; fire suppression and prevention systems; and medical prevention and attention stations; etc.

Mechanical Systems: Systems, elements and components that are contained in facilities and that supply and distribute ventilation and climate control. These systems include, but are not limited to, HVAC systems and components, thermostats, boilers, combustion dampers, heat exchangers, furnaces, air handling units, fresh air intakes, ductwork, return fans, zone dampers, exhaust fans, chillers/condensers, pumps, etc.

Plumbing Systems: Systems, elements and components that are contained in facilities, and that supply, distribute and provide potable water, or dispose of waste water. These systems include, but are not limited to, valves, piping, water heaters, water storage tanks, faucets, toilets, sinks, showers, booster pumps, ejector pumps, sanitary piping, hot/cold water piping, etc.

Preventive Maintenance: Services required to maintain a facility and its components, equipment and systems at the original design standards throughout their intended life span, including periodic and scheduled inspections, adjustment, calibration, cleaning, replacement of parts and minor repairs to restore equipment to normal function.

Security Systems: Systems, elements and components which promote safety and security of the people and facilities from outside parties. These systems include, but are not limited to, alarms, cameras, monitor stations, intercoms and radios, access control, etc.

Uninterruptible Power Supply (UPS): Power supplies that operate in parallel with the electric utility sources and supply their load without interruption when and if the utility source fails. Such power supplies must be utilized to meet the operating needs of the computers and critical elements of the Parking Fee Collection System

O.2. References

All stated references must be the most current version, or the document known to have succeeded or replaced the original stated herein:

- “International Building Code (IBC 2003)”, ICC.
- “National Fire Codes”, NFPA.
- “National Electrical Code”, NFPA.
- “International Mechanical Code”, IMC.
- “National Plumbing Code, ANSI.
- “Uniform Plumbing Code”, WPOA.
- “Uniform Heating and Cooling Code”, WPOA.
- “Boiler and Unfired Pressure Vessel Code, ASME.
- “Chimneys, Fireplaces and Vents Code”, NFPA.
- Americans with Disabilities Act (ADA)”, U.S. Department of Justice.
- Occupational Health and Safety Act (OSHA) Guidelines
- OSHA Publications List via Catalog or Website, OSHA (Website: <http://www.osha.gov/pls/publications/pubindex.list>).
- Standards, Specifications and Regulations as applicable, from the following organizations:
 - National Electrical Manufacturers Association (NEMA).
 - American Waterworks Association (AWWA).
 - American National Standards Institute (ANSI).
 - American Society for Testing and Materials (ASTM).
 - Federal Communications Commission (FCC).
 - Underwriters Laboratory (UL).
- Original Equipment Manufacturer’s (OEM) specifications, Maintenance Manuals, Handbooks, Procedures Guides, etc. as applicable for all installed equipment, systems and components.

O.3. Policy for Performing Facility Maintenance Work

O.3.1. Objective

The objective of Facility Maintenance is to ensure that all Facilities within the Project and the components, elements and systems located within such Project are properly maintained in such a manner that they remain safe, clean, welcoming, accessible, and continually operational in their functions of supporting the Project.

Facilities require maintenance; repairs due to weather damage, wear and breakage, age and other use-related factors; emergency maintenance; preventative maintenance; retro- fittings; and replacements due to age and obsolescence.

In addition, effective Facility Maintenance requires management of inventory; physical assets; workforce; building systems; equipment operation; inspection and repair by qualified personnel; and protocols for tracking and fulfilling work.

O.3.2. Responsibility of Development Entity

In order to meet the requirements of this Chapter, the Development Entity must engage in practices to ensure that all Facilities as well as their components, elements and systems remain continually operational, secure, clean, sound, and in all ways safe and suitable for use. This requires that the Development Entity carry out its obligations in accordance with this Chapter in a manner that maintains and/or improve the condition and functionality of the Facilities; and prevents unforeseen breakdowns.

The Development Entity is responsible for all Facilities to remain in full and constant operation, and all staff, equipment, systems, components and resources are required to support the Facilities without fail. All repair, replacement and maintenance work must be scheduled, staged and replanned so as not to adversely impact or impair the operation of the Facilities.

In order to ensure compliance with the objectives and requirements of this Chapter, the Development Entity must incorporate sound and established Facility Maintenance practices; and must perform preventative maintenance strategies to ensure that the equipment service continues to function reliably.

The Development Entity must perform Facility Maintenance, inspection and work activities at a frequency that ensures uniform and consistent compliance with all State and Federal regulations and the requirements specified within this Chapter.

The Development Entity must engage qualified, bonded and/or licensed personnel to service, operate, inspect, and repair the systems within the Facilities.

All materials and construction requirements for Facilities Maintenance work performed by the Development Entity must conform to the appropriate and applicable requirements of the Reference Documents noted in Section O.2 of this Chapter.

Once a particular maintenance repair has been started, the work must continue during consecutive working days as weather permits until a thorough, complete and workmanlike repair has been achieved.

Work on the Facilities, and the elements, components, systems and appurtenances housed within each Project Facility that must be performed by the Development Entity includes, but is not limited to, the following:

- General:

- Create and maintain an inventory and history record of all Facility equipment, elements, components, systems and appurtenances.
- Ensure that only qualified, certified, licensed and/or well trained personnel perform work to these items, especially to sensitive, proprietary and complex equipment and systems.
- Coordination with all utilities and services including, but not limited to, electric, gas, fuel, telephone, sewer, sanitary and water.
- Ensure that the work areas are left in a manner that presents a clean and tidy appearance.

- Building Exteriors:

Generally: Ensure that the Facility exteriors are maintained so to preserve the integrity of the exterior building envelopes; ensure the safety of the Facility and its occupants and visitors; and

- Foundations: Ensure that visible components of foundations and supported elements are inspected where settlement conditions are found, and repaired as instructed by Licensed Professional Engineer in the Commonwealth of Pennsylvania. In addition, all visible surfaces should be maintained free of cracks, seepage, scaling, spalling, corrosion, deterioration, or efflorescence.
- Exterior Walls: Ensure that the walls are free of corrosion, spalls, cracks, misalignment, rust, peeling, blistering and other such defects and deficiencies; and that all bolts, clips, rivets, nails, and other fasteners are properly attached and secure.
- Exterior Walls: Ensure that the masonry wall facades are free of cracks, broken masonry units, open mortar joints, efflorescence, and deterioration and correct all suspected moisture infiltration.
- Flag Pole: Ensure that the flag pole remains free of rust, corrosion, deterioration, and remains well secured.
- Roofing: Ensure that roofing is free of all surface bare spots, blistering, splits, cracks, ridging, loose laps and seams, punctures, missing fasteners and general deterioration.
- Roofing: Ensure that all flashing, counter flashing, copings, seals, roof penetration points, around roof top HVAC equipment, and parapet wall roofing terminations are free of leaks, cracks, punctures and deterioration.

- Roofing: Ensure that roofing drains adequately so that it remains free of ponding, staining and debris collection.
 - Roofing: Ensure that roof ventilation systems provide continual airflow, prevent condensation and prevent icing at the eaves and roof edges.
 - Gutters: Ensure that all gutters and downspouts are free of leaks, obstructions, rust and corrosion, and function as intended. Downspouts to discharge directly into drains or onto rainwater splashblocks or impervious surfaces to lead water away from face of building, as intended.
 - Exterior Doors: Ensure that all doors are free of leaks, drafts and air gaps; all hinges, closers, locksets, and other hardware or components operate as intended; and all door frames and panels are secure and properly set.
 - Garage Doors: Ensure that all door panels are free of defects and deficiencies; frames and panels are secure and properly set; and springs, cables, door openers and other hardware operate as intended.
 - Windows: Ensure that all windows are free of breaks, leaks, voids and non-operational components.
 - Surface Finishes: Ensure that all exterior paints and coatings are free of flaking, blistering, chalking and other deterioration.
 - Sealants: Ensure that joint sealants, weather-protection sealants and draft-stopping sealants are intact and functioning as intended.
 - Signs: Ensure that all signs and sign components are free of rust, corrosion and deterioration, and are well secured.
- Building Interiors:
 - Access Tunnels: Ensure that floors, walls and roofs are free of damage due to water/moisture penetration and/or structural deterioration. Remove rust from metal surfaces and re-paint. Ensure that surfaces generally are free of efflorescence and mold.
 - Interior Floors: Ensure that all floor coverings are clean, free of trip and slip hazards, and replaced or repaired when worn.
 - Walls and Partitions: Ensure that all walls are free of cracks, penetrations, water damage, faded or damaged coverings, and all other damage that might be either aesthetic or structural. Ensure that cracked tiles of tiled surfaces are replaced and that joints which are functionally or visually deteriorated are re-grouted.
 - Toilet Partitions: Ensure that partitions are securely mounted, free of damage and corrosion, correctly aligned so that doors operate without binding, and that hardware operates as intended.

Ensure that toilet accessories and mirrors are securely mounted, free of damage and operate as intended.

- Interior Doors: Ensure that all doors frames and panels are secure and properly set; and all hinges, closers, locksets, and other hardware or components operate as intended.
- Interior Windows: Ensure that all windows are free of breaks and non-operational components.
- Ceilings: Ensure that the drywall ceilings, suspended ceiling, and other types of ceilings are firmly attached and secure; and remain free of all cracks, water damages, and other deficiencies.
- Built-in Fixtures: Ensure that worktops, vanity tops, cabinets, lockers and other built-in fixtures are free of damage, doors and drawers operate smoothly and cabinet hardware operates as intended.
- Mechanical Systems:
 - HVAC Controls: Ensure that all thermostats, automatic control valves and dampers, diffusers, control units, etc. are inspected, tested, maintained, repaired and replaced as required to maintain space temperature set point and operation of all HVAC systems.
 - HVAC Distribution System: Ensure that all of the HVAC distribution components and systems, including ductwork, grills, registers, volume dampers, supply, return fans, exhaust systems, etc., are inspected and tested; free of rust, corrosion, damage, or defects; and replaced or repaired as required to maintain system operation.
 - HVAC Heating/Cooling Units: Ensure that all heating and cooling units provide trouble free operation to maintain space temperature set points. Ensure that all HVAC equipment such as air handling units, unitary air conditioning units, split system air conditioning units, etc., are inspected and tested. Maintenance of this equipment requires inspection of associated hydronic and refrigerant coils, gas fired furnaces, condenser coils, and supply fans, return fans, exhaust fans, etc. Additionally terminal equipment such as duct mounted heaters, furnaces, air terminal units, unit heaters, etc., will require inspection and testing. All equipment or equipment component must be free of damage, deterioration and non-functional items replaced. All equipment must conform to all applicable codes and regulations as noted in Section O.2 of this Chapter. Equipment must be kept clean and continually operational at all times.
 - Central Plant Equipment: Where applicable, all central plant equipment such as water cooled chillers, air cooled chillers, cooling towers, boilers (gas/fuel or electric fired), pumping systems, chemical feed systems, expansion tanks, etc., must be inspected and maintained as required. Any damaged or non-functional components of the above mentioned equipment must be replaced to ensure proper operation of the equipment. If replacement of equipment components is not sufficient to ensure proper operation of the equipment, the entire unit may have to be replaced. All equipment shall conform to all applicable codes and regulations as noted in Section O.2 of this Chapter. Equipment must be kept clean and continually operational at all times.

- Plumbing Fixtures: Ensure that all plumbing fixtures, including sinks, toilets, showers, spigots, drains, faucets, drinking fountains, etc., remain free of leaks, are clean, remain unclogged, and are free of damage and defects that affect their function and operation. Replace any damaged plumbing fixture or associated components that are beyond repair.
 - Plumbing Hot Water Heaters: Ensure that all hot water heaters are free of leaks, corrosion, malfunctions and defects that would impair or interrupt the intended service. If mixing valves are installed any temperature sensors are required to be checked to meet the applicable Code required at the discharge temperature.
 - Plumbing Pumping Systems: Ensure that all ejector pumps, sewage pumps, sump pumps, water pumps, portable-dewatering pumps, submersible pumps and all other pumps within the Facilities function as intended, and are fully capable of operating as intended when required.
 - Domestic Water Piping System: Ensure that all supply and pipelines including anti-siphon devices are free of leaks, damage, corrosion and deterioration; and are well secured. Ensure that backflow preventer(s) is/are present and operational on all lines that allow a hose hookup. Ensure the piping insulation and labels are installed and are in good condition, and repair/replace any damaged insulation.
 - Sanitary and Vent System: Ensure that the sanitary and vent piping systems are free of any clogs. Repair or replace any damaged piping and ensure that all clean-outs are kept accessible and are sealed.
- Electrical Systems
 - Electrical Supply and Distribution: Ensure that all wiring, raceways, unit substations, panel boards, circuits, receptacles, switches, etc., or other items that distribute or supply electricity to systems or items within the Facilities conform to all applicable codes and regulations; are free of “short”, loose connections, defects and damage; are clearly identified and marked; are secured as required to prevent unwarranted entry; and are properly attached and secured at all times.
 - Electrical Lighting: Ensure that all lighting provides the proper illumination for the function intended; is secured in its place; conforms to all applicable codes and regulations; is free of burnt-out or malfunctioning bulbs; is free of broken, damaged or defective reflectors, fixtures, or lenses; and is free of loose and faulty wiring.
 - Electrical Motor Control Units: Ensure that all operations both to and from the Motor Control Units provide the proper volts and amperage; function and supply the equipment in the correct order and manner; are free of defects and deficiencies; and provide full operating capacity when required.

- Facility Services:
 - Grounds Maintenance: Ensure that with respect to the grounds around each Facility within the Project, landscaping and cleaning is performed in accordance with the requirements stated in Volume I – Maintenance Manual, Chapter E, “Landscape and Roadside Maintenance”; and the snow and ice on the parking areas and the sidewalks around each Facility is removed and cleaned as addressed by the procedures established in Volume II – Operations and Procedures Manual, Chapter G, “Snow and Ice Control Plan”.
 - Housekeeping: Ensure that all portions, areas and rooms of each Facility are cleaned at least daily to remove trash; sanitize and disinfect bathrooms and locker rooms; and restock bathroom amenities.
 - Pest Control: Ensure that pest control is performed, monitored and maintained if and when required; the remains of the traps properly disposed; and the source of the problem is located and corrected.

- Life Safety:
 - Communication Systems: Ensure that all telephones, intercoms, radios systems, mobile communication base stations, and all other communication systems that are housed or originate in a Facility are maintained, repaired, tested, inspected, and replaced so that they remain in full and continual operation.
 - Fire Suppression, Fire Alarm and Precaution Systems: Ensure that all fire alarms, sprinkler systems, heat sensors, smoke detectors, carbon dioxide detectors, fire extinguishers, call buttons, exit signs, emergency lighting, and all other fire suppression and precaution items are fully charged and replaced on a determined schedule; conform to all applicable codes, laws and regulations; are free of defects, deficiencies and malfunctions; and are inspected, tested, maintained, repaired and replaced so that they remain ready for proper operation when required.
 - Medical Prevention and Attention Stations: Ensure that all medical prevention and attention stations are inspected, replenished, updated and clearly located at all times. These items include, but are not limited to, first-aid kits, emergency contact signage, eye wash stations, safety showers, etc.
 - Security Systems: Ensure that all systems that provide for the safety of the Development Entity’s staff, the public, equipment and Facilities are maintained, inspected, tested, repaired and replaced so as to provide full and continual operation. These security systems include, but are not limited to, cameras, monitoring stations, access control, surveillance, alarms, etc.

- Emergency Power Supply System:
 - The Uninterrupted Power Supply (UPS) system located on the Project, as well as central feeds, provides power to the Project 24 hours a day, 365 days a year. In order to ensure that this service is provided without interruption a back-up power supply should be present at each location. The Development Entity must inspect, test, maintain, repair and if required replace or supplement the back-up power supply so that if a power interruption does occur, the Project will continue to operate and function.

O.3.3. Performance Time Frames

The following table establishes the maximum duration from the time a deficiency is or reasonably should be detected by or reported to the Development Entity, within which the Development Entity must complete the required maintenance, repair or replacement work to Facility and/or its systems, equipment, elements, components or appurtenances:

Facility Component, Element or System	Maximum Time Duration
<u>Building Exterior:</u> - Exterior Doors - Exterior Walls - Flag Pole - Foundations - Garage Doors - Gutters - Roofing - Signs - Windows - Platform and Shelter Sweeping - Platform Concrete Repair - Station Fence	1 Day 2 Weeks 7 Days 7 Days 2 Days 4 Weeks 7 Days 24 Hours 7 Days 1 Day 2 Days 24 Hours (Temporary); 30 Days (Permanent)
<u>Building Interiors:</u> - Ceilings - Interior Doors - Interior Floors - Interior Windows - Walls and Partitions - Station Cleaning	4 Weeks 24 Hours 3 Weeks 1 Week 4 Weeks 3 times per day
<u>Mechanical Systems:</u> - HVAC - Plumbing - Elevators	8 Hours 12 Hours 24 Hours
Electrical Systems	24 Hours
<u>Life Safety:</u> Fire Suppression and Precaution Medical Prevention and Attention Security Systems	2 Hours 4 Hours 1 Hours
Emergency Power Supply System	Immediate

O.3.4. *Acceptance Criteria*

Facility maintenance work will be considered acceptable when the following criteria are met or exceeded:

- General:
 - The inventory and history record is current and complete.
 - The work areas inside and outside of the Facilities present a clean, tidy and neat appearance.

- Building Exteriors:
 - Exterior Doors: All exterior doors are free of leaks, drafts, voids; all hinges, closers, locksets, and other hardware or components operate as intended; and all door frames and panels are secure and properly set.
 - Exterior Walls: All exterior walls are structurally sound; do not present any safety hazards; are free of corrosion, spalls, cracks, misalignment, rust, peeling, blistering, and other defects and deficiencies; all bolts, clips, rivets, nails, and fasteners are secure; and all masonry wall facades are free of cracks, broken masonry units, open mortar joints, efflorescence, and deterioration.
 - Flag Pole: The flag pole is free of rust, corrosion, deterioration, and is secure.
 - Foundations: The foundations are free of all settlement, deflection, expansion, or contraction conditions; and all cracks, seepage, scaling, spalling, corrosion, deterioration, and efflorescence has been repaired
 - Garage Doors: All door panels are free of defects and deficiencies; frames and panels are secure and properly set; and springs, cables, door openers and other hardware operate as intended.
 - Gutters: All gutters and downspouts are free of leaks, obstructions, rust and corrosion, and function as intended.
 - Roofing: All roofing is free of all bare spots, blistering, splits, cracks, ridging, loose laps and seams, punctures, missing fasteners; all flashing, counter flashing, copings, seals, roof penetration points, and parapet wall roofing terminations are free of leaks, cracks, punctures and deterioration; the roofing drains adequately so that it remains free of ponding, staining and debris collection; and the roof ventilation provides continual airflow, prevents condensation and prevents icing at the eaves and roof edges.
 - Windows: All windows are free of breaks, leaks, voids and non- operational components.
 - Signs: All signs are free of rust, corrosion, deterioration, and are well secured.

- Building Interiors:
 - Ceilings: All ceilings are firmly attached and secure; and remain free of cracks, water damages and other deficiencies.
 - Interior Doors: All doors frames and panels are secure and properly set, and all hinges, closers, locksets, and other hardware or components operate as intended.
 - Interior Floors: All floor coverings are clean, free of trip and slip hazards, and replaced or repaired when worn.
 - Interior Windows: All windows are free of breaks and non-operational components.
 - Walls and Partitions: All walls are free of cracks, penetrations, water damage, faded or damaged coverings, and all other aesthetic and structural damage.

- Mechanical System:
 - HVAC Controls: All thermostats, automatic control valves and dampers, diffPatrons, control units, etc., have been inspected, tested, maintained, repaired and replaced as required to maintain space temperature set point and operation of all HVAC systems.
 - HVAC Distribution System: All HVAC distribution components and systems, including ductwork, grills, registers, volume dampers, supply, return fans, exhaust systems, etc., have been inspected and tested; free of rust, corrosion, damage, or defects; replaced or repaired as required to maintain system operation.
 - HVAC Heating/Cooling Units: All heating and cooling units are operating trouble free to maintain space temperature set points. All HVAC equipment such as air handling units, unitary air conditioning units, split system air conditioning units etc. have been inspected and tested. All associated hydronic and refrigerant coils, gas fired furnaces, condenser coils, supply fans, return fans, exhaust fans, etc., has been inspected. Additionally, terminal equipment such as duct mounted heaters, furnaces; air terminal units, unit heaters, etc., have been inspected and tested. All equipment or equipment components are free of damage, deterioration, and non-functional items have been replaced. All equipment conforms to all applicable codes and regulations. Equipment is clean and continually operational.
 - Central Plant Equipment: All central plant equipment such as water cooled chillers, air cooled chillers, cooling towers, boilers (gas/fuel or electric fired), pumping systems, chemical feed systems, expansion tanks, etc., have been inspected and are being maintained. Any damaged or non-functional components have been replaced to ensure proper operation of the equipment. When replacement of equipment components is not sufficient to ensure proper operation, the entire unit has been replaced. All equipment conforms to all applicable codes and regulations. Equipment is clean and continually operational.

- Plumbing Fixtures: All plumbing fixtures, including sinks, toilets, showers, spigots, drains, faucets, drinking fountains, etc., are free of leaks, are clean, remain unclogged, and are free of damage and defects. Damaged plumbing fixture or associated components beyond repair have been replaced in kind.
- Plumbing Hot Water Heaters: All hot water heaters are free of leaks, corrosion, malfunctions and defects. Mixing valves are properly installed and temperature sensors meet the required code discharge temperature.
- Plumbing Pumping Systems: All ejector pumps, sewage pumps, sump pumps, water pumps, portable-dewatering pumps, submersible pumps, and all other pumps are functioning as intended, and are fully capable of operating as intended when required.
- Domestic Water Piping System: All supply and pipelines, including anti-siphon devices, are free of leaks, damage, corrosion and deterioration; and are well secured. Backflow preventer(s) is/are present and operational on all lines that allow a hose hookup. Piping insulation and labels are installed, and in good condition.
- Sanitary and Vent System: All sanitary and vent piping systems are free of any clogs; no damaged piping is present; and all clean-outs are accessible and sealed.
- Electrical Systems:
 - Electrical Supply and Distribution: All electrical supply and distribution items conform to all applicable codes and regulations; are free of “shorts”, loose connections, defects and damage; are clearly identified and marked; and are secured to prevent unwarranted entry.
 - Electrical Lighting: All lighting provides the proper illumination; fixtures are secure; conforms to all applicable codes and regulations; is free of burnt-out or malfunctioning bulbs; is free of broken, damaged or defective reflectors, fixtures, or lenses; and is free of loose and faulty wiring.
 - Electrical Motor Control Units: All Motor Control Units provide the proper power supply; conveys the proper function commands to the equipment in the correct order and manner; are free of defects and deficiencies; and provide full operation.
- Facility Services:
 - Grounds Maintenance: All grounds around each facility are neatly landscaped and clean; and snow and ice has been properly removed.
 - Housekeeping: All portions, areas and rooms of each facility are cleaned, disinfected and restocked with supplies daily.
 - Pest Control: Pest control is being performed, monitored and maintained when required; the remains of the traps are being properly disposed; and the source of the problem has been corrected.

- Life Safety:
 - Communication Systems: All communication systems are being maintained, repaired, tested, inspected, and replaced so that they remain in full and continual operation.
 - Fire Suppression, Fire Alarm and Precaution Systems: All fire suppression and precaution systems are being fully charged and replaced; conform to all applicable codes, laws and regulations; are free of defects, deficiencies and malfunctions; are being inspected, tested, maintained, repaired and replaced so that they remain ready for proper operation when required.
 - Medical Prevention and Attention Stations: All medical prevention and attention stations have been inspected, replenished, updated and are clearly located.
 - Security Systems: All security systems are being maintained, inspected tested, repaired and replaced to provide full and continual operation.

- Emergency Power Supply System:
 - All back-up generators have been inspected, tested, maintained and repaired so that if a power interruption does occur, the Project will continue to operate and function.

O.4. Additional Requirements

O.4.1. Inventory and History Record

The Development Entity must obtain and store all Operations and Maintenance Manuals, OEM guidelines, and manufacturer's specifications in a log and file so that they can be referred to for specific maintenance requirements.

Blueprints and line schematics must be preserved, or developed if missing or incomplete, for each MEP system, showing all outlets, appliances, motors, panels, etc. for easier maintenance and repairs.

The Development Entity must develop, maintain, and keep current a complete and detailed inventory and history record of all Facility equipment, components, systems and appurtenances, and must keep an ample supply of replacement parts available on-site. The inventory and history record must include the following at a minimum:

- Type, make, model, age, installation date and location of each and every parking fee booth component and element.
- Chronological history of all repairs/replacements including a brief note of what the change was (i.e. replaced furnace, repaired boiler curtain, replaced alarm system, etc.).

O.4.2. Building Exteriors

Any improvement or maintenance required must meet all applicable Federal and State Codes, Ordinances and Laws, and all work must be undertaken in accordance with all applicable permit requirements as necessary. All improvements must be made to current requirements at the time of the improvement.

O.4.3. Building Interiors

Any improvement or maintenance required must meet all applicable Federal and State Codes, Ordinances and Laws, and all work must be undertaken in accordance with all applicable permit requirements as necessary. All improvements must be made to current requirements at the time of the improvement.

All lighting and interior electric repairs or replacements must be made in accordance with current Federal and State codes, ordinances and Laws in effect at the time of the repair.

O.4.4. Mechanical Systems

Any improvement or maintenance required must meet all applicable Federal and State Codes, Ordinances and Rules, and all work must be undertaken in accordance with all applicable permit requirements as necessary. All improvements must be made to current requirements at the time of the improvement.

O.4.5. *Electrical Systems*

Any improvement or maintenance required must meet all applicable Federal and State Codes, Ordinances and Laws, and all work must be undertaken in accordance with all applicable permit requirements as necessary. All improvements must be made to current requirements at the time of the improvement.

O.4.6. *Services*

Special attention should be provided to the aesthetic and cleanliness values of the ground and services within the Project.

All Pest control services must be performed in accordance with all current Federal, State and Local codes, ordinances and Laws in effect at the time of the service.

O.4.7. *Life Safety & Security*

Any improvement or maintenance required must meet all applicable Federal, State and Local Codes, Ordinances and Laws, and all work must be undertaken in accordance with all applicable permit requirements as necessary. The Development Entity must remain well-informed of the latest life safety and security requirements and maintain current life safety and security features throughout the Project.