



# **CASHLESS TOLLING**

# **DESIGN-BUILD PROJECT**

**TA 19-1, Contract No. D800002**

# **Request for Proposals**

**Addendum #3**

**April 1, 2019**

Modification to the Request for Proposals

CASHLESS TOLLING

Design-Build Project

TA 19-1, Contract No. D800002

**Note to Proposers**

Differences between the deleted pages and the revised pages have been identified as follows:

- Brackets have been inserted on the left-hand margin of the pages to indicate where changes have been made to the documents; and
- Text additions have been shown in underlined red font and text deletions have been shown in crossed out red font.

**General Instructions**

Delete Page 2 of the Instructions to Proposers, Appendix D, Price Proposal Submittal Requirements and substitute the attached revised Page 2.

Delete Pages 63, 70, 71, 75, 78, 81, 84, 85, 88 through 90, 93 through 95, 100, 103, 110, 114, 116, 122, 124, 133, 134, 136, 153, 156, 163 through 166, and 171 of the DB Contract Documents, Part 3, Project Requirements and substitute the attached revised Pages 63, 70, 71, 75, 78, 81, 84, 85, 88 through 90, 93 through 95, 100, 103, 110, 114, 116, 122, 124, 133, 134, 136, 153, 156, 163 through 166, and 171. Please note, there are no tracked changes on Pages 84, 94, 95, and 164, but the page is included due to the shift of text resulting from the additions to Pages 85, 93, 163, and 165.

Delete Pages A-1 and A-2 of the DB Contract Documents, Part 4, Utility Requirements, and substitute the attached revised Pages A-1 and A-2.

Delete all Drawings in the DB Contract Documents, Part 6 – RFP Plans – Indicative/Concept Plans and replace with the attached revised Drawings.

Note to Design Build Proposers, the following changes have been made to Final RFP Part 7 – Engineering Data since Amendment #2 was posted on March 22, 2019:

Part 7 Section 6 – Asbestos and Hazardous Materials: Renamed Hazardous Material Reports for Interchanges 23, 24, 25, 25A, 34A, 36, 39, 45, 46, 47 and for Terminus locations Canaan, Ripley & Lackawanna, Williamsville, and Woodbury – 3/22/19

Part 7 Section 6 – Asbestos and Hazardous Materials: Added Hazardous Material Reports (Testing not Final) for ORT Exits 26, 27, 28, 29, 37, 38, 40, 41, 42, 43, 48 and Special Exit 35 - 3/22/19

Part 7 Section 9 – Utilities: Added Interchange 44 – 3/22/19

Part 7 Section 6 – Asbestos and Hazardous Materials: Added Hazardous Material Reports (Testing not Final) for ORT Exits B1, B2, 29A, 30, 31, 32, 33, 34 and for ORT Exits 37, 38, 40, 41, 42, 43, 48A, 48, 49 and Interchange 44- 3/25/19

Part 7, Section 17 – VMS Locations: Replaced VMS Placement file – 3/27/19

Part 7, Section 18 – Existing & Proposed Conditions: Revised Proposed Conditions Table for Interchanges and Terminus – Revised design speed for Interchange 46 – 4/1/19

Part 7, Section 18 – Existing & Proposed Conditions: Revised Toll Plaza Positive Protection Inventory Conditions Table for Interchanges and Terminus – Revised design speed for Interchange 46 – 4/1/19

Part 7, Section 14 – Pavement Repairs: Changed order of Pavement Removal Limits at Tolling Areas – 4/1/19

Part 7, Section 3 – Tandem Lot Routes: Eliminated Interchange 61 (Ripley) Proposed Tandem Route

New York State Thruway Authority

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– 4/1/19

Part 7, Section 2: ORT Concept Plans: – Replaced ORT Concept Plans - 4/1/19

Part 7, Section 5- Terminus Concept Plans: Replaced Terminus Locations Concept Plans – 4/1/19

Part 7, Section 15 – Special Exits: Replaced Exit 17 and Exit 35 Concept Plans – 4/1/19

Part 7, Section 23 – Record Plans: Moved Record Plans to Engineering Data – 4/1/19

Replace the Kapsch Equipment Cut Sheets in the DB Contract Documents, Part 8 – Special Specifications (PDF page 111-133) with the attached revised Kapsch Equipment Cut Sheets.

Replace the MSI Bolt and Washer Specification in the DB Contract Documents, Part 8 – Special Specifications (PDF page 172-173) with the attached revised MSI Bolt and Washer Specification.

No other provision of the solicitation is otherwise changed or modified.

The Price Proposal Due Date is found in Appendix A, Section A5.1 and Section A5.3

**D2.2 Schedule of Prices (Form SP)**

Complete Form SP, Schedule of Prices (see ITP Appendix E).

Form SP shall be in compliance with the following instructions:

- A) Price in US dollars (\$);
- B) Provide a lump sum price for each Price Item on Form SP;
- C) The Lump Sum Price for each Price Item shall be the total price to complete all Work for that Price Item, including such planning, management, overhead, design, materials, labor, use of tools and equipment, hazardous material and environmental inspections and remediation, utility work, and other work as required to complete such work and such costs necessary to integrate the work with the work of other Price Items except those costs included in other Price Items;
- D) The sum of the Lump Sum Price for each Price Item shall be the Proposal Price. The Proposal Price will become the Contract Price, as agreed to by the Authority, less the unused portion of the lump sum price for the Design-Build – Force Account Work (Item No. 800.04000015), if the Contract is Awarded.

**D2.3 Work Payment Schedule**

Using Form WPS, provide the proposed percent of the Lump Sum Price for Design-Build Construction Work (Item Nos. 800.06000115 through 800.06007015) for each Work Item listed on the Form. The total percent for all Work Items on each Form WPS shall equal 100%.

**D2.4 Proposal Bond**

Using Form PB, submit a Proposal Bond in the sum indicated in the Appendix to Form of Proposal (Form FP(A)). See also ITP Section 2.10.

**D3.0 FORMAT FOR VOLUME 3**

Organize and submit the Price Proposal in the format shown in Table D and submit the Price Proposal on the Date per ITP, Appendix A, with the cover of the volume labeled as follows:

<p><del>Cashless Tolling Syracuse Division Bundled Bridges</del></p> <p><b>DESIGN-BUILDER'S PROPOSAL</b></p> <p><b>VOLUME 3</b></p> <p><b>Price PROPOSAL</b></p> <p><b>PROPOSER:</b> _____</p>
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At minimum, the Design Plans shall cover the following pavement marking aspects:

- K) Plan views showing the proposed pavement markings with the transitions and tapers appropriate for the design speed. Existing markings shall be graphically distinguished from proposed markings, for example by using a lighter-weight drawing line than for the proposed markings;

### **12.3.2 Variable Message Signs (VMS)**

The Design-Builder shall refer to the google images for the identified locations of where the variable message sign structures shall be located. The images provided in Part 7 – Engineering Data, Section 17 provide locations of VMS sites and deal with directions approaching entry to the Thruway System. The VMS shall be ground mounted and shall be utilized to notify motorists of Thruway closures due to weather, accidents, or emergency conditions. The google images of the VMS sign locations limit placement at each site by a distinct colored line. One sign is a different distinct color on the Google Image. The reason for the different colored line is that VMS at that location shall be fiber connected and be powered by electricity. The distance to the available sources of fiber and electricity make this a cost-effective approach. Lastly, there are approximately 81 VMS sign locations. The one sign is required to be fiber and electric and the Authority prefers to have all signs that are located on the Authority's right of way to also be powered by electricity and connected to the Authority's fiber network. The signs that are within a few hundred feet of an existing Authority Toll Plaza and Toll utility building can be easily connected to both power and fiber at the building. For locations listed in 12.3.2.1, the Design-Builder has the option of providing fiber and/or electrical or both between the location of the VMS and the Toll Utility Building (TUB), Maintenance building or the new Comm. Bldg., or provide cellular and/or solar type VMS at these locations. The Design-Builder is responsible for the design, supply, construction, inspection of these VMS along with testing of their performance. These shall all be ground mounted except for Exit 17 (Newburgh), which shall be canopy mounted on Thruway entry side at this location and shall be electric powered and fiber connected. Part 7 – Engineering Data, Section 22 provides the Right of Way areas for the VMS signs. Part 7 – Engineering Data, Section 17 only provides a longitudinal limit of where the VMS shall be placed within, but the Design-Builder shall cross-reference with Part 7, Section 22.

The VMS signs shall be in place anytime the Design-Builder can install but must be installed a minimum of two months prior to the overall Contract completion date.

[The Authority will secure a Statewide permit from NYSDOT so that the VMS/DMS locations identified are available for the Design-Builder to install the signs required, along with the WZTC required to install them.](#)

#### **12.3.2.1 Connectivity to Variable Message Signs (VMS)**

The DB will be responsible for installation and connection to VMS near the entrance(s) to the Thruway as shown in the Part 7 – Engineering Data, Section 17.

For the locations listed below, the Design-Builder has the option of providing fiber and/or electrical or both connections between the location of the VMS and the Toll Utility Building (TUB), Maintenance building or the new Comm. Bldg., or provide cellular and/or solar type vims at these locations.

The Design-Builder's Obligations for the communications are as follows-  
Additional details regarding these obligations can be found in the appropriate specifications.

The Lighting Systems installed by the Design-Builder within the Project limits shall be fully maintained by the Design-Builder for the duration of the Project.

#### **13.3.1.1 Power Supply Requirements**

For reference, the lighting installation shall comply with the following:

- A) Meet all requirements of NFPA 70 – National Electrical Code (NEC);
- B) All outdoor electrical enclosures shall be type 316 stainless steel, rated NEMA 4X or a higher degree of protection; and
- C) Meet all requirements of applicable IEEE and ANSI power engineering standards.

#### **13.3.1.2 Removal of Existing Equipment**

The Design-Builder shall be responsible for ensuring that:

- A) All wiring, conduits, switches, electrical junction boxes, panels, cabinets, enclosures, and other electrical equipment in working condition shall be turned over to the Authority for storage and re-use at other locations.

### **13.3.2 Permanent Lighting System**

#### **13.3.2.1 Lighting Locations**

Exit 39 – A new Tandem Lot is to be constructed at the Exit and the old Tandem Lot put out of service. The lighting at the new Tandem Lot must illuminate the entire new Tandem Lot and meet, as a minimum, the lighting requirements under 13.3.1. Design-Builder is responsible for the design and construction, electrical connection to the nearby power source. See information relative to GPS located utilities provided by the Thruway under Part 7 - Engineering Data, Section 9.

The old Tandem Lot lighting shall be removed when the new lot is placed in service. Placement into service has to be granted by the Authority's Project Manager.

Exit 27, 29 (North Lot), 45, 46, 57, Ripley (Westbound): Some illuminators exist at this Tandem Lot already. The Design-Builder shall design and construct additional lighting to illuminate the dark areas of the Tandem Lot. The Lot lighting not consistently or comparably illuminated are not accepted. The Design-Builder is responsible for providing the comparable lighting so the illumination is consistent across the Tandem Lots. Existing Power is already at these Tandem Lots providing power to the initial lighting. The Design-Builder shall be aware of Part 7 - Engineering Data, Section 13 for other potential electrical sources.

Exits/Locations Ripley Eastbound, Exits 19, 22 and 24

Ripley Eastbound has no lighting in the Tandem Lot. Check Part 7 – Engineering Data, Section 9 for the GPS of Utility locations at the Ripley Terminus location. There is a need for lighting at this location and the entire lot needs illumination. Power does exist in Ripley Westbound Lot.

Exits 19 and 22 has no lighting. Check Part 7 - Engineering Data, Section 13 for potential power sources. The Design-Builder shall place lighting to consistently illuminate across the Tandem Lot. Power may also be available at TUB locations or nearby Maintenance Facilities.

Exit 24 – Most of the Lot is consistently illuminated from the Toll buildings, the Toll Booths, which will go away after the AET goes live and the gore lights. Supplemental Lighting should be added in the area of the acceleration entrance(s) of Tandem access to I-90 Eastbound to ensure motorists can adequately see merging Tandem from the Tandem Lot. Power sources at this Interchange can be found at Part 7 – Engineering Data, Section 9 and/or Sections 13.

The new DeWitt service area Tandem Lot being built by the Design-Builder has no lighting. The Design-Builder shall place lighting to consistently illuminate across the Tandem Lot. Power may be available at the service area building, or nearby Maintenance Facilities, or adjacent lighting locations.

### 13.3.2.2 Construction Requirements

The Design-Builder shall use materials listed on the NYSDOT approved list of materials and consistent with the details shown on the Authority's Standard Sheets.

The Design-Builder shall provide permanent lighting materials that satisfy the Project Requirements and applicable codes. In addition, the Design-Builder shall:

- A) Provide all permanent and temporary lighting and related supports, lamping, controls for operational systems throughout the duration of the Project;
- B) Ensure that all temporary lighting used during construction and demolition works shall conform to the glare control requirements of NYSDOT Standard Specification Construction and Materials §619-3.19;
- C) Provide all new luminaires, poles, mounting, controls, wiring, grounding and bonding, electrical raceways/conduits, pull boxes, switches, junction boxes, panels, cabinets, enclosures, and related electrical equipment as needed;
- D) Ensure that all electrical work is performed by or under the supervision of a licensed electrician;
- E) Ensure that all exposed raceways/conduits are made of PVC coated rigid galvanized steel (RGS). Short runs (no longer than 15 feet) of liquid-tight flexible metal conduit may only be used to make a final connection between the main power feeder and a light pole or fixture;
- F) Ensure that all outdoor electrical enclosures and attached parts (e.g. breather drain) shall be type 316 stainless steel, rated NEMA 4X or a higher degree of protection;
- G) Provide As-Built Plans with narratives fully describing the lighting installation;
- H) Ensure that any new electrical enclosures shall have a key lock;
- I) Ensure that all lighting installed by the Design-Builder shall be maintained in an operational condition until Final Acceptance.

### 13.3.3 Temporary Lighting System

The Design-Builder shall ensure that the existing lighting levels within the Project limits are maintained at all times. A temporary lighting system shall be installed as necessary to meet this

damages shall be applied under Section 619 of the Standard Specifications. This is considered a major violation act.

### **15.3.2 Work Zone Traffic Control at Toll Plazas Prior to AET Going Live**

The Authority provide(s) under Part 7 – Engineering Data, Section 16 the Design-Builder with the number of lanes that must remain open at each Exit for each hour of the day. The number of lanes that must remain open is a Project Requirement and shall not be violated. The work at the Exits where the Toll Plaza work is occurring prior to AET going live shall be completed within these requirements.

At the ORT Exit sites, the Design-Builder can take a single lane out of service in a two lane directional scenario provided the hourly volume of traffic is 1200vph or less.

The Design-Builder can direct traffic to the shoulder area (if available) in a single lane directional scenario provided the hourly volume of traffic is 1200vph or less. Alternating one way traffic with flaggers is allowed provided the combined opposing traffic hourly volumes are 600vph or less. Alternating one way traffic does not constitute a closure of traffic or traffic stoppage and does require state police presence.

Any violation of these established restrictions shall result in Liquidated Damages as applied under Section 619 of the Standard Specifications. Regardless of the Liquidated Damages amount, this is considered a major violation act.

### **15.3.3 Work Zone Traffic Control at Toll Plazas to be Demolished**

The Design-Builder shall follow the requirements as stated below. The demolition of the Toll Booths shall require staging as stated under the Mainline Gantry Requirements Section 23 and ORT Exit Sites, section 25. The Authority has determined that once the Cashless Tolling is activated and the booths are all EZPass at speeds of 20 MPH that 1,100 cars per hour per booth per direction can be processed. The Design-Builder shall determine the number of booths in each direction that shall be required to be used for each stage of toll booth removal based on the 1,100 vehicles per lane booth/per hour based on the traffic data provided in Section 19 of the Engineering Data Part 7, for all locations requiring Toll Booth removals. Failure to provide the necessary required number of toll booths for staging purposes will result in safety issues/congestion/public outcry and Liquidated Damages resulting in the number of booths deficient to handle the traffic X multiplied by 1,100 vehicles multiplied by Y hours of direction in effect multiplied by \$2.50/vehicle. Where X is the number of Booths deficient and Y is the number of hours the deficiency existed. This is considered a major violations act.

### **15.3.4 Work Zone Traffic Control Plans**

The Design-Builder shall prepare and submit WZTC Plans, for each Project Toll Collection location current and proposed, for managing traffic operations and controlling access until Project Completion. The Plans shall identify stages and phases of construction and provide appropriate operating procedures. The plans shall be signed and stamped by a New York-registered professional engineer and submitted to the Authority's Project Manager prior to initiation of any work in proximity to traffic or the implementation of any change in traffic patterns.

The Authority will retain responsibility for toll operations throughout the Project's duration.

The WZTC Plans shall be submitted to the Authority's Design Quality Assurance Engineer a minimum of two weeks prior to initiation of any Work requiring a lane closure or the implementation of any change in traffic patterns.



**15.3.7 Access to Commercial Properties and Driveways**

The Design-Builder shall provide uninterrupted access to all commercial properties and driveways within the Project Limits at all times, if any exist.

**15.3.8 Closure Restrictions**

Additional lane closures and time periods can be found on the Thruway Authority's Standard Sheets. Failure of the Design-Builder to stay within the restrictions defined shall result in liquidated damages applied under Section 619 of the Standard Specifications. This is considered a major violation act.

**15.3.9 Minimum Lane Widths during Construction**

In general, the Design-Builder shall maintain a minimum travel lane width of 11 feet during construction. Shoulder widths during construction shall be 1 foot minimum.

The allowable minimum lane widths and shoulder widths are only allowable during the construction season of March 15<sup>th</sup> to December 1<sup>st</sup>. Outside that period, the original lane widths and shoulder widths shall be returned to the work site for snow and ice control.

**15.3.10 Portable Variable Message Signs**

The Design-Builder shall provide, as a minimum, **eight (8)** Portable Variable Message Signs, but more should the Design-Builder's design dictate, for the duration of this Contract. The Portable Variable Message Signs shall be deployed as necessary for the various WZTC schemes developed in coordination and concurrence/acceptance by the Authority's Project Manager. The portable variable message signs provided shall meet the requirements of Item No. 619.111112 (Portable Variable Message Boards with Cellular Communication).

The development of messages for the Variable Message Sign(s) shall be the responsibility of the Authority's CQAE and operations staff with approval by the Authority's Project Manager.

The Design-Builder shall contact the Authority's CQAE at least two weeks prior to placement of any Variable Message Sign regarding their location and receive concurrence of the location.

**15.3.11 Temporary and Interim Pavement Markings**

The Design-Builder shall provide temporary and interim pavement markings during all construction phases conforming to the requirements of the Standard Specifications. See Section 12 of Part 3 for additional directions. Grinding for removal of pavement markings shall not be allowed on new pavement surfaces.

**15.3.12 Coordination with Division Traffic Management Center**

The Design-Builder is advised that the Authority's Division Office will provide support for the Project's WZTC activities. Therefore, coordination among the Authority's Construction Quality Assurance Engineer, Design-Builder, and Authority's Project Manager, will be required for all WZTC activities, particularly with respect to the use of Variable Message Signs (VMS) in the Project areas.

## SECTION 16 PAVEMENT DESIGN AND CONSTRUCTION

### 16.1 SCOPE

The Design-Builder shall perform all Work necessary to provide all pavement required for the Project. This includes design, furnishing of materials, fabrication and construction of all temporary and permanent pavement for impacted roadways within the Project Limits including:

- A) Thruway mainline on subgrade, from the Gantry approach slabs to the points where pavement Work limits are met;
- B) Thruway ramps on subgrade, to the extent they need to be reconstructed, repaired, and/or resurfaced;
- C) Toll plaza area pavement removal locations, at interchanges, ORT, Exit Sites, and Terminus locations including approaches, to the extent they need to be reconstructed, repaired, and/or resurfaced;
- D) Local roads to the extent they need to be reconstructed, repaired, and/or resurfaced;
- E) Maintenance entrances and exits and maintenance access roads to the extent they need to be reconstructed, repaired, and/ or resurfaced;
- F) Tandem Lots entrances and exits and Tandem Lot access roads to the extent they need to be reconstructed, repaired, and/ or resurfaced or constructed new;
- G) Commuter Lots entrances and exits and Commuter Lot access roads to the extent they need to be reconstructed, repaired, and/ or resurfaced or constructed new;
- H) Full depth pavement repair locations identified in Part 7, Engineering Data Section 14.
- I) Temporary Pavements;
- J) Identified isolated resurfaced/repared or damaged pavement locations.

The Design-Builder shall be responsible for the review and acceptance of all submittals needed for the scope of work. The review and acceptance process shall be in conformance with the Design-Builder's accepted/approved Quality Control Plan.

### 16.2 STANDARDS

The Design-Builder shall perform the pavement activities in accordance with the Contract Requirements and the applicable Standards, Design Codes and Manuals listed in Section 1.6, unless otherwise stipulated in this Project Requirement, or otherwise applicable to the Project.

### 16.3 REQUIREMENTS

All pavement materials except as stated below and construction methods shall be in accordance with the requirements of the NYSDOT *Standard Specifications* and *NYSTA Addendum to the NYSDOT Specifications* and the NYSDOT materials and pavement installation methods as supplemented by NYSTA requirements.

prepared surface, across the entire width of all lanes and shoulders. Locations retaining curb or other controlling edge of pavement features shall be milled to the depth of the resurfacing section.

Existing profiles and cross slopes of local roadways shall be maintained, unless a transition to match the new construction profiles and cross slopes is necessary.

The finish quality of the pavement shall meet the requirements of NYSDOT standards as supplemented by Authority requirements prior to opening the facility to traffic.

### **16.3.6 Maintenance, Trucking, and Commuter Access Roadways and Parking Lots**

New or Reconstructed maintenance, trucking, and commuter access roadways and parking lots shall be constructed of HMA or Concrete pavement. Installed pavement and supporting subbase shall meet or exceed the maximum thickness requirements as defined for minor commercial driveways in NYSDOT Standard Sheet 608-03.

The finish quality of the pavement shall meet the requirements of NYSDOT standards as supplemented by the Authority requirements prior to opening the facility to traffic.

### **16.3.7 Temporary Pavement**

The Design-Builder shall design, construct, and maintain all temporary pavements within the Project Limits in compliance with the following requirements:

- A) Engineered to provide adequate pavement support for existing traffic loading for duration of temporary condition. As required under 619 of the Standard Specifications, the pavement surface in such a condition as to permit the safe, comfortable passage of vehicle at posted speed limit;
- B) Provide a pavement system that meets the same friction aggregate specifications as the permanent pavement,
- C) Provide a durable, maintainable pavement system that meets the requirements of NYSDOT and NYSTA Section 619 Specifications;
- D) Include pavement-to-structure transition areas as a part of ride quality;
- E) Minimize pavement-to-structure transition deviations;
- F) Minimize pavement type-to-pavement type transition deviations;
- G) Provide adequate cross slope to drain water from pavement surface, consistent with maximum grade breaks between lanes and between lanes and shoulders;

### **16.3.8 Structures Approach Pavement**

Approach pavement shall be designed and placed in accordance with Project Requirement 10 - Structures and placed over a subgrade course equaling or exceeding the properties outlined in Section 16.3.1 herein.

### **16.3.9 Repaired or Damaged Pavement**

Except as noted in this section, requirements of Section 619 of the Standard Specifications, as supplemented by the Thruway Addendum, apply.

**Concrete or Composite Pavement:** Locations of concrete or composite pavement systems shall be repaired by the Design-Builder in accordance with the Authority's methodologies and repair details. Slab replacements at locations with existing precast pavement shall utilize precast pavement slabs with in-kind thickness.

**Asphalt Pavement:** Wearing course repairs and/or full depth asphalt sections shall be repaired by the Design-Builder in accordance with the Authority's methodologies and repair details.

Pavement to remain that is damaged by the Design-Builder's operations, whether within or outside the Project Limits, shall be repaired such as to maintain safe and reliable operation during construction, and restored to its original or better condition, at the end of construction.

### 16.3.10 Subsurface Drainage System

The Design-Builder shall design and construct edge drains, where stipulated within this Project Requirement, and in accordance with the applicable Standards. Subsurface drainage outlets shall not cross roadways. Left- and right-side subsurface drainage systems shall not use a common outlet pipe.

Additionally, the Design-Builder shall evaluate and provide an underdrain system as follows:

- A) Underdrain shall be installed where an existing ground water condition needs to be addressed;
- B) The proposed pavement traverses an area with high ground water;
- C) Where identified as needed by the Engineer or Foundations Lead Designer of record.

### 16.3.11 Pavement Removal

Obsolete and unnecessary pavement shall be removed and disposed of by the Design-Builder. Pavement removal shall be such as to permit the unimpeded use of the space for the immediate and/or permanent purposes of the affected space. At a minimum, obsolete and unnecessary pavement shall be removed to the top of the subbase. Any pavement to remain that is damaged during pavement removal operations shall be replaced by the Design-Builder. In the absence of the need for treatments associated with specific subsequent uses, disturbed material underlying removed pavement shall be re-compacted to not less than 95% standard proctor maximum density, and then top soiled and seeded.

## 16.4 PROJECT LIMITS

Project limits are defined as follows:

- A. For the ORT Exit Sites and Special Exit 35 the minimum project limits are from the existing Authority gore areas to the intersecting NYSDOT Road or the existing intersecting local roads. The Design-Builder shall meet all current standards, including proper cross slopes and proper drainage.
- B. For the interchange locations (11 locations) the minimum project limits are from interstate gore areas to interstate gore areas. Essentially from the existing Authority gore area to the interstate gore areas of the NYSDOT interstate system. In these applications, the gore areas are not defined as the striped gore area but rather the gore areas are defined by the grassy area or where no grassy areas exist, where existing ramp guiderail ends and concrete barrier (positive separation) is required.
- C. The mainline gantry locations ~~and terminus locations~~ project limits are defined by the Design-Builder, as required by Section 18 of Part 3 and the requirements under this Section of Part 3.
- D. The two remaining special exits are Exits 16 and 17. At Exit 17, the proposed limits are identified by the limits of new guiderail required to be placed. At Exit 16, Harriman, the Project Limits are defined by the Toll Booth removal to the straightening of the alignment via potential striping.

In all situations defined above, project limits do not include necessary guiderail replacements on existing ramps or Work Zone traffic limits or new signage, replacement signage, temporary signage, ~~or~~ signage removals, or pavement striping. These effects constitute the work limits at each location, not the project limits.

To provide better clarity relative to project limits; the Terminus locations, the Interchange locations, the ORT Exit Site locations, and the Special Exits 35, 16, and 17 Google images will display the project limits (directive). For any contradiction with the text above, the Google images shall dictate.

## SECTION 18 HIGHWAY DESIGN

### 18.1 SCOPE

The Design-Builder shall be responsible for the design, construction or reconstruction of the permanent roadway(s) to be constructed or reconstructed within the Project Limits, and any other roads damaged by construction operations, or necessary for permanent operations, all in accordance with the design requirements stated herein. Highway design, construction and reconstruction shall be understood to include the design, furnishing, and construction of all road appurtenances, protections, and safety devices not specifically cited in other Project Requirements.

In addition, the Design-Builder shall be responsible for the removal of non-standard and non-conforming systems/features that currently exist within the Project limits, whether they are affected by the proposed work or not, and replacement with systems meeting current Authority Standards.

U-turns shall be constructed of HMA or Concrete pavement. Installed pavement and supporting subbase shall meet or exceed the maximum thickness requirements as defined for minor commercial driveways in NYSDOT Standard Sheet 608-03. Minimum turning path shall be for Interstate Single Unit truck (SU-40) Design Vehicle.

### 18.2 STANDARDS

The Design-Builder shall perform the Work in accordance with the Contract Documents and the Applicable Standards, Design Codes and Manuals listed in Section 1.6, unless otherwise stipulated in this Project Requirement or otherwise applicable to the Project.

### 18.3 REQUIREMENTS

#### 18.3.1 General

The Design-Builder shall be responsible for performing the detailed highway design and construction within the Project Limits in accordance with the Project Requirements set forth herein.

#### 18.3.2 Design Requirements

Design requirements for the reconstruction of roadways within the Project Sites shall be as specified below.

- Design Speed shall be 40 mph for ramp leg from Thruway ramps to Intersecting Road at the following ORT Exit locations: 17, 18, 19, 20E, 20W, 21, 21B B1, ~~B2~~, 22, 26, 27, 28, 29, 29A, 30, 31, 32, 33, 34, 35, 37, 38, 40, 41, 42, 43, 48, 48A, 49, 56, 57, 57A, 58, 59, and 60.
- Design Speed shall be 40 mph for Interchanges at the following locations: 36, 39, 46, and 47.
- Design Speed shall be 50 mph for Interchanges at the following locations: 23, 25, 34A, and 44, and 46.
- Design Speed shall be 55 mph for ORT Exit B2.
- Design Speed shall be 70 mph for Interchanges at the following locations: 24 ~~and 25~~.
- Design speed shall be ~~80~~60 mph for Interchanges 25A and 45.

- Design Speed shall be 70 mph for Mainline Gantries at the following Terminus Locations: Williamsville and Lackawanna.
- Design Speed shall be 80 mph on the Thruway Mainline for Mainline Gantries and Terminus Locations at the following Locations: Woodbury, Canaan, 23, 24, 25, 25A, 34A, 36, 39, 44, 45, 46, 47, and Ripley.
- Required number of lanes, refer to Table of proposed conditions for required number of lanes, located in Part 7 – Engineering Data, Section 18;
- Lane and Shoulder Widths: per HDM Design Criteria

### 18.3.3 Guide Railing, Barrier Systems and Impact Attenuators

The Design-Builder is responsible for the design and construction of systems that shall be implemented where opposing traffic is not currently separated or the system in place does not meet current standards. The criteria and requirements that shall be followed by the Design-Builder shall be in accordance with the Table shown in Part 7 – Engineering Data, Section 18. Inventory/Existing/Proposed Conditions for Median Protection between opposing Lanes in Plazas and Interchanges.

The Design-Builder shall remove and dispose of all existing guide railing, barrier systems and/or impact attenuators within the Project limits that do not meet current standards, and replace with new guide railing, barrier systems and/or impact attenuators if required, as per NYSDOT Standards and Authority practices.

The limits of work for new roadside and new median barrier shall be the lesser of the following:

- 1) The point where barrier is no longer warranted unless specifically required elsewhere in the Project Requirements; or
- 2) The Design Builder will be responsible for upgrading all guiderail, median barrier and terminal end sections within the project limits to current standards. The Design Builder will be allowed to transition and connect new guiderail/barrier system into existing guiderail/barrier system not meeting current standards beyond the project limits if the system being connected to extends greater than 500 feet beyond the project limits. Runs of guide rail or median barrier that extend less than 500 feet beyond the project limits shall be entirely replaced with components meeting current standards. The exception to this rule is for median barrier between opposite direction ramps with two-way AADT of ETC+ 10 of less than 10,000 vehicles per day. For this case, existing median barrier not meeting current standards may be retained since it falls below the threshold for requiring positive separation..

All existing barrier systems that are removed shall become property of the Design-Builder.

### 18.3.4 Median Protection Requirements for Opposite Direction Flow of Traffic Ramps

The Authority has determined that opposite direction ramps where the AADT of ETC + 10 exceeds 10,000 vehicles per day, requires positive separations. For Interchanges (23, 24, 25, 25A, 34A, 36, 39, 44, 45, 46, 47) positive separation will consist of permanent concrete barrier from the

Thruway ramp gore area to the connecting highway gore (concrete barrier limits as shown in Part 6ramp terminus location). Median barrier meeting current standards is required at all ~~other~~ opposite direction ramp locations where the AADT of ETC + 10 exceeds 10,000 vehicles.

For opposite direction ramps that exceed ETC + 10 of 10,000 vehicles per day and already have a form of separation, the existing mechanism of separation that currently exists can be retained as long as it meets the current standards for median barrier. If the mechanism does not meet current standards then the existing separation shall be replaced with barrier that meets the current standards.

Regardless of replacement or retainage of the opposite direction Ramp Separation Mechanism, standard transitions are required between change in median barrier type.

When the opposite direction ramp volumes of ETC + 10 equal or drop below 10,000, separation of opposing directional traffic shall be accomplished through the use of striping, rumble strips and delineators, 25 ft. center to center, (easily removable). These delineators shall be placed from the Thruway ramp termination to where the opposite/opposing directional traffic begins/ends.

Opposite direction ramps within volumes equal to or below of AADT ETC + 10 of 10,000 requiring delineators and already having an established means of separation such as corrugated beam median barrier, concrete median barrier, or box beam median barrier, etc. shall be retained and left in place.

The Design-Builder is required to meet the requirements of this Section. At ORT Exits 27, 33, 34, 37, 38, 56 and 57 replace and provide additional delineators per the specifications provided and the RFP requirements, including the bridge areas. At Interchange 47 and ORT Exit 43, the current delineators can remain however additional delineators shall be required to provide for the proper spacing requirements as stated in the RFP.

In each of the categories described above; positive separation, delineators, and enhanced striping and rumble strips (CARDS), where two types of applications might apply: one for the opposite direction ramp(s) from gore area, and one for the Toll Plaza removal area, from terminus location at intersecting roadway or connecting highway to ramp gore area, it is the Design-Builder's responsibility to ensure that safe transitions exist. There shall be logical and standard transitions, or logical termini locations, and standard protection of blunt ends.

### **18.3.5 Access Modifications**

Should the Design-Builder's proposed designs result in a new access point or revised access point to the Thruway mainline or ramps, the Design-Builder shall obtain approval from the FHWA prior to implementing such a design, in accordance with NYSDOT's Project Development Manual, Appendix 8.

### **18.3.6 Clear zone**

The Design-Builder shall document clear zone on the final record plans.

## **18.4 DESIGN EXCEPTIONS AND NON-STANDARD FEATURES**

It is the responsibility of the Design-Builder, in coordination with the Authority, to obtain acceptance of any non-standard features included by the Design-Builder in the final design, prior to that non-standard feature being incorporated.

## **18.5 DELIVERABLES**

Deliverables shall be as stated elsewhere in the RFP documents.

## SECTION 20 TANDEM LOTS

### 20.1 SCOPE

The Design-Builder shall be responsible for the demolition of the Tandem Lot at Toll Exits 23 (Boulevard) and 39 (State Fair) and for the design and construction of a new Tandem Lot at Exit 39 and the service area (Dewitt) to be located as shown in the RFP Plans. The design and construction of the Tandem Lot at Exit 39 and Dewitt service area shall be understood to include the design, furnishing, and construction of all entrances and/or driveways providing access to and from the Tandem Lot(s), road appurtenances, lighting and safety devices not specifically cited in other Project Requirements.

The Design-Builder shall be responsible for the design, construction or reconstruction or modification thereof the driveway entrances and/or exits providing access to and egress from the Tandem Lots at Toll Plazas 17 (Newburgh), 18 (New Paltz), 19 (Kingston), 22 (Selkirk), 23 (Boulevard), 24 (Washington Ave.), 25A (Duanesburg), 27 (Amsterdam), 28 (Fultonville), 29 (Canajoharie), 31 (Utica), 32 (Westmoreland), 33 (Verona), 34 (Canastota), 34A (Collamer), 35 (Thompson Road), 36 (Mattydale), 39 (Statefair), 40 (Weedsport), 42 (Geneva), 43 (Manchester), 45 (Victor), 46 (Henrietta), 47 (Leroy), 48 (Batavia), 57 (Hamburg), 59 (Dunkirk), and 61 (Ripley), and any other entrances/exits or driveways damaged by construction operations, or necessary for permanent operations, all in accordance with the design requirements stated herein. Tandem Lot modifications Tandem Lot driveway design, construction and reconstruction shall be understood to include the design, furnishing, and construction of all road appurtenances, protections, and safety devices not specifically cited in other Project Requirements.

Proposed Tandem Lot routes are included in Part 7, Engineering Data, Section 3 – Tandem Lot Routes.

The proposed legislative routing at Ripley is being removed. However, single axle tractor trailers need to use Shortman Road, the intersection improvements to the Thruway off ramp to Shortman Road, and the improvements to the intersection of Shortman Road to the Thruway on ramp to travel Northeast. These intersections shall be designed to accommodate a design vehicle of WB-67.

### 20.2 STANDARDS

The Design-Builder shall perform the Work in accordance with the Contract Documents and the Applicable Standards, Design Codes and Manuals listed in Section 1.6, unless otherwise stipulated in this Project Requirement or otherwise applicable to the Project.

### 20.3 REQUIREMENTS

#### 20.3.1 Design Requirements

Design requirements for the reconstruction of Tandem Lot driveway entrances and exits within the Project Sites shall be as specified below.

#### 20.3.2 Access Gate at Tandem Lot

There are 3 Tandem Lots and one service area (Dewitt) that require access gate control to the local and/or State DOT side of the Tandem Lot. These exits are Exit 24, Exit 46 and Exit 47 with the one service area being the DeWitt service area.

The Design-Builder is responsible for the design; acquiring all equipment, material, hardware and installation of the access gate. In addition, the Design-Builder is responsible for fiber connectivity, and providing electrical power to the access gate location. The location of access gate shall not be located within 100 feet of access drive road/intersection with local and/or State highway.

#### 20.3.3 Cameras at Tandem Lots

The Design-Builder is responsible for purchasing and installing cameras potentially mounting hardware at various Tandem lots and an identified service area (Dewitt). Camera pole design, installation may also be required. Refer to Table 20-1 for the locations, availability of existing poles to mount the cameras and other information that may be of value to the Design-Builder.



The cameras required shall be able to view the entire lot including the entering and departure locations. The cameras required for the access gate area shall be mounted so that Thruway TSOC can identify the single trailer seeking backside access to the Tandem Lot. The viewing of the vehicles will allow the Authority to raise and lower the access gate when needed and/or requested. The following specifications apply, Items 651.0201, Item 651.02001525, Item 683.6730-25.

**20.3.4 Protections of Existing Utilities at Tandem Lot Locations**

The Design-Builder is responsible for ensuring that all existing utility structures, utilities or utility facilities are properly protected by appropriate guiderail systems depending on driveway designs or driving modifications.

**Table 20-1**

**Tandem Locations**

<b>INTERCHANGE/LOT</b>	<b>OPEN/CLOSE/ RELOCATE/NEW</b>	<b>CAMERA NEEDED (Y/N)</b>	<b>ADD TO EXISTING TRAFFIC CAMERA POLE</b>	<b>ACCESS GATE NEEDED (Y/N)</b>
6A (MP 5.47)	N/A	N/A	N/A	N/A
14 (MP 24.31)	N/A	N/A	N/A	N/A
15 (MP 32.40)	N/A	N/A	N/A	N/A
17 (MP 60.10 S)	OPEN	Y	Y	N
18 (MP 76.01)	OPEN	Y	Y	N
19 (MP 91.37)	OPEN	Y	Y	N
23 (MP 141.92)	CLOSE	N	N/A	N
24 (MP 148.15)	OPEN	Y	Y	Y
25A (MP 158.82)	OPEN	Y	N	N
27 (MP 173.59)	OPEN	Y	N	N
29 (MP 194.10)	OPEN	Y	N	N
31 (MP 232.85)	OPEN	Y	Y	N
32 (MP 243.37)	OPEN	Y	N	N
33 (MP 252.71)	OPEN	Y	N	N
34 (MP 261.50)	OPEN	Y	N	N
34A (MP 276.58)	OPEN	Y	N	N
35 (MP 278.93)	OPEN	Y	Y - Raise Camera/Pole	N
DeWitt Service Area (MP 279.9)	NEW	Y	Currently no camera/structure	Y
36 (MP 282.93)	OPEN	Y	Y	N
39 (MP 289.53)	RELOCATE	N	Y	N
40 (MP 304.19)	OPEN	Y	Y	N
42 (MP 327.10)	OPEN	Y	N	N
43 (MP 340.15)	OPEN	Y	N	N
45 (MP 350.99)	OPEN	Y	Y	N

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46 (MP 362.44)	OPEN	Y	N	Y
47 (MP 378.56)	OPEN	Y	N	Y
48 (MP 390.13)	OPEN	Y	N	N
49 (MP 417.27)	OPEN	Y	N	N
57 (MP 436.22)	OPEN	Y	N	N
59 (MP 467.74)	OPEN	Y	N	N
61 (MP 494.50)	OPEN	N	Y	N

### 20.3.5 Tandem Lot Barrier Gate System

The Design-Builder shall provide a Barrier Gate System (BGS) to control access into and out of tandem lots at I-90 Interchanges 24, 46, 47, and the DeWitt Service Area. A single lane shall be instrumented with a BGS at each of these locations.

Door King Model # 1601 is provided as an example BGS that may satisfy these requirements, but the Design-Builder is free to propose other solutions. The Design-Builder must verify that all requirements are met by whatever solution is proposed.

The BGS shall control access to a single, bi-directional traffic lane 14 feet in width.

The BGS arm shall be 14 feet in length and constructed of wood.

The BGS shall be operable in temperatures between -20 to 140 degrees Fahrenheit, and shall include appropriate heaters and/or fans as specified by the manufacturer to meet this range of temperatures.

The BGS shall include a Vehicular/Pedestrian Detection System that prevents the barrier from coming down if a pedestrian or vehicle is detected under the gate.

The BGS shall include loops embedded in pavement on either side of the gate as specified by the manufacturer to prevent the gate from closing on vehicles in the path of the gate. The loops shall be connected to the BGS using loop controllers as specified by the manufacturer.

The BGS shall be operated on 115 VAC, 60 HZ input. The Design-Builder shall provide power to the BGS.

The BGS shall include a feature to automatically open the gate if power is lost.

The Design-Builder shall provide a means of gate equipment protection to protect the gate equipment from being damaged from vehicle hits (e.g. guiderail, post, etc.)

### 20.3.6 Tandem Lot Equipment Cabinet

The Design-Builder shall provide an equipment cabinet as specified in 680.8020XX25 Cabinets for ITS Equipment. The cabinet provided shall be the one specified for TRANSMIT. The Equipment Cabinet shall be mounted on a 20 foot tall pole, per the following specifications: 670.1120 (20' tall light pole), and 670.0106 (6' pole foundation)

The cabinet shall be mounted on the pole at a height of 3 feet.

The Design-Builder shall provide power and fiber optic communications to the cabinet. The fiber optic communications cable shall be terminated "SC".

The Design-Builder shall install a conduit between the equipment cabinet and the BGS cabinet. The conduit shall contain an appropriate multi-conductor cable. In the BGS cabinet, the cable shall be connected to the appropriate connections on the BGS controller that when electrically connected cause the gate to rise. In the Equipment Cabinet, the multi-conductor cable shall be

- The Design-Builder shall reconstruct the entire pavement shoulders within the reconstruction limits defined above. The shoulders to be reconstructed shall be full depth asphalt to allow for loops to be cut into the asphalt. The Design-Builder is responsible to ensure proper drainage of the shoulder areas and treadle slabs.
- The Mainline Gantries shall be fully completed and conduits from the Communication Building to the Mainline Gantries along with all the mounting hardware, brackets or arms shall be in place so that cameras, antennas, laser scanners and illuminators can be attached by Kapsch and adjusted.
- Cashless Toll lanes and shoulders shall as a minimum match the maximum number of approach lanes and shoulders entering the Cashless Toll Collection Zone;
- Design-Builder shall ensure the slab containing the treadle and trench drain shall be embedded in a minimum of 22 inch of heavily reinforced Portland Cement Concrete (PCC) utilizing fiber reinforced polymer (FRP) reinforcing bars so as not to interfere with the Authority's toll collection system

#### **21.4.1 Woodbury Terminus Location**

Terminus location at Woodbury requires the design and construction of a vehicle enforcement area for the State Police. It shall be provided after the mainline gantry as traffic heads South. The required enforcement area shall be constructed utilizing the current available concrete pavement located to the West of the traffic headed South. Proper deceleration and acceleration lanes shall be applied. The vehicle enforcement pertains to all types of vehicles utilizing the Thruway, from tandems to passenger vehicles. Proper pavement striping, signage is required. The Design-Builder is responsible for the full design and construction at this location. Refer to Part 7 – Engineering Data, Section 5 for concept drawings. This particular location does not require a reduction of the overall infrastructure foot print, with the exception of the area specifically designated to be removed involving the deceleration lane and ramp to Exit 16 for traffic heading South, and area heading North as shown on the See concept drawings. The Design-Builder shall be aware for traffic heading North that the pavement area is more than required. The Design-Builder based on the design shall be required to properly channelize traffic with, as a minimum proper striping, cross hatching, and signage to ensure the proper and safe passage of traffic heading North to through the mainline gantry or Exit 16.

The design speed at the Woodbury terminus location is 80 mph and is designated a rural/suburban area. The  $e_{max}$  in this area shall be 8%.

#### **21.4.2 Williamsville and Lackawanna Terminus Locations**

Terminus locations at Williamsville and Lackawanna have design speeds of 70 mph and are designated as urban areas. The  $e_{max}$  in these areas shall be 6%.

#### **21.4.3 Canaan and Ripley Terminus Locations**

Terminus locations at Canaan and Ripley have design speeds of 80 mph and are designated as rural areas. The  $e_{max}$  in these areas shall be 8%.

### **21.5 KAPSCH REQUIREMENTS**

The Authority has selected Kapsch TrafficCom USA Inc. (Kapsch) to supply, install and monitor the Cashless Tolling system at all Mainline Gantries. The Design-Builder shall coordinate activities with Kapsch for installation at each Communication Building site as per the following requirements:

Kapsch will provide a maximum of six (6) teams that will be able to install and test the Cashless Tolling Equipment at each Communication Building site. Kapsch will install all tolling

## 21.7 KAPSCH SYSTEM INFORMATION AND REQUIREMENTS

### 21.7.1 Design-Builder Requirements to Support Kapsch System

#### 21.7.1.1 Overview

The Communications Building is used to house computers, switches, power supplies and other electronics in racks.

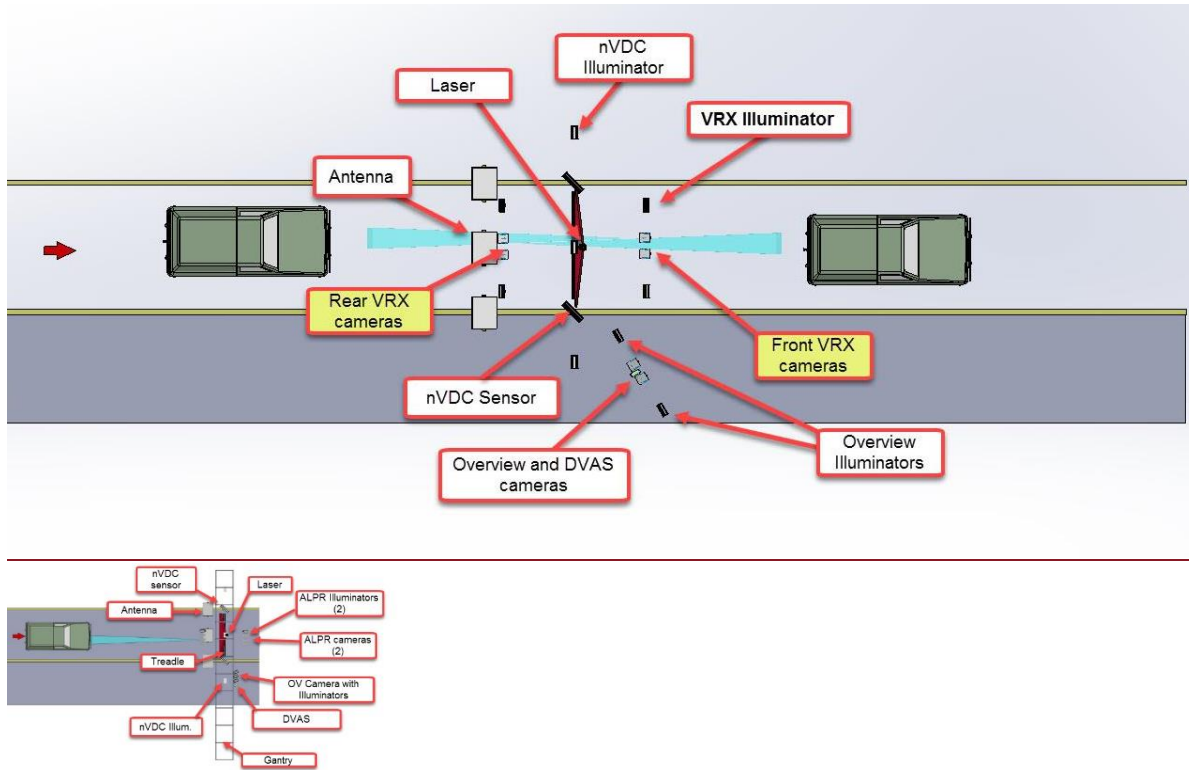
The lanes have the peripheral devices that are used to detect and process vehicles. Lasers, treadles, cameras, and nVDC sensors are examples of lane peripherals.

### 21.7.2 Communications Building Requirements

All travel lanes and full shoulders ( $\geq 6'$ ) are fully instrumented. Un-instrumented lanes  $< 6'$  wide do not have lane hardware, in such cases the shoulders are not included in the lane count for the toll zone. Three travel lanes and two full shoulders ( $\geq 6'$ ) in both directions which share a Communication Building will have a maximum of eight racks (See Figure 1) not including the rack provided by the Design-Builder for the network communications.

Communications Building Requirements:

- The Design-Builder shall include a workbench, minimum size of 4 feet x 2 feet, that can support 200 pounds. Electrical outlets shall be installed in close proximity to the workbench.
- Kapsch to install APC NetShelter SX 42U Server Rack Enclosures. 23.62"w, 42.13"d and 78.39"H
- All racks are installed side by side including the Network Rack
- Design-Builder shall provide clearance of 36" on all 4 sides of each group of racks
- Design-Builder shall provide air conditioned, heated and humidity controlled environment
- Design-Builder shall provide wiring racks from gantry conduit entrance, vertically up the wall and horizontally across the top center of all frames (See Figure 1 for reference)
- An earth ground termination is required within 10' of the nearest rack (See Figure 1 for reference)
- Design-Builder shall install the Network Rack as listed in Figure 1. Note that racks can be moved up or down as per the minimums listed in Figure 1. In addition the doorway can be switched.
- Design-Builder to provide a 1" PVC conduit through the exterior of the building approximately one (1) foot from ceiling and a 4 in. x 4 in. x 2 in. PVC Junction Box (Mfg: Carlson Model # E989NNJ-CAR) mounted on the exterior. Kapsch will be responsible for running cabling for a GPS antenna to synchronize time.



Note:

In the plan view in Figure 8 there is a required established relationship between all of the components. Most importantly, the treadle and the nVDC sensors are mounted on a center line. All measurements are made from this center line.

Kapsch Gantry Devices:

1. nVDC sensors are mounted above the lane dividers (N lanes have N+1 sensors)
2. nVDC Illuminators are centered between the nVDC sensors, and 6' outside instrumented shoulders or instrumented travel lane where the shoulder is un-instrumented (N sensors have N+1 illuminators)
3. ALPR cameras and illuminators are mounted over the lane center, on both the upstream and downstream sides of the gantry (4 cameras & 4 illuminators per lane)
4. OV & DVAS cameras are mounted over the shoulder on the downstream side only. There are 2 illuminators for each OV camera (DVAS has no illuminator). These cameras are mounted 6 feet outside of the instrumented lanes to capture the side view of exiting traffic.
5. Lasers are mounted in the lane center, 18" behind the nVDC illuminator. 1 laser per lane.
6. Antennas are mounted in the lane center and on the lane dividers.

Kapsch Cabling Information:

1. Each device that is used in the lane, is connected to the Communications Building with two cables, one power and one network.
2. Antennas are connected with a single and/or dual coax cables, based on tag reader configuration.
3. The cables are routed from the rack, to the ceiling across a wiring rack, and down the exterior wall to the conduit.
4. The conduit connects the gantry and the Communications Building.

Equipment heights specified in this section are relative to the pavement in the lane over which the equipment is mounted.

A schematic of the ORT Gantry with various lane configurations is provided in the Part 7 – Engineering Data, Section 4.

### **22.3.2 ORT Toll Lane Requirements**

Travel lanes shall be 12 feet wide. Lanes approaching the tolling area that are wider than 12 feet shall taper so that lanes passing under the mini-gantry shall be 12 feet exactly.

Exit lanes shall be constructed of concrete, as described below. Entry lanes shall be constructed of full depth asphalt.

For sites where there are two or more travel lanes in one direction, right shoulders shall be a minimum of 6 feet wide. For sites with only one travel lane in a given direction, right shoulders shall be a minimum of 10 feet wide. Shoulders with a width greater than 6 feet shall be fully instrumented with toll equipment for ORT.

Concrete slabs containing the treadle, trench drain, and loops shall be 22 inch reinforced Portland cement concrete (PCC) utilizing fiber reinforced polymer (FRP) reinforcing bars so as to not interfere with the Authority's toll collection system for ORT.

In exit lanes, each loop must be contained in a single concrete slab.

If the treadle slab is constructed within pavement super elevation transitions, the maximum cross slope shall not exceed 3 percent (%).

Treadle approach pavement shall be a minimum of 18-feet long of new, full depth concrete pavement.

Treadle departure pavement shall be a minimum of 18-feet long of new, full depth concrete pavement.

Cross-slope through the plaza shall not exceed 3 percent (%) and shall be 1.5 percent (%) minimum and continuous through the shoulders.

### **22.3.3 Gantry Requirements**

The Design-Builder shall provide an overhead structure functionally consistent with the ORT Gantry Schematic.

The Design-Builder shall procure and install equipment mounts as specified below. The ORT gantry shall support flexible placement of equipment mounts. All supports in the vicinity of the equipment shall not interfere with the placement or field of view of the equipment. Supports shall not be placed on the center lines or split lines of the lanes.

Conduit shall not impede access to equipment for installation or maintenance purposes.

The ORT Gantry shall be grounded.

The Design-Builder shall ensure that any extra fiber cable will be coiled inside the ORT Communication Building.

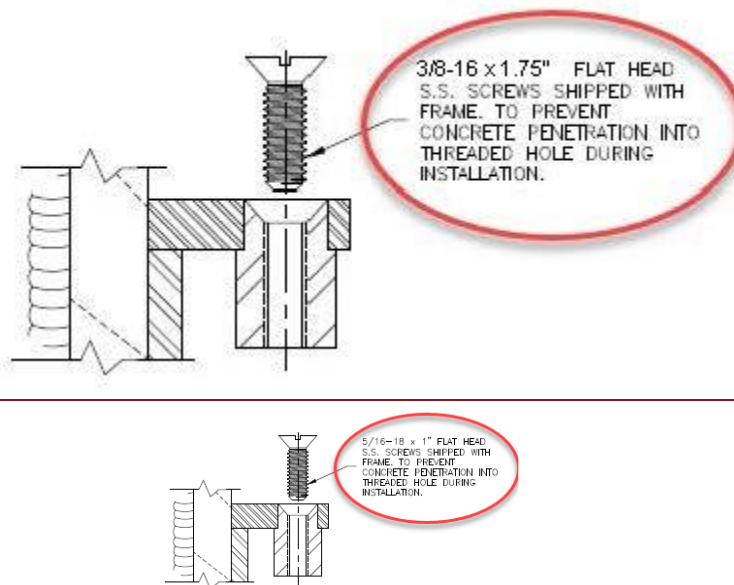
There shall be no splicing of fiber cables. They shall be ordered sufficiently long to reach from the lane to the ORT Communication Building, plus a minimum additional 30 foot length inside the building.

The Design-Builder shall install an appropriately sized individual conduit from the pullbox to the ORT Communication Building.

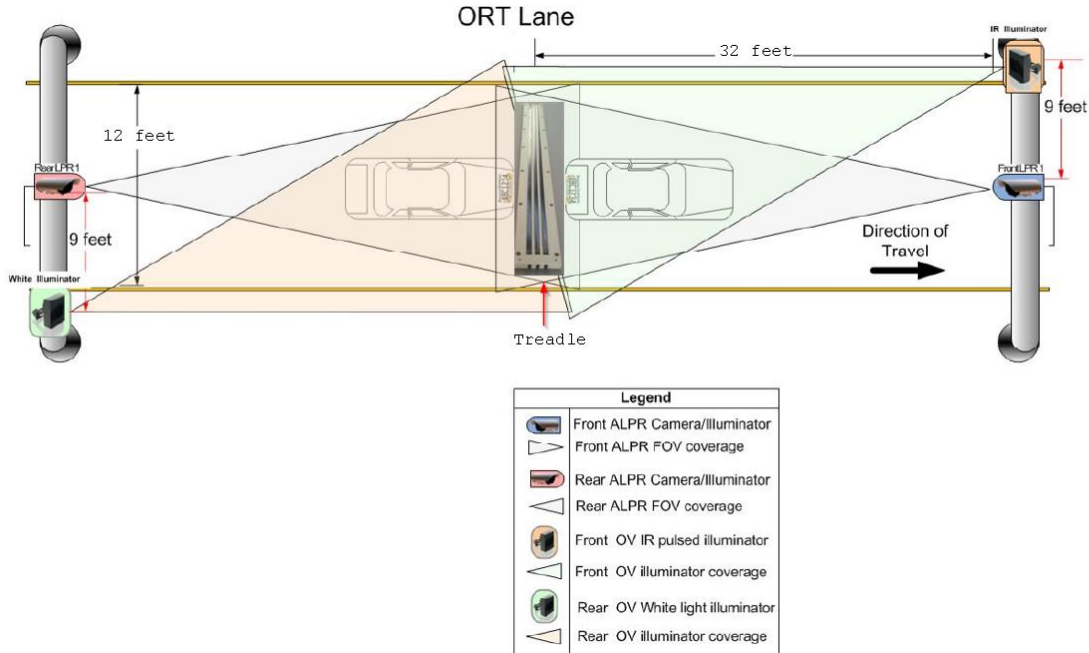
The Design-Builder shall ensure that the following steps are observed during installation of the fiber treadle:

- Use ~~5/16-18 by 1.5"~~ 3/8-16 by 1.75" full thread 316 stainless bolts to secure the treadle frames (McMaster P/N: 93190A58793190A630)
- -Install a single Belleville washer, with the crown side up -on each bolt. (McMaster P/N: 9713K423-Garr part # 9713K418)
- Use Loctite #243 thread locker on the side of the mounting hole, not the bolts.
- Do not substitute any other mounting bolts
- Bolts are torqued to 138 inch pounds, starting with the bolts closest to the leads and working outward to the opposite end.
- Bolt holes are filled with 100% silicone sealant after all of the bolts have been torqued
- Fibers are labelled 1, 2 and 3. Strip 1 is the strip that is contacted first when vehicles are travelling in the forward direction.

The Design-Builder shall ensure that flat head screws shipped with the treadle frame remain installed during treadle frame installation to prevent accidental plugging with concrete, as shown below:



The picture below depicts a typical fiber treadle installation in treadle frames embedded in concrete pavement:



The camera shall be Inex part # IZA-800ORT-L-TWY. Dimensions for the camera are 17.7 x 6.7 x 4.6 inches. Weight is 5 lbs.

The proper Inex camera mount and Inex illuminator mount depend upon the gantry proposed by the Design-Builder. The Design-Builder shall contact Inex to determine the correct mounts to order.

The camera shall be mounted using Inex part # MNT-GL-UCAIZ or MNT-GS-UCAIZ. There shall be one front and one rear camera in each lane.

The rear camera illuminator shall be Inex part # IZ-SW2-20 (white light illuminator). The rear camera illuminator shall be mounted using Inex part # MNT-GL-UIL or MNT-GS-UIL.

The front camera illuminator shall be Inex part # IZ-S2-20 (infrared light illuminator). The front camera illuminator shall be mounted using Inex part # MNT-GL-UIL or MNT-GS-UIL.

The Design-Builder shall provide and install two appropriately sized conduits for power cables, communication cables, and possible future addition of a second front camera in each instrumented lane. Power cables and communication cables shall be routed through separate conduits. The Design Builder shall provide a hinged, stainless steel junction box for D.C. power and communications within 6 feet of each camera to support the “whip” cables from the camera/illuminator to the junction box. The enclosure is to be NEMA 4x rated and have a minimum size of 4216”H x 4214”W x6”D. The enclosure must include a removable back panel and no conduit connectors shall impede the installation and removal of the back panel. The design builder shall install 4 weather tight connectors for 1/4” diameter cables in the enclosure to support the whip cables. No penetrations are permitted through the top of the enclosure.

The Design-Builder shall provide:

- A separate power cable for each camera.
- A separate power cable for each illuminator.
- A separate communication cable for each camera.



Due to limited space, transfer switches shall be installed in a Nema 4X cabinet outside the ORT Communication Building where applicable.

The ORT Communication Building ceiling height shall be 9 foot minimum.

The Design-Builder shall provide all computer racks, cabling, and conduits.

~~Provide a minimum of 2 parking spaces within 15 feet of the ORT Communications Building for light maintenance service vehicles.~~

Provide HVAC equipment sized and designed for proper conditioning and ventilation of electronic equipment with an estimated heat load of 18,000 BTUs per hour with a maximum power consumption of 7200 watts.

Anti-static resilient flooring.

Power: Normal convenience power standards

Lighting: General LED

Receptacles: Standard convenience outlets

Exterior Door Size: 36" x 84" minimum to be located on a 10 foot, not the 14 foot wall. Door must open out of the ORT Communication Building.

The Design-Builder shall procure and install two of the following equipment racks (or approved equivalent) in the ORT Communication Building. The racks shall be installed side-by-side, and there shall be 3 feet of space from the ORT Communication Building walls to the front and rear of the cabinets. Access is required to the front and rear of all racks. The racks cannot be arranged back to back.

- Part # AR2507 - NetShelter SV 48U 600mm Wide x 1200mm Deep Enclosure with Sides Black

The ORT Communication Building shall provide a mechanism to ground all installed components and equipment racks.

The ORT Communication Building shall include cable ladders for running cables, both vertically from the conduit, and horizontally to the top of the racks.

The ORT Communication Building shall include a workbench, minimum size of 4 feet x 2 feet, that can support 200 pounds. Electrical outlets shall be installed in close proximity to the workbench.

### **22.3.11 ORT Communication Building Components**

The Design-Builder shall procure ORT system components for installation in the ORT Communication Building. The installation will be performed by Authority personnel. See the section entitled Component List and Responsibility Matrix for details.

**New York State Thruway Authority**

Mfg part #	SUB	Description	Source	Quantity Required	Installation Responsibility
IZ-SW2-20	N	Illuminator-white	Inex Zamir	1 per instrumented lane	TA
IZ-S2-20	N	Illuminator-Infrared	Inex Zamir	1 per instrumented lane	TA
MNT-GL-UIL or <u>MNT-GS-UIL</u>	N	Illuminator Mount	Inex Zamir	2 per instrumented lane	DB
MNT-GL-UCAIZ or <u>MNT-GS-UCAIZ</u>	N	Camera Mount	Inex Zamir	2 per instrumented lane	DB
#7919A	Y	Cat5e cable – 328 feet - Belden Multi-Conductor - Category 5e DataTuff® Twisted Pair Cable, part	Belden	TBD by DB	DB
# 5100UE	Y	Belden, 2 Conductor, 14 Gauge	Anixter	TBD by DB	DB

**22.3.15 Spare Parts**

The Design-Builder is to procure and provide to the Authority the following additional parts in the quantities specified:

Mfg Part #	Quantity
Inex camera part # IZA-800ORT-L-TWY	20
Inex White Light illuminator part # IZ-SW2-20	20
Inex Infrared illuminator part # IZ-S2-20	20
Inex White Light Illuminator part # IZ-SW1-30(white)	8
Inex Infrared Illuminator IZ-S1-30 (IR)	8
OSI LaserScan part # AS615-UDK	35
MSI Fiber strips, part # SL 3 EZ TREADLE3042-3-1-100	20
Dell PowerEdge R330	20
MSI SL PUR 215-1-125-PE	10

## 22.4 OPEN ROAD TOLLING (ORT) WORK AT EXIT SITES

### 22.4.1 General Requirements

Directive Requirements for the construction of the Open Road Tolling (ORT) system at each interchange shall be as specified below and elsewhere in this RFP. Refer to the corresponding concept plans for details found in Part 7 – Engineering Data, Section 2:

- ORT Zones shall be installed within the “Potential Tolling Area” locations shown on the concept plans
- Locations for access to the Maintenance Facilities, Tandem Lots, Commuter Parking Lots and State Police Facilities as shown on the concept plans. The locations are directive but the path from Point A to B can be modified. A new location is not allowed without an ATC.
- ~~A single lane access driveway with two (2) parking spots shall be provided within 15 ft. of each communications building door. These lots shall be paved, as will the access driveway and walkways to the Communication Buildings.~~
- All TUBs are to remain in place.

General Design Requirement for the construction of the Open Road Tolling (ORT) system at each interchange shall be as specified below (Refer to corresponding concept plans for details):

- Ramp lane widths – 12 ft minimum
- Ramp shoulder widths ~~—A single lane paved access driveway with two (2) paved parking spots shall be provided. Paved vehicle access to within 15 ft. of each communications building door shall be provided as well so that equipment can be unloaded. From vehicle access termination to the door entry shall also be paved.~~
- Ramp shoulder widths within the ORT Zones shall be in accordance with the graphics posted.
- Design vehicle for tandem truck movements – WB-109D
- Design vehicle for Thruway Maintenance facility driveways – WB-62 unless shared with tandem truck lot, then use WB-109D
- The alignments shown in Part 7 – Engineering Data, Section 2 and those alignments are conceptual (not engineered) and the Design-Builder is responsible for alignment design but with meeting the requirements below.
- Design Speed of 40 MPH – Semi-direct Connecting Ramp
- The Design-Builder based on design speed stated is responsible for proper superelevation or cross section of highways, within the defined project limits.
- Pavement repairs are required at some ORT sites and can be found in Part 7 – Engineering Data, Section 14.
- All Gantry supports shall be protected with some level of guiderail per current standards. Even if the Gantry supports are outside the clear zones a guiderail protective system is still required to protect the Thruway’s Tolling revenue.
- There currently exist at the ORT Exit sites four (4) foot medians leading from the Thruway into the Toll Plaza area. That median area needs to be carried through the new ORT Exit site alignments. Whether it is positive separation or delineators, a minimum of 1 foot left shoulder shall be required.

**Exit 19 Kingston**

The Design Builder shall construct an ORT zone at the north end of the existing toll plaza with 2 lanes and a shoulder in each direction with positive protection barrier for a Design Speed of 40 MPH – Semi-direct Connecting Ramp. Prior to the Go Live Date the Design Builder shall:

- A. Retain the existing northern most Maintenance Driveway. Provide a temporary access If conflicts with Toll Zone Construction.
- B. Construct a new two-way driveway for Tandem Access (WB-67409D) vehicles from NYS RTE 28 into the Maintenance Facility, connecting to the Tandem lot and Maintenance Yard.

After the ORT toll system becomes functional Design Builder shall remove the existing toll plaza and connect the ORT Toll Zone to Rte 28 as follows:

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Construct a driveway connection from the parking lot south of the TUB to the maintenance yard, employee parking lot, and the tandem truck lot Close the driveways from the ramp to the maintenance facility, tandem truck lot and the employee parking lot.
- C. Entering traffic
  - a. The northbound entering lanes shall transition from the existing 3 lanes and shoulder entering the plaza from Rte 28 and transition to 2 lanes with shoulder at the south limit of the ORT zone.
- D. Exiting Traffic
  - a. The 2 southbound exit lanes shall widen to 3 lanes after the toll zone and continue as 3 lanes to meet the existing 3 lanes at the slip ramp to RTE 28 west
- E. Complete installation of positive protection barrier and delineators.
- F. Remove pavement to provide footprint reduction areas and these areas should be top soiled and seeded.

**Exit 20E Saugerties East**

The Design Builder shall construct an ORT zone within the limits shown on the concept plan a minimum of 1 lane and a shoulder in each direction and a 4 foot median with delineators for a Design Speed of 40 MPH – Semi-direct Connecting Ramp.

After the ORT toll system becomes functional Design Builder shall remove the existing toll plaza and connect the ORT Toll Zone to Rte 32 as follows:

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Entering Traffic
  - Provide 1 lane and shoulder.
- C. Exiting Traffic

- The 2 westbound exit lanes shall continue as 2 lanes with shoulder after the toll zone and widen to develop a median/turn lane for the Maintenance/Tandem Access Driveway. And then taper back to 2 lane with shoulder to meet the existing 2 lanes at the slip ramp for Rte 75.
- D. Complete installation of positive protection barrier.
- E. Remove pavement to provide footprint reduction areas and these areas should be top soiled and seeded.

### **Exit 57A Eden-Angola**

The Design Builder shall construct an ORT zone on either side of the toll booths with 1 lane and a shoulder, or 2 lanes and a shoulder in each direction, depending on the selected location of the zone, with delineators for a Design Speed of 40 MPH – Semi-direct Connecting Ramp.

After the ORT toll system becomes functional Design Builder shall remove the existing toll plaza and connect the ORT Toll Zone to Eden Evans Center Road as follows:

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Entering Traffic
- The entering lane shall transition from the existing 1 lane and shoulder to 2 lanes at the ramp split.
- C. Exiting Traffic
- The 2 exit lanes shall taper to 1 lane with shoulder after the ramps merge.
- D. Complete installation of delineators.
- E. Remove pavement to provide footprint reduction areas and these areas should be top soiled and seeded.

### **Exit 58 Silvercreek**

The Design Builder shall construct an ORT zone to the south of the existing toll plaza with 2 lanes and a shoulder in the southbound entering each direction and with 1 lane and a shoulder in the northbound exiting direction with delineators for a Design Speed of 40 MPH – Semi-direct Connecting Ramp. Prior to the Go Live Date the Design Builder shall:

- A. Remove the existing Maintenance Access Drive just south of the ramp merge from Rte 5/20 and before the existing toll plaza.

After the ORT toll system becomes functional Design Builder shall remove the existing toll plaza and connect the ORT Toll Zone to Rte 5/20 interchange as follows:

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Entering Traffic
- The 2 entering lanes shall continue from the existing 2 lane at the Rte 5/20 ramp merge to meet the 2 lanes past the existing toll plaza.

## SECTION 23 INTERCHANGE WORK

### 23.1 SCOPE

The Design-Builder shall be responsible for the design and construction of all work in the interchanges of Exit 23, 24, 25, 25A, 34A, 36, 39, 44, 45, 46, and 47. The concept plans can be found in Part 6 Indicative/Concept Plans. The Concept Plans provide an overview of the idea and scope of work the Thruway wants to see in the proposals. The number of lanes of opposing traffic is shown which corresponds to the information provided in Part 7 – Engineering Data Section 18. The volume of traffic and the hour by hour data of traffic can be found in Part 7 – Engineering Data Sections 19. Section 18 also provides other information relative to positive separation, design speeds, etc. that the Design-Builder shall use in the design and modifications of these interstate to interstate connections.

### 23.2 STANDARDS

The Design-Builder shall perform the Work in accordance with the Contract Documents and the Applicable Standards, Design Codes and Manuals listed in Section 1.6, unless otherwise stipulated in this Project Requirement(s) or otherwise applicable to the Project.

### 23.3 GENERAL REQUIREMENTS

Concept plans for all eleven interchanges are found in Part 6 Indicative/Concept Plans. Pavement repairs and the required minimal limits to those repairs are provided in Part 7 – Engineering Data Section 14. Requirements for these interchanges include the sealing of concrete cracks, full depth isolated repairs, toll booth removal to the limits defined in Section 14 and the addition of the proper superelevations or cross slopes for the design speeds. At some interchange to interchange connections, significant reconstruction of entire previous tolling areas are required. The Design-Builder is responsible for the Toll Plaza removals and those requirements are in other sections of Part 3. Signage packages, Tandem Lot work, pavement repairs and pavement design and construction, Work Zone Traffic Control, TUB removals, and other relevant information are found in other sections of Part 3 – Project Requirement sections, and other Part 7 – Engineering Data Sections. Positive Separation at all Interchanges (required) shall be Concrete Barrier.

All these Interchanges require positive separation and the Authority is requiring reinforced concrete barrier as the positive separation. The TUBS and all Toll Booths shall be removed at all these interchange locations. The existing generators are to be salvaged for the Thruway. The traffic data for these locations can be found in Part 7 – Engineering Data, Section 19. The Work Zone Traffic Control, Section 15 of Part 3 is applicable at all these locations. The signage package associated with transition before and after AETC ‘goes live’ and then after the Toll Booths are removed can be found in Engineering Data, Part 7 - Section 8. The Design-Builder is responsible for the improvements to the proposed legislation routes for Tandems, which are shown in Part 7 - Engineering Data, Section 3. ~~All turning movements shall be improved, where required, to ensure the Tandems can properly remain in the correct travel lanes.~~ The concept plans are not fully engineered however, the plans do show the required/intended number of lanes that are necessary when the interchange work is completed. Those requirements can be found in Engineering Data, Part 7 – Section 18. Refer to Section 12 of Part 3 – Project Requirements for specifics relative to signage, pavement markings and signals (if required). The actual sign sizes and text for the transition and final signage where Toll Booths are eliminated are also found in Engineering Data, Part 7 - Section 8. While the Toll Booths are operational, prior to AETC “going live”, work within the Toll Booth areas is governed by Engineering Data, Part 7 – Section 16, which is the number of Toll Booths required to be operational based on time of day. The Design-Builder shall notify the

## SECTION 25 DEMOLITION OF TOLL PLAZAS

### 25.1 SCOPE

The Design-Builder shall demolish Toll Plazas at the following terminus locations: 15 (Woodbury, MP 45.03), B3 (Canaan, MP 17.83), Williamsville (MP 419.69, Lackawanna (MP 430.51), Ripley (MP 494.51) and interchange Locations 23 (Boulevard), 24 (Washington Ave.), 25 (Schenectady), 25A (Duanesburg), 34A (Collamer), 36 (Mattydale), 39 (State Fair), 44 (Canandaigua), 45 (Victor), 46 (Henrietta), 47 (Leroy), B1 (Post Road), B2 (Taconic), 17 (Partial Demolition) (Newburgh), 18 (New Paltz), 19 (Kingston), 20E (Saugerties E.), 20W (Saugerties W.), 21 (Catskill), 21B (Coxsackie), 22 (Selkirk), 26 (Rotterdam), 27 (Amsterdam), 28 (Fultonville), 29 (Canajoharie), 29A (Little Falls), 30 (Herkimer), 31 (Utica), 32 (Westmoreland), 33 (Verona), 34 (Canastota), 35 (Thompson Road), 37 (Electronics Parkway), 38 (Liverpool), 40 (Weedsport), 41 (Waterloo), 42 (Geneva), 43 (Manchester), 48 (Batavia), 48A (Pembroke), 49 (Depew), 56 (Blasdell), 57 (Hamburg), 57A (Eden-Angola), 58 (Silvercreek), 59 (Dunkirk), and 60 (Westfield).Standards.

At the existing Woodbury Terminus locations, the Toll Plaza includes a pedestrian bridge. The pedestrian bridge removal is required and its cost of removal shall be included under the Toll Plaza Removal.

The Design-Builder shall perform the Work in accordance with the Contract Documents and the Applicable Standards, Design Codes and Manuals listed in Section 1.6, unless otherwise stipulated in this Project Requirement or otherwise applicable to the Project.

### 25.2 REQUIREMENTS

#### 25.2.1 General

The Design-Builder shall not remove the Toll Booths until the Cashless Tolling System is activated. The removal of the Toll Booths shall be completed in stages and traffic lanes shall be maintained to avoid congestion at the Toll Booths.

The Design-Builder shall demolish the existing Toll Plazas in stages and remove the demolished material. Refer to Section 15 for specifics of Work Zone Traffic Control to avoid traffic congestion.

The Design-Builder shall salvage for the Authority the following items:

- LED canopy lights;
- Lane indicator lights; and
- ~~Drum sign/structures~~Existing generators to be removed.

The Design-Builder shall relocate the salvaged equipment to a location to be identified by the Authority that will not be more than 10 miles from the demolition site.

#### 25.2.2 Toll Booth Demolition

- A. The Toll Booths shall not be removed by the Design-Builder until all electronic cashless tolling is activated. Refer to Part 3 – Project Requirements, Section 15 for specifics on Work Zone Traffic Control.
- B. The Design-Builder is responsible at all locations where full Toll Plaza removal is required to provide in the tunnel under those toll plazas to install 2-4 inch conduit capped at both ends for future use by Authority Resources. Upon completion of that installation of the Thruway special specification conduit, the tunnel is to be filled with low strength fill.
- C. The Design-Builder is responsible for capping or repairing the highway pavement void after the Toll Booths are removed. The Design-Builder shall design and construct an appropriate reconstructed section of pavement for this voided section as per Section 25.5 indicated in Part 7 – Engineering Data, Section 14 prior to the necessary normal crown or super elevated highway section (the final pavement highway section for these locations being applied).

- D. One week prior to the beginning of the removal of the Toll Booths at each location, the Design-Builder shall notify the Authority's Project Manager so that Thruway personnel can remove tolling equipment. It shall take Thruway personnel a maximum of three (3) days to remove the equipment.
- E. If the first Toll Booth removals are not to occur until a time greater than 1 month after the AETC "go live" date than the previous paragraph does not apply as the equipment at all locations shall be removed within that one month period.
- F. Prior to Toll Booth removal, all electric and fiber connected to the Toll Booths shall be appropriately terminated at the existing TUB locations by the Design-Builder.

**25.2.2.1 Exit 17 (Newburgh) Partial Toll Booth Demolition**

The only location in this Project that does not require complete Toll Booth removal is Exit 17 (Newburgh). At Newburgh (entry) and Newburgh (exit), one Toll Booth removal per location is required.

Paragraphs A, C, D and E in section 25.2.2 apply for Exit 17 (Newburgh).

**25.2.2.2 Exit 16 (Harriman) Partial Toll Booth Demolition**

Paragraphs A, C, D, E and F in Section 25.2.2 apply for Exit 16 (Harriman).

**25.2.3 Hazardous Materials**

The Design-Builder shall ensure the removal and disposal is done in accordance with all applicable laws and standards.

The abatement of all Hazardous Materials shall be completed to the greatest extent possible prior to any demolition taking place unless a legal variation from related laws, rules and regulations can be obtained. If the Hazardous Material has been identified through the Hazardous or Asbestos Screening document and/or the record plans, the Design-Builder is responsible for all costs. Should Hazardous Material or Asbestos be found and information related to its presence was not previously available to the Design-Builder, all costs associated with abatement, containment, removal, and disposal shall be covered under the Fixed Force Account item.

The Design-Builder shall perform all Work with care so that any materials that are to remain in place, or that are to remain the property of the Authority shall not be damaged. If the Design-Builder damages any materials that are to remain in place or which are to become or to remain the property of the Authority, the damaged materials shall be repaired or replaced in a manner satisfactory to the Authority at no cost to the Authority.

The Design-Builder shall ensure that no aspects of the Works have a detrimental effect on public safety or the environment.

The Design-Builder shall assume responsibility for safety and maintenance of all existing structures within the Project Limits, identified for removal in accordance with DB §105-12.



Utility connections shall be discontinued and capped in accordance with the requirements of the utilities companies or the Authority prior to demolition works.

**25.2.4 Deliverables**

A Demolition and Removal Plan, signed and stamped by a Professional Engineer, registered in the State of New York, shall be submitted to the Authority for review and written comment.

**25.3 TOLL BOOTH REMOVAL INCENTIVES**

The Authority has determined that there is value in the removal of the Toll Booths as soon as possible after the AETC “go live” date. Based on volumes of traffic, incentives are being offered in an attempt to remove the Toll Booths at these higher traffic volume locations. The Interchange and Terminus locations involved and the associated incentives are shown below:

Location	AADT	Incentive
Interchange 24	≈ 75,600	\$1,000,000
Williamsville	≈ 54,200	\$720,000
Lackawanna	≈ 49,200	\$655,000
Interchange 25	≈ 40,300	\$535,000
Interchange 45	≈ 36,800	\$490,000
Canaan	≈ 23,600	\$315,000
	Potential Incentives	\$3.715 M

To be eligible for the incentive payment the following conditions have to be met:

1. The final permanent alignment and lane configurations shall be in place (travel lanes and shoulders) and shall remain in place for the winter months until March 15, 2021
2. Positive separation shall be in place, either permanent or temporary concrete barrier, for the median and right side to channelize traffic through the Toll plaza area.
3. Pavement repairs are complete
4. Construction of temporary asphalt pavement where Toll Booths were removed and meet the existing Toll plaza elevations of roadway surface.
5. Temporary striping and temporary directional signage shall be in place. The temporary striping can be reflectorized paint, or epoxy.
6. The work at the individual locations shall be complete by January 15, 2021.

The temporary conditions defined above shall comply with Standard Specifications.

**25.4 TOLL BOOTH REMOVAL DATE**

The Design-Builder is responsible to have all Toll Booths removed and the final lane configurations in place by August 4, 2021. Failure to meet this dateline shall result in a loss of the project completion incentive of one calendar day incentive (\$20,000)/per calendar day late/per each Toll Booth removal location. If the Design-Builder is not pursuing the incentive this value constitutes the liquidated damages associated with not meeting the defined deadline date.

**25.5 MINIMUM TOLL BOOTH REMOVAL LIMITS**

The Design-Builder is responsible for the complete removal of the Toll Booths which means the entire canopy, the toll booths, the toll booth islands, the treadles, and concrete pavement and/or asphalt pavement sections as indicated in Engineering Data, Part 7, Section 14.

## SECTION 26 COMMUNICATIONS BUILDINGS

### 26.1 SCOPE

The Design-Builder shall design and construct a Communications Building and Building Foundations at each Gantry location and provide three paved parking spaces adjacent to each Communications Building.

The Design-Builder shall install all conduits and electrical service for electrical power to the Communications Buildings and the Gantries.-

The Design-Builder shall provide backup diesel powered generators capable of providing a minimum of 96 hours of continuous operation of Cashless Tolling Facilities.

The Design-Builder shall install all Fiber Optic inner-duct to Communication Buildings and Gantries for Fiber Optic cable to be provided and installed by Adesta.

The Design-Builder shall install all equipment cabinets and mounting components in the Communications Buildings for the Cashless Tolling Equipment to be provided and installed by Kapsch.

The Design-Builder shall be responsible for designing and implementing the structural, mechanical, electrical and plumbing (the "SMEP") and the fire and life safety aspects of the design in accordance with this Project Requirement and ensure that on-site / construction radio frequency device(s) shall not interfere with the Authority's toll collection system;

### 26.2 STANDARDS

The Design-Builder shall perform the Work in accordance with the Contract Documents and the Applicable Standards, Design Codes and Manuals listed in Section 1.6, unless otherwise stipulated in this Project Requirement or otherwise applicable to the Project.

### 26.3 REQUIREMENTS

Each Communication Building shall meet all code requirements and shall be a minimum of 21 ft. X 21 ft. The Design-Builder shall be responsible for coordinating with the Authority via the Authority's Project Manager to ensure that the relevant design requirements of the Authority are met.

The Design-Builder shall be responsible for providing electric service to the Communications Building. Coordination and payment with and to the Electric Company/Supplier for providing electrical service, power pole placement, or other necessary work will be the responsibility of the Design-Builder, and then reimbursed by the Authority through the draw down Force account item.

The electric service to the Communications Building shall be 225-amp service from their selected pole to the interior of the Communications Building entering through the foundation up into the backside wall to the rack. Power receptacles shall be provided on ceiling to support the cashless tolling and network equipment.

A single lane paved access driveway with three (3) paved parking spots for Mainline locations and two (2) parking spots for ORT locations shall be provided. Paved vehicle access to within 15 ft. of each communication building door shall be provided as well so that equipment can be unloaded. The pathway from the vehicle access end to the Communication Building door shall be paved as well (~15').

Communications Buildings are critical to the receipt of correct tolling revenue, similar to the mainline gantries, mini-gantry, smaller communication buildings at the ORT Exits and thus require traffic

**26.3.2.9 Wiring Devices**

- A) Receptacles: duplex, straight blade, 125 V , 20 A. Provide ground fault circuit interrupter (GFCI) non-feed through receptacles in all wet locations and as required by code.
- B) Toggle switches: 120/277 V, 20 A. Provide pilot-light and key-operated switches where required.
- C) Indoor occupancy sensors: dual-technology type, with separate, externally mounted relay unit.
- D) Lighting control shall be time-switch type, photo sensor type or motion sensor type, electronic, programmable units.

**26.3.2.10 Interior Lighting**

~~See Project Requirement 15 – Lighting-As per NYS Building Codes.~~

**26.3.2.11 Exterior Lighting**

Vandal Resistant exterior LED light(s) with photo cell/switch mounted is/are required adjacent to the entry door and mounted above the Communication building's HVAC components.

~~26.3.2.11~~**26.3.2.12 Data Communications**

The Design-Builder shall provide all data communication wiring to each device required at the communication building. This shall include; security equipment, generator monitors, designated work bench or desk area and cameras. The wiring shall consist of a minimum of Category 5e (enhanced) cable and shall be terminated in patch panels at the top of the Authority designated network rack, wall receptacle (jack) location(s), communication panels (generator and security), as required.

**26.4 DELIVERABLES**

See Project Requirements 13 – Lighting; and 26 – Toll In Place Modifications.

## New York State Thruway Authority

### APPENDIX A UTILITY REQUIREMENTS

The Authority has reviewed the potential Project limits and has made a preliminary assessment of which utility facilities located within the potential Project limits may be impacted by the Project

#### A-1 UTILITY COMPANIES

Table A-1 lists the Electric utility companies and their respective contacts in areas throughout the Project limits with facilities located on, under or above the Project roadways and/or structures:

**TABLE A-1**

MP Range	Interstate	Electrical service Provider	Contact Name	Telephone	E-mail
<b>Mainline</b>					
45.2 to 51.0	I-87	Orange & Rockland Utilities	<u>FRANK CORKUM</u> <u>MICHAEL CASALE</u>	<u>845-783-5505</u> <u>845-577-3463</u>	<u>corkumf@oru.com</u> <u>casalem@oru.com</u>
51.0 to <del>76.0</del> <u>76.0</u> <u>131.0</u>	I-87	Central Hudson Gas & Electric	<u>LISA CARVER</u> <u>LINDSA Y-CULLEN</u>	<u>845-563-4529</u> <u>845-486-5430</u>	<u>lcarver@cenhud.com</u> <u>ycullen@cenhud.com</u>
<u>76.0 to 131.0</u>	<u>I-87</u>	<u>Central Hudson Gas &amp; Electric</u>	<u>JASON MALIZIA</u>	<u>845-334-3513</u>	<u>jmalizia@cenhud.com</u>
131.0 to 287.2	I-87 / I-90	National Grid	<u>SCOTT GRAHAM</u> <u>REMO MUSCEDERE</u>	<u>800-642-4272</u> <u>315-428-5663</u> <u>315-433-3043</u>	<u>scott.graham@nationalgrid.com</u> <u>remomuscudere@nationalgrid.com</u>
287.2 to 289.0	I-90	Village of Solvay	JOSEPH HAWKSBY	315-468-6229	<u>jhawksby@solvayny.org</u>
289.0 to 290.6	I-90	National Grid	<u>SCOTT GRAHAM</u> <u>JAMES ZUCCOLOTTO</u>	<u>800-642-4272</u> <u>315-428-5663</u> <u>315-428-3465</u>	<u>scott.graham@nationalgrid.com</u> <u>james.zuccolotto@nationalgrid.com</u>
290.6 to 337.4	I-90	NYS Electric & Gas	<u>KIM LOWREY</u> <u>KRISTA ROOT</u>	<u>585-484-4302</u> <u>585-484-4304</u>	<u>kmlowrey@nyseg.com</u> <u>kareoot@nyseg.com</u>
337.4 to 370.5	I-90	Rochester Gas and Electric	SHAWN DRISCOLL	585-771-6573	<u>shawn_driscoll@rge.com</u>
370.5 to 410.9	I-90	National Grid	<u>SCOTT GRAHAM</u> <u>ANNETTE COMER</u>	<u>800-642-4272</u> <u>315-428-5663</u> <u>315-834-7583</u>	<u>scott.graham@nationalgrid.com</u> <u>annettecomer@nationalgrid.com</u>

## New York State Thruway Authority



410.9 to 418.2	I-90	NYS Electric & Gas	GEOFFREY S. HALLAM	716-698-0474	gshallam@nyseg.com
418.2 to 420.8	I-90	National Grid	<del>SCOTT GRAHAMANNETTE-COMER</del>	<del>800-642-4272 315-428-5663746-834-7583</del>	<del>scott.graham@nationalgrid.comannette-comer@nationalgrid.com</del>
420.8 to 430.6	I-90	NYS Electric & Gas	GEOFFREY S. HALLAM	716-698-0474	gshallam@nyseg.com
430.6 to 431.6	I-90	National Grid	<del>SCOTT GRAHAMANNETTE-COMER</del>	<del>800-642-4272 315-428-5663746-834-7583</del>	<del>scott.graham@nationalgrid.comannette-comer@nationalgrid.com</del>
431.6 to 439.1	I-90	NYS Electric & Gas	GEOFFREY S. HALLAM	716-698-0474	gshallam@nyseg.com
439.1 to 455.1	I-90	National Grid	<del>SCOTT GRAHAMANNETTE-COMER</del>	<del>800-642-4272 315-428-5663746-834-7583</del>	<del>scott.graham@nationalgrid.comannette-comer@nationalgrid.com</del>
455.1 to 460.2	I-90	NYS Electric & Gas	GEOFFREY S. HALLAM	716-698-0474	gshallam@nyseg.com
460.2 to 481.8	I-90	National Grid	<del>SCOTT GRAHAMDIANE HARDING</del>	<del>800-642-4272 315-428-5663746-673-7249</del>	<del>scott.graham@nationalgrid.comdiane-harding@nationalgrid.com</del>
481.8 to 489.5	I-90	Town of Westfield Utilities	ANDREW THOMPSON	716-326-2145	athompson@villageofwestfield.org
489.5 to 496.0	I-90	National Grid	<del>SCOTT GRAHAMDIANE HARDING</del>	<del>800-642-4272 315-428-5663746-673-7249</del>	<del>scott.graham@nationalgrid.comdiane-harding@nationalgrid.com</del>
<b>Berkshire Spur</b>					
800.00 to 810.0	I-90	National Grid	<del>SCOTT GRAHAMREMO MUSCEDERE</del>	<del>800-642-4272 315-428-5663548-433-3043</del>	<del>scott.graham@nationalgrid.comremo-muscedere@nationalgrid.com</del>
810.0 to 824.0	I-90	NYS Electric & Gas	BILL GALLUP	800-572-1111 518-944-0378	wgallup@nyseg.com

### A-2 UTILITY INVENTORY

The types, sizes and approximate locations of utilities present in the immediate project area are shown in Part 7, Engineering Data, Section 9 - Utilities.



DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 Plotted By: scdusers  
 Design File: scd01a.dwg  
 Plot Date: 3/22/2019



 <b>Thruway Authority</b>	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
	LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
	TITLE OF DRAWING INTERCHANGE 23 CONCEPT	DRAWING NUMBER:



DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 PLOTTED BY: scdusers  
 DESIGN FILE: scdfiles  
 PLOT DATE: 3/22/19



 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway Authority</b>	TITLE OF PROJECT	CONTRACT NUMBER:
		CASHLESS TOLLING ON THE NYS THRUWAY	
		LOCATION OF PROJECT	DATE:
		EXITS 16 TO 61	3/22/2019
		TITLE OF DRAWING	DRAWING NUMBER:
		INTERCHANGE 24 CONCEPT	

Plotted By: scdusers  
 Design File: scd11e  
 Plotted: 8/21/19  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY





 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway          Authority</b>	TITLE OF PROJECT	CONTRACT NUMBER:
		CASHLESS TOLLING ON THE NYS THRUWAY	
		LOCATION OF PROJECT	DATE:
		EXITS 16 TO 61	3/22/2019
		TITLE OF DRAWING	DRAWING NUMBER:
		INTERCHANGE 25 CONCEPT	





Plotted By: scduser  
 Design File: scdfiles  
 Plotted: 8:01:18  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY



 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway          Authority</b>	TITLE OF PROJECT	CONTRACT NUMBER:
		CASHLESS TOLLING ON THE NYS THRUWAY	
		LOCATION OF PROJECT	DATE:
		EXITS 16 TO 61	3/22/2019
		TITLE OF DRAWING	DRAWING NUMBER:
		INTERCHANGE 25A CONCEPT	



DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 Plotted By: scculvers  
 Design File: sccn11es  
 Plot Date: 3/22/19



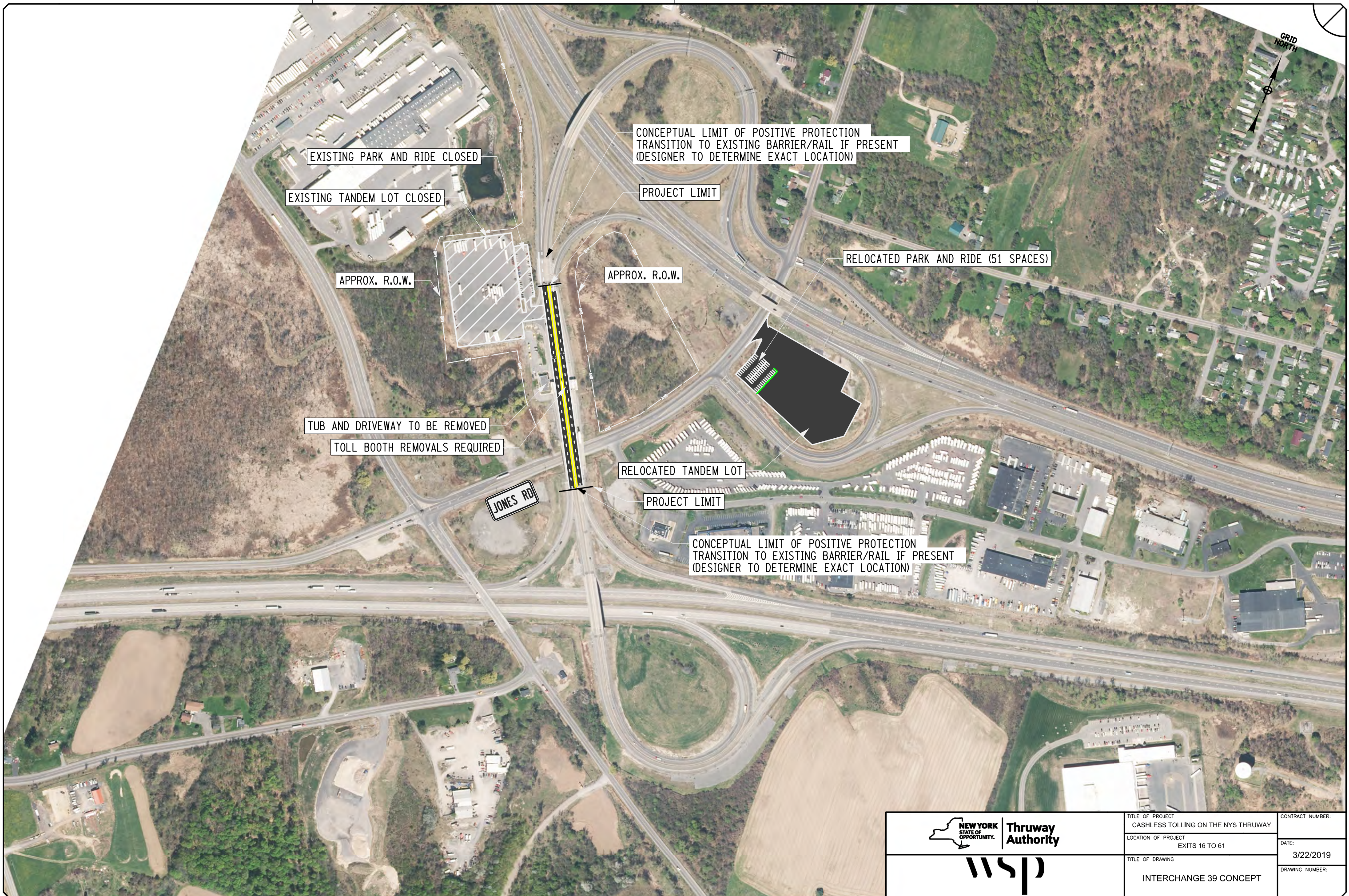
 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway Authority</b>	TITLE OF PROJECT	CONTRACT NUMBER:
		CASHLESS TOLLING ON THE NYS THRUWAY	
		LOCATION OF PROJECT	DATE:
		EXITS 16 TO 61	3/22/2019
		TITLE OF DRAWING	DRAWING NUMBER:
		INTERCHANGE 34A CONCEPT	



DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 Plotted By: scdusers  
 Design File: scdgnfile  
 Plot Date: 3/22/19

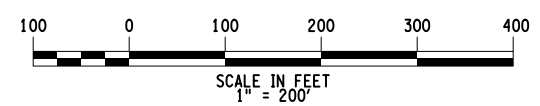
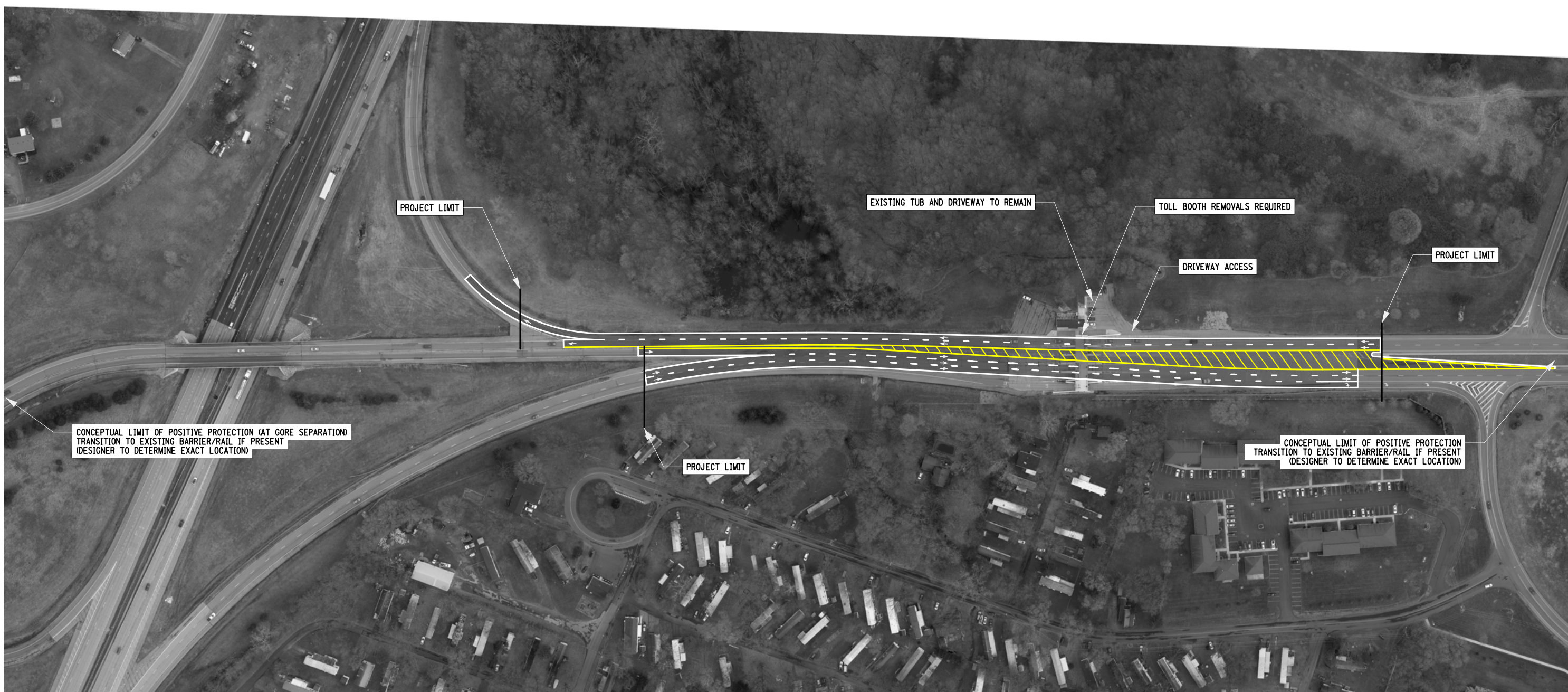
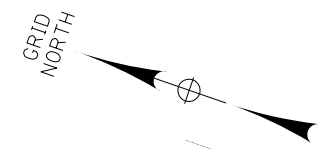


 <b>Thruway Authority</b>	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
	LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
	TITLE OF DRAWING INTERCHANGE 36 CONCEPT	DRAWING NUMBER:


Plotted By: scduzers  
 Design File: scduz18  
 Plotted: 8/2/19  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 DESIGN SUPERVISOR: B. DOHERTY



 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway          Authority</b>	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
		LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
		TITLE OF DRAWING INTERCHANGE 39 CONCEPT	DRAWING NUMBER:





PLOTTED BY: \$cduser\$  
 DESIGN FILE: \$cdprojname\$  
 PLOTTED: \$cdtime\$  
 DRAFTED BY: E. BAXTER  
 CHECKED BY: J. GLEN  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY

 <b>Thruway Authority</b>	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
	LOCATION OF PROJECT EXITS 16 TO 61	DATE: 12/21/2018
	TITLE OF DRAWING EXIT 44 - CANANDAIGUA, VICTOR	DRAWING NUMBER:

DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 Plotted By: scduars  
 Design File: scduars  
 Plot Date: 3/22/19



 <b>Thruway Authority</b>	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
	LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
	TITLE OF DRAWING INTERCHANGE 45 CONCEPT	DRAWING NUMBER:



Plotted By: scdusers  
 Design File: scdfiles  
 Plotted: 8/31/18  
 \$ times  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY



TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
TITLE OF DRAWING INTERCHANGE 46 CONCEPT	DRAWING NUMBER:

Plotted By: scdusers  
 Design File: scd01e8  
 Plotted: 3/22/2019 10:01:08 AM  
 CHECKED BY: K. CZORA  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 DESIGN SUPERVISOR: B. DOHERTY



 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway Authority</b>	TITLE OF PROJECT	CONTRACT NUMBER:
		CASHLESS TOLLING ON THE NYS THRUWAY	
		LOCATION OF PROJECT	DATE:
		EXITS 16 TO 61	3/22/2019
		TITLE OF DRAWING	DRAWING NUMBER:
		INTERCHANGE 47 CONCEPT	



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# Kapsch Equipment Cut Sheets.

*Highlighted section of Kapsch cut sheets provide the Design-Builder the dimensions and weight of each device.*

US

# Kapsch VRX: LPR camera for All Electronic Tolling (AET) and Enforcement.



The Kapsch VRX is a high-performing and cost-efficient license plate recognition camera designed for sophisticated ETC and ITS systems. It is an autonomous image-capturing device optimized for reading plates and for documenting traffic scenes.

Kapsch VRX uses the latest sensor and image-processing technology to provide high-resolution, high-quality image capturing and automatic license-plate reading with the highest possible accuracy. Whether your project involves Automatic License Plate Recognition (ALPR/LPR), the USDOT Number Tracking for Commercial Vehicles in the United States, or Dangerous Goods Detection (DGD/ADR) in Eurasia, Africa, or Australia – no matter the continent, the VRX will meet your needs.

At Kapsch we excel in optimizing system design and in delivering a comprehensive suite of vehicle registration systems, including AET video tolling; enforcement for AVI (RFID), video, or satellite-based tolling; ITS systems such as Traffic Surveillance, Road Safety Enforcement, and Electronic Vehicle Registration Monitoring (EVR); or Commercial Vehicle Enforcement (CVE) systems.

Kapsch VRX may cover one lane or several lanes at a time and can be single or dual-headed. It can be set to trigger autonomously or to receive triggers from a vehicle detection and classification subsystem, or to perform both functions simultaneously for the highest accuracy (redundant vehicle detection). Kapsch VRX is designed for high availability, robust and redundant systems. It also buffers images to compensate for time delays and uncertainties in other roadside subsystems, while continuing to produce accurate high-quality images that are correlated to and synchronized with other subsystems.

Kapsch VRX offers powerful on-board processing. It uses state-of-the-art optical character recognition engines to read vehicle registration plates, and organizes the resulting data - including images - into a package that may be encrypted and signed with the latest cryptographic

algorithms, ensuring both data security and integrity. Further security features are hardware tamper detection and secure key management.

In addition, Kapsch VRX supports high-definition video streaming, which allows real-time visual monitoring of current roadway activities as well as a cost-effective method for evaluating performance and accuracy.

The Kapsch VRX is the result of continuous adaptation to the latest technology while continuing to ensure full Kapsch in-house control of critical areas such as in-time delivery, performance optimization, seamless system integration, quick and easy customer-specific adaptations, as well as long-term end-of-life management.

## Technical features.

### VRX Overall

- Various ALPR / USDOT software packages may be used on-board
- VRX offers various camera types, resolutions, lenses, and filters
- Sophisticated, video-based, software self-trigger
- External real-time triggering, either digital or software based
- Post-trigger mechanism allows for time delay in external triggering system
- Automatic exposure control based on the license plate or image as a whole
- Frame synchronisation with other cameras in the roadside system
- Synchronized integrated and / or external illumination, non-distracting to drivers, with several wavelength options
- Encryption, signature and key management
- Configurable data bar / black strip in the image and JPEG compression
- H264 HD streaming at full frame rate
- Continuous monitoring and status information (SNMP)
- Local buffering to avoid data loss in case of network or server failures
- Prepared for downgraded modes and redundant system design
- Prepared for dual-lane and dual-head

### VRX Camera

- High dynamic range camera sensor:
  - Color 2040 x 1536 / 2040 x 2046 (configured / native)
  - Monochrome 2048 x 1536 / 2048 x 2048 (configured / native)
- Field of view: Typically 5m at 12m (Various lenses available)
- Integrated or external illumination: 40W optical ( $\pm 12^\circ$  FWHM)
- Enclosure: Extruded aluminium alloy, corrosion resistant
- **Dimensions (W x H x L): 7.76 x 8.98 x 13.15 in (197 x 228 x 459mm)**
- **Weight: 22 lbs (10kg)**
- Ambient temperature:
  - Operating:  $-40^\circ\text{F}$  to  $131^\circ\text{F}$  ( $-40^\circ\text{C}$  to  $+55^\circ\text{C}$ )
  - Non-operating:  $-40^\circ\text{F}$  to  $131^\circ\text{F}$  ( $-40^\circ\text{C}$  to  $+55^\circ\text{C}$ )
- Configurable, sophisticated heating control
- Controlled cold start with preheating at  $-40^\circ\text{F}$  ( $-40^\circ\text{C}$ )
- Relative humidity (operating): 4% to 100%
- IEC protection rating: IP66
- Power supply: 24-48 VDC / Power consumption: 20-40W excl. heating, depending on application
- MTBF: > 40.000h
- Vibration: 5-150Hz,  $2\text{m/s}^2$
- Shock:  $200\text{m/s}^2$ , 11ms
- EMC: 2004/108/EC LVD: 2006/95/EC RoHS2: 2011/65/EU FCC: 47CFR15
- Photo-Biological Safety: EN62471
- Interface: 10 / 100 / 1000BASE-TX

### Optional VRX External Illumination

- Optical power: 120W ( $\pm 10^\circ$  FWHM)
- Peak wavelength 830nm (other wavelengths available on request, as well as white light)
- Spectral bandwidth 40nm
- Light emitting aperture app. 130 x 130mm
- Pulse width max. 400 $\mu\text{s}$  / 700 $\mu\text{s}$
- Frequency max. 30Hz / 15Hz
- Enclosure: Extruded aluminium alloy, corrosion resistant
- **Dimensions (W x H x L): 7.76 x 8.98 x 13.15 in (197 x 228 x 334mm)**
- **Weight: < 13 lbs (6kg)**
- Ambient temperature:
  - Operating:  $-40^\circ\text{F}$  to  $131^\circ\text{F}$  ( $-40^\circ\text{C}$  to  $+55^\circ\text{C}$ )
  - Non-operating:  $-13^\circ\text{F}$  to  $131^\circ\text{F}$  ( $-25^\circ\text{C}$  to  $+55^\circ\text{C}$ )
- Relative humidity (operating): 4% to 100%
- IEC protection rating: IP66
- Power supply: 24VDC, max. 25W
- MTBF: > 40.000h
- Vibration: 1-9Hz  $3.5\text{mm}$ , 9-150Hz  $10\text{m/s}^2$
- Shock:  $200\text{m/s}^2$ , 11ms
- EMC: 2004/108/EC LVD: 2006/95/EC RoHS2: 2011/65/EU FCC: 47CFR15
- Photo-Biological Safety: EN62471

### VRX Remote Manager Application

- User-friendly standard Windows® Application
- Setting of configuration parameters on VRX camera
- Image visualization: Display of the images from the lane cameras and the overview cameras
- Manual triggering of images possible
- Download of firmware for the camera modules
- Allocation of security keys for the VRX ANPR cameras
- Monitoring of input (trigger) and output (result) messages

## About Kapsch Group.

Kapsch is one of Austria's most successful technology corporations to specialize in the future-oriented market segments of intelligent transport systems (ITS) and information and communications technology (ICT). Kapsch. Always one step ahead.



# Kapsch VDC for Single Gantry - A True 3D Vehicle Detection, Tracking, Triggering and Classification System

***The Kapsch VDC system is designed to detect, track, trigger and classify vehicles in real time in all traffic environments***

## **Overview**

The Kapsch VDC system has true 3D-measurement functions based on image processing of stereo video images. This enables the Kapsch VDC system to determine the outline as well as the height profile and the path of the passing vehicles of all kinds. With continuous imaging processing, covering the full road width, the Kapsch VDC system has excellent performance in complex stop & go traffic situations. All without compromising the Kapsch VDC system's high-speed performance in multi lane free flow situations exceeding 200 km/h.

## **The Core Functionality**

The Kapsch VDC system detects every vehicle and tracks it through the entire tracking zone. Through the tracking zone, the Kapsch VDC system provides real time vehicle positions, for e.g. tag correlation, and triggers to both front and rear LPN cameras. As vehicles leave the tracking zone, the Kapsch VDC system provides measurements of the vehicle dimensions and associated vehicle class. With its large field of view, the Kapsch VDC system is not depending on constant vehicle speed to accurately track and measure the vehicles. Stop & go traffic produces as accurate output as constant speed traffic. The Kapsch VDC system can also perform deeper analysis of the images and e.g. indicate whether vehicles that have the same dimensions in fact are buses, trucks or

vehicles with trailers. The Kapsch VDC system can also capture overview images of each passing vehicle, or vehicles of a certain class or shape, to aid in placing the vehicle at the scene for evidential purposes.

## **Scalable and Versatile**

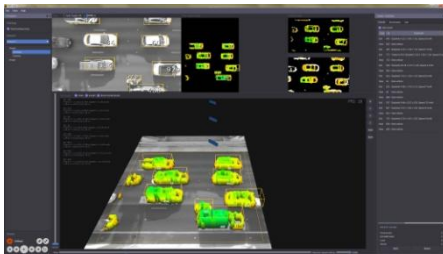
The Kapsch VDC system consists of a controller, sensors and illuminators. The numbers of sensors and illuminators to be used are decided by the road width and application. The Kapsch VDC system can cover road widths exceeding 25 m. The Kapsch VDC system uses invisible infrared light. All sensors and illuminators can be mounted on a single structure, without any extension arms, spanning the road.

### System Components

- > 8633 004-989 VDC Controller 2U (VDCC)
- > 8633 004-529 VDC Sensor 4i (VDCS)
- > 8633 004-650 VDC Illuminator IR (VDCI)

### Key Features

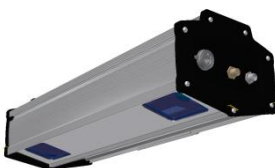
- > Full support of multi lane free flow including stop & go traffic, turning traffic and high speed traffic
- > Full support of bi-directional traffic
- > Full support of all vehicle types
- > Full support of all volumetric vehicle classes
- > Flexible real time triggers to auxiliary equipment, like front and rear LPN cameras, typically between -10 m and +10 m in the tracking zone
- > Provision of real time vehicle passage data
- > Flexible mounting height but optimized for 7.0 m
- > Flexible separation between sensors depending on application, typically between 3.5 m and 7.0 m
- > Typically one illuminator per lane
- > VDC GUI supporting installation, maintenance and live views of the traffic



### VDC Controller 2U

- > Industrial standard PC featuring Intel Core i7 and Linux
- > RAID system
- > Redundant power supply
- > Rugged design

### VDC Sensor 4i



- > Two stereoscopic camera pairs
- > Support for Quick Fastening Device

- > Sealed outdoor connectors
- > Gigabit Ethernet 1000Base-T, UDP/IP, CAT5e/6 outdoor cable
- > Extruded aluminium profile enclosure

### VDC Illuminator IR



- > LED, infrared light
- > Support for Quick Fastening Device
- > Sealed outdoor connectors
- > Digital synchronization pulse, opto-coupled
- > RS-485 network for supervision
- > Extruded aluminium profile enclosure and polycarbonate glass

### Host Interface

- > Gigabit Ethernet 1000Base-T, TCP/IP
- > Real time vehicle passage data, i.e. vehicle positions, dimensions and overview images
- > Real time triggers for e.g. front and rear LPN cameras
- > Real time supervision data
- > Configuration and control data

### Power Supply and Power Consumption

- > VDCC: 110-240 VAC, 90 W typical and 150 W maximum
- > VDCS: 48 VDC, 20 W plus 0-40 W for heating depending on outdoor temperature
- > VDCI: 48 VDC, 30 W

### MTBF

- > VDCC: > 50 000 hours
- > VDCS: > 50 000 hours
- > VDCI: > 50 000 hours

### Dimensions and Weight

- > VDCC: 482 mm x 472 mm x 88 mm (19" by 2U), 13 kg
- > VDCS: 700 mm x 270 mm x 200 mm, 10 kg
- > VDCI: 375 mm x 230 mm x 135 mm, 4 kg

### Climatic Conditions

#### Storage and transportation:

- > VDCC: -25 °C to +55 °C
- > VDCS: -25 °C to +55 °C
- > VDCI: -25 °C to +55 °C

Reference: IEC60721-3-1, Class 1K4, IEC60721-3-2, Class 2K2

#### Operational:

- > VDCC: +5 °C to +40 °C
- > VDCS: -40 °C to +55 °C
- > VDCI: -40 °C to +55 °C

Reference: IEC60721-3-3 Class 3K3, IEC60721-3-4 Class 4K2 extended to +55 °C

#### Humidity:

- > VDCC: 5 - 85%
- > VDCS: 5 - 100%, condensing
- > VDCI: 5 - 100%, condensing

Reference: IEC60721-3-3 Class 3K3, IEC60721-3-4 Class 4K2

### Ingress Protection

- > VDCC: IP20<sup>(1)</sup>
- > VDCS: IP65
- > VDCI: IP65

Reference: IEC60529 Class 4K2

### Mechanical Conditions

#### Vibration:

- > VDCC: 1 - 150 Hz 2 m/s<sup>2</sup>
- > VDCS: 1 - 150 Hz 10 m/s<sup>2</sup>
- > VDCI: 1 - 150 Hz 10 m/s<sup>2</sup>

Reference: IEC60721-3-3 Class 3M2, IEC60721-3-4 Class 4M4

#### Shock:

- > VDCC: 150 m/s<sup>2</sup>, 11 ms<sup>(2)</sup>
- > VDCS: 150 m/s<sup>2</sup>, 6 ms
- > VDCI: 150 m/s<sup>2</sup>, 6 ms

Reference: IEC60721-3-3 Class 3M2, IEC60721-3-4 Class 4M4

### Certifications

- > VDCC: EMC 2004/108/EC, LVD 2006/95/EC, RoHS2 2011/65/EU
- > VDCS: EMC 2004/108/EC, LVD 2006/95/EC, RoHS2 2011/65/EU
- > VDCI: EMC 2004/108/EC, LVD 2006/95/EC, RoHS2 2011/65/EU, Eye safety EN 62471 Risk Group 1

**VDCC = nVDC Controller**  
**VDCS = nVDC Sensor**  
**VDCI = nVDC Illuminator**

<sup>(1)</sup> Data from manufacturer, optional IP52.

<sup>(2)</sup> Data from manufacturer.

# Kapsch Antenna Summary.

Parameter / Antenna:	IAG-1 Antenna	IAG-1 Antenna "B"	IAG-2 Antenna	IAG2-T Antenna	VRC Antenna	mGate Antenna
<b>Part #</b>	800260-011	800260-012	800260-008	800260-007	800260-010	800260-009
<b>Lane Kit #</b>	801692-014	801692-017	801692-012	801692-009	801692-013	801300-002 (Reader Kit)
<b>Description</b>	3x3 patch	3x3 patch	2x2 patch	2x2 patch	2 patch	1 patch
<b>Size WxHxD (in)</b>	34.75 x 31.75 x 2.3"	34.75 x 31.75 x 2.23"	17.72 x 15.47 x 1.2"	18 x 16 x 2"	17.22 x 10.22 x 1.1"	11.84 x 10.72 x 1.22"
<b>Weight<sup>1</sup> (lb)</b>	28 lb	28 lb	4 lb	4 lb	4 lb	2 lb
<b>Horizontal Beamwidth</b>	28 deg	28 deg	40 deg	40 deg	60 deg	55 deg
<b>Vertical Beamwidth</b>	28 deg	28 deg	40 deg	40 deg	40 deg	60 deg
<b>Gain</b>	16 dBi	16 dBi	12 dBi	12 dBi	10 dBi	9 dBi
<b>Mounting</b>	Horizontal	Horizontal	Horizontal	Horizontal	Vertical	Horizontal

Parameter / Antenna:	IAG-3 Antenna	IAG-4 Antenna	IAG-5 Antenna	Patch - Lab Use	Patch - Toll Booth <sup>3</sup>	Patch - Toll Booth <sup>4</sup>
<b>Part #</b>	800260-015	800260-016	800260-017	700257-001	700257-002	700257-003
<b>Lane Kit #</b>	801692-019	801692-020	801692-021	N/A	N/A	N/A
<b>Description</b>	3x4 dipole array	6x4 dipole array	4x4 dipole array	1 patch	1 patch	1 patch
<b>Size WxHxD (in)</b>	34.5 x 21.25 x 3.13"	45.6 x 38.0 x 6.25"	36.13 x 30.81 x 3.13"	7.75 x 4.625 x 2.25"	8.813 x 7.437 x 6.093"	10.781 x 7.432 x 4.091"
<b>Weight<sup>1</sup> (lb)</b>	19 lb	73 lb	32 lb	1.3 lb	3.65 lb	3.35 lb
<b>Horizontal Beamwidth</b>	29 deg	19 deg	22 deg	N/A	N/A	N/A
<b>Vertical Beamwidth</b>	40 deg	23 deg	30 deg	N/A	N/A	N/A
<b>Gain</b>	14 dBi	17 dBi	16.5 dBi			
<b>Mounting<sup>2</sup></b>	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal

**Notes:**

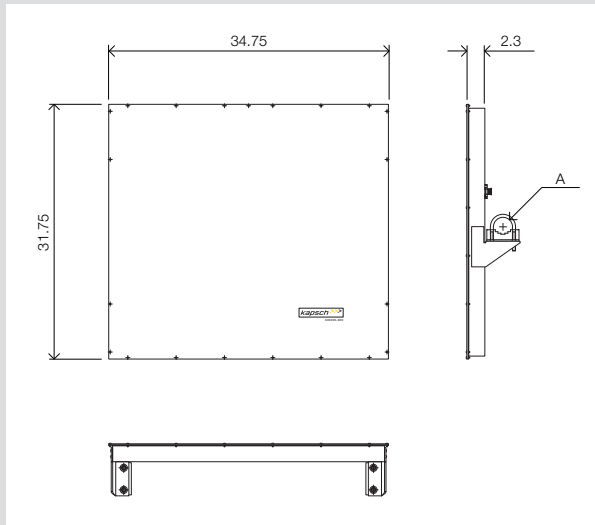
<sup>1</sup> Weight specified is applicable to the antenna structure only i.e. it does not include mounting hardware.

<sup>2</sup> Mounting information is provided as a guideline. Site details may require some adjustment beyond the ranges specified.

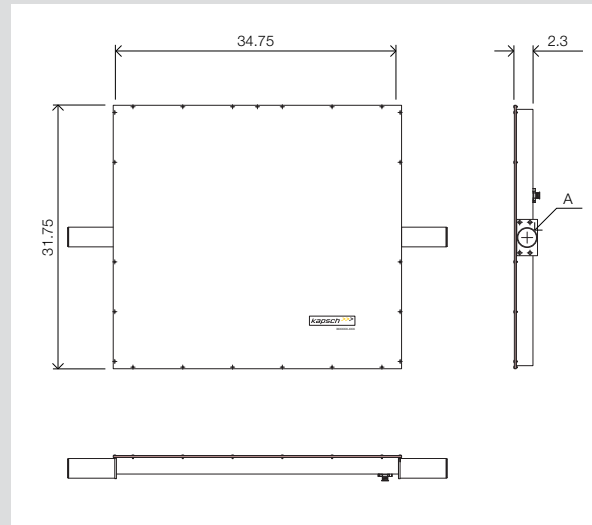
<sup>3</sup> Includes a switch that is wired discreetly.

<sup>4</sup> Includes a switch that disables the antenna directly.

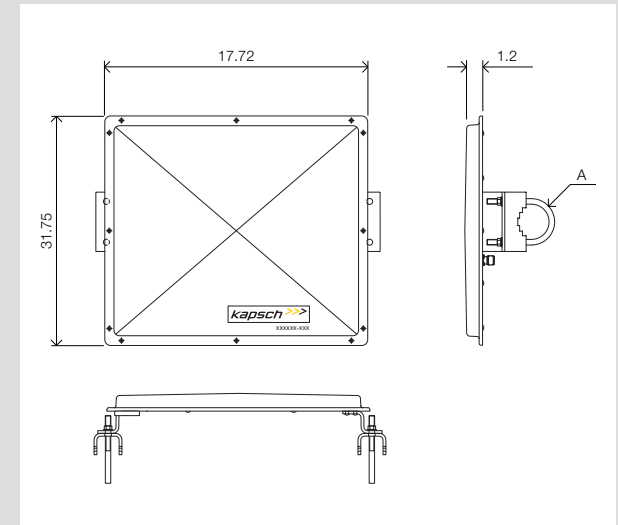
## Technical Drawings



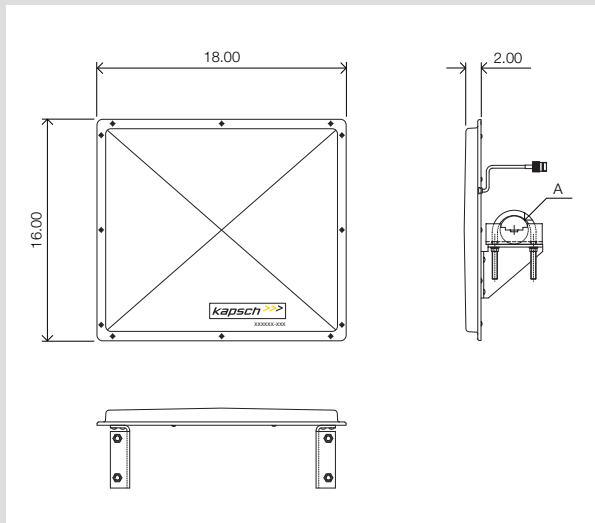
**IAG-1 Antenna**



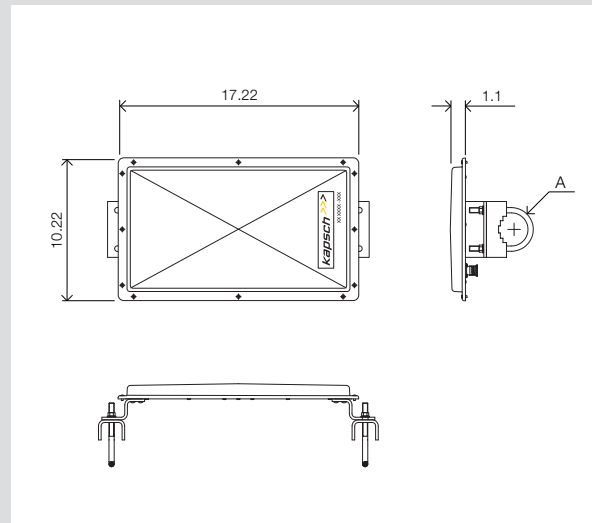
**IAG-1 Antenna "B"**



**IAG-2 Antenna**



**IAG-2 T Antenna**

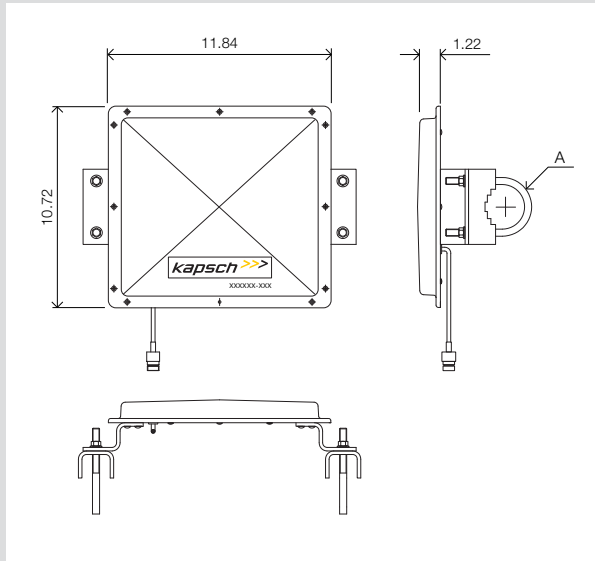


**VRC Antenna**

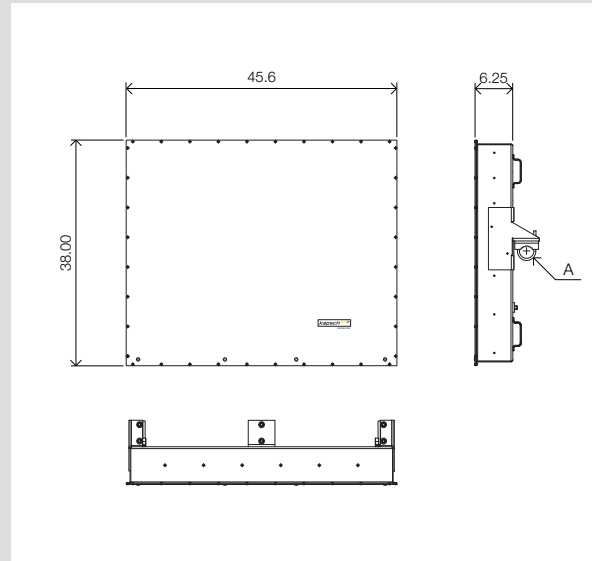
**DETAIL "A":** 2.00 in. diameter pole mounting.

Measurements in inches.

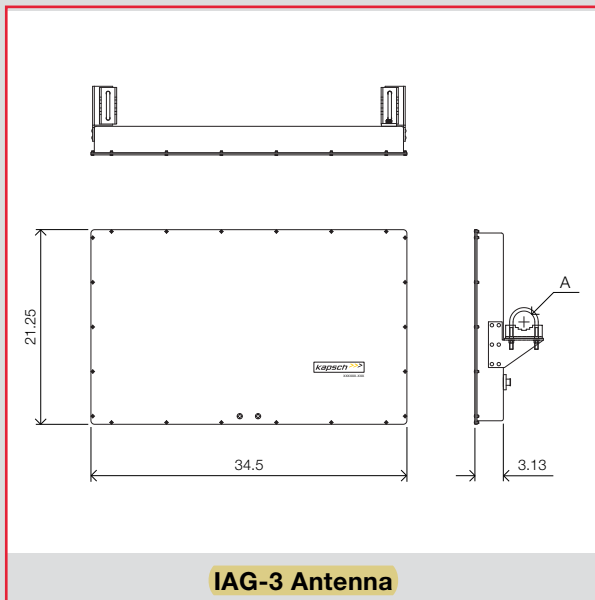
## Technical Drawings



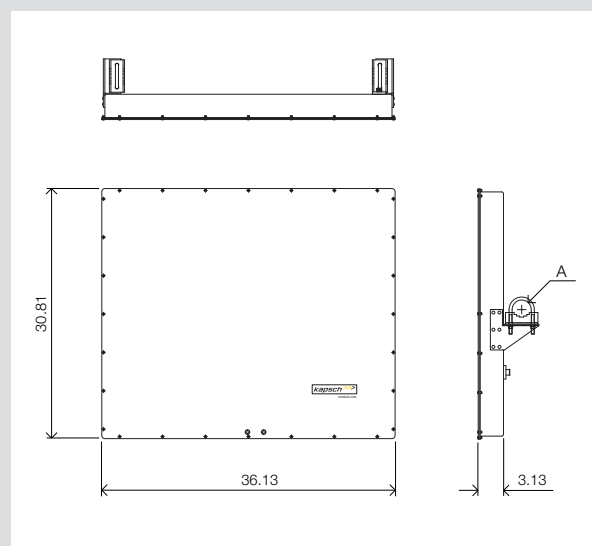
**mGate Antenna**



**IAG-4 Antenna**



**IAG-3 Antenna**



**IAG-5 Antenna**

**DETAIL "A":** 2.00 in. diameter pole mounting.  
Measurements in inches.



## Applications

Parameter / Antenna:	IAG-1 Antenna	IAG-1 Antenna "B"	IAG-2 Antenna	IAG2-T Antenna	IAG-3 Antenna	IAG-4 Antenna	IAG-5 Antenna	VRC Antenna
<b>Standard Lane</b>	15±1 ft height 15 deg tilt 10-12 ft lane width				IAG ORT lane 15±1 ft height 15 deg tilt 12 ft lane width	IAG high overhead mount (toll plaza) 22±2 ft height 10 deg tilt 10-12 ft lane width		407 ETR lanes for IAG and TDMA 5 deg tilt (IAG) 40 deg tilt (TDMA)
<b>Alternate Mount</b>		15±1 ft height 15 deg tilt 10 - 12 ft lane width						
<b>Wide</b>			15±1 ft height 10 deg tilt 10 - 16 ft lane width	15±1 ft height Low clearance 0 deg tilt (flat) 10 - 16 ft lane width				
<b>Low Canopy</b>			9-12 ft height 12 ft: 10 deg tilt 9 ft: 15 deg tilt 10-12 ft lane	9-13 ft height Low clearance 0 deg tilt (flat) 10-12 ft lane				
<b>Traffic Management Overhead Mount</b>								17-20 ft height 5 deg tilt 12-15 ft lane width
<b>Side-fire Mount</b>								17±1 ft height 30 deg pitch 45 deg yaw 12-15 ft lane width
<b>ORT Lanes</b>	16±1 ft height 15 deg tilt 12 ft lane width				IAG ORT lane 17±1 ft height 10 deg tilt 12 ft lane width		IAG high overhead mount (ORT) 22±2 ft height 10 deg tilt 12 ft lane width	

### Kapsch Group.

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E-Mail: [ktc.na@kapsch.net](mailto:ktc.na@kapsch.net) | [www.Kapsch.us](http://www.Kapsch.us) | [www.kapsch.net](http://www.kapsch.net)

Version 6 Released 2/4/2019



2D LIDAR SENSORS

**SICK**  
Sensor Intelligence.



Illustration may differ



### Ordering information

Type	Part no.
LMS511-10100 PRO	1046135

Other models and accessories → [www.sick.com/LMS5xx](http://www.sick.com/LMS5xx)

### Detailed technical data

#### Features

<b>Version</b>	Mid Range
<b>Variant</b>	PRO
<b>Application</b>	Outdoor
<b>Resolution power</b>	Standard Resolution
<b>Light source</b>	Infrared (905 nm)
<b>Laser class</b>	1 (IEC 60825-1:2014, EN 60825-1:2014)
<b>Aperture angle</b>	190°
<b>Scanning frequency</b>	25 Hz / 35 Hz / 50 Hz / 75 Hz / 100 Hz
<b>Angular resolution</b>	0.167° 0.25° 0.333° 0.5° 0.667° 1°
<b>Heating</b>	Yes
<b>Working range</b>	1 m ... 80 m
<b>Max. range with 10 % reflectivity</b>	40 m
<b>Spot size</b>	11.9 mrad
<b>Amount of evaluated echoes</b>	5
<b>Fog correction</b>	Yes

#### Performance

<b>Response time</b>	≥ 10 ms
<b>Detectable object shape</b>	Almost any
<b>Systematic error</b>	± 25 mm (1 m ... 10 m) ± 35 mm (10 m ... 20 m) ± 50 mm (20 m ... 30 m) <sup>1)</sup>
<b>Statistical error</b>	6 mm (1 m ... 10 m)

<sup>1)</sup> Typical value; actual value depends on environmental conditions.

	8 mm (10 m ... 20 m) 14 mm (20 m ... 30 m) <sup>1)</sup>
<b>Integrated application</b>	Field evaluation
<b>Number of field sets</b>	10 fields
<b>Simultaneous evaluation cases</b>	10

<sup>1)</sup> Typical value; actual value depends on environmental conditions.

## Interfaces

<b>Ethernet</b>	✓, TCP/IP
Remark	OPC
Function	Host
Data transmission rate	10/100 MBit/s
<b>Serial</b>	✓, RS-232, RS-422
Function	Host
Data transmission rate	9.6 kBaud ... 500 kBaud
<b>CAN</b>	✓
Function	Extension of outputs
<b>USB</b>	✓
Remark	Mini-USB
Function	AUX
Data transmission rate	9.6 kBaud ... 500 kBaud
<b>Switching inputs</b>	4 (Encoders)
<b>Switching outputs</b>	6
<b>Optical indicators</b>	5 LEDs (Additional 7-segment display)

## Mechanics/electronics

<b>Electrical connection</b>	4 x M12 round connector
<b>Operating voltage</b>	24 V DC
<b>Power consumption</b>	22 W, + 55 W heating (typical)
<b>Housing color</b>	Gray (RAL 7032)
<b>Enclosure rating</b>	IP65, IP67 (IEC 60529 Edition 2.2:2013-08)
<b>Protection class</b>	III (EN 60529, Section 14.2.7)
<b>Weight</b>	3.7 kg
<b>Dimensions (L x W x H)</b>	160 mm x 155 mm x 185 mm

## Ambient data

<b>Object remission</b>	2 % ... > 1,000 % (reflectors)
<b>Electromagnetic compatibility (EMC)</b>	IEC 61000-6-2:2016-08 / IEC 61000-6-3:2006-07
<b>Vibration resistance</b>	IEC 60068-2-6:2007-12
<b>Shock resistance</b>	IEC 60068-2-27:2008-02
<b>Ambient operating temperature</b>	-30 °C ... +50 °C
<b>Storage temperature</b>	-30 °C ... +70 °C
<b>Ambient light immunity</b>	70,000 lx

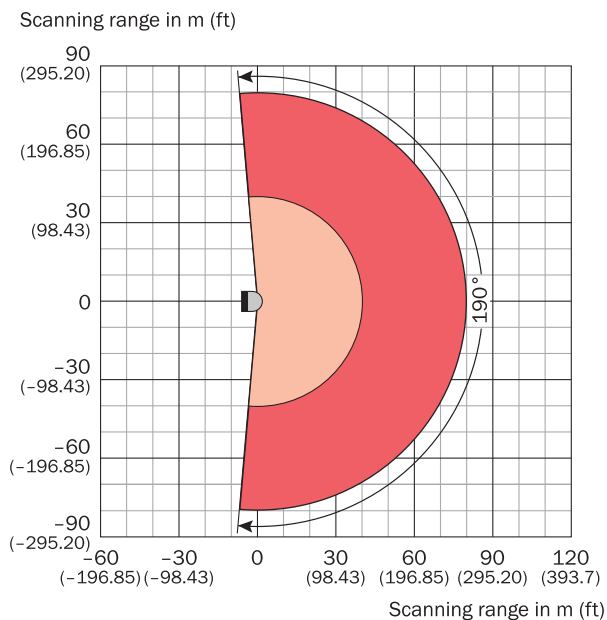
General notes

<b>Note on use</b>	The sensor does not constitute a safety component as defined by relevant legislation on machine safety.
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Classifications

<b>ECl@ss 5.0</b>	27270990
<b>ECl@ss 5.1.4</b>	27270990
<b>ECl@ss 6.0</b>	27270913
<b>ECl@ss 6.2</b>	27270913
<b>ECl@ss 7.0</b>	27270913
<b>ECl@ss 8.0</b>	27270913
<b>ECl@ss 8.1</b>	27270913
<b>ECl@ss 9.0</b>	27270913
<b>ETIM 5.0</b>	EC002550
<b>ETIM 6.0</b>	EC002550
<b>UNSPSC 16.0901</b>	46171620







Working range diagram



- Scanning range max. 80 m (262.47 ft)
- Scanning range for objects up to 10 % remission 40 m (131.23 ft)

## Recommended accessories

Other models and accessories → [www.sick.com/LMS5xx](http://www.sick.com/LMS5xx)

	Brief description	Type	Part no.
Device protection (mechanical)			
	Protection hood	Protection cover	2056850
Mounting brackets and plates			
	1 piece, mounting bracket for direct mounting, from the rear, on wall or machine, not adjustable	Mounting kit 1	2015623
Plug connectors and cables			
	Head A: female connector, M12, 12-pin, straight, A-coded Head B: Flying leads Cable: Power, I/O, twisted pair, PUR, halogen-free, shielded, 5 m	Connecting cable (female connector - open)	6042735
	Head A: female connector, M12, 5-pin, straight, A-coded Head B: Flying leads Cable: Power, shielded, 5 m	Connecting cable (female connector - open)	6036159
	Head A: male connector, M12, 12-pin, straight, A-coded Head B: Flying leads Cable: Power, I/O, twisted pair, PUR, halogen-free, shielded, 5 m	Connecting cable (male connector-open)	6042732
	Head A: male connector, M12, 4-pin, straight, D-coded Head B: male connector, RJ45, 8-pin, straight Cable: Ethernet, twisted pair, PUR, halogen-free, shielded, 5 m	SSL-2J04-G05ME	6034415

## SICK AT A GLANCE

SICK is one of the leading manufacturers of intelligent sensors and sensor solutions for industrial applications. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

We have extensive experience in a wide range of industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services complete our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

**For us, that is “Sensor Intelligence.”**

## WORLDWIDE PRESENCE:

Contacts and other locations – [www.sick.com](http://www.sick.com)

# IXE20 Series Sarix® IP Camera

## 2.1 MEGAPIXEL EXTENDED PLATFORM HIGH DEFINITION DIGITAL CAMERAS

### Product Features

- Open IP Standards
- Up to 2.1 Megapixel Resolution (1920 x 1080)
- Up to 30 Images per Second (ips) at 1920 x 1080
- Auto Back Focus
- H.264 and MJPEG Compression Capability
- Day/Night Models
- Video Setup Jack
- Sensitivity Down to 0.03 Lux
- Power over Ethernet (IEEE 802.3af) or 24 VAC
- Up to 2 Simultaneous Video Streams
- Built-in Analytics
- Local Storage (Micro SD) for Alarm Capture

The **Sarix® IXE20 Series extended platform (EP)** is a 2.1 megapixel (Mpx) high performance day/night camera with advanced low-light technology and a mechanical IR cut filter for increased sensitivity in low-light installations.

Designed to install quickly, the camera includes automatic back focus control, built-in analytics, and other advanced features needed for demanding security applications.

**Sarix** technology defines the next generation of video security imaging performance, delivering high definition (HD) resolution, advanced low-light capabilities, consistent color science, and fast processing power. The H.264 compression video files are considerably smaller, making HD video more affordable.

### Camera

The **IXE20 Series** has two 2.1 MPx models: color and day/night. Both models feature advanced low-light technology capabilities. The day/night model has a mechanical IR cut filter for increased sensitivity in low-light installations.

The **IXE20 Series** can support two simultaneous video streams. The two streams can be compressed in MJPEG and H.264 formats across several resolution configurations. The extended platform gives real-time video (30 ips) with HD resolution using H.264 compression for optimized bandwidth and storage efficiency. The streams can be configured to a variety of frame rates, bit rates, and GOP (group of pictures) structures for additional bandwidth administration.



(LENS NOT SUPPLIED WITH CAMERA)

- Adaptive Motion Detection
- ONVIF v1.02 Conformant
- Audio Accessory Available

### Built-in Analytics

**Pelco Analytics** enhance the flexibility and performance of the IXE20 Series camera. Eight Pelco behaviors are preloaded and included as a standard feature of the IXE20DN. Pelco behaviors can be configured and enabled using a standard Web browser, and they are compatible with Endura® or a third-party system that supports alarms using Pelco's API. Camera models are also available with preloaded **OV Analytic Suites**.

### Web Interface

The **IXE20 Series** uses a standard Web browser for powerful remote setup and administration.

### Window Blanking

Window blanking is used to conceal user-defined privacy areas that cannot be viewed by an operator. The **IXE20 Series** supports up to four blanked windows. A blanked area will appear on the screen as a solid gray window.

### Video Systemization

The **IXE20 Series** easily connects to Pelco IP and hybrid systems such as Endura version 2.0 (or later) and Digital Sentry® version 7.3 (or later). The camera is also compatible with Digital Sentry NVs (DS NVs), a full-featured video management software, which is available as a free download at [www.pelco.com](http://www.pelco.com). DS NVs includes four free Pelco IP licenses and allows for the management of video from up to 64 cameras.

The **IXE20 Series** features open architecture connectivity to third-party software. Pelco offers an application programming interface (API) and software developer's kit (SDK) for interfacing with Pelco's IP cameras.



by Schneider Electric

International Standards  
Organization Registered Firm,  
ISO 9001 Quality System



C2955 / REVISED 3-22-12



## PELCO ANALYTICS

The IXE20 series includes eight user-configurable behaviors. The camera is capable of running up to three behaviors at the same time; although, the number of behaviors is limited to the available processing power of the camera and the type of analytic being used.

**Note:** Available processing power is determined by the settings for compression standards, resolution, image rate, bit rate, and analytic configuration.

For each behavior, you can create several custom profiles that contain different camera settings. With these profiles, you can set up different scenarios for the behavior, which will automatically detect and trigger alarms when specific activity is detected.

Pelco Analytics are configured and enabled using a standard Web browser, and Pelco behavior alarms are compatible with Endura or a third-party system that supports Pelco's API system. Multiple Pelco behaviors can be scheduled to work during a certain time or condition. For example, during the day, a camera can be configured with Object Counting to count the number of people that enter a lobby door. At night, the operator can change the profile to Camera Sabotage to trigger an alarm if a camera is moved or obstructed. Available Pelco behaviors include:

- **Abandoned Object:** Detects objects placed in a defined zone and triggers an alarm if the object remains in the zone longer than the user-defined time allows. An airport terminal is a typical installation for this behavior. This behavior can also detect objects left behind at an ATM, signaling possible card skimming.
- **Adaptive Motion Detection:** Detects and tracks objects that enter a scene and then triggers an alarm when the objects enter a user-defined zone. This behavior is primarily used in outdoor environments with light traffic to reduce the number of false alarms caused by environmental changes.
- **Camera Sabotage:** Detects contrast changes in the field of view. An alarm is triggered if the lens is obstructed with spray paint, a cloth, or a lens cap. Any unauthorized repositioning of the camera also triggers an alarm.
- **Directional Motion:** Generates an alarm in a high traffic area when a person or object moves in a specified direction. Typical installations for this behavior include an airport gate or tunnel where cameras can detect objects moving in the opposite direction of the normal flow of traffic or an individual entering through an exit door.
- **Loitering Detection:** Identifies when people or vehicles remain in a defined zone longer than the user-defined time allows. This behavior is effective in real-time notification of suspicious behavior around ATMs, stairwells, and school grounds.
- **Object Counting:** Counts the number of objects that enter a defined zone or cross a tripwire. This behavior might be used to count the number of people at a store entrance/exit or inside a store where the traffic is light. This behavior is based on tracking and does not count people in a crowded setting.
- **Object Removal:** Triggers an alarm if an object is removed from a defined zone. This behavior is ideal for customers who want to detect the removal of high value objects, such as a painting from a wall or a statue from a pedestal.
- **Stopped Vehicle:** Detects vehicles stopped near a sensitive area longer than the user-defined time allows. This behavior is ideal for airport curbside drop-offs, parking enforcement, suspicious parking, traffic lane breakdowns, and vehicles waiting at gates.

## OBJECTVIDEO (OV) ANALYTIC SUITES

ObjectVideo Analytics Suites are preloaded on selected IXE20 Series cameras and require an OV Ready system to configure the behaviors for alarm notification.

### OV Security Suite

The OV Security Suite is easy to use and includes Tripwire Detection, Inside Area Detection, and Camera Tamper Detection behaviors.

- Tripwire Detection identifies objects that cross a user-defined line drawn within the camera's field of view.
- Inside Area Detection identifies objects entering, appearing, or moving within a user-defined area.
- Camera Tamper Detection identifies significant contrast changes in the camera's field of view; for example, if the lens is obstructed by spray paint, a cloth, or a lens cap.

### OV Security Suite Plus

The OV Security Suite Plus includes the behaviors of the OV Security Suite plus Multi-Line Tripwire Detection, Loitering Detection, and Leave Behind Detection behaviors.

- Multi-Line Tripwire Detection identifies objects that cross two defined lines and generates an event based on defined parameters, including directionality. Defined parameters for this behavior include direction, sequential order, and time between crossing each tripwire.
- Loitering Detection identifies when people or vehicles remain within a user-defined area beyond a specified period of time. This behavior is effective for real-time notification of suspicious behavior around ATMs, stairwells, and school grounds.
- Leave Behind Detection detects objects placed in a defined zone and triggers an alarm if the object remains in the zone longer than the user-defined time allows.

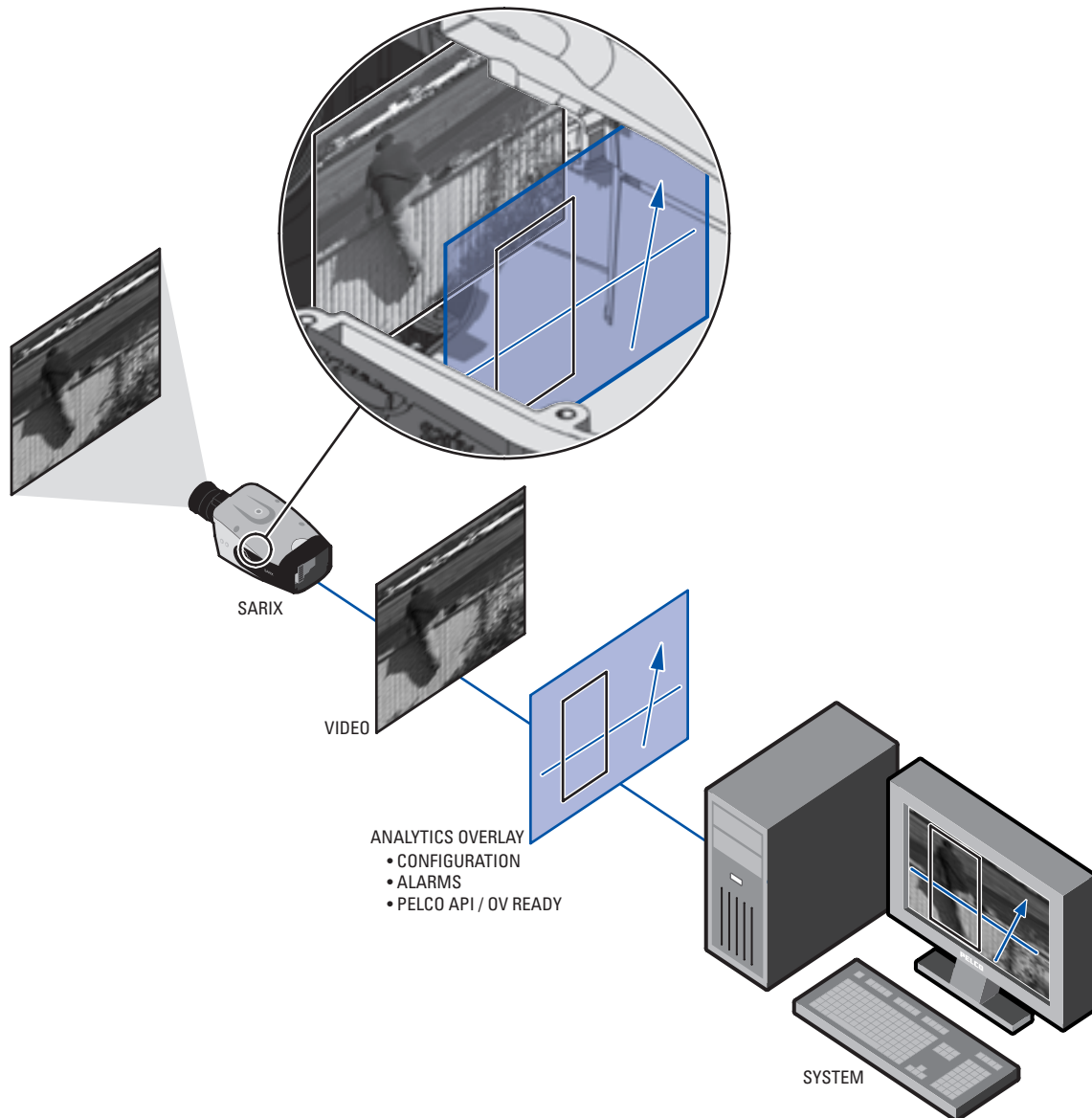
### OV Event Counting Suite

The OV Event Counting Suite uses advanced object calibration and additional features for schedules, parameters, and multiple rules. The suite includes behaviors for Tripwire Counting, Enters/Exits Counting, Loiter Counting, Occupancy Sensing, and Dwell-Time Monitoring.

- Tripwire Counting counts people or objects that cross a user-defined line.
- Enters/Exits Counting calculates the number of people that enter and exit an area without using a tripwire.
- Loiter Counting is useful in analyzing how frequently people stop in front of a product, display, or other area of interest. This feature is also useful in assessing promotion effectiveness and product interest.
- Occupancy Sensing counts people and generates a new value every time the occupancy level changes. Since each occupancy output is time-stamped, the data can be used to determine average occupancy levels or to correlate data to point-of-sale or other business scenarios.
- Dwell-Time Monitoring rules can be set up to record the length of time it takes an object to enter and exit an area. Along with queue size information, wait times can also be assessed. This behavior can be used to evaluate consumer interaction for a point-of-sale display or digital advertisement.

# TECHNICAL SPECIFICATIONS

The following diagram illustrates how the camera system interprets streaming video when embedded analytics are configured and enabled.



**IMPORTANT NOTE: PLEASE READ.** The network implementation is shown as a general representation only and is not intended to show a detailed network topology. Your actual network will differ, requiring changes or perhaps additional network equipment to accommodate the system as illustrated. Please contact your local Pelco Representative to discuss your specific requirements.

# TECHNICAL SPECIFICATIONS

## GENERAL

Imaging Device	1/3-inch (effective)
Imager Type	CMOS
Imager Readout	Progressive scan
Maximum Resolution	1920 x 1080
Signal-to-Noise Ratio	50 dB
Auto Iris Lens Type	DC drive
Electronic Shutter Range	1 ~ 1/100,000 sec
Wide Dynamic Range	60 dB
White Balance Range	2,000° to 10,000°K
Sensitivity	f/1.2; 2,850°K; SNR >24 dB
Color (33 ms)	0.50 lux
Color SENS (500 ms)	0.12 lux
Mono (33 ms)	0.25 lux
Mono SENS (500 ms)	0.03 lux
Weight (without lens)	0.50 kg (1.11 lb)
Shipping Weight	0.90 kg (2.00 lb)

## ELECTRICAL

Port	RJ-45 connector for 100Base-TX Auto MDI/MDI-X
Cabling Type	Cat5 or better for 100Base-TX
Power Input	22 to 34 VAC; 24 VAC nominal or PoE (IEEE 802.3af class 3)
Power Consumption	<7 W
Current Consumption	
PoE	<200 mA maximum
24 VAC	<295 mA nominal; <390 mA maximum
Local Storage	Micro SD
Alarm Input	10 VDC maximum, 5 mA maximum
Alarm Output	0 to 15 VDC maximum, 75 mA maximum
Service Port	External 3-connector, 2.5 mm provides NTSC/PAL video output

## MECHANICAL

Lens Mount	CS mount, adjustable
Camera Mount	0.25-inch (0.64 cm) UNC-20 screw, top and bottom of camera housing

## ENVIRONMENTAL

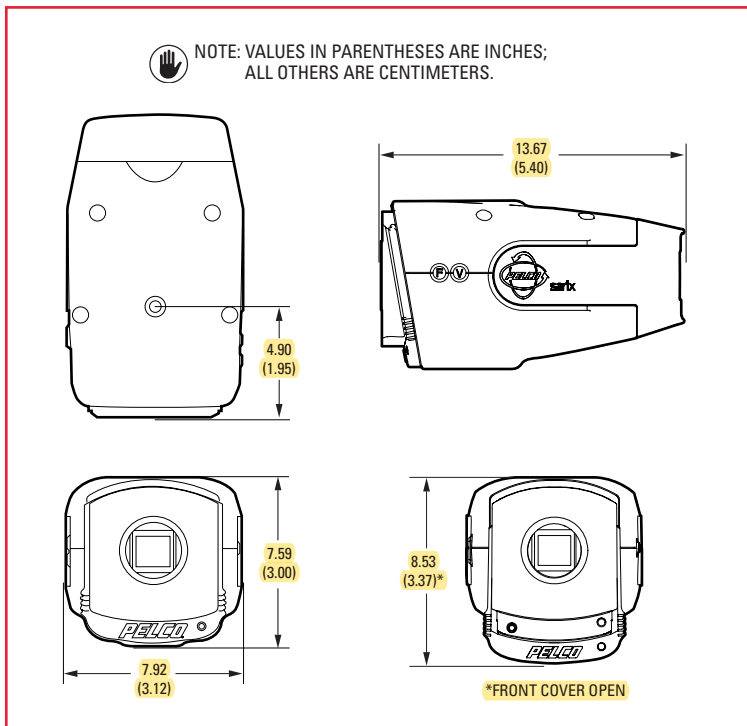
Operational Temperature	-10° to 50°C (14° to 122°F)
Storage Temperature	-10° to 70°C (14° to 158°F)
Storage Humidity	20% to 90%, noncondensing



FRONT VIEW, CAMERA ONLY  
(OPENED TO EXPOSE SERVICE PORT)



REAR VIEW



# TECHNICAL SPECIFICATIONS

## VIDEO

Video Encoding	H.264 High, Main, or Base profiles and MJPEG
Video Streams	Up to 2 simultaneous streams; the second stream is variable based on the setup of the primary stream
Frame Rate	Up to 30, 25, 24, 15, 12.5, 12, 10, 8, 7.5, 6, 5, 4, 3, 2.5, 2, 1 (dependent upon coding, resolution, and stream configuration)

Available Resolutions

Resolution				MJPEG		H.264 High Profile	
MPx	Width	Height	Aspect Ratio	Maximum IPS	Recommended Bit Rate	Maximum IPS	Recommended Bit Rate
2.1	1920	1080	16:9	15.0 ips	10.0 Mbps	30.0 ips	6.0 Mbps
1.9	1600	1200	4:3	20.0 ips	10.0 Mbps	20.0 ips	4.0 Mbps
1.3	1280	1024	5:4	20.0 ips	10.0 Mbps	20.0 ips	3.25 Mbps
1.2	1280	960	4:3	20.0 ips	10.0 Mbps	20.0 ips	3.0 Mbps
0.9	1280	720	16:9	30.0 ips	10.0 Mbps	30.0 ips	2.9 Mbps
0.5	800	600	4:3	30.0 ips	7.7 Mbps	30.0 ips	2.0 Mbps
0.3	640	480	4:3	30.0 ips	4.9 Mbps	30.0 ips	1.5 Mbps
0.1	320	240	4:3	30.0 ips	1.2 Mbps	30.0 ips	0.5 Mbps

Additional Resolutions	640 x 512, 640 x 352, 480 x 368, 480 x 272, 320 x 256, and 320 x 176
Supported Protocols	TCP/IP, UDP/IP (Unicast, Multicast IGMP), UPnP, DNS, DHCP, RTP, RTSP, NTP, IPv4, SNMP v2c/v3, QoS, HTTP, HTTPS, LDAP (client), SSH, SSL, SMTP, FTP, and 802.1x (EAP)
Users	
Unicast	Up to 20 simultaneous users depending on resolution settings (2 guaranteed streams)
Multicast	Unlimited users H.264
Security Access	Password protected
Software Interface	Web browser view and setup
Pelco System Integration	Endura 2.0 (or later) Digital Sentry 7.3 (or later)
Open API	Pelco API or ONVIF v1.02
Minimum System Requirements	
Processor	Intel® Core® 2 Duo microprocessor, 2.6 GHz
Operating System	Microsoft® Windows® XP, Windows Vista®, or Mac® OS X 10.4 (or later)
Memory	2 GB RAM
Network Interface Card	100 megabits (or greater)
Monitor	Minimum of 1024 x 768 resolution, 16- or 32-bit pixel color resolution
Web Browser*	Internet Explorer® 7.0 (or later) or Mozilla® Firefox® 3.5 (or later); Internet Explorer® 8.0 (or later) is recommended for configuring analytics
Media Player†	Pelco's Media Player or QuickTime® 7.6.5 for Windows XP, Windows Vista, or QuickTime 7.6.4 for Mac OS X 10.4

\*Internet Explorer is not supported by Mac OS X 10.4.

†This product is not compatible with QuickTime version 7.6.4 for Windows XP or Windows Vista. If you have this version installed on your PC, you will need to upgrade to QuickTime version 7.6.5.

## ANALYTICS

Required Systems for Pelco Analytics	
Pelco Interface	WS5200 Advanced System Management Software on an Endura 2.0 (or later) system
Open API	The Pelco API can transmit behavior alarm data to third-party applications, available at <a href="http://pdn.pelco.com">pdn.pelco.com</a>
Required System for Object Video Suites	OV ready-compliant system with OV Ready video management system

# TECHNICAL SPECIFICATIONS

## MODELS

IXE20DN	Sarix 2.1 MPx network day/night camera, extended platform with built-in Pelco Analytics
IXE20DN-OS	Sarix 2.1 MPx network day/night camera, extended platform with built-in OV Security Suite
IXE20DN-OSP	Sarix 2.1 MPx network day/night camera, extended platform with built-in OV Security Suite Plus
IXE20DN-OCP	Sarix 2.1 MPx network day/night camera, extended platform with built-in OV Event Counting Suite

## CERTIFICATIONS

- CE, Class B
- FCC, Class B
- UL/cUL Listed
- C-Tick
- ONVIF v1.02

## ACCESSORIES

IX-SC	Service/monitor cable, 1.22 m (4 ft); compatible with standard BNC connectors
AUD-1	External audio accessory
ALM-1	External alarm accessory

## RECOMMENDED MOUNTS

C10-UM	Universal camera mount
--------	------------------------

## RECOMMENDED ENCLOSURES

EH1512	Indoor/outdoor enclosure
EH3512	Outdoor enclosure
DF8	8-inch fixed mount dome

## RECOMMENDED LENSES

13M2.2-6	Megapixel lens, varifocal, 2.2 ~ 6.0 mm, f/1.3 ~ 2.0
13M2.8-8	Megapixel lens, varifocal, 2.8 ~ 8.0 mm, f/1.2 ~ 1.9
13M2.8-12	Megapixel lens, varifocal, 2.8 ~ 12.0 mm, f/1.4 ~ 2.7
13M15-50	Megapixel lens, varifocal, 15.0 ~ 50.0 mm, f/1.5 ~ 2.1

Pelco megapixel lenses have been designed and tested to deliver optimal image quality for the IXE20 Series camera. The use of standard definition lenses on IXE20 Series megapixel cameras will limit the resolution of the camera, creating poor image quality.

Field of View in Degrees		Aspect Ratio		
		16:9	4:3	5:4
2.2 mm	Horizontal	109	109	109
	Vertical	63	83	89
2.8 mm	Horizontal	89	89	89
	Vertical	48	66	70
6.0 mm	Horizontal	42	42	42
	Vertical	24	32	34
8.0 mm	Horizontal	32	32	32
	Vertical	18	24	25
12.0 mm	Horizontal	21	21	21
	Vertical	12	16	17
15.0 mm	Horizontal	16	16	16
	Vertical	9	12	13
50.0 mm	Horizontal	5	5	5
	Vertical	3	4	4

**Note:** For 800 x 600 (or lower) resolutions in 4:3 or 5:4 aspect ratios, the field of view is smaller than listed above. Refer to the Installation/Operation manual for details.

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[www.pelco.com](http://www.pelco.com)

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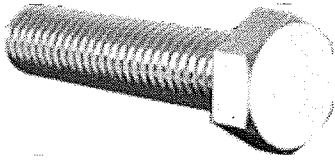
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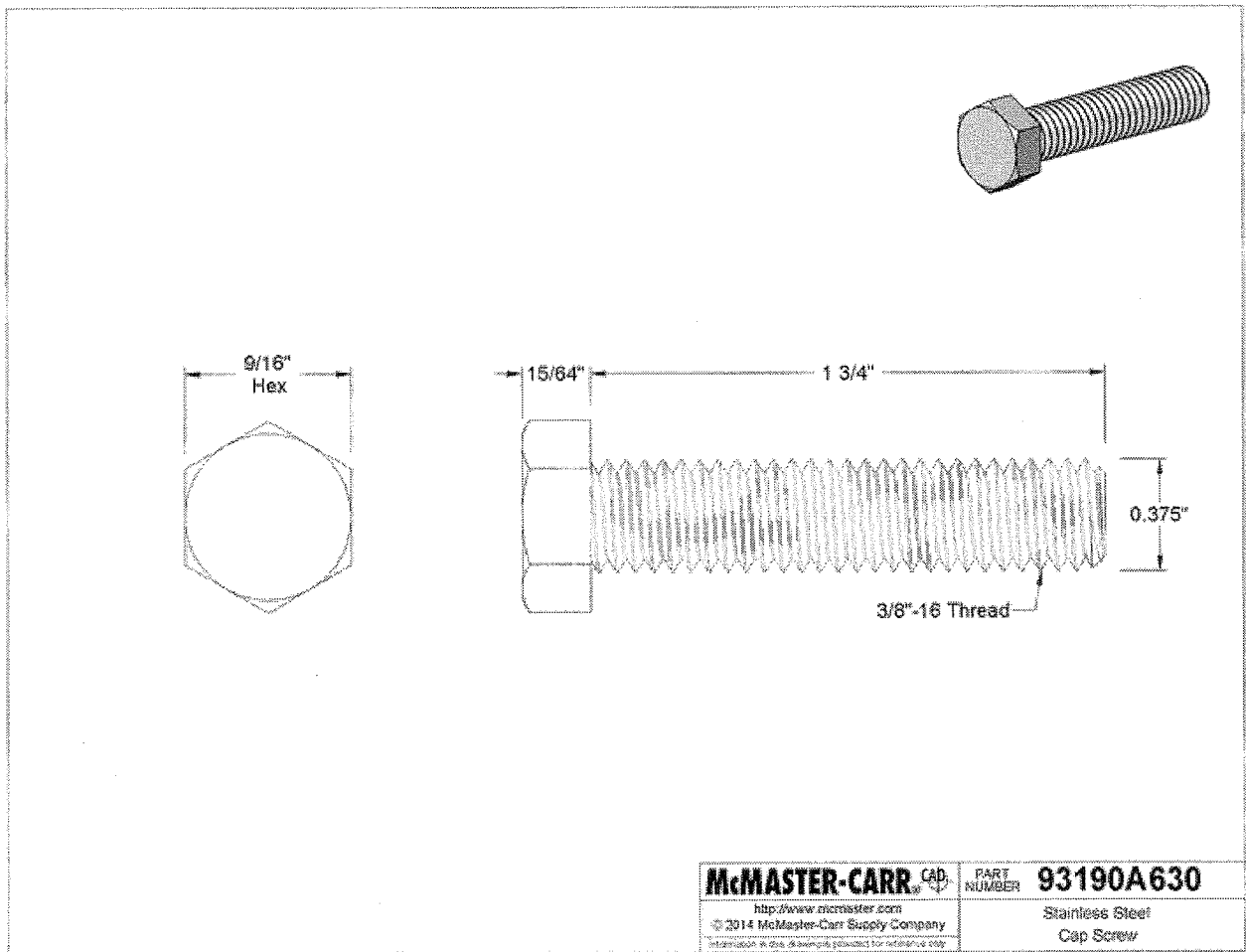
Super-Corrosion-Resistant 316 Stainless Steel Hex Head Screw  
3/8"-16 Thread Size, 1-3/4" Long, Fully Threaded

\$5.06 per pack of 5  
93190A630



Thread Size	3/8"-16
Length	1 3/4"
Threading	Fully Threaded
Head Width	9/16"
Head Height	15/64"
Material	316 Stainless Steel
Hardness	Rockwell B70
Tensile Strength	70,000 psi
Screw Size Decimal Equivalent	0.375"
Thread Type	UNC
Thread Spacing	Coarse
Thread Fit	Class 2A
Thread Direction	Right Hand
Head Type	Hex
Hex Head Profile	Standard
Drive Style	External Hex
Specifications Met	ASME B18.2.1
System of Measurement	Inch
RoHS	Compliant

More corrosion resistant than 18-8 stainless steel screws, these screws have excellent resistance to chemicals and salt water. They may be mildly magnetic. Length is measured from under the head.

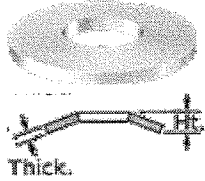


The information in this 3-D model is provided for reference only.



**Corrosion-Resistant Belleville Disc Spring**  
for 3/8" Shaft Diameter, 0.390" ID, 0.937" OD, 0.0700" Thick

\$10.45 per pack of 6  
9713K423



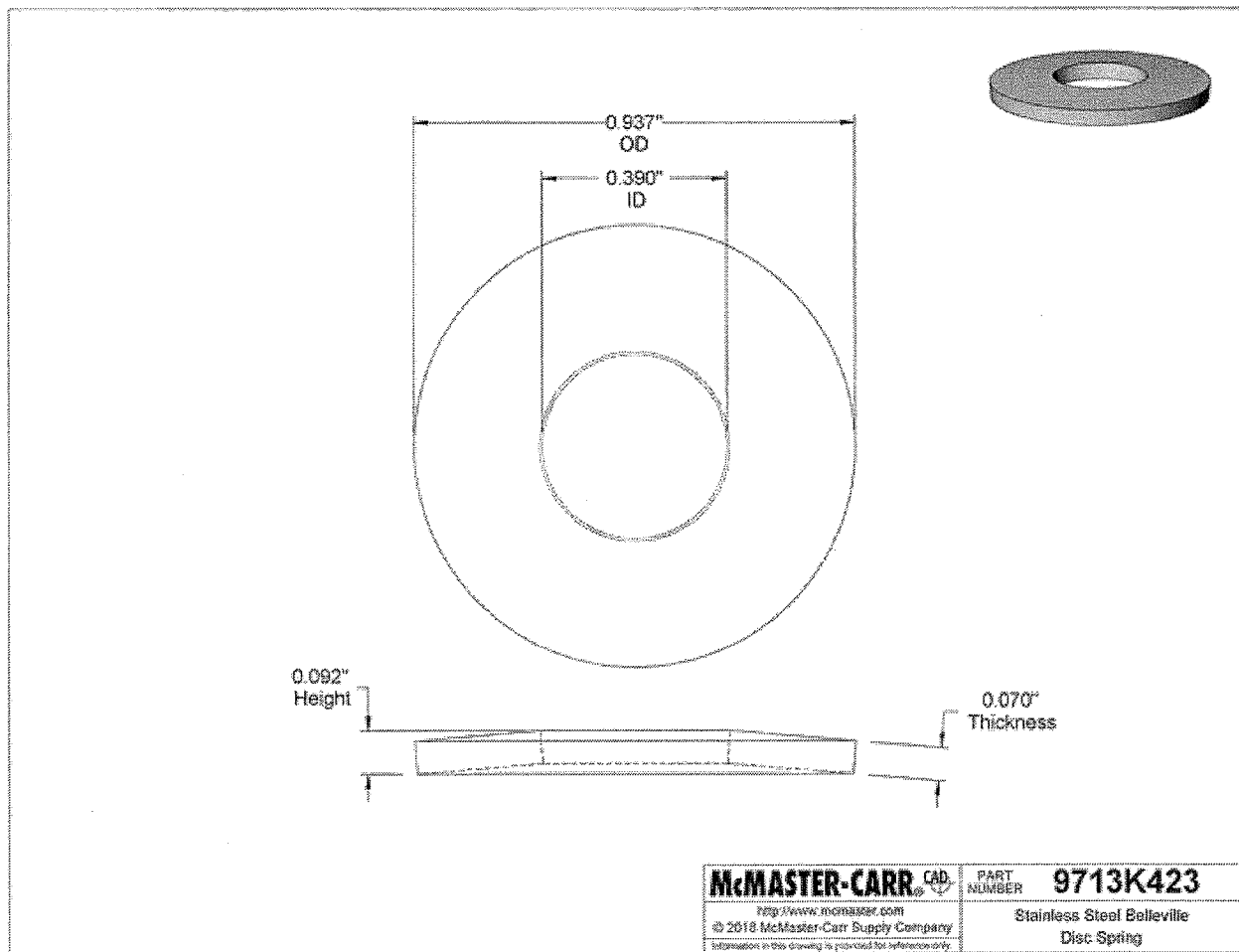
Spring Type	Disc
Disc Spring Type	Belleville
System of Measurement	Inch
For Shaft Diameter	3/8"
ID	0.39"
OD	0.937"
Thickness	0.07"
Height	0.092"
Deflection @ Working Load	0.018"
Working Load	1,070 lbs.
Flat Load	1,528 lbs.
Material	302 Stainless Steel
RoHS	Compliant

Made of stainless steel, these springs are more corrosion resistant than steel springs. Use them on shafts, bolts, and the ends of valves to maintain tension and separate components. Unlike Belleville washers, they return to their original height once the load is removed.

Deflection is the distance a spring compresses under load. Flat load is the load at which the spring is completely compressed.

Springs may be stacked to increase working load and deflection. In a nested stack, working load is multiplied by the number of springs used, while deflection remains unchanged. In an inverted stack, deflection is multiplied by the number of springs used, while the working load remains unchanged. In a nested and inverted stack, both load and deflection are increased.





The information in this 3-D model is provided for reference only.