APPENDIX J: PROPERTY IMPACTS
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## TABLES

**TABLE 1:** Shallow foundation – Depth below surface with 30% stress increase due to building loads  
**TABLE 2:** Deep foundation – Depth below pile tip with 30% stress increase due to building loads
1 PROPERTY IMPACTS

1.1 METHODOLOGY FOR ASSESSMENT OF PROPERTY IMPACTS

The following methodology has been used for identifying impacted properties:

- Prepare conceptual horizontal alignment and profile for each alternative in In-Roads format.
- Prepare conceptual typical tunnel cross sections for Cut and Cover type, Bore- double tube, and bore single (two level) tube.
- The following assumptions were made to determine the extent and type of tunnelling in each alternative (cut and cover versus bore):
  - Tunnel section at 35+ feet below existing grade would be bored
  - Tunnel sections that are less than 35 feet below existing grade will be cut and cover
  - Horizontal limits of property impact in the vicinity of the cut and cover tunnels section is determined based on 45-degree influence line extending from bottom of excavation to existing grade.
  - Horizontal limits of property impact in the vicinity of the single tube bored tunnel section is assumed to be 10 feet from the outside edge of each tube (refer to attached typical sections)
  - Horizontal limits of property impact in the vicinity of the single tube (two level) bored tunnel section is assumed to be 10 feet from the outside edges of tube (refer to attached typical sections)
  - Horizontal limits of property impact in the vicinity of the approach section between portal and at-grade varies based on the 45-degree influence line extending from bottom of excavation to existing grade.
  - Horizontal limits of property impact in the vicinity of the approach section at-grade is assumed to be 5 feet from the right edge of pavement in each direction.

- Parcel data for the private properties within the impact limits (as determined based on the above assumptions) were collected from Onondaga County and SOCPA on April 13th, 2017, and presented in the attached spreadsheet, noting the following:
  - Any missing data/information within this spreadsheet is a result of null values/no information listed in the Onondaga County Tax Data.
  - The analysis performed utilizing Esri ArcGIS - Model Builder
  - All data projected to NAD83 State Plane New York Central PIPS 3102 (US FT).
  - Parcel Sizes listed are products of Onondaga County Tax Data (Acres, Front Feet & Depth) and ArcGIS Software (Original Parcel Area & Impacted Area); these values could contain discrepancies and a field survey of the parcel would be needed to obtain accurate sizes of each parcel
  - “Percent Impacted Area” = The percentage of the parcel impacted within the specific options property impact limits
  - Equation used to calculate “Percent Impacted Area” = ([Shape_Area] / [Orig_Area]) * 100
  - Percent Impacted Area values equal to zero indicate an impacted percentage less than 1
  - Property Class Code Definitions retrieved from https://www.tax.ny.gov/research/property/assess/manuals/prclas.htm

- Equation used to calculate “Percent Impacted Area” is assumed to be 10 feet from the outside edge of each tube (refer to attached typical sections)

- Partial Impact indicates that 50% or less of the parcel area is impacted by the anticipated construction, full Impact indicates that greater than 50% of the parcel area is impacted by the anticipated construction. However, for value assessments it is assumed that any impact, partial or full will result in full acquisition irrespective of percentage of lot size.
- Permanent Easement is assumed required on all properties that are located directly above the structure limits of bored section of tunnel.
- Properties owned by Public Agency are highlighted in the list of impacted properties

A table summarizing the land use of all impacted properties, under each of the four alternatives is provided in Section 5. Each table provides estimated needs for easements, partial acquisitions, and full acquisitions and estimates the costs for total takings per alternative.

- Permanent Easements
  - Permanent Easements will be required for mined tunnels, cut-and-cover tunnels, open approach excavations and depressed roadways.
- Partial Acquisitions
  - Partial Acquisitions will be required for cut and cover impacts that significantly affect the future use of the property
- Full Acquisitions
  - Full Acquisitions will be required where the amount of taking essentially renders the remaining property without value, at least during construction.

This occurs in areas of cut and cover construction or above grade construction. This includes areas where tunnel construction requires demolition of an occupied structure.

1.2 MINED TUNNELS

1.2.1 BI-LEVEL TUNNEL

The bi-level tunnel will have an excavated diameter of approximately 60 feet. A permanent sub-surface easement approximately 75 feet wide will be required for tunnel constructed within public right-of-way.

For tunnel reaches outside the public right-of-way, a wider surface easement and a covenant will be required with respect to deep and shallow foundations. The surface easement should be extended to 130 feet.

The covenant should state the following:
- No deep foundations can be installed within the surface easement, except that deep foundation elements can be installed along the pillar centerline and no closer than 15 feet to a cross passage
- Load transfer of deep foundations cannot occur less than 10 feet below the tunnel invert
- Load-bearing elements (drilled pile or caisson) should be included within a steel casing to assure that no inadvertent load transfer occurs above the covenanted depth below the tunnel invert.

This is similar to restrictions the Port Authority of New York and New Jersey (PANYNJ) imposed on a high-rise structure studding the PATH tunnels immediately west of the Exchange Place Station in Jersey City, New Jersey.

Surface structures supported on shallow foundations may be constructed over the tunnel, provided that numerical modeling indicates that the tunnel lining will not be overstressed.

1.2.2 SINGLE LEVEL TUNNEL

The single level tunnel alternative will consist of two parallel, uni-directional tunnels with an excavated diameter of approximately 43 feet and a 25 foot wide pillar between tunnels. A permanent easement of 120 feet will be required for tunnel constructed within public right-of-way.

For tunnel reaches outside the public right-of-way, a wider surface easement and a covenant will be required with respect to deep and shallow foundations. The surface easement should be extended to 130 feet.

The covenant should state the following:
- No deep foundations can be installed within the surface easement, except that deep foundation elements can be installed along the pillar centerline and no closer than 15 feet to a cross passage
- Load transfer of deep foundations cannot occur less than 10 feet below the tunnel invert
- Load-bearing elements (drilled pile or caisson) should be included within a steel casing to assure that no inadvertent load transfer occurs above the covenanted depth below the tunnel invert.

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1.3 CUT-AND-COVER TUNNELS, OPEN APPROACH EXCAVATIONS AND DEPRESSED ROADWAYS

- **Permanent Easements**
  - Permanent easements for cut-and-cover tunnels, open approach tunnels and depressed roadways should extend 10 feet beyond the footprint defined by the exterior of the Support of Excavation (SOE) wall.
  - For structures located outside of public right of way, buildings can be constructed over the cut-and-cover tunnels provided that the foundation load is no greater than a uniform surcharge of 600 psf. Zones with capacity for taller (heavier) structures could be incorporated into the tunnel design for a cost premium.

- **Temporary Easements**
  - Temporary easements for the above classes of structures should extend 30 feet beyond the exterior of the SOE wall to accommodate temporary tieback installation.
  - Additional temporary easements will be required during construction for offices, storage, and lay-down areas.

1.4 ANALYSIS OF INFLUENCE OF FUTURE CONSTRUCTION ON TUNNEL LOADING

A study was performed to evaluate the potential for future development over the I-81 bored tunnels. Simplified Boussinesq analyses were performed to assess the order of magnitude of the additional vertical stresses at the level of the tunnel crown if a building is constructed and founded over it. In reality, this is a complex foundation-soil-tunnel interaction problem that would have to be modeled and analyzed in 2D or 3D to obtain an accurate prediction of the effect of future shallow footings or piles on the tunnel loading and deformation. The simplistic approach used incorporates a lot of assumptions and was divided into two main alternatives. In the first scenario, the crown of the tunnel is located in soft soil and a building constructed over it would either sit on shallow foundation (Figure 1) or end-bearing piles going around and past the tunnel and into the soft rock. In the second scenario, the tunnel is located entirely within the weak shale and there is some rock above the crown to potentially accommodate end-bearing piles or shafts (Figure 2).

The main assumptions and simplifications made in order to get an approximate solution were the following. The analysis does not take the tunnel itself into account and stress distribution with depth is assumed to not be affected by its presence. Therefore reported stress increase is really in-soil stress and stress actually acting on the lining might be different if foundation-soil-tunnel interaction was incorporated in the analysis. Only a single building with between 2 and 20 stories was considered for all cases, no basements were assumed for all building options and the tunnel section was assumed to be centered under the building. The total load per story was taken as 350 psf (200 psf dead load and 150 psf live load for commercial spaces). Depth to top of rock was assumed to be either 20 ft. or 50 ft. in the area of analysis. For the shallow foundation analysis, loads are assumed to be applied at the ground surface. For the piles analysis, piles are assumed to transfer all the load at the tip, being either 20 ft. or 50 ft. below ground surface. Regarding the shallow foundation alternative, the effect of number of stories, building footprint, and continuous mat foundation vs. 10 ft. x 10 ft. square footings on a 20 ft. x 20 ft. grid was studied. The last option was only analyzed for one building footprint alternative for each number of stories examined. For the deep foundation, 2 ft. diameter piles were assumed to be placed on a 6 ft. x 6 ft. grid (three pile diameters). The effect of pile length, diameter and spacing was studied for some cases in addition to number of stories and building footprint. Note that no foundations were designed, i.e. no checks were performed for soil or rock capacity, etc. This study did not take soil properties into account and is a simple elastic stress bulb analysis.

The results are summarized in Tables 1 and 2 in terms of additional imposed vertical stress in the soil. The added stress is expressed as a percentage of the total vertical geostatic stress assuming unit weight of 110 pcf regardless of depth and soil or rock material. Values of main variables and of the approximate depth at which the additional stress is 30% of the geostatic stress are reported in the tables. A 30% increase was judged reasonable to be used as the maximum allowable stress increase in the tunnel lining. These tables can serve as a rough guide for the number of stories that can be built over a tunnel depending on its location, depth and acceptable stress increase on the lining either for a bored tunnel in soil (Table 1, Figure 1) or in rock (Table 2, Figure 2). If the values of stress increase in the tables are not acceptable or the tunnel is very shallow, the alternative of slip coated piles that transfer loads below the tunnel invert may be considered. All loading cases considered (2 – 20 stories) are included in both tables for comparison, even though a 2-story building would not require piles bearing on rock. These tables should only be used to get an estimate, as more accurate assumptions and analyses could result in significant changes.

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![Figure 1: Shallow foundation — Representative Sketch (not to scale).](image)

![Figure 2: Deep foundation — Representative Sketch (not to scale).](image)
### TABLE 1: Shallow foundation – Depth below surface with 30% stress increase due to building loads

<table>
<thead>
<tr>
<th>Number of stories</th>
<th>Distributed load on foundation (psf)</th>
<th>Building Footprint</th>
<th>Continuous Mat Foundation</th>
<th>10 ft x 10 ft Footings on 20 ft x 20 ft Grid</th>
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</thead>
<tbody>
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<td>2</td>
<td>700</td>
<td>50 ft</td>
<td>50 ft</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 ft</td>
<td>Infinite strip</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 ft</td>
<td>Infinite strip</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>1750</td>
<td>50 ft</td>
<td>50 ft</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 ft</td>
<td>Infinite strip</td>
<td>45</td>
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<tr>
<td></td>
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<td>100 ft</td>
<td>Infinite strip</td>
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</tr>
<tr>
<td>10</td>
<td>3500</td>
<td>50 ft</td>
<td>50 ft</td>
<td>45</td>
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<td>50 ft</td>
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<td>100 ft</td>
<td>Infinite strip</td>
<td>73</td>
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<tr>
<td></td>
<td></td>
<td>100 ft</td>
<td>100 ft</td>
<td>86</td>
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</tbody>
</table>

Additional stress in soil due to building load expressed in % of total vertical geostatic stress at that depth (assuming $y=110\text{pcf}$)

### TABLE 2: Deep foundation – Depth below pile tip with 30% stress increase due to building loads

<table>
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<th>Number of stories</th>
<th>Distributed load on foundation (psf)</th>
<th>Total load per pile (kips)</th>
<th>Building Footprint</th>
<th>Pile Length (ft)</th>
<th>Pile Spacing (ft)</th>
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<th>Depth from surface</th>
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<td>2</td>
<td>6400</td>
<td>20</td>
<td>50 ft</td>
<td>50</td>
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<td>2</td>
<td>52</td>
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<td>5</td>
<td>16000</td>
<td>50</td>
<td>50 ft</td>
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<td>3</td>
<td>53</td>
</tr>
<tr>
<td>10</td>
<td>32000</td>
<td>101</td>
<td>50 ft</td>
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<td>20</td>
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<td>184000</td>
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<td>184000</td>
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<td>100 ft</td>
<td>20</td>
<td>10</td>
<td>46</td>
<td>66</td>
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</table>

Pile Diameter is 2 ft.
2 PROPERTY IMPACTS: RED ALTERNATIVE

PROPERTY IMPACTS: RED ALTERNATIVE

Double Red Tunnel Alignment
Property Impact & Tunnel Structure Limits
and Full/Partial Takes and Easements

Double Red Legend

- Double Red Alignment
- Easements
- Full Takings
- Partial Takings
- Tunnel Structure Limits
- Property Impact Limits

Notes
Total Partial Takings = 16
Total Full Takings = 30
Total Permanent Easements = 86
Full Fee Takings with Buildings = 17

Analysis Conducted using Esri ArcGIS 10.5
Parcel Data acquired from SOCRA on April 13th, 2017
Orthoimagery acquired from NYS GIS Clearinghouse on April 13th, 2017
3 PROPERTY IMPACTS: ORANGE ALTERNATIVE

Double Orange Tunnel Alignment
Property Impact & Tunnel Structure Limits
and Full/Partial Takes and Easements

Notes
Total Partial Takings = 13
Total Full Takings = 22
Total Permanent Easements = 34
Full Fee Takings with Buildings = 12

Analysis Conducted using Esri ArcGIS 10.5
Parcel Data acquired from SOCPA on April 13th, 2017
Orthoimagery acquired from NYS GIS Clearinghouse on April 13th, 2017

Double Orange Legend
- Double Orange Alignment
- Permanent Easements
- Partial Takings
- Full Takings
- Property Impact Limits
- Tunnel Structure Limits

1 inch = 0.22 miles 1:14,000
4 PROPERTY IMPACTS: GREEN ALTERNATIVE

Single Green Tunnel Alignment
Property Impact & Tunnel Structure Limits
and Full/Partial Takes and Easements

Single Green Legend
- Single Green Alignment
- Partial Takings
- Full Takings
- Permanent Easements
- Tunnel Structure Limits
- Property Impact Limits

Notes
- Total Partial Takings = 9
- Total Full Takings = 6
- Total Permanent Easements = 12
- Full Fee Takings with Buildings = 2

Analysis Conducted using Esri ArcGIS 10.5
Parcel Data acquired from SOCPA on April 13th, 2017
Orthoimagery acquired from NYS GIS Clearinghouse on April 13th, 2017
5 PROPERTY IMPACTS: BLUE ALTERNATIVE
APPENDIX K: COST ESTIMATE
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PROJECT COST ESTIMATION

1.1 OVERVIEW

This study looked at building tunnel alternatives set in an urban environment to replace the aging I-81 Viaduct section in downtown Syracuse. Successfully delivering one of these alternatives will present many challenges to overcome in the design and construction of the facilities and engage many trades and equipment and construction materials. In developing the cost estimate for the project, the work was broken down into the different areas to be addressed by experienced staff to determine the project cost for each alternative. The study team looked at the project in the following areas:

- **Tunneling and Heavy Civil work**—this includes the major excavations for the cut and the cut and cover transitions to the mining portal, the major reinforced concrete work for the cut and cover tunnels, the Tunnel Boring Machine (TBM) drive(s) and handling and disposal of muck, along with the placement of pre-cast concrete segmental liners for the tunnel as well as providing the temporary power, draining pumps and ventilation needed to work underground. This work was prepared by an experienced underground estimator with prior contractor bidding experience. The project work was detailed out and was “built” – by estimating crew size, man-hours, equipment usage and expected production rates, etc. The prevailing wages for Onondaga County were used as well as equipment quotes from TBM manufacturers and precast concrete liner manufacturers. The production rates of the work were applied to the quantities taken off for each alternative. A development based on unit prices of the typical bid items was used and applied to each alternative. The cost was developed based on unit prices of the typical bid items based on quantity take-offs for each alternative. A few items such as maintenance of traffic (MOT) or zone traffic control, and landscaping were estimated at a reasonable percentage of construction costs in accordance with other similar projects. The estimate includes an appropriate contingency at this point of the project.

- **Civil Highway and misc.** This scope includes all the pavement, roadway construction, surface drainage, concrete barriers, guide rails, lighting, signs, landscaping, and utilities for each alternative. The cost was developed based on unit prices of the typical bid items based on quantity take-offs for each alternative. A few items such as maintenance of traffic (MOT) or zone traffic control, and landscaping were estimated at a reasonable percentage of construction costs in accordance with other similar projects. The estimate includes an appropriate contingency at this point of the project. The production rates of the work were applied to the quantities taken off for each alternative’s conceptual design. The cost includes an appropriate contingency at this point of the project development.

- **Ventilation and Fire Life Safety Systems work**—this includes the permanent ventilation fans and equipment, fire protections, final tunnel drainage, lighting and finish and special systems in the tunnel. Tunnels have requirement for 24 hour per day ventilation, lighting, and pump sump operation. This estimated cost was prepared for each alternative by experienced professionals with experience in new tunnels as well as renewal of systems in existing highway tunnels. The estimated costs were compared with recent similar projects to check for completeness and reasonableness. The cost also includes an appropriate contingency at this point of the project.

- **Bridges & Ramps**—new, temporary and demolishing portions of existing viaduct. This cost estimate was prepared by calculating the quantities for each alternative on a square foot basis for the different types of bridge, ramps, temporary structures, underpinning/ temporary support of existing structures as well as the portions of the existing viaduct to be demolished. The cost includes an appropriate contingency at this point of the project.

- **Right of Way (ROW) and Property Easement costs.** This estimate was prepared by reviewing the number of parcels by type that are affected by the tunnel and roadway alignments. Fair market value was estimated and applied to each alternative.

- **Soft Costs (Project Management/Construction Management and Support, Design Services, Geotechnical Exploration program, Procurement Services, Legal, Public Outreach, etc.)** Delivering a large multi-year project in an urban area will take a considerable effort to successfully deliver. At this stage of a project, it is appropriate to estimate the “soft” cost of professional services costs at thirty-five percent of the construction cost.

- **Escalation and risk reserve.** Any tunnel alternative considered in this study would be a multi-year project to deliver. With the environmental analysis that would need to be done, along with required geotechnical investigation and design development needed, the earliest that construction could begin is estimated at three years. The construction duration would be between five and seven years. That puts the mid-point of construction in 2022, so dollars must be added to the current year costs to account for escalation. In addition, all underground construction has inherent risks that are usually greater than surface or elevated works. These tunnel alternatives have not been subject of a risk analysis yet. Faced with the many unknowns yet to be discovered through implementation of a geotechnical exploration program and design development, as well as potential issues that might arise during construction, it is strongly advisable and appropriate to carry a project reserve for risk at this point. We have recommended 20% as an appropriate value at this time.
## Table 1: Alternatives Project Cost Estimation

<table>
<thead>
<tr>
<th>Item</th>
<th>Red</th>
<th>Orange</th>
<th>Green A</th>
<th>Blue</th>
<th>Remarks</th>
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<tr>
<td><strong>Tunneling &amp; Heavy Civil</strong></td>
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<td>Site Preparation for tunneling</td>
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<td>$370,848,635</td>
<td>$351,804,263</td>
<td>$381,476,544</td>
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<td>TBM tunnel construction</td>
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<td>South Cut &amp; Cover Concrete Works</td>
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<td>North Cut &amp; Cover Concrete Works</td>
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<td>Mechanical &amp; Electrical for tunnel construction</td>
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<td><strong>Subtotal - Tunneling</strong></td>
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<td>$856,041,644</td>
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<td>Ventilation</td>
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<td>Tunnel fire protection</td>
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<td>Tunnel drainage</td>
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<td>Lighting</td>
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<td>Finishes</td>
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<td>$123,599,391</td>
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<td><strong>Subtotal - Tunnel and Tunnel Systems</strong></td>
<td>$1,244,516,114</td>
<td>$921,370,324</td>
<td>$979,641,035</td>
<td>$1,704,476,423</td>
<td></td>
</tr>
<tr>
<td><strong>Bridges &amp; Ramps, Civil, roads, - demolition, temporary and new for</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-81 Mainline work</td>
<td>$107,460,530</td>
<td>$200,983,175</td>
<td>$205,435,575</td>
<td>$343,255,846</td>
<td>includes demo, temporary works, new works</td>
</tr>
<tr>
<td>I-81 to I-490 connections</td>
<td>$257,742,178</td>
<td>$148,608,390</td>
<td>$125,991,367</td>
<td>$175,502,883</td>
<td>includes demo, new connections</td>
</tr>
<tr>
<td>I-490 Mainline</td>
<td>$670,360</td>
<td>$218,612,365</td>
<td>$173,188,607</td>
<td>$77,635,893</td>
<td>Includes demo and new structure and/or road lightings</td>
</tr>
<tr>
<td>Local roads</td>
<td>$56,399,914</td>
<td>$197,849,582</td>
<td>$131,731,371</td>
<td>$30,636,330</td>
<td>includes demo &amp; new ramps and streets (Almond)</td>
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<tr>
<td><strong>Subtotal - Bridges &amp; Ramps, Civil, roads,</strong></td>
<td>$502,269,590</td>
<td>$968,333,520</td>
<td>$600,347,180</td>
<td>$635,000,951</td>
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<tr>
<td><strong>ROW &amp; Property Easements</strong></td>
<td>$35,500,000</td>
<td>$43,950,000</td>
<td>$24,700,000</td>
<td>$61,400,000</td>
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</tr>
<tr>
<td>Item</td>
<td>Red</td>
<td>Orange</td>
<td>Green A</td>
<td>Blue</td>
<td>Remarks</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
<td>----------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Soft Costs (PM/CM, Design, procurement, outreach, etc.)</td>
<td>$623,799,997</td>
<td>$676,778,845</td>
<td>$561,640,875</td>
<td>$840,307,081</td>
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</tr>
<tr>
<td>Total project cost (2017 Dollars)</td>
<td>$2,406,085,708</td>
<td>$2,610,432,689</td>
<td>$2,166,329,090</td>
<td>$3,241,184,454</td>
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<td>Escalation &amp; risk reserve</td>
<td>$457,156,283</td>
<td>$495,902,211</td>
<td>$411,602,527</td>
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<td></td>
<td>$461,217,140</td>
<td>$522,056,538</td>
<td>$433,365,818</td>
<td>$648,236,891</td>
<td></td>
</tr>
<tr>
<td>Total Project Capital Budget</td>
<td>$3,344,459,124</td>
<td>$3,628,301,438</td>
<td>$3,011,197,435</td>
<td>$4,505,246,392</td>
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</tr>
<tr>
<td>Annual O &amp; M Cost (Estimated in 2017 $)</td>
<td>$14,000,000</td>
<td>$10,000,000</td>
<td>$8,000,000</td>
<td>$17,000,000</td>
<td></td>
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</tbody>
</table>
2 SYSTEM COST ESTIMATE

2.1 INTRODUCTION

The systems component of the cost estimate was broken down into the following categories:
- Ventilation
- Tunnel fire protection
- Tunnel drainage
- Lighting
- Finishes
- Electrical
- Special systems (ITS, etc.)
- Operations and maintenance

The overall cost of each item is provided in the table below. A detailed calculation sheet was developed listing all assumptions made. Discussion follows below outlining the approach taken for each item. The estimate is based primarily on previous project experience and an engineer’s estimate, and the estimate is not based on any more detailed information at this time. As a concept and more detailed design is developed this estimate should be refined and eventually an estimator prepared cost estimate should be developed.

2.2 VENTILATION

The ventilation estimate assumed the following schemes:
- Red – longitudinal ventilation with jet fans (500 ft spacing), portal exhaust provided at each end.
- Orange – longitudinal ventilation with jet fans (500 ft spacing), portal exhaust provided at each end.
- Green – minimal number of jet fans for control of air balance (1000 ft spacing), exhaust duct provided.
- Blue – longitudinal ventilation with jet fans (500 ft spacing), portal exhaust provided at each end.

An allowance was also made for air quality sensors. A ventilation building allowance, at each portal region, was included for all options.

2.3 TUNNEL FIRE PROTECTION AND DRAINAGE

Estimates for these systems are based on related data from previous tunnel projects using both linear and area take-offs as primary cost basis. Allowances were assumed for portal and tunnel pumping equipment and supporting pump station infrastructure.

2.4 LIGHTING

Lighting was estimated based on linear tunnel and provision of a daylight portal at each end. Allowance was made for controls, fixtures, luminance meters, power and software.

2.5 FINISHES

Tunnel finishes includes items such as signage, elements such as hand railings, fire protection (structural), equipment cabinets, portal features and surface buildings. The estimate was progressed on a “per 100 linear foot” basis.

2.6 ELECTRICAL

The electrical estimate assumes two ventilation buildings, one at each end of the tunnel, where electrical equipment is housed. Allowances are made for items such as switchgear, uninterrupted power supply, motor control centers, cables and conduit. The quantities are based on the length of each tunnel option and are extrapolated from costs on previous projects.

2.7 SPECIAL SYSTEMS

Items include features such as fiber optic network, telephones, ITS, radio rebroadcast, fire alarm and detection, security system, CCTV, SCADA system, overheight detection and cabling.

2.8 OPERATIONS AND MAINTENANCE

Costs were based on per linear foot of tunnel length from four US tunnels in the year 2005. A discounting was applied to this cost to provide an estimate in 2017 equivalent dollars, and a margin was added due to the early status of the design. Costs were then applied to each option scaled by the option’s length. The cost of this item is an annual cost, not an initial lump sum.
**Item** | **Red** | **Green A** | **Blue** | **Orange** | **Remarks**
--- | --- | --- | --- | --- | ---
Length (daylight to daylight portal) | 11098 | 6100 | 12980 | 7550 |  
Ventilation | $26,352,000 | $28,350,000 | $27,216,000 | $22,842,000 | Refer to detailed notes for assumptions affecting number of jet fan, partial building inclusion, exhaust duct not included.  
Tunnel fire protection | $23,492,246 | $14,361,840 | $27,476,064 | $15,981,840 | Includes: Dry standpipe system, deluge type fixed firefighting system, piping, supports, valves, pumps, hydrants, extinguishers and service connections. See notes for more information regarding assumptions.  
Tunnel drainage | $7,612,920 | $4,914,000 | $8,629,200 | $5,697,000 | Includes: Portal pump stations and pumps, tunnel low point pump station(s) and pumps, roadway piping, roadway grated inlets and service connections. See notes for more information regarding assumptions.  
Lighting | $10,298,358 | $8,184,204 | $11,094,444 | $8,797,554 | Includes: LED tunnel lighting fixtures, mechanical support, installation and adaptive lighting control system.  
Finishes | $71,475,620 | $41,408,280 | $82,879,524 | $49,966,470 | Includes egress signs, includes fireproofing, does NOT include internal structures, jersey barriers or raised walkways.  
Electrical | $19,216,343 | $10,050,750 | $21,910,878 | $13,677,930 | Refer to detailed notes for assumptions and elements used for estimating purposes. Cost for buildings in “Ventilation” assume space within for electrical rooms also.  
Special Systems (ITS, etc.) | $8,724,287 | $5,094,009 | $10,744,718 | $6,510,294 | Refer to detailed notes for assumptions and elements used for estimating purposes. Cost for buildings in “Ventilation” assume space within for communications/special systems rooms also.  
Total (not including O&M annual costs) | $166,571,774 | $112,363,083 | $189,950,828 | $123,473,088 |  
Operations and maintenance (annual estimate) | $14,345,065 | $7,879,248 | $16,766,006 | $9,732,184 | Derived from a cost per foot basis from other tunnels/projects. Includes: staff, utilities, routine maintenance, major support equipment. Does not include: major equipment replacement/repair, cyclical equipment replacements.

**TABLE 2:** Alternatives Operations & Maintenance Costs
APPENDIX L: PUBLIC COMMENTS ANALYSIS REPORT
# TABLE OF CONTENTS

## PUBLIC COMMENTS RESULTS

1.1 General Overview  
1.2 Results Analysis  
1.3 Non-Favorable Responses  
1.4 Public Officials  
1.5 Overall Trends  
1.6 Conclusion

## FIGURES

FIGURE 1: Breakdown of Public Comments

1
1 PUBLIC COMMENTS RESULTS

1.1 GENERAL OVERVIEW

Out of a total of 353 respondents, 89% (313) offered some sort of opinion on this project. 76% (270) of total respondents offered specific suggestions for the project.

![Diagram showing breakdown of public comments]

**FIGURE 1:** Breakdown of Public Comments

- 33% (116) of respondents prefer to keep Interstate 81 and either fix, redesign, or enhance it.
- 19% (67) of respondents prefer a community grid or some kind of a local boulevard.
- 11% (39) of respondents prefer a tunnel.
- 11% (40) of respondents prefer a hybrid solution.
- 1% (4) of respondents prefer some sort of aboveground or elevated replacement for Interstate 81.
- 1% (3) of respondents prefer a depressed highway.
- 0.25% (1) of respondents a suspension bridge.
- Of the 11% of respondents who want a hybrid solution:
  - 8 respondents want a community grid, a tunnel, and I-481
  - 7 respondents want to keep I-81 and add a tunnel and/or depressed highway
  - 4 respondents want a tunnel and/or depressed highway
  - 4 respondents want a raised highway and a community grid
  - 3 respondents want a community grid, a tunnel, and/or depressed highway
  - 2 respondents want to eliminate I-81 in downtown, reroute all through traffic to the new I-81 (I-481 North), and leave what is left to a state-designated route or a boulevard
  - 2 respondents want a community grid, underground roundabouts, elimination of I-81, and a reroute of I-81 traffic to I-481
  - 2 respondents want to improve the design of I-81, but if a tunnel is necessary, do it via a depressed highway
  - 2 respondents want a tunnel or to lower I-81, with elevated side streets
  - 1 respondent wants to move I-81 out of downtown, add a I-481 North Beech Street tunnel, and a community grid
  - 1 respondent wants to eliminate I-81 from downtown and add a tunnel
  - 1 respondent wants stacked lanes
  - 1 respondent wants to build the western half of the I-481 bypass
  - 1 respondent wants to keep I-81, and add a community grid and tunnel and/or depressed highway
  - 1 respondent wants an underground highway, with a greenhouse and aviary

1.2 RESULTS ANALYSIS

Overall, the public favors keeping Interstate 81 and either repairing it or redesigning certain aspects of it. Suggestions include making I-81 taller and wider, connecting it to Route 690, and creating breakdown lanes. The second-most popular option is the community grid or boulevard.

Many of the respondents in favor of the tunnel cited aesthetics (the removal of the I-81 barrier that bisects the city was mentioned repeatedly) and the positive effects on commerce as major reasons for wanting the tunnel.

Some of those in favor of a depressed highway referenced depressed highways that they have driven on in other parts of the country, such as Chicago, Cleveland, and southern New Jersey. Those in favor of the depressed highway also stated that they believed a depressed highway would possess all the benefits of a tunnel without the high costs to build and maintain.

1.3 NON-FAVORABLE RESPONSES

- Of the 353 total respondents, 122 (35%) do not want a tunnel.
- 38 total respondents (11%) do not want a community grid.
- 27 total respondents (8%) do not want to repair/redesign Interstate 81.
- 26 total respondents (6%) do not want a depressed highway.
- 12% (43) of respondents, while offering no real solution, were very adamant about what they did NOT want to happen. Of those who solely expressed objections, 38 (88%) do not want a tunnel.

Overall, non-favorable responses were most centered on the possible construction of a tunnel. The most common reasons cited were the soil conditions and the cost. It was repeatedly stated by respondents that the proposed relocation of I-81 runs through swampy ground, and that the water is of a high saline content. Many respondents objected to the potentially high costs associated with digging a tunnel and relocation of utility lines. In addition, respondents objected to the cost of maintaining and operating the tunnel, including running drainage pumps that would need to be regularly repaired or replaced due to the salinity of the water.

The second least desirable option is the community grid. The most common reasons cited were the potential traffic congestion and pollution.

Many of the objections relating to the depressed highway focused on the potential for frequent flooding. Some respondents also referred to the City of Rochester’s now-obsolete depressed highway as an example of why a depressed highway should not be constructed in Syracuse.
1.4 PUBLIC OFFICIALS

Of the nine public officials whose comments were documented, four (44%) were in favor of the community grid option. The reasons included that the grid would restore connectivity within the City and that it would lend to financial and cultural revitalization. Two (22%) officials were in favor of keeping Interstate 81. They believed that getting rid of the Interstate would adversely affect suburban municipalities and would hamper the ability of first responders to travel quickly, when needed. One (11%) official suggested a hybrid option consisting of a community grid with an Interstate 81 thoroughfare in the form of a depressed highway or a tunnel. Another official (11%) gave no opinion as to which option he preferred; however, he issued a word of caution regarding the construction and maintenance costs associated with both the tunnel and depressed highway options. The final official (11%) mailed his response in the form of multiple CDs. The CDs were unable to be accessed at the time of this report.

1.5 OVERALL TRENDS

Regardless of what solution respondents were in favor of, a large number displayed concern for the social and economic impact that the final decision will have on the City’s businesses and its residents. Many, even those who want to keep I-81, acknowledged the socio-economic impact that the construction of I-81 has had on the City. They seem to believe that I-81 has effectively cut off historically African-American neighborhoods from the rest of the City, leading to a decline in the vibrancy of those communities.

Many respondents in favor of keeping I-81 stated concerns that tearing it down would have a negative economic impact on the businesses located along its corridor, as well as the potential for traffic gridlock its elimination would cause.

Another topic of concern with many respondents is that some of the proposed options, including the tunnel, could require the demolition of several of the City’s historic buildings.

In addition, several respondents suggest that whatever plan is adopted should include some sort of pedestrian-friendly greenspace. Some respondents also suggested that the ultimate project should focus on making Syracuse more public transportation friendly and less dependent on passenger vehicles, which they believe would alleviate City traffic and allow for more walkability, leading to possible cultural and economic growth.

1.6 CONCLUSION

Overall, the public is very much divided on what should be done. However, the largest number of respondents are in favor of keeping Interstate 81 and either repairing or redesigning portions of it. The second and third most popular options are fairly controversial topics. The second most popular option (the community grid) is supported by 19% of respondents, but 11% are against it. The third most popular option (the tunnel) is supported by 11% of respondents, yet 35% are against it. Other ideas, including a depressed highway, an aboveground/elevated replacement for I-81, and a suspension bridge did not gain much traction.