
# MTP 2050

# Appendix E

# Cost Estimation Model

Credit: Wichita

# APPX E

# Cost Estimation Model Development and Use

From September 15, 2023, through February 2, 2024, a Call for Projects was issued for WAMPO member jurisdictions and planning partners to submit projects for Metropolitan Transportation Plan 2050 (MTP 2050). On October 3, 2024, the WAMPO Project Selection Committee (PSC) convened to make recommendations of which of the submitted projects to include in the MTP 2050 Fiscally Constrained Project List (see Chapter 7). On October 28, 2024, the WAMPO Technical Advisory Committee (TAC) recommended that the WAMPO Transportation Policy Body (TPB) approve the Fiscally Constrained Project List, as recommended by the PSC. On November 12, 2024, the TPB voted to approve the PSC- and TAC-recommended Fiscally Constrained Project List.

When the PSC convened to make its recommendations, they were provided with a variety of information from the project submitters (e.g., project scope, project location, project score (see Appendix D)) on the basis of which to make decisions. One especially significant piece of information from the project submitters was the estimated cost of each project. Having such cost estimates was necessary in order to ensure that the selection of projects to be listed in MTP 2050 could be done in a manner that maintains the fiscal constraint of the plan (i.e., the combined, estimated costs of the selected projects do not exceed the revenues projected to be available for them after subtracting routine operations and maintenance costs (see Chapter 6)).

WAMPO had the consulting firm PEC prepare spreadsheet-based project-cost-estimation models that project submitters could optionally use to generate their cost estimates. Having such a model was intended to serve two purposes: Making it easier for smaller jurisdictions, with fewer resources, to generate cost estimates and submit projects and making cost estimates more consistent across projects.

Cost estimation models were provided to potential project submitters for the following categories of projects:

- Bridge Rehabilitation
- Bridge Replacement
- Traffic Signals
- Road Diets
- Bicycle Lanes
- Sidewalks/Multiuse Paths
- Turn Lanes
- Intersections
- Roadway Expansion
- Roadway Reconstruction
- New Roadways

These are not all of the types of transportation projects that may be submitted for inclusion in a Metropolitan Transportation Plan. However, most project submissions either fall into one (or more) of these categories or at least have elements of them. If project submitters chose to not use these cost-estimation models (either because they were submitting a project of a type that the models do not account for or because they had the means to generate more accurate estimates without them), they were still asked to document how their cost estimates were arrived at.

Importantly, the cost-estimation models were only designed to provide high-level planning estimates and are not a substitute for the detailed estimates prepared by licensed engineers closer to the time of project commencement. Furthermore, as these models were prepared in 2023, it is advisable that any future use of them, beyond the development of MTP 2050, be accompanied by a periodic review of the assumed unit costs. PEC arrived at these unit costs on the basis of average project bid tabulations in the Wichita area and Kansas Department of Transportation (KDOT) quarterly Bid Averages reports and cross-referenced them with detailed preliminary estimates that PEC had produced for clients.

## Model Inputs

The following tables document default unit costs (in 2023 dollars) and other assumptions that were employed in the cost-estimation models. Some project costs, because they are difficult to accurately predict on a simple per-unit basis (e.g., square yard, square foot, linear foot, cubic yard, number of a certain item included in the project, or a binary variable indicating whether the project includes a given element), were left, to one extent or another, to the judgment of the user of the model.

- Table E.1 documents assumed unit costs for various elements of bridge-rehabilitation projects. Table E.2 does the same for bridge-replacement projects.
- Table E.3 documents assumed unit costs for traffic-signal projects that do not involve roadway-pavement work.
- Table E.4 shows cost assumptions for road-diet and bicycle-lane projects that may or may not require pavement work in addition to updating the lane markings on the street.
- Table E.5 shows the assumed cost of installing sidewalks and multiuse paths, the cost of which goes up when they cross more driveways or side streets.
- Table E.6 lists the assumed costs associated with removing, adding, or modifying roadway pavement, both at intersections (including turn lanes) and away from intersections; this table also shows the assumed cost of adding a sidewalk or multiuse path along the road, the cost of signalizing an intersection, and a user-inputted factor for incorporating storm-sewer work into a roadway project (it is common practice to combine roadway-improvement and storm-sewer work whenever possible, to avoid the cost of tearing up the pavement twice).
- Following the application of the various unit-cost assumptions documented in Tables E.1-E.6, the cost-estimation models estimate projects' ancillary costs (secondary construction costs, such as traffic control, mobilization, site clearing, and restoration), by assuming that those costs will be equal to a certain percentage of the more primary costs already estimated, with the assumed percentage varying by project type, as documented in Table E.7.

- As shown in Table E.8, after estimated ancillary construction costs are added, the model user is asked to input a contingency factor to add to the construction-cost estimate, in case unforeseen events increase the project cost beyond expectations; then, estimates are performed of the various non-construction costs that infrastructure projects commonly include; finally, to express the final cost estimate in year-of-expenditure dollars, an inflation factor of 4.5% per year is applied (equal to the default inflation factor used by the Kansas Department of Transportation (KDOT)).
- Among the non-construction costs listed in Table E.8 is Right of Way (ROW) acquisition, the assumed cost of which varies by project type, as documented in Table E.9.



**Table E.1: Cost Estimation Model Assumed Unit Costs: Bridge Rehabilitation**

| Bridge Deck or Culvert Ceiling | | Bridge Superstructure or Culvert Walls & Wingwalls | | Bridge Substructure or Culvert Floor & Toewall | | Channel & Miscellaneous | |
|---|---|---|---|---|---|---|---|
| **Project Element** | **Cost** | **Project Element** | **Cost** | **Project Element** | **Cost** | **Project Element** | **Cost** |
| Asphalt Wearing Surface Repair | $60/square yard | Bridge - Bearing Replacement/Repair | $5,000 each | Backfill Replacement | $50/cubic yard | Clean Brush/Debris - From Channel | $200/cubic yard |
| Bridge Rail Repair | $275/linear foot | Bridge - Clean Debris - Abutments/Pier Caps | $4,150 | Concrete Crack Repair - Abut./B.W. | $125/linear foot | Clean Silt/Debris From Inside Culvert | $275/cubic yard |
| Concrete Wearing Surface Repair | $350/square yard | Bridge - Concrete Crack Repair - Diaphragms | $125/linear foot | Concrete Crack Repair - Foundations | $125/linear foot | Clearing/Chipping/Grubbing | $1,650 |
| Concrete Approach Slab Repair | $500/square yard | Bridge - Concrete Crack Repair - Girders | $125/linear foot | Concrete Crack Repair - Miscellaneous | $125/linear foot | Concrete Channel Protection - Repair | $150/square yard |
| Concrete Cracking (Top of Deck) | $125/linear foot | Bridge - Concrete Crack Repair - Haunched Slab | $130/linear foot | Concrete Crack Repair - Pier/Columns | $125/linear foot | Drain & Pipe Repair/Replacement | $2,500 each |
| Concrete Deck Repair (Full-Depth) | $550/square yard | Bridge - Concrete Crack Repair - Miscellaneous | $125/linear foot | Concrete Crack Repair - Wings/Walls | $125/linear foot | Erosion - Earth Fill | $75/cubic yard |
| Concrete Median Repair - Cracking | $125/linear foot | Bridge - Concrete Crack Repair - Underside Deck | $150/linear foot | Concrete Patching - Abut./B.W. | $550/square yard | Gabion Wall Repair | $275/cubic yard |
| Concrete Median Repair - Patching | $200/square yard | Bridge - Concrete Patching - Diaphrams | $500/square yard | Concrete Patching - Foundations | $550/square yard | Regrade Channel | $40/cubic yard |
| Concrete Patching (Top of Deck) | $375/square yard | Bridge - Concrete Patching - Girders | $500/square yard | Concrete Patching - Miscellaneous | $550/square yard | Rip-Rap (Stone) | $100/cubic yard |
| Curb/Barrier Repair - Cracking | $125/linear foot | Bridge - Concrete Patching - Haunched Slab | $540/square yard | Concrete Patching - Pier/Columns | $550/square yard | Tree Removal - Individual | $450 each |
| Curb/Barrier Repair - Patching | $200/square yard | Bridge - Concrete Patching - Miscellaneous | $500/square yard | Concrete Patching - Wings/Walls | $550/square yard | Utility Repair | $825 each |
| Curb/Barrier Repair - Replacement | $550/linear foot | Bridge - Concrete Patching - Underside Deck | $640/square yard | Erosion - Earth Fill Replacement | $75/cubic yard | Repair/Replace Scour Protection Syst. | $825 |
| Deck Sealing | $40/square yard | Bridge - Paint (Structural Steel) | $10/square foot | Gabion Wall Repair | $275/cubic yard | | |
| Drain & Pipe Repair/Replacement | $2,500 each | Bridge - Replace Missing Nuts/Bolts/Rivets | $825 | Repair Abutment Piles | $1,650 each | | |
| Drain Cleanout (Along Top of Deck) | $185 each | Bridge - Replace Missing or Deter. Reinforcement | $500/square yard | Rip-Rap (Stone) Replacement | $100/cubic yard | | |
| Expansion Joint Repair/Replace | $375/linear foot | Bridge - Repair/Replace Intermediate Diaphrams | $1,650 each | Slope Protection (Concrete) - Repair | $150/square yard | | |
| Fence (Chain Link) Repair/Installation | $110/linear foot | Bridge - Repair/Replace Stiffener Plates | $825 each | Wingwall Joint(s) Repair | $275/linear foot | | |
| Guardrail Repair/Installation | $110/linear foot | Culvert - Concrete Crack Repair - Barrel | $100/linear foot | | | | |
| Guardrail Terminal Sect. Repair/Install. | $2,725 each | Culvert - Concrete Crack Repair - Wings/Walls | $100/linear foot | | | | |
| Replace Missing & Deter. Reinforcement | $500/square yard | Culvert - Concrete Patching - Ceiling/Floor | $500/square yard | | | | |
| Remove Vegetative Growth | $3,300 | Culvert - Concrete Patching - Headwall | $500/square yard | | | | |
| Sign Repair | $200 each | Culvert - Concrete Patching - Toe | $500/square yard | | | | |
| Sign Replacement | $375 each | Culvert - Concrete Patching - Vertical Walls | $500/square yard | | | | |
| Ditch Checks | $175 each | Culvert - Concrete Patching - Wings/Walls | $500/square yard | | | | |
| | | Culvert - Wingwall Joint Repair | $550/linear foot | | | | |

### Table E.2: Cost Estimation Model Assumed Unit Costs: Bridge Replacement

| Costs per Square Foot of Deck Area by Bridge Type | |
|---|---|
| Bridge Type: Slab | $150/square foot of deck area |
| Bridge Type: Girder - Prestress | $185/square foot of deck area |
| Bridge Type: Girder - Rolled Beam | $185/square foot of deck area |
| Bridge Type: Girder - Plate Steel | $200/square foot of deck area |
| Bridge Type: Culvert | $17/square foot of deck area |
| **Other Costs** | |
| Hydrology & Hydraulics/Permitting (if applicable) | 7.5% of above costs |
| Traffic Control (Urban) | $30,000 |
| Traffic Control (Rural) | $25,000 |
| Removal of Existing Structure | User input |

### Table E.3: Cost Estimation Model Assumed Unit Costs: Traffic Signal Projects

| Project Element | Cost |
|---|---|
| Signal Upgrades | $275,000/intersection |
| ADA Wheelchair Ramp Upgrades | $2,000/ramp |
| Pedestrian Pushbuttons | $27,500/intersection |

### Table E.4: Cost Estimation Model Assumed Unit Costs: Road Diets and Bicycle Lanes

| Project Element | Cost |
|---|---|
| Pavement Marking | $8/linear foot |
| Mill & Overlay (2") (if needed) | $18/square yard |
| Asphalt Overlay (2") (if needed) | $10/square yard |

### Table E.5: Cost Estimation Model Assumed Unit Costs: Sidewalks/Multiuse Paths

| Project Element | Cost |
|---|---|
| Sidewalk/Path | $8/square foot |
| Sidewalk/Path Crossing Driveway/Side Street | $12/square foot |

### Table E.6: Cost Estimation Model Assumed Unit Costs: Pavement Projects (Turn Lanes, Intersections, Roadway Expansion, Roadway Reconstruction, New Roadways)

| Project Element | Cost |
|---|---|
| Removing Old Pavement | $10/square yard |
| New Pavement (Non-Intersection) | $75/square yard |
| Turn-Lane Pavement | $120/square yard |
| Intersection Pavement | $90/square yard |
| Sidewalk/Path | $8/square foot |
| Sidewalk/Path Crossing Driveway/Side Street | $12/square foot |
| Storm Sewer Allowance | User input: 0%, 10%, 17.5%, or 25% of above costs |
| Signalization of Intersection | $300,000 |

## Table E.7: Cost Estimation Model Assumed Ancillary Costs in Addition to Applied Unit Costs, by Project Type

| Project Type | Ancillary Costs (%) |
|---|---|
| Bridge Rehabilitation | 10% |
| Bridge Replacement | 10% |
| Traffic Signal | 30% |
| Road Diet: Requiring new surface prior to new pavement markings | 25% |
| Road Diet: Not requiring new surface prior to new pavement markings | 100% |
| Bike Lane: Requiring new surface prior to new pavement markings | 25% |
| Bike Lane: Not requiring new surface prior to new pavement markings | 100% |
| Sidewalk or Multiuse Path: >2,500 feet long | 75% |
| Sidewalk or Multiuse Path: ≤2,500 feet long | 150% |
| Turn Lane: Left turn | 150% |
| Turn Lane: Right turn | 75% |
| Intersection: With curb & gutter | 60% |
| Intersection: With open-ditch drainage | 30% |
| Roadway Expansion: With curb & gutter | 80% |
| Roadway Expansion: With open ditch drainage | 30% |
| Road Reconstruction: With curb & gutter | 80% |
| Road Reconstruction: With open ditch drainage | 30% |
| New Roadway: With curb & gutter | 60% |
| New Roadway: With open ditch drainage | 20% |

## Table E.8: Cost Estimation Model Assumed Non-Construction Costs and Other Cost Adjustments

| Non-Construction Cost or Cost Adjustment | Assumed Cost or Factor |
|---|---|
| Contingency Factor | User input: 10%, 20%, 30%, or 40% of construction cost, including ancillary costs |
| Construction Engineering | 12.5% of construction cost, including ancillary costs and contingency factor |
| Refinement Studies | User input |
| Preliminary Engineering | 10% of construction cost, including ancillary costs and contingency factor |
| ROW Acquisition | Varies by project type |
| Utility Relocation | 5% of construction cost, including ancillary costs and contingency factor |
| Inflation Rate | 4.5% per year (projecting to year of expenditure from 2023 U.S. dollars) |

## Table E.9: Cost Estimation Model Assumed Right of Way-Acquisition Costs, by Project Type

| Project Type | Assumed ROW-Acquisition Cost |
|---|---|
| Bridge Rehabilitation | 2.5% of Construction cost with ancillary costs and contingency factor |
| Bridge Replacement | 2.5% of Construction cost with ancillary costs and contingency factor |
| Traffic Signal | 2.5% of Construction cost with ancillary costs and contingency factor |
| Road Diet | 2.5% of Construction cost with ancillary costs and contingency factor |
| Bike Lane | 2.5% of Construction cost with ancillary costs and contingency factor |
| Sidewalk or Multiuse Path: Narrow space btwn. rd. & ROW line | 5.0% of Construction cost with ancillary costs and contingency factor |
| Sidewalk or Multiuse Path: Typical space btwn. rd. & ROW line | 2.5% of Construction cost with ancillary costs and contingency factor |
| Sidewalk or Multiuse Path: Open space btwn. rd. & ROW line | 1.5% of Construction cost with ancillary costs and contingency factor |
| Turn Lane | 2.5% of Construction cost with ancillary costs and contingency factor |
| Intersection | 2.5% of Construction cost with ancillary costs and contingency factor |
| Roadway Expansion: Narrow space btwn. rd. & ROW line | 5.0% of Construction cost with ancillary costs and contingency factor |
| Roadway Expansion: Typical space btwn. rd. & ROW line | 2.5% of Construction cost with ancillary costs and contingency factor |
| Roadway Expansion: Open space btwn. rd. & ROW line | 1.5% of Construction cost with ancillary costs and contingency factor |
| Road Reconstruction: Narrow space btwn. rd. & ROW line | 5.0% of Construction cost with ancillary costs and contingency factor |
| Road Reconstruction: Typical space btwn. rd. & ROW line | 2.5% of Construction cost with ancillary costs and contingency factor |
| Road Reconstruction: Open space btwn. rd. & ROW line | 1.5% of Construction cost with ancillary costs and contingency factor |
| New Roadway | Square feet to acquire * User-estimated cost per square foot, based on local knowledge |