



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 C)) 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 K.1 documents assumed unit costs for various elements of bridge-rehabilitation projects. Table K.2 does the same for bridge-replacement projects.
- Table K.3 documents assumed unit costs for traffic-signal projects that do not involve roadway-pavement work.
- Table K.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 K.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 K.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 signaling 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 K.1-K.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 K.7.

- As shown in Table K.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 K.8 is Right of Way (ROW) acquisition, the assumed cost of which varies by project type, as documented in Table K.9.

Table K.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 - Diaphragms	\$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 Diaphragms	\$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 K.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 K.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 K.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 K.5: Cost Estimation Model Assumed Unit Costs: Sidewalks/Multiluse Paths

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

Table K.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 K.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 K.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 K.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