ESTIMATING MAINTENANCE OF TRAFFIC AT THE CONCEPTUAL LEVEL

John-Allen Ennis, PE – VDOT Staunton District
Caroline Rice, PE – CES Consulting LLC

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Presentation Outline

General Info for MOT Design/Constructability and Cost Estimates

VDOT Requirements and Resources for MOT

Advanced Work Zone Training, Work Area Protection Manual)

Non-Complex Project Example (Route 340 Turn Lane)

MOT Evaluation, Estimate Development

Moderately Complex Project Example (Route 50 DDI)

MOT Evaluation, Major Quantity Development, Estimate Development

MOT Design Considerations

Do your homework!

- **Site Visit**
  - Verify information from any available plans/survey/as-builts
  - Assess visible utilities
  - Note any changes or potential challenges

MOT Design Considerations

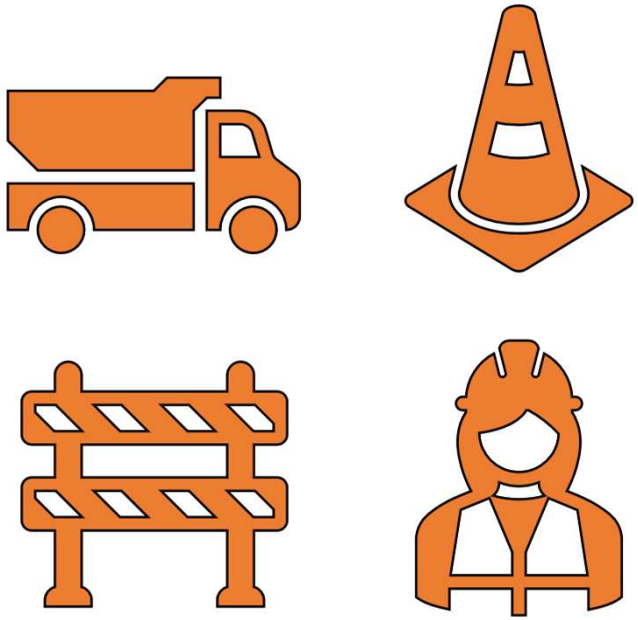
Do your homework!

- **Consider the needs of all users**

MOT Design Considerations

Do your homework!

- **Closures and Detours**



MOT Design Considerations

Do your homework!

- **ROW and Utility**

MOT Design Considerations

Do your homework!

- **Temporary Items**

MOT Design Considerations

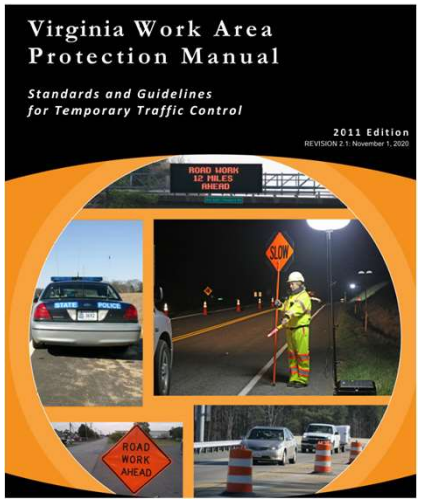
Do your homework!

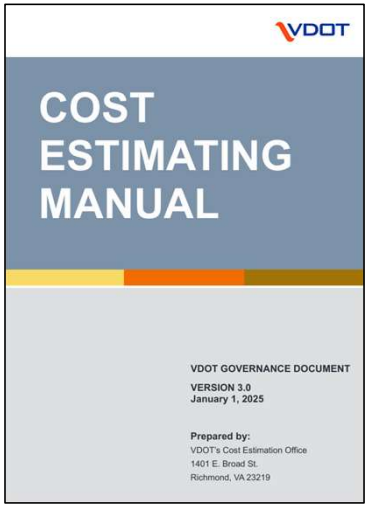
- **Timing and Special Events**

VDOT Resources for MOT

Guides and Training

- **Advanced Work Zone Traffic Control Certification**
  - (Work zone safety and operations | Virginia Department of Transportation)
- **Virginia Work Area Protection Manual (WAPM)**
  - (Virginia Work Area Protection Manual)





Cost Estimating Resources

- **Cost Estimating Manual**
- **Pre-Quantity Tool**
- **SPECC**
- **Statewide Bid Tab Query**
- **All the above are available online: Cost Estimation | Virginia Department of Transportation**

VDOT Pre-Quantity Tool

SPECC

VDOT | Statewide Bid Tab Query

Determining Project Complexity

Table 5-1: VDOT Project Complexity Classification for the Cost Estimating Process

Most Complex	Moderately Complex	Non-Complex
Most VDOT Tier 2 Projects (See IIM-LD-249)	**Higher Risk VDOT Tier 1 Projects Such As:**	**Most VDOT Tier 1 Projects (See IIM-LD-249)**
Medium to high complexity **and** schedule risks	T1 Projects with higher risks	Very low to medium complexity schedule risks
Special provisions for special time related conditions	T1 projects with multiple and potentially challenging RW needs	Short straightforward operations, typically single season **and** schedule type work
Multi-season projects with multiple concurrent operations and work paths	T1 projects with significant utility relocations	Simple repairs, multiple locations, flexible schedule
Challenging work and conditions	T1 projects with multiple and significant environmental impacts	Familiar work, favorable conditions
Several major subcontractors, multiple crews	T1 projects in rural areas close to sensitive areas (military bases, government facilities, major airports)	Simple low risk rehab projects
Major reconstruction / realignment	T1 projects in highly urban locations - multiple businesses along project	Drainage improvements
Major intersection improvements	T1 bridge projects with significant approach work	Trench widening projects
New roadway / bridge construction, not meeting the Moderately Complex criteria	**Lower Risk VDOT Tier 2 Projects Such As:**	Maintenance project schedule work (pavement, bridge, guardrail)
Large, very complex single-contract projects	T2 projects with lower risks	Intersection improvements, including signals
Multiple, roadways, bridges and ramps	T2 projects with few (if any) RW needs	Minor reconstruction projects
Projects with major traffic impacts	T2 projects with only minor utility relocations	Bridge or large culvert only projects with minimal approach work, no RW or utilities, and on secondary roads.
Projects that require RW from Federal government agencies.	T2 projects with few (if any) environmental impacts	Pavement markings and markers
T2 bridge projects involving large and/or complex structures	T2 projects in rural areas not near sensitive areas (military bases, government facilities, major airports)	
	T2 bridge projects with approach work, RW, utilities, environmental, and/or staging, etc.	

MOT Cost Estimating

How is estimating MOT different than other categories

- Rarely have quantities
- Usually have little to no design work complete
- Considered a “Known Unknown”, meaning it should fall under allowances as opposed to defined costs

MOT Cost Estimating

What tools are available to us?

- Pre-Quantity Tool (PQT)
- Similar Project Estimates by Cost Category (SPECC)
- Other misc. tools or spreadsheets

MOT Cost Estimating

Using the PQT – Picking an MOT Lane

- Percentage (%)
- Lump Sum (LS)
- Cost Per Month

MOT Cost Estimating

What's included in the percentage

- Channelizing Devices
- Construction Signs
- Temporary Pavement Markings
- Other Misc. and Incidental Traffic Control Items

MOT Cost Estimating

Additional Major Cost Items

- Temporary Signals
- Concrete Barrier and other Protective Items
- Temporary Pavement
- Significant amounts of flagging

MOT for a Non-Complex Project

MOT for a Non-Complex Project

Route 340 Turn Lane (Luray, VA)

MOT for a Non-Complex Project

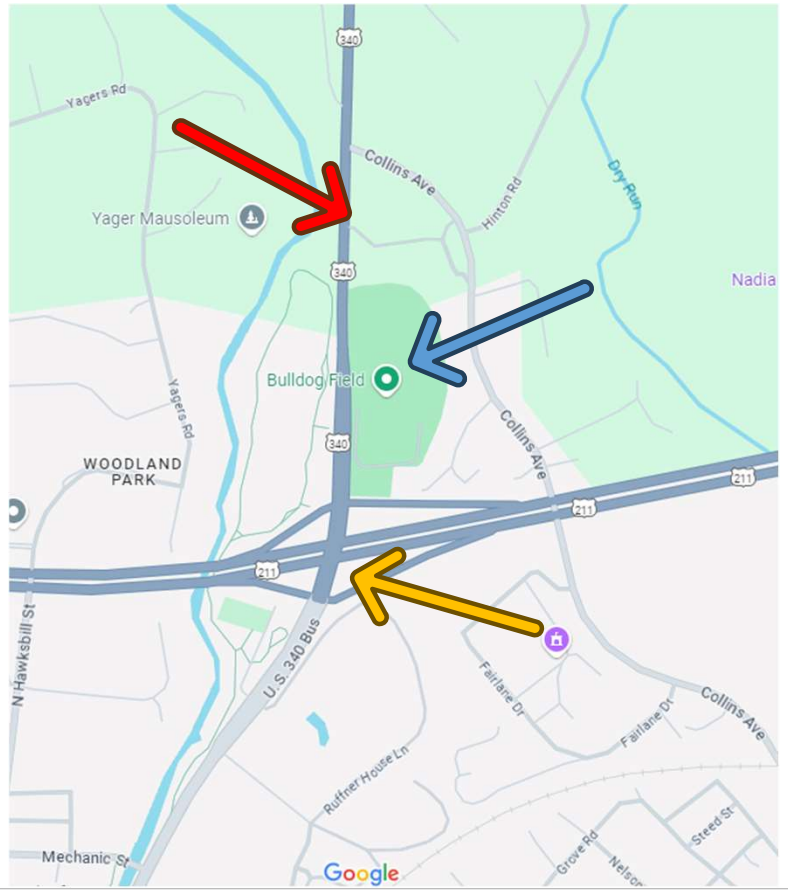
Route 340 Turn Lane (Luray, VA)

MOT for a Non-Complex Project

Route 340 Turn Lane (Luray, VA)

Considerations

- **Nearby Sports Complex**
- **Near interchange of Lee Highway and Route 340 Business**
- **Private Driveway**



MOT for a Non-Complex Project

TTC 5.2

Typical Traffic Control

Shoulder Operation with Minor Encroachment

(Figure TTC-5.2)

NOTES

Standard

1. **For required sign assemblies for multi-lane roadways see Note 1, TTC-4.**[1]

Guidance

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *When work takes up part of a lane on a high volume roadway; vehicular traffic volumes, vehicle mix, speed and capacity should be analyzed to determine whether the affected lane should be closed. Unless the lane encroachment analysis permits a remaining lane width of 10 feet, the lane should be closed. If the closure operation is on a Limited Access highway, the minimum lane width is 11 feet.*

Option:

4. The ROAD WORK AHEAD (W20-1) sign on an intersecting roadway may be omitted where drivers emerging from that roadway will encounter another advance warning sign prior to this activity area.

Standard:

5. **A shadow vehicle with either an arrow board operating in the caution mode, or at least one high-intensity amber rotating, flashing, or[1] oscillating light shall be parked 80' - 120' in advance of the first work crew.**
6. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
7. **Taper length (L) and channelizing device spacing shall be at the following:**

Taper Length L

Speed Limit (mph)	Lane Width (Feet) 9	10	11	12	Remarks	Speed Limit (mph)	Lane Width (Feet) 9	10	11	12	Remarks
25	95	105	115	125	$L=S^2W/60$	50	450	500	550	600	L=SW
30	135	150	165	180	$L=S^2W/60$	55	495	550	605	660	L= SW
35	185	205	225	245	$L=S^2W/60$	60	540	600	660	720	L=SW
40	240	270	295	320	$L=S^2W/60$	65	585	650	715	780	L=SW
45	405	450	495	540	L=SW	70	630	700	770	840	L=SW

Limited Access highways shall use a 1000' merging taper regardless of the posted speed, a 750' shifting taper for posted speeds < 65 mph and a 1000' shifting taper for posted speeds ≥ 65 mph.[2]

Shoulder Taper = ½ L Minimum

8. **Channelizing device spacing shall be at the following:**

Channelizing Device Spacing

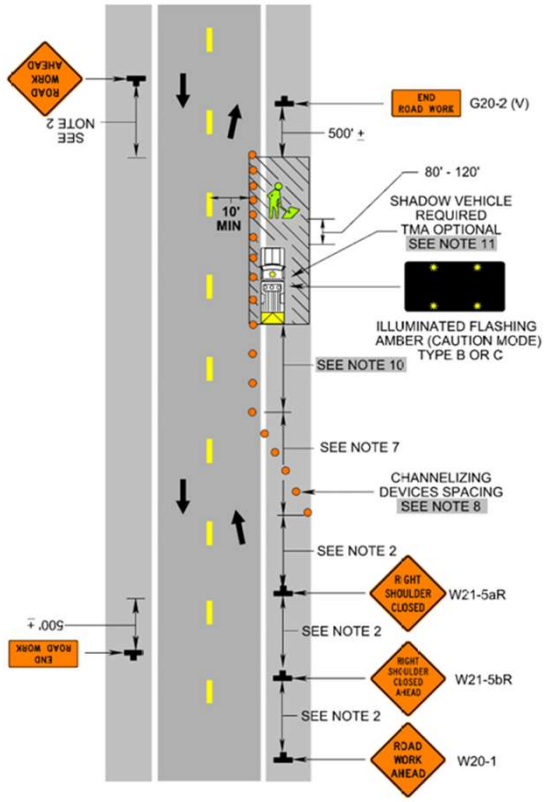
Location Spacing	Speed Limit (mph) 0 -35	36 +	Location Spacing	Speed Limit (mph) 0 -35	36 +	Location Spacing	Speed Limit (mph) 0 -35	36 +
Transition	20'	40'	Travelway	40'	80'	*Construction Access	80'	120'

*Construction access spacing may be increased to this distance, but shall not exceed one access per ¼ mile.

9. **On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.**[2]
10. **The buffer space length The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
11. **A truck-mounted attenuator (TMA) shall be used on Limited Access highways and multi-lane roadways with posted speed limit equal to or greater than 45 mph.**
12. **When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be placed as needed.**

Shoulder Operation with Minor Encroachment

(Figure TTC-5.2)



MOT for a Non-Complex Project

Building the Estimate – Determining the %

- PQT Recommends 2 to 15%
- Consider elements such as project duration, size of work area, number of access points, etc.
- Consider similar projects, in this case left turn lanes
- Finally, consider major MOT cost drivers to include in addition to percentage. It is unlikely you will have many of these on a non-complex project

MOT for a Non-Complex Project

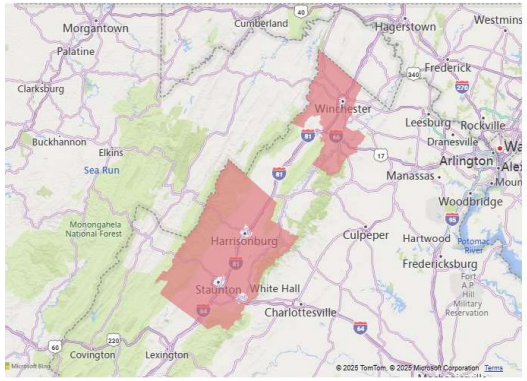
Building the Estimate – Determining the %

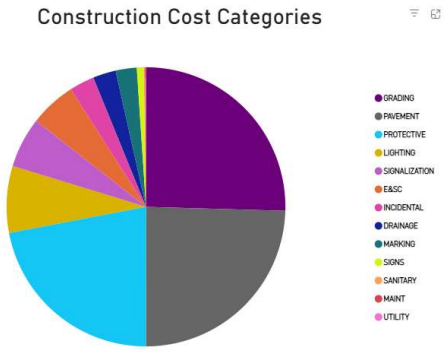
- In the example MOT should be simple and straight forward
- Short project, widening to one side, no anticipated major cost items
- Taking all of this into account the percentage should probably be on the low end, around 3-5%
- Only major cost driver to consider would be flagging

MOT for a Non-Complex Project

Building the Estimate – Checking the %

- Reference similar projects recently completed
- Run it by another Estimator for a gut check
- Quick review in SPECC





Project List

Please Note that UPC Hyperlinks are only accessible when connected to the COV Network.

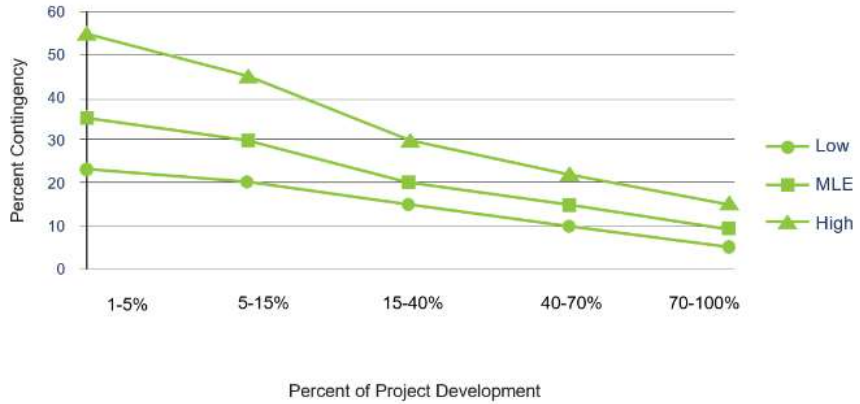
UPC	Project Description	Contract Award Amount	Project Type	Project Sub-Category	District	Bid Date
111055	#SMART18 - (St) I-81 EXIT 235 ACCESS IMPROVEMENTS	$1,144,958	Intersection	Add Turn Lane	Staunton	4/26/2023
111050	#SMART18 - (St) PAPERMILL ROAD TURN LANE	$367,162	Intersection	Add Turn Lane	Staunton	12/19/2018
115719	#SMART20 US 33 & ROUTE 620 TURN LANES	$442,716	Intersection	Add Turn Lane	Staunton	3/27/2024
106406	Rev Sharing Rt 55 Construct EB RTL and NB LTL on Rt 626	$194,435	Intersection	Add Turn Lane	Staunton	3/22/2017
102997	Rte. 608 Construct Right Turn Lane	$195,255	Intersection	Add Turn Lane	Staunton	12/19/2018

MOT for a Non-Complex Project

Building the Estimate – Determining the Contingency

- For Non-Complex projects, the contingency is typically a % of defined costs and allowances
- Contingency tables in the CEM are helpful but should not be applied without consideration of risk
- Based on the level of risk identified recommend contingency in the low to mid level of the range

Figure 5-3b: Risk and Contingency Sliding Scale – Non-Complex



Range of Contingency % by Project Level of Definition

	1-5%	5-15%	15-40%	40-70%	70-100%
High	55%	45%	30%	22%	15%
MLE*	35%	30%	20%	15%	8%
Low	23%	20%	15%	10%	5%

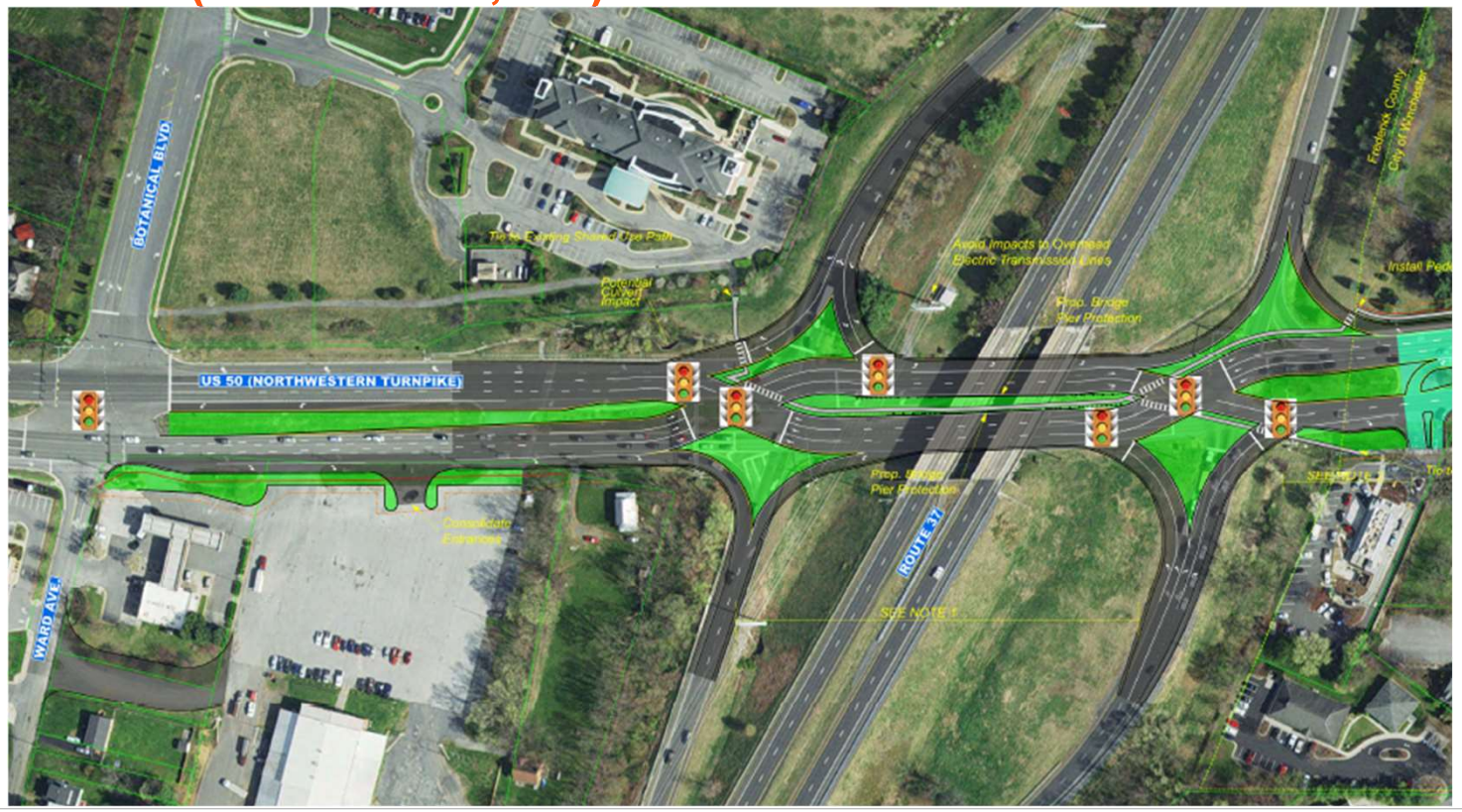
*MLE – Most Likely Estimate

***Excerpt from Table 5-3b in the CEM**

MOT for a Moderately Complex Project

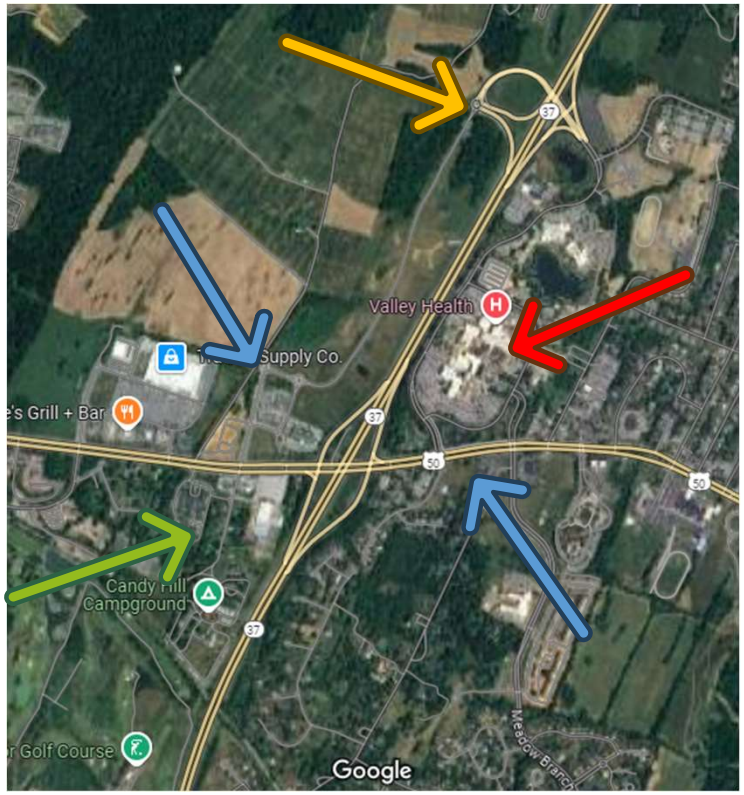
MOT for a Moderately Complex Project

Route 50 DDI (Winchester, VA)



MOT for a Moderately Complex Project

Route 50 DDI (Winchester, VA) – Considerations



- Nearby Interchange
- Hospital
- Nearby Businesses
- Nearby Residential

MOT for a Moderately-Complex Project

Building the Estimate – Determining the %

- PQT Recommends 2 to 15%
- Consider elements such as project duration, size of work area, number of access points, etc.
- Consider similar projects, in this case left turn lanes
- Consider your base estimate. Are there high cost items in the estimate that drive the base cost up but have little impact on the MOT?

MOT for a Moderately-Complex Project

Building the Estimate – Determining the %

- In the example MOT will be complex
- It will involve multiple phases with a significant amount of work during construction to maintain traffic
- Taking all of this into account the percentage should probably be on the higher end, around 10-15%

MOT for a Moderately-Complex Project

Building the Estimate – Additional Items

- Additional items can account for significant costs on more complex projects
- In our example, many of these items will be necessary and should be quantified (field office, concrete barrier, flagging, temporary pavement, etc.)

Item	Unit	Quantity	
Field Office	MO	0	
Concrete Barrier *(Traffic Barrier Service TCB-1 used for estimating)*	LF		
Flagging	HR	500	
Double Face Barrier *(Traffic Barrier Service, Conc. Dbl. Fc MB-11A used for estimating)*	LF		
Impact Attenuator *(Service Ty. 1 TL-3, > 40MPH used for estimating)*	EA		
Temporary Pavement	SF		**Pave. Depth (IN)**
Asphalt Concrete Ty. SM	TON	0.00	
Asphalt Concrete Ty. IM	TON	0.00	
Asphalt Concrete Ty. BM	TON	0.00	
Aggr. Matl. No. 21A or 21B	TON	0.00	

			Cost
Temporary Bridges Allowance	LS	0	$ -
Temporary Signals Allowance	LS	0	$ -
Temporary Earthwork Allowance	LS	0	$ -
Temporary Sheet Piling Allowance	LS	0	$ -

MOT for a Moderately-Complex Project

Building the Estimate – Checking the %

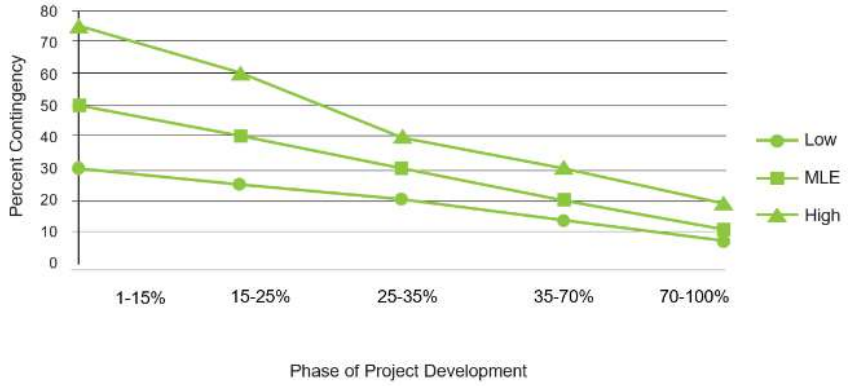
- Reference similar projects recently completed
- Run it by another Estimator for a gut check
- Quick review in SPECC

MOT for a Moderately-Complex Project

Building the Estimate – Determining the Contingency

- For Moderately-Complex projects, the contingency can be either a % of the base estimate or a deterministic contingency can be used
- Contingency tables in the CEM are helpful but should not be applied without consideration of risk
- If a % is used, based on the level of risk identified recommend contingency in the mid to high level of the range

Figure 5-3c: Risk and Contingency Sliding Scale – Moderately Complex



Range of Contingency % by Project Level of Definition

	1-15%	15-25%	25-35%	35-70%	70-100%
High	75%	60%	40%	30%	18%
MLE*	50%	40%	30%	20%	10%
Low	30%	25%	20%	12%	7%

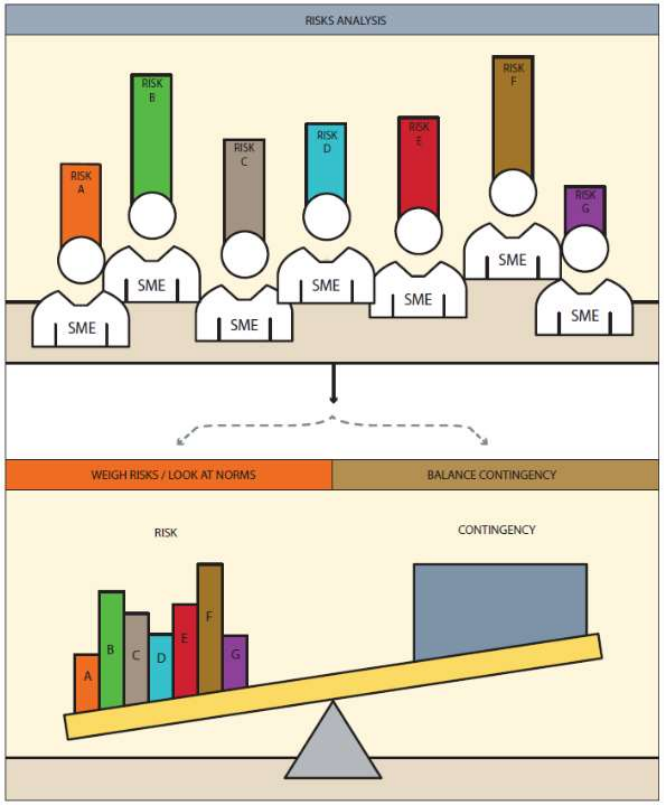
*MLE – Most Likely Estimate

***Excerpt from Table 5-3c in the CEM**

MOT for a Moderately-Complex Project

Building the Estimate – Determining the Contingency

- For Moderately-Complex projects, you may want to consider a deterministic approach
- This would require evaluating the probability and impact of each risk
- Recommend involving subject matter experts to develop
- See chapter 5 of the CEM for more detail



*Excerpt from Figure 5-4 in the CEM

Questions?