

## Appendix A – Countermeasure Matrix

Table 3 to Table 6 list recommended countermeasures for each focus type organized by facility type (i.e., minor stop-controlled intersection or signalized intersection) and crash type for primary, high, and medium risk categories. Table 6 includes a baseline set of countermeasures which are recommended as standards for each facility type (this includes some treatments that are already VTrans standards but may be absent on local roads). At higher risk levels, additional countermeasures are added for consideration. Recommendations presume minimum signage is present as recommended in the MUTCD but include supplemental signs at higher-risk intersections which may not already have signage present. Note that countermeasures are not divided between State route and local route sites – the proposed countermeasures can and should be feasibly considered for both.

As discussed elsewhere in the plan, the countermeasures are applicable to all sites at the applicable risk level or above. As such, standard countermeasures are applicable to all risk sites; medium risk level countermeasures are applicable to medium risk, high risk, and primary risk sites; high risk level countermeasures are applicable to high-risk sites and primary risk sites; and primary risk level countermeasures are applicable to primary risk sites. The tables are applicable as follows:

- Primary risk sites – Table 3
- High risk sites – Table 4
- Medium risk sites – Table 5
- Standard countermeasures – Table 6



**Table 4 Countermeasure Matrix for High-Risk Sites**

Risk Level	Countermeasure (Focus Crash and Facility Type)	Target Crash Types and Facilities								
		Left turn & angle crashes, minor stop controlled (1, 2, 6, 7)	Rear-end crashes, unsignalized (3)	Rear-end crashes, signalized (4)	Angle crashes, signalized (5)	Head-on crashes, minor stop controlled (8)	Single vehicle crashes (9, 10)	Pedestrian-vehicle crashes (11, 12, 13)	Bicycle-vehicle crashes (14)	Pedestrian-vehicle crashes at night (15)
High	Reduce Intersection Skew	●	●			●	●	●	●	●
	Double-Up and Oversize Advance Signage, Upgrade to Fluorescent Sheeting <sup>20</sup>	●	●	●	●	●	●	●	●	●
	Curb Extensions							●		●
	Advanced Dilemma Zone Detection			●	●					
	Protected Left-Turn Phasing				●			●		●
	Flashing Yellow Arrow				●					
	Dedicated Bicycle Lanes								●	

<sup>20</sup> At medium risk sites, designers are recommended to choose one. At high risk sites, designers are recommend to deploy both.

Risk Level	Countermeasure (Focus Crash and Facility Type)	Target Crash Types and Facilities								
		Left turn & angle crashes, minor stop controlled (1, 2, 6, 7)	Rear-end crashes, unsignalized (3)	Rear-end crashes, signalized (4)	Angle crashes, signalized (5)	Head-on crashes, minor stop controlled (8)	Single vehicle crashes (9, 10)	Pedestrian-vehicle crashes (11, 12, 13)	Bicycle-vehicle crashes (14)	Pedestrian-vehicle crashes at night (15)
High	High-Visibility Crosswalk <sup>21</sup>							●		●
	Pedestrian Refuge Island							●		●
	Targeted Speed Reduction Measures <sup>22</sup>	●	●	●	●	●	●	●	●	●

<sup>21</sup> Longitudinal crosswalk markings implemented using thermoplastic paint.

<sup>22</sup> Designers can refer to VTrans' Traffic Safety Toolbox for potential speed reduction countermeasures:

<https://vtrans.vermont.gov/sites/aot/files/documents/20230606%20Toolbox.pdf>. Note, this does not include changing the posted speed limit.

**Table 5 Countermeasure Matrix for Medium Risk Sites**

Risk Level	Countermeasure (Focus Crash and Facility Type)	Target Crash Types and Facilities								
		Left turn & angle crashes, minor stop controlled (1, 2, 6, 7)	Rear-end crashes, unsignalized (3)	Rear-end crashes, signalized (4)	Angle crashes, signalized (5)	Head-on crashes, minor stop controlled (8)	Single vehicle crashes (9, 10)	Pedestrian-vehicle crashes (11, 12, 13)	Bicycle-vehicle crashes (14)	Pedestrian-vehicle crashes at night (15)
Medium	Double-Up or Oversize Advance Signage, Upgrade to Fluorescent Sheeting	•	•	•	•	•	•	•	•	•
	Retroreflective Sheeting on Sign Posts	•	•	•	•	•	•	•	•	•
	Enhanced Pavement Markings that Delineate Intersection <sup>23</sup>	•	•			•	•	•	•	•
	Improve Intersection Sight Distance	•	•	•	•	•	•	•	•	•
	Leading Pedestrian Interval							•		•

<sup>23</sup> Countermeasures can include a painted splitter island if sufficient pavement width is available or a "STOP AHEAD" in pavement markings, edge lines delineating the curb return if not already present.

Risk Level	Countermeasure (Focus Crash and Facility Type)	Target Crash Types and Facilities								
		Left turn & angle crashes, minor stop controlled (1, 2, 6, 7)	Rear-end crashes, unsignalized (3)	Rear-end crashes, signalized (4)	Angle crashes, signalized (5)	Head-on crashes, minor stop controlled (8)	Single vehicle crashes (9, 10)	Pedestrian-vehicle crashes (11, 12, 13)	Bicycle-vehicle crashes (14)	Pedestrian-vehicle crashes at night (15)
Medium	Prohibit Right-Turn on Red				●			●	●	●
	Adjust Yellow Change Intervals to Reduce Dilemma Zone			●	●					
	Install Crosswalks if Not Present <sup>24</sup>							●		●
	R10-15 "Turning Vehicles Yield to Pedestrians"							●		●
	Parking Restriction Near Crossing							●	●	●

<sup>24</sup> Designers should review the VTrans Guidelines for Pedestrian Crossing Treatments to verify site eligibility for a crosswalk: <https://vtrans.vermont.gov/sites/aot/files/highway/documents/ltf/VTrans%20Ped%20Crossing%20Guide%20August%202019%20Update.pdf>.

**Table 6 Countermeasure Matrix for All Sites**

Risk Level	Countermeasure (Focus Crash and Facility Type)	Target Crash Types and Facilities								
		Left turn & angle crashes, minor stop controlled (1, 2, 6, 7)	Rear-end crashes, unsignalized (3)	Rear-end crashes, signalized (4)	Angle crashes, signalized (5)	Head-on crashes, minor stop controlled (8)	Single vehicle crashes (9, 10)	Pedestrian-vehicle crashes (11, 12, 13)	Bicycle-vehicle crashes (14)	Pedestrian-vehicle crashes at night (15)
Standard	Properly Placed Stop Bar	●	●	●	●			●	●	●
	Double Arrow Warning Sign at Stem of T-Intersections	●					●			
	Brush Trimming and Sight Line Maintenance	●	●	●	●	●	●	●	●	●
	Backplates with Retroreflective Borders			●	●					
	Pedestrian Countdown Signals							●		●