

SMART SCALE Planning Level CMFs

Project Extent	Improvement Type/Features	F+I CMF
Intersection	Convert stop control to yield control (when warranted)	0.45
	Convert stop/yield control to signal	0.65
	Convert stop/yield control to roundabout	0.20
	Convert signal to roundabout	0.40
	Convert two-way stop control to unsignalized RCUT	0.45
	Convert signal control to signalized RCUT	0.65
	Convert signal control to continuous green T signal	0.85
	Displaced left turn intersection	0.80
	Median U-turn intersection	0.70
	New quadrant roadway	Design Dependent
	Convert pedestal to mast arm	0.55
	Enhanced signal conspicuity	0.85
	Intersection lighting	Targeted
	Convert unsignalized intersection warning beacons from static to dynamic	0.95
	Install conflict warning system – 4-lane at 2-lane intersection	0.80
	Install conflict warning system – 2-lane at 2-lane intersection	0.70
	New turn lane (none present)	0.85
	Add turn lane (to existing)	0.97
	Extend turn lane	0.97
	Median acceleration lane	0.85
Add median or close median opening (convert to right-in/right-out)	0.40	
Improve intersection skew angle	Function	
Increase intersection radii	0.95	

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Interchange	At-grade to new interchange	0.50
	Convert stop-control diamond interchange to DDI	0.30
	Convert signalized diamond interchange to DDI	0.37
	Convert diamond interchange to SPUI	0.60
	Change loop ramp to flyover ramp	Volume-based
	Non-freeway: replace arterial turns with loops or directional ramps	0.65
	Add freeway collector-distributor roads	0.90
	Add freeway independent loop or directional ramp entrances	0.95
	Extend ramp acceleration lane length	Function
	Extend ramp deceleration lane length 250-500 ft up to 700 ft in total length	0.85
	Implement ramp metering	0.65
Pedestrian and Bicycle	<i>Refer to Targeted CMF Short List for pedestrian and bicycle CMFs</i>	Targeted
Bridge	Widen shoulders	0.95
Freeway Segment	ITS for incident management	0.85
	ITS for ATM	0.80
	ITS for variable speed limits	0.90
	Add auxiliary lanes between ramps	0.80
	Directional widening 2 to 3 lanes – Rural	0.70
	Directional widening 2 to 3 lanes – Urban	0.90
	Directional widening 2 to 4+ lanes – Urban	0.75
	Directional widening 3 to 4+ lanes – Urban	0.80
Install lighting	Targeted	

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Non-Freeway Segment	Adaptive signal control – Urban Intersection – 3-leg intersection	0.45
	Adaptive signal control – Urban Intersection – 4-leg intersection	0.60
	Adaptive signal control – Suburban Intersection	0.92
	Signal retiming/optimization	0.91
	ITS for Advanced Traffic Management (ATM)	0.90
	Close driveway	0.70
	Provide median (right-in/right-out only)	0.40
	Alignment reconstruction	0.85
	Convert two-way road to one-way road	0.45
	Addition of two-way left turn lane (four to five lane conversion)	0.45
	Addition of two-way left turn lane (two to three lane conversion)	0.75
	Pavement re-utilization (road diet)	0.55
	Widen 2-lane to multilane divided – Rural	0.70
	Widen 2-lane to 4-lane divided – Urban	0.80
	Widen 2-lane to 6-lane divided – Urban	0.75
	Widen 4-lane to 6+-lane divided – Urban	0.85
	Widen travel lanes – Rural	Function
	Widen travel lanes – Urban	Function
	Add or widen shoulder	Function
	Shoulder/clear zone/roadside improvement	Targeted
Addition of truck climbing or passing lanes	Targeted	
Lighting	Targeted	

Targeted CMF Short List

CMF Type	CMF Description	Targeted Crash Type	CMF Value	Application Notes
Pedestrian and Bicycle	Add new sidewalk	Pedestrian ₁	0.12	Does not apply for sidewalk upgrades or widening
	Add bicycle lane	Bicyclist ₁	0.42	
	Add shared-use path or mixed-use trail	Pedestrian ₁	0.12	
		Bicyclist ₁	0.41	
	Add high-visibility crosswalk	Pedestrian ₁	0.70	Applies for new crosswalk or upgrades from low-visibility crosswalk
	Install countdown pedestrian timer	Pedestrian ₁	0.30	If a countdown pedestrian timer is installed in coordination with a new or upgraded crosswalk, apply only this CMF
	Install leading pedestrian interval (LPI)	Pedestrian ₁	0.413	
	Install HAWK	Pedestrian ₁	0.45	
		Rear End and Sideswipe ₁	0.876	
Install RRFB	Pedestrian ₁	0.53		
	Rear End ₁	0.93		
Lighting	Install lighting at intersection	Darkness – Road Not Lighted ₂	0.881	
	Install lighting at interchange	Darkness – Road Not Lighted ₂	0.50	Apply to merge/diverge areas and ramps. Apply intersection CMF to ramp terminals
	Install lighting on segment	N/A	N/A	

For CMF Functions, reference the SMART SCALE CMF Calculator in Excel.

Refer to the following fields when identifying the targeted crashes:

- (1) – Collision Type
- (2) – Light Condition
- (3) – Roadway Departure Type
- (4) – Single- or Multiple-Vehicle

Targeted CMF Short List

CMF Type	CMF Description	Targeted Crash Type	CMF Value	Application Notes
Segment	Install centerline rumble strips	Head On ₁	0.55	
		Roadway Departure – Left ₃	0.55	
		Sideswipe – Opposite Direction ₁	0.55	
	Install edge rumble strips	Roadway Departure – All ₃	0.62	
	Install truck climbing lane	Head On ₁	0.66	
		Sideswipe – Same Direction ₁	0.66	
		Sideswipe – Opposite Direction ₁	0.66	
		Roadway Departure – All ₃	0.66	
	Widen paved inside shoulder on freeway from X to Y ft	Roadway Departure – Left ₃	Function	
	Widen paved outside shoulder on freeway from X to Y ft	Roadway Departure – Right/Unknown ₃	Function	Separate functions for horizontal curve and tangent segments
Widen average shoulder width on non-freeway from X to Y ft	Roadway Departure – All ₃	Function		
Improve Roadside Hazard Rating (RHR)	Roadway Departure – All ₃	Function		
Interchange	Add entrance ramp lane (1 to 2 lanes)	Multiple-Vehicle ₄	1.60	No impact on single-vehicle crashes
	Add exit ramp lane (1 to 2 lanes)	Multiple-Vehicle ₄	1.65	

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- (1) – Collision Type
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- (3) – Roadway Departure Type
- (4) – Single- or Multiple-Vehicle