Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Crashes July 2014

This chart summarizes studies about the effectiveness of engineering countermeasures. Studies where an increase in crashes were reported are also shown since this information is also relevant in selection of countermeasures.

Category	Safety Focus	Area	Roadway	Reference	Sites	Study Period (before/after)	Crash Type	CMF	CMF Clearinghouse Star Rating	Crash Reduction	Location	Notes
Vertical Deflections Within the Roadway												
Speed Hump—rounded, raised area placed across the roadway, typically 12 to 14 feet long	pedestrian	urban	—	100 (2009)	6	—	all	—	—	-48%	CA	-43% change in average volume
	pedestrian	urban	—	100 (2009)	5	—	all	—	—	3%	FL	-28% change in average volume
	pedestrian	urban	—	100 (2009)	16	—	all	—	—	-46%	MD	-32% change in average volume
	pedestrian	urban	—	100 (2009)	20	—	all	—	—	-33%	NE	volume change unknown
	pedestrian	urban	—	100 (2009)	4	—	all	—	—	-46%	OH	-29% change in average volume
	pedestrian	urban	—	100 (2009)	5	—	all	—	—	-40%	OR	-20% change in average volume
Speed Table—a long speed hump typically 22 feet in length with a flat section in the middle and ramps on the ends	pedestrian	urban	residential	6 (2003)	19	2-3 yrs./2-3 yrs.	total	—	—	-38%	GA	
	pedestrian	urban	residential	6 (2003)	19	2-3 yrs./2-3 yrs.	injury	—	—	-93%	GA	
	pedestrian	urban	—	100 (2009)	4	—	all	—	—	-64%	MD	-15% change in average volume
	pedestrian	urban	—	100 (2009)	4	—	all	—	—	-36%	OR	-20% change in average volume

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Speed Cushion—raised area that allows most emergency vehicles to straddle the hump	pedestrian	no crash studies found for speed cushions										
Raised Intersection—a raised plateau, with ramps on all approaches, where roads intersect	pedestrian	—	—	69 (2004)	—	—	serious/ minor injury	1.05	★	—	—	
Horizontal Deflections/Roadway Narrowing												
Choker/Bulb-out—mid-block curb extensions that narrow road by extending the sidewalk or widening the planting strip	pedestrian	no crash studies found for chokers										
Neck Down—intersection curb extensions that narrow a road by extending the width of a sidewalk	pedestrian	no crash studies found for neck-downs										
Chicanes—curb extensions that alternate from one side of the street to the other forming S-shaped curves	pedestrian	no crash studies found for chicanes										
Center Island—raised or painted island along the centerline that narrows travel lanes	pedestrian	—	—	70 (2011)	—	—	all	0.61	★★★★	—	UT	raised median
	pedestrian	—	—	70 (2011)	—	—	fatal/ serious	0.56	★★★★	—	UT	raised median
	pedestrian	urban	principal arterial	71 (2008)	—	—	all	0.29	★★★	—	UT	raised median
	pedestrian	urban	principal arterial	71 (2008)	—	—	angle	0.45	★★★	—	UT	raised median
	pedestrian	urban	principal arterial	72 (2010)	—	—	all	0.86	★★★	—	NJ	raised median
	pedestrian	urban	principal arterial	69 (2004)	—	—	serious/ minor	0.78	★★★★★	—	—	raised median
	pedestrian	urban	principal arterial	69 (2004)	—	—	PDO	1.09	★★★★★	—	—	raised median
	pedestrian	rural	principal arterial	69 (2004)	—	—	serious/ minor	0.88	★★★★★	—	—	raised median
	pedestrian	rural	principal arterial	69 (2004)	—	—	PDO	0.82	★★★★★	—	—	raised median
	pedestrian	urban	—	69 (2004)	—	—	fatal/seri-ous/ minor	0.61	★★★★	—	—	raised median
	pedestrian	rural	—	69 (2004)	—	—	PDO	2.28	★★	—	—	raised median
	pedestrian	rural	—	69 (2004)	—	—	fatal/ serious/ minor	1.94	★	—	—	raised median

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(*cont'd*) **Center Island**—raised or painted island along the centerline that narrows travel lanes	pedestrian	urban/ suburban	principal arterial	73 (2002)	—	—	vehicle/ped	0.61	★★	—	WA, OR, CA, AZ, UT, KS, TX, MO, Wi, OH, PA, MA, MD, NC, FL	raised median + unmarked crosswalk
	pedestrian	urban/ suburban	principal arterial	73 (2002)	—	—	vehicle/ped	0.54	★★★	—	WA, OR, CA, AZ, UT, KS, TX, MO, Wi, OH, PA, MA, MD, NC, FL	raised median + marked crosswalk
	pedestrian	rural	stop-controlled intersection	74 (2008)	—	—	all	0.69	★★	—	PA, KY, MO	lane narrowing + painted median + rumble strips
	pedestrian	rural	stop-controlled intersection	74 (2008)	—	—	fatal/serious/ minor	0.80	★★	—	PA, KY, MO	lane narrowing + painted median + rumble strips
	pedestrian	rural	stop-controlled intersection	74 (2008)	—	—	angle	0.58	★★	—	PA, KY, MO	lane narrowing + painted median + rumble strips
	pedestrian	rural	stop-controlled intersection	74 (2008)	—	—	rear-end	1.54	★★	—	PA, KY, MO	lane narrowing + painted median + rumble strips
Reduce Lane Width with Markings—narrowing of the lanes using pavement markings, median, etc.	roadway departure	rural	—	69 (2004)	—	—	injury	1.05	★★★	—	—	8 inch edge line
Road Diet—reducing the number of lanes by reallocating roadway space for other uses (e.g. bike lanes, center turn lanes, medians, parking, shoulder lanes, etc.	pedestrian	urban	3-lane	75 (2003)	1	20 mon/ 20 mon	all	—	—	62%	MT	4- to 3-lane
	pedestrian	urban	3-lane	75 (2003)	1	—	all	—	—	-28%	MN	4- to 3-lane
	pedestrian	urban	3-lane	75 (2003)	1	1 yrs./1 yrs.	all	—	—	-17%	CA	4- to 3-lane
	pedestrian	urban	3-lane	75 (2003)	1	1 yrs./1 yrs.	all	—	—	-17%	CA	4- to 3-lane
	pedestrian	urban	3-lane	75 (2003)	1	2 yrs./2 yrs.	all	—	—	-52%	CA	4- to 3-lane
	pedestrian	urban	3-lane	75 (2003)	9	1 yrs./1 yrs.	all	—	—	-34%	WA	4- to 3-lane
	pedestrian	urban	3-lane	75 (2003)	9	1 yrs./1 yrs.	all	—	—	-57%	IA	4- to 3-lane
	pedestrian	suburban	3-lane	76 (2010)	30 treatment/ 51 control	17.5 yrs./4.5 yrs.	all	0.81	—	—	CA, WA	4- to 3-lane

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(*cont'd*) **Road Diet**—reducing the number of lanes by reallocating roadway space for other uses (e.g. bike lanes, center turn lanes, medians, parking, shoulder lanes, etc.	pedestrian	small urban	3-lane	76 (2010)	15 treatment/ 296 control	4.7 yrs./3.5 yrs.	all	0.53	—	—	IA	4- to 3-lane
	pedestrian	urban	3-lane	77 (2007)	—	—	all	0.67	—	—	MN	4- to 3-lane
	pedestrian	urban	3-lane	77 (2007)	—	—	injury	1.00	—	—	MN	4- to 3-lane
	pedestrian	urban	3-lane	77 (2007)	—	—	PDO	0.54	—	—	MN	4- to 3-lane
	pedestrian	urban	3-lane	77 (2007)	—	—	angle	0.76	—	—	MN	4- to 3-lane
	pedestrian	urban	3-lane	78 (2012)	—	—	all	0.95	★★★	—	MI	4- to 3-lane
	pedestrian	urban	3-lane	79 (2006)	15 treatment / 15 control	11 to 21 yrs./1 to 11 yrs.	all	—	—	-25%	IA	4- to 3-lane
	pedestrian	urban	3-lane minor arterial	80 (2008)	—	—	all	0.71	★★★★	—	—	4- to 3-lane
	pedestrian	urban	3-lane arterial	78 (2012)	—	3 yrs./3 yrs.	all	0.91	—	—	MI	4- to 3-lane
	pedestrian	urban	3-lane arterial	78 (2012)	—	3 yrs./3 yrs.	not specified	0.59	—	—	MI	4- to 3-lane
Surface Treatments and Markings												
Transverse Rumble Strips—raised or grooved patterns installed on the roadway travel lane or shoulder pavements perpendicular to the direction of travel	roadway departure	urban/ suburban	local	69 (2004)	—	—	all	0.66	★★★★	—	—	
	roadway departure	urban/ suburban	local	69 (2004)	—	—	serious/ minor	0.64	★★★★	—	—	
	roadway departure	urban/ suburban	local	69 (2004)	—	—	PDO	0.73	★★	—	—	
	roadway departure	rural	minor arterial at stop control	81 (2010)	—	—	all	1.2	★★★★	—	MN, IA	
	roadway departure	rural	major collector at stop control	81 (2010)	—	—	all	0.67 to 1.4	★★★	—	MN, IA	
	roadway departure	rural	major collector at stop control	81 (2010)	—	—	fatal/serious/ minor	0.91	★★★★	—	MN, IA	
	roadway departure	rural	major collector at stop control	81 (2010)	—	—	fatal/serious	0.75	★★★★	—	MN, IA	

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(*cont'd*) **Transverse Rumble Strips**—raised or grooved patterns installed on the roadway travel lane or shoulder pavements perpendicular to the direction of travel	roadway departure	rural	major collector at stop control	81 (2010)	—	—	PDO	1.20	★★★★	—	MN, IA	
	pedestrian	rural	low-volume	82 (2011)	—	—	all	0.76	★★★	—	China	at pedestrian crosswalk
	roadway departure	rural	curve	69 (2004)	—	—	ROR serious/minor	0.94	★★	—	—	with RPMs
	roadway departure	rural	—	83 (1986)	—	—	all	0.47	★★	—	KY	with RPMs
	roadway departure	rural	—	83 (1986)	—	—	wet road	0.51	★	—	KY	with RPMs
	roadway departure	rural	—	83 (1986)	—	—	nighttime	0.36	★	—	KY	with RPMs
	roadway departure	rural	—	83 (1986)	—	—	all	1.10	★	—	KY	with RPMs + transverse markings
	roadway departure	rural	—	83 (1986)	—	—	wet road	0.91	★	—	KY	with RPMs + transverse markings
	roadway departure	rural	—	83 (1986)	—	—	nighttime	0.83	★	—	KY	with RPMs + transverse markings
Transverse Markings—pavement markings placed across the lane perpendicular to direction of travel	roadway departure	rural	freeway to freeway connector	36 (2003)	1	2 yrs./2 yrs.	—	—	—	-48%	WI	converging chevrons
	roadway departure	urban	—	84 (1996)	—	—	all	0.68	★★★	—	—	converging chevrons
	roadway departure	no crash studies found for optical speed bars, herringbone, dragon's teeth, or transverse bars										
Pavement Marking Legends—speed limit or other on-pavement signing	roadway departure	no crash studies found for any type of pavement marking legends										
In-roadway Warning Lights	roadway departure	rural	interstate (4-lane)	45 (1977)	1	9 mon/9 mon	crashes under foggy conditions	—	—	-75%	VA	
Vertical Delineation												
Vertical Treatments—vertical objects such as post mounted delineators which are placed along the roadway to provide better delineation and/or provide a feeling of friction	roadway departure	rural	curve	85 (2006)	—	—	ROR	—	—	-15%	OH	post mounted delineator
	roadway departure	rural	—	69 (2004)	—	—	injury	1.04	—	—	—	post mounted delineator
	roadway departure	rural	curve	86 (2008); 87 (2005)	—	—	total	0.70 to 0.80	—	—	—	post mounted delineator
	roadway departure	rural	curve (4-lane)	88 (2009)	4	—	total	—	—	-47%	Italy	sequential flashing beacons + chevrons + curve warning signs

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(*cont'd*) **Vertical Treatments**—vertical objects such as post mounted delineators which are placed along the roadway to provide better delineation and/or provide a feeling of friction	roadway departure	rural	curve (4-lane)	88 (2009)	4	—	nighttime	—	—	-76%	Italy	sequential flashing beacons + chevrons + curve warning signs
	roadway departure	rural	curve (4-lane)	88 (2009)	4	—	ROR	—	—	-47%	Italy	sequential flashing beacons + chevrons + curve warning signs
	roadway departure	rural	curve (4-lane)	88 (2009)	4	—	rainy	—	—	-42%	Italy	sequential flashing beacons + chevrons + curve warning signs
	roadway departure	rural	curve (4-lane)	88 (2009)	4	—	injury	—	—	-37%	Italy	sequential flashing beacons + chevrons + curve warning signs
	roadway departure	no crash studies found for reflective post treatment, streaming PMDs										
Landscaping—roadside plantings used to create vertical friction	roadway departure	urban	collector	48 (2000)	1	31 mon/17 mon	all	no change	—	—	—	landscaped median and curbside islands
Gateway Entrance Treatments												
Gateway Treatment—placed at community entrance to remind drivers of changing roadway character	pedestrian	rural	community entrance	89 (2009)	7	3-9 yrs./2-7 yrs.	—	—	—	-2% & -32%	CA	3400 to 27500 vpd gateway monument
	pedestrian	no crash studies found for pavement marking gateways or combination of entrance treatments										
Dynamic Signing												
Dynamic Speed Feed-back Signs—displays message for drivers traveling over the threshold speed	roadway departure	rural	curve (2-lane)	59 (2002)	2	—	injury	—	—	-54 to -100%	United Kingdom	"SLOW DOWN" + curve warning
	roadway departure	rural	interstate	61 (2000)	5	5-yrs./6-mon	all	—	—	-2%	CA	"50 MPH CURVES" + "YOUR SPEED XX"
	roadway departure	rural	curve (2-lane)	57 (2013)	22	3-yrs./ 2-yrs.	all	0.93 to 0.95	—	—	IA, FL, WA, AZ, OR, OH, TX	"YOUR SPEED XX" + curve advisory sign
	roadway departure	rural	curve (2-lane)	57 (2013)	22	3-yrs./ 2-yrs.	single vehicle	0.95	—	—	IA, FL, WA, AZ, OR, OH, TX	"YOUR SPEED XX" + curve advisory sign
	roadway departure	no crash studies found for flashing beacons										

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Intersection Treatments												
Roundabout—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse	intersection	—	—	90 (1994)	181	—	injury	0.35	★★	—	Nether-lands	
	intersection	—	—	90 (1994)	181	—	PDO	0.58	★★	—	Nether-lands	
	intersection	all	—	90 (1994)	181	—	vehicle/ped	0.27	★	—	Nether-lands	
	intersection	all	—	90 (1994)	181	—	vehicle/ped	0.27	★	—	Nether-lands	
	intersection	all	urban/ rural	91 (2013)	13	3 yrs./3 yrs.	fatal/injury	0.47	★★★★	—	WI	low speed roundabout
	intersection	all	urban/ rural	91 (2013)	11	3 yrs./3 yrs.	all	0.66	★★★★	—	WI	high speed roundabout
	intersection	all	urban/ rural	91 (2013)	11	3 yrs./3 yrs.	fatal/injury	0.51	★★★	—	WI	high speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	all	0.33	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	injury	0.13	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	fatal/injury	0.11	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	angle	0.17	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	rear-end	0.85	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	injury angle	0.09	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	sideswipe	2.79	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	fixed object	4.66	★★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	frontal/ opposing direction/ sideswipe	2.40	★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout
	intersection	rural	rural	92 (2012)	19	98 data yrs./98 data yrs.	rear-end injury	0.54	★★	—	MD, WA, KS, WI, MN, OR	high-speed roundabout

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(*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse	intersection	all	urban/ rural	91 (2013)	13	3 yrs./ 3 yrs.	all	1.10	★★★★	—	WI	low speed roundabout
	intersection	rural	one-way stop	92 (2012)	2	98 data yrs./98 data yrs.	all	0.74	★★★	—	OR, KS	3-leg to roundabout
	intersection	rural	one-way stop	92 (2012)	2	98 data yrs./98 data yrs.	injury	0.28	★★★	—	OR, KS	3-leg to roundabout
	intersection	all	urban/ rural	91 (2013)	2	3 yrs./3 yrs.	all	1.24	★★★	—	WI	no control/yield to roundabout
	intersection	all	urban/ rural	91 (2013)	12	3 yrs./3 yrs.	all	1.10	★★★★	—	WI	multi-lane roundabout
	intersection	all	urban/ rural	91 (2013)	12	3 yrs./3 yrs.	fatal/injury	0.37	★★★★	—	WI	multi-lane roundabout
	intersection	all	urban/ rural	91 (2013)	12	3 yrs./3 yrs.	all	0.64	★★★★	—	WI	single-lane roundabout
	intersection	all	urban/ rural	91 (2013)	12	3 yrs./3 yrs.	fatal/injury	0.82	★★★	—	WI	single-lane roundabout
	intersection	urban	—	93 (2001)	9	2 to 5 yrs./1.3 to 5.3 yrs.	all	0.95	★★★	—	CO, FL, KS, ME, MD, SC, VT	stop-control to multi-lane roundabout
	intersection	urban	—	93 (2001)	14	2 to 5 yrs./1.3 to 5.3 yrs.	all	0.28	★★★★	—	CO, FL, KS, ME, MD, SC, VT	stop-control to single-lane roundabout
	intersection	urban	—	93 (2001)	14	2 to 5 yrs./1.3 to 5.3 yrs.	injury	0.12	★★★★	—	CO, FL, KS, ME, MD, SC, VT	stop-control to single-lane roundabout
	intersection	urban	—	93 (2001)	14	2 to 5 yrs./1.3 to 5.3 yrs.	all	0.42	★★★★	—	CO, FL, KS, ME, MD, SC, VT	stop-control to single-lane roundabout
	intersection	urban	—	93 (2001)	14	2 to 5 yrs./1.3 to 5.3 yrs.	injury	0.18	★★★★	—	CO, FL, KS, ME, MD, SC, VT	stop-control to single-lane roundabout
	intersection	all	urban/ rural	91 (2013)	5	3 yrs./3 yrs.	all	1.11	★★★★	—	WI	all-way stop-control to roundabout
	intersection	all	urban/ rural	91 (2013)	5	3 yrs./3 yrs.	fatal/injury	0.54	★★★	—	WI	all-way stop-control to roundabout
	intersection	all	all	94 (2007)	10	3.7 yrs./3.3 yrs.	all	1.03	★★★	—	FL, MS, MO, NV, OR, WA	all-way stop-control to roundabout
	intersection	all	urban/ rural	91 (2013)	12	3 yrs./3 yrs.	all	0.75	★★★★	—	WI	two-way stop-control to roundabout

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	Intersection	all	multi-lane/ single-lane	94 (2007)	36	3.7 yrs./3.3 yrs.	all	0.56	★★★★★	—	CO, FL, KS, MD, ME, NV, OR, VT, WA, WI	minor stop-control to roundabout
	intersection	all	multi-lane/ single-lane	94 (2007)	36	3.7 yrs./3.3 yrs.	injury	0.18	★★★★★	—	CO, FL, KS, MD, ME, NV, OR, VT, WA, WI	minor stop-control to roundabout
	intersection	rural	single-lane	94 (2007)	9	3.7 yrs./3.3 yrs.	all	0.29	★★★★	—	KS; MD	minor stop-control to roundabout
	intersection	rural	single-lane	94 (2007)	9	3.7 yrs./3.3 yrs.	injury	0.13	★★★★	—	KS; MD	minor stop-control to roundabout
	intersection	urban	multi-lane/ single-lane	94 (2007)	17	3.7 yrs./3.3 yrs.	all	0.61 to 0.88	★★★★	—	FL, KS, MD, ME, NV, OR, VT, WA, WI	minor stop-control to roundabout
	intersection	urban	multi-lane/ single-lane	94 (2007)	17	3.7 yrs./3.3 yrs.	injury	0.19 to 0.22	★★★★	—	FL, KS, MD, ME, NV, OR, VT, WA, WI	minor stop-control to roundabout
	intersection	subur-ban	multi-lane/ single-lane	94 (2007)	10	3.7 yrs./3.3 yrs.	all	0.22 to 0.81	★★★★	—	CO, KS, MD, WA	minor stop-control to roundabout
	intersection	subur-ban	multi-lane/ single-lane	94 (2007)	10	3.7 yrs./3.3 yrs.	injury	0.22 to 0.29	★★★★	—	CO, KS, MD, WA	minor stop-control to roundabout
	intersection	—	—	95 (2007)	62	3 yrs./1 yrs.	injury	0.56	★★★★	—	Belgium	unsignalized to roundabout
	intersection	—	—	95 (2007)	62	3 yrs./1 yrs.	minor injury	0.54	★★★★	—	Belgium	unsignalized to roundabout
	intersection	—	—	95 (2007)	62	3 yrs./1 yrs.	serious injury	0.80	★★★★	—	Belgium	unsignalized to roundabout
	intersection	urban/ subur-ban	2-lane urban/sub-urban	96 (2013)	16	3.9 yrs./3.1 yrs.	all	0.81	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to 2-lane roundabout
	intersection	urban/ subur-ban	2-lane urban/ suburban	96 (2013)	16	3.9 yrs./3.1 yrs.	injury	0.29	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to 2-lane roundabout

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(*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse	intersection	urban/ suburban	1-lane urban/ suburban	96 (2013)	12	3.9 yrs./3.1 yrs.	all	0.74	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to single-lane roundabout
	intersection	all	urban/ rural	91 (2013)	5	3 yrs./3 yrs.	all	0.96	★★★	—	WI	signalized to single- or multi-lane roundabout
	intersection	urban	urban/ rural	91 (2013)	5	3 yrs./3 yrs.	all	0.65	★★★	—	WI	signalized to single- or multi-lane roundabout
	intersection	urban	urban/ rural	91 (2013)	5	3 yrs./3 yrs.	injury	0.26	★★★	—	WI	signalized to single- or multi-lane roundabout
	intersection	urban/ suburban	2-lane/1-lane	96 (2013)	28	3.9 yrs./3.1 yrs.	injury	0.45	★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to single- or multi-lane roundabout
	intersection	all	urban/ rural	91 (2013)	5	3 yrs./3 yrs.	fatal/injury	0.35	★★★	—	WI	signalized to single- or multi-lane roundabout
	intersection	—	—	95 (2007)	33	3 yrs./1 yrs.	injury	0.68	★★★★	—	Belgium	signalized to roundabout
	intersection	—	—	95 (2007)	33	3 yrs./1 yrs.	major injury	0.87	★★★	—	Belgium	signalized to roundabout
	intersection	—	—	95 (2007)	33	3 yrs./1 yrs.	minor injury	0.69	★★★	—	Belgium	signalized to roundabout
	intersection	all	2-lane/1-lane: (urban/ suburban)	96 (2013)	28	3.9 yrs./3.1 yrs.	all	0.52	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	all	2-lane/1-lane: (urban/ suburban)	96 (2013)	28	3.9 yrs./3.1 yrs.	injury	0.22	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	urban/ suburban	2-lane/1-lane	96 (2012); 94 (2007); 97 (2011)	13/5/13	3.9 yrs./3.1 yrs.	all	0.99 to 1.15	★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	urban	multi-lane/ single-lane	94 (2007)	5	3.7 yrs./ 3.3 yrs.	injury	0.40	★★★★	—	FL, MD, MI, SC	signalized to roundabout

Category	Safety Focus	Area	Roadway	Reference	Sites	Study Period (before/after)	Crash Type	CMF	CMF Clearinghouse Star Rating	Crash Reduction	Location	Notes
(*cont'd*) **Roundabout**—large, raised, circular islands at the middle of major intersections, around which all oncoming vehicles must traverse	intersection	urban	2-lane/ 1-lane: (urban)	96 (2013)	13	3.9 yrs./3.1 yrs.	injury	0.45	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	urban	urban	97 (2011)	13	3.9 yrs./3.1 yrs.	fatal/injury	0.44	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	urban/ suburban	2-lane/ 1-lane	96 (2012); 97 (2011)	28/ 28	3.9 yrs./3.1 yrs.	injury	0.34 to 0.37	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	urban/ suburban	2-lane/ 1-lane	96 (2012)	28	3.9 yrs./3.1 yrs.	fatal/injury	0.28 to 0.45	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	suburban	multi-lane/ 2-lane/ 1-lane/ suburban (2-lane: 8, 1-lane: 7)	94 (2007); 96 (2013); 97 (2011)	4/ 15/ 15	3.7 yrs./ 3.3 yrs.	all	0.33 to 0.58	★★★★	—	CO and VT/ CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	suburban	2-lane/ 1-lane	96 (2013)	15	3.9 yrs./3.1 yrs.	injury	0.26	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	suburban	suburban	97 (2011)	15	3.9 yrs./3.1 yrs.	fatal/injury	0.26	★★★★	—	CO, FL, IN, MD, MI, NY, NC, SC, VT, WA	signalized to roundabout
	intersection	rural	inter-change off ramp/on ramp	98 (2012)	1	30 mon/ 6 mon	all	0.63	★★★	—	MS	signalized to roundabout
	intersection	rural	inter-change off ramp/on ramp	98 (2012)	1	30 mon/ 6 mon	injury	0.40	★★★	—	MS	signalized to roundabout

Category	Safety Focus	Area	Roadway	Reference	Sites	Study Period (before/after)	Crash Type	CMF	CMF Clearinghouse Star Rating	Crash Reduction	Location	Notes
Signing												
Chevron Signs—use of standard chevron signing	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009)	15	—	all crashes	0.59	★★★	—	Italy	with curve warning sign
	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009)	15	—	ROR crashes	0.56	★★★	—	Italy	with curve warning sign
	roadway departure	rural	2-lane	88 (2009)	15	—	fatal/serious injury/mi-nor injury	1.46	★★★	—	Italy	with curve warning sign
	roadway departure	rural	2-lane	88 (2009)	15	—	nighttime	0.66	★★★	—	Italy	with curve warning sign
	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009); 99 (2009)	—	—	all crashes on	0.63 to 1.27	★★★	—	CA, WA; Italy	
	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009); 99 (2009)	—	—	ROR crashes	0.9	★★★	—	CA, WA; Italy	
	roadway departure	rural	on principal arterial/ freeways/ express-ways	88 (2009); 99 (2009)	—	—	property damage	0.83	★★★	—	CA, WA; Italy	
	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009); 99 (2009)	—	—	fatal and in-jury crashes	1.46	★★★	—	CA, WA; Italy	
	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009); 99 (2009)	—	—	nighttime	1.92	★★★	—	CA, WA; Italy	
	roadway departure	rural	principal arterial/ freeways/ express-ways	88 (2009); 99 (2009)	—	—	wet road crashes on	0.41	★★★	—	CA, WA; Italy	

Category	Safety Focus	Area	Roadway	Reference	Sites	Study Period (before/after)	Crash Type	CMF	CMF Clearinghouse Star Rating	Crash Reduction	Location	Notes
(*cont'd*) **Chevron Signs**—use of standard chevron signing	roadway departure	rural	2-lane	88 (2009); 99 (2009)	—	—	all crashes	0.96	★★★	—	CA, WA; Italy	
	roadway departure	rural	2-lane	88 (2009); 99 (2009)	—	—	head-on/ sideswipe	0.94	★★★	—	CA, WA; Italy	
	roadway departure	rural	2-lane	88 (2009); 99 (2009)	—	—	fatal and injury	0.84	★★★	—	CA, WA; Italy	
	roadway departure	rural	2-lane	88 (2009); 99 (2009)	—	—	nighttime	0.75	★★★	—	CA, WA; Italy	
	roadway departure	rural	2-lane	88 (2009); 99 (2009)	—	—	nighttime head-on/ sideswipe	0.78	★★★	—	CA, WA; Italy	
Access Control												
Closure/Diversions—road closings or diversion of traffic	roadway departure	no crash studies found for half-closure										
	roadway departure	no crash studies found for diagonal diverters										
	roadway departure	no crash studies found for full closure										

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The crash modification factor warehouse can be accessed at: http://www.cmfclearinghouse.org

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Abbreviations

common state destinations are used and are not listed here (e.g. Iowa = IA)
advisory (adv)
intersection (isect)
month (mon.)
pedestrian (ped)
post mounted delineator (PMD)
rumble strips (RS)
run off road (ROR)
years (yrs.)

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