

Section 1 – Prioritized Low-Cost Improvements for Evaluation

From the 24 returned TAC ballots, 132 “low-cost” improvements were identified. To help summarize the results, VHB assigned a category to each strategy that best described its focus area. (In several instances, an improvement was also assigned a second category, which yielded a total of 140 categorized strategies.) The three most frequently-identified categories were *traffic signals*, *pedestrians and bicyclists*, and *pavement markings*, respectively. A summary of the improvements by category is presented in Table 1. The results of the weighted scoring for low-cost improvements are provided in appendix A.

Table 1. General summary of balloted low-cost improvements by category.

Category	Number of strategies
Traffic signals	22
Pedestrians and bicyclists	20
Pavement markings	15
Intersection geometry / alternative intersection	10
Intersection warning	10
Roadside	9
Curves	8
Rumble strips / stripes	7
Speed management	7
Pavement / roadway	5
Stop control	5
Access management	4
Highway lighting	3
Weather	3
Wrong way	3
Automated enforcement	2
Lane designation	2
LED-bordered signs	2
Work zones	2
Intersection sight distance	1
TOTAL	140

Tables 2 through 21 present details for each improvement category, including the specific type of safety treatment, the number of times it appeared on the ballots, and on which State ballots it appeared. If a State is listed in **bold**, then this improvement was identified at the top of the State’s low-cost ballot. As an example, Table 2 indicates that three States (Ohio, Oklahoma, and Wisconsin) identified *signal timing* as a priority, with this being the top low-cost priority for Ohio.

Table 2. Itemization of balloted low-cost traffic signals improvements.

Traffic signals		States
Flashing yellow arrow signal	9	
FYA - general	5	IL, MA, MO, OH, SC
FYA - at previously protected-only LT sites	1	WI
FYA - phasing	1	MA
FYA - RT turn	1	SD
FYA - time-dependent applications	1	MN
Enhanced visibility of signal heads (backplates and/or LED indicators)	4	IN, OH, SC, WI
Signal timing	3	OH, OK, WI
Signal coordination	1	OH
Install street name signs on mast arms	1	WI
Install systemic low-cost multiple improvements	1	PA
Install or upgrade traffic or pedestrian signals	1	FL
Signal preemption for emergency vehicles	1	AZ
Use of double red indications on traffic signals	1	KY
TOTAL	22	

Table 3. Itemization of balloted low-cost pedestrians and bicyclists improvements.

Pedestrians and bicyclists		States
Motorist alert systems	9	
Pedestrian hybrid signal (HAWK)	3	CA, MO, NY
Rectangular rapid flashing beacons (RRFB)	3	CA, MO, NY
General	1	FL
RRFB - at ramp termini	1	UT
RRFB - at roundabouts and midblock crossings	1	WI
Signs and markings	4	CA, FL, KY, PA
Lighting/illumination at crossings	2	AZ, FL
Pedestrian signals (including countdown heads)	3	FL, MO, NY
Bike lanes in urban areas	1	MA
Bike crashes at locations w/ edgeline rumble strips	1	MS
TOTAL	20	

Table 4. Itemization of balloted low-cost pavement markings improvements.

Pavement markings		States
Wider striping	6	
6" centerline and edgelines (possibly on low-volume roads)	4	CA, IL, OH, VA
6" edgelines on low-volume roads	1	KS
6" or 8" edgeline on horizontal curves	1	CT
Wet reflective beads / paint	3	KY, MO, NY
Speed reduction markings	1	CT
Dashed markings across median openings	1	FL
Yield bars and symbols in median at expressway minor stop intersections.	1	IL
Shadow striping on concrete	1	CA
Larger synthetic beads in pavement marking for rumble stripes	1	IL
Use of edgeline markings only	1	KY
TOTAL	15	

Table 5. Itemization of balloted low-cost intersection geometry/alternative intersection improvements.

Intersection geometry / alternative intersection		States
Offset turn lanes	4	
General	2	IN, SC
Left- and right-turn lanes at unsig. intersections	1	PA
Right-turn lanes	1	IL
J-turns	2	PA, SC
Mini roundabouts	2	PA, SC
Impacts of channelized right-turn lane on traffic control selection	1	WI
Impacts of approach angle and island design on crashes	1	IL
TOTAL	10	

Table 6. Itemization of balloted low-cost intersection warning improvements.

Intersection warning		States
Active warning / dynamic signing	7	IN, MO, OK, PA, SC, UT, WI
Provide speed reference point for side-road drivers	1	VA
Enhanced delineation and signing	1	FL
Sign post reflectorization (e.g., on STOP signs)	1	TN
TOTAL	10	

Table 7. Itemization of balloted low-cost roadside improvements.

Roadside		States
Delineation	6	
<i>Barrier delineation</i>	3	NC, TN, WI
<i>Roadside delineation</i>	2	IL, VA
<i>Delineation of fixed objects w/in clear zone (e.g., signal poles, trees, etc.)</i>	1	WI
Removal of objects	2	KS, OH
Guardrail upgrades	1	WI
TOTAL	9	

Table 8. Itemization of balloted low-cost curves improvements.

Curves		States
Innovative approaches (beyond chevrons)	4	
<i>General</i>	2	MO, PA
<i>Dynamic warning systems</i>	1	PA
<i>In-pavement lighting</i>	1	MA
Signing	3	IL, IN, WI
6" or 8" edgeline pavement markings	1	CT
TOTAL	8	

Table 9. Itemization of balloted low-cost rumble strips/stripes improvements.

Rumble strips / stripes		States
Centerline and edgeline rumble strips	2	MO, NY
Edgeline rumble strips on roads with narrow or no shoulders	2	KS, KY
Centerline rumble strips	1	IN
Evaluation of bicycle crashes at locations having edgeline rumble strips	1	MS
Larger synthetic beads in pavement marking for rumble stripes	1	IL
TOTAL	7	

Table 10. Itemization of balloted low-cost speed management improvements.

Speed management		States
Driver feedback signs	4	CA, KS, PA, WI
Speed reduction markings	1	CT
Variable speed limit signs	1	SC
Traffic calming	1	WI
TOTAL	7	

Table 11. Itemization of balloted low-cost pavement/roadway improvements.

Pavement / roadway		States
Safety Edge	3	
<i>General</i>	2	OH, PA
<i>As an add-on (not part of a complete overlay)</i>	1	KS
Surface friction	2	
<i>General</i>	1	IN
<i>Evaluation of chip seal / DBST</i>	1	MS
TOTAL	5	

Table 9. Itemization of balloted low-cost stop control improvements.

Stop control		States
Systemic low-cost signing and marking improvements	2	IN, PA
Concrete island with stop signs	1	NC
LED flashing stop signs	1	WI
Replace red/amber flashing overhead beacon with flashing red beacons on stop signs	1	OK
TOTAL	5	

Table 10. Itemization of balloted low-cost access management improvements.

Access management		States
Eliminate / reduce turning movements by signing	2	CT, FL
General access management solutions	2	SC, WI
TOTAL	4	

Table 11. Itemization of balloted low-cost highway lighting improvements.

Highway lighting		States
Warrants for lighting for safety purposes	1	MS
Rural intersection lighting	1	KS
Effects of removing highway lighting	1	NY
TOTAL	3	

Table 12. Itemization of balloted low-cost weather-related improvements.

Weather-related		States
Icy Bridge signs w/ flasher tied to air temperature	1	MT
Sensor-activated salt dispensers	1	WI
GPS device to keep snowplows on pavement	1	WI
TOTAL	3	

Table 13. Itemization of balloted low-cost wrong way improvements.

Wrong way		States
Wrong way detection and warning systems	1	MO
Wrong way driving on ramps to interstates	1	IL
Wrong way crash countermeasures (on controlled-access highways)	1	NY
TOTAL	3	

Table 14. Itemization of balloted low-cost automated enforcement improvements.

Automated enforcement		States
Automated enforcement	2	FL, MO
TOTAL	2	

Table 15. Itemization of balloted low-cost lane designation improvements.

Lane designation		States
Provide lane assignment signing or marking at complex intersections	1	FL
Advanced overhead lane use signs	1	OH
TOTAL	2	

Table 19. Itemization of balloted low-cost LED-bordered signs improvements.

LED-bordered signs		States
Flashing LED-bordered signs	2	
<i>General</i>	1	OK
<i>Stop signs</i>	1	WI
TOTAL	2	

Table 20. Itemization of balloted low-cost work zones improvements.

Work zones		States
Enhance enforcement of traffic laws in work zones	1	MA
Work zone safety improvements	1	CT
TOTAL	2	

Table 16. Itemization of balloted low-cost intersection sight distance improvements.

Intersection sight distance		States
Improve intersection sight lines for minor approach	1	IL
TOTAL	1	

Section 2 – Prioritized Higher-Cost Improvements for Evaluation

From the 24 returned TAC ballots, 54 “higher-cost” improvements were identified. The Project Team assigned a category to each strategy that best described its focus. (In two instances, a particular improvement was assigned a second category.) *Intersection geometry/alternative intersection* was the category overwhelmingly most-represented on the State higher-cost ballots. Two categories were tied for a distant second in number of listed strategies – *pavement/roadway* and *roadside*. A summary of the number of higher-cost strategies by category is presented in Table 17, and the results of the weighted scoring for higher-cost improvements are provided in appendix B.

Table 17. General summary of balloted higher-cost improvements by category.

Category	Number of strategies
Intersection geometry / alternative intersection	29
Pavement / roadway	7
Roadside	7
Highway lighting	3
Intersection warning	2
Rumble strips / stripes	2
Access management	1
Lane designation	1
Pavement markings	1
Speed management	1
Traffic signals	1
Work zones	1
TOTAL	56

Tables 23 through 34 present details for each improvement category. If a State is listed in **bold**, then this improvement was identified at the top of the State’s higher-cost ballot.

Table 18. Itemization of balloted higher-cost intersection geometry/alternative intersection improvements.

Intersection geometry / alternative intersection		States
J-turns	7	
<i>General</i>	6	MN, MO, MS, NC, SC, WI
<i>On roads with narrow medians</i>	1	IL
Offset turn lanes	4	
<i>Right-turn lane - general</i>	2	AZ, CT
<i>Left-turn lane - unsignalized intersections on divided highways</i>	1	MO
<i>Right-turn lane - unsignalized intersections on divided highways</i>	1	MO
Roundabouts	4	
<i>General</i>	3	FL, IL, IN
<i>At the termini of interchange ramps</i>	1	SC
Mini roundabouts	3	IN, OK, SC
Converting single left-turn lane to dual left-turn lanes	1	OH
Curb radius reduction	1	FL
Displaced left turn	1	SC
Diverging diamond interchanges	1	MO
Intersection realignment - general	1	NC
Median acceleration lane for left turns onto divided highways	1	OK
Median U-turn	1	SC
Offset intersections	1	WI
Right-turn lanes on high-speed divided highways	1	OK
Alternative intersection on high-speed divided roads - general	1	IN
Alternative intersection design - general	1	KY
TOTAL	29	

Table 19. Itemization of balloted higher-cost pavement/roadway improvements.

Pavement / roadway		States
Add shoulders	5	
<i>Paved, shoulder only (i.e., no overlay)</i>	1	NC
<i>Paved or rock wedge - 1'-2'</i>	1	KS
<i>Adding 2' shoulders with rumble stripes on minor roads (below principal arterials)</i>	1	MO
<i>2'-4' Paved Shoulder with 8" rumble strip on rural highways on 2 lane roadway</i>	1	IL
<i>Widen paved shoulders (from 0-1' to 2-4')</i>	1	KY
General superelevation improvements	1	NC
Flatten vertical curve	1	OH
TOTAL	7	

Table 20. Itemization of balloted higher-cost roadside improvements.

Roadside		States
Cable barrier	4	
<i>General median</i>	1	MO
<i>Narrow median (14' or less)</i>	1	OK
<i>On two-lane roads</i>	1	OK
<i>On slopes steeper than 4:1</i>	1	MS
Animal exclusion fencing	1	MT
Fill roadside ditches	1	OH
Roadside slope improvements (flatten nontraversable)	1	KY
TOTAL	7	

Table 21. Itemization of balloted higher-cost highway lighting improvements.

Highway lighting		States
Enhancing lighting on a roadway segment to obtain desired light level	1	AZ
Enhancing lighting in a roadway tunnel to obtain desired light level	1	AZ
Street Lighting at at-grade expressway intersections	1	WI
TOTAL	3	

Table 22. Itemization of balloted higher-cost intersection warning improvements.

Intersection warning		States
Active warning / dynamic signing	1	PA
Driver assist technology for rural intersections	1	WI
TOTAL	2	

Table 23. Itemization of balloted higher-cost rumble strips/stripes improvements.

Rumble strips / stripes		States
Rumble strips	2	
<i>Adding 2' shoulders with rumble stripes on minor roads (below principal arterials)</i>	1	MO
<i>2'-4' Paved Shoulder with 8" rumble strip on rural highways on 2 lane roadway</i>	1	IL
TOTAL	2	

Table 24. Itemization of balloted higher-cost access management improvements.

Access management		States
General access management	1	IN
TOTAL	1	

Table 25. Itemization of balloted higher-cost lane designation improvements.

Lane designation		States
Alternating passing zones (i.e., "shared four-lanes")	1	MO
TOTAL	1	

Table 26. Itemization of balloted higher-cost pavement markings improvements.

Pavement markings		States
Impacts of retroreflectivity degradation over time on crashes	1	NC
TOTAL	1	

Table 27. Itemization of balloted higher-cost speed management improvements.

Speed management		States
Variable speed limit signs	1	WI
TOTAL	1	

Table 28. Itemization of balloted higher-cost traffic signals improvements.

Traffic signals		States
Remove unwarranted signal	1	OH
TOTAL	1	

Table 29. Itemization of balloted higher-cost work zones improvements.

Work zones		States
Using ITS applications to increase safety of work zones	1	MA
TOTAL	1	

Appendix A—Weighted Results for Section 1 (Low-Cost Improvements)

Each low-cost strategy identified on a ballot was assigned an improvement category. The prioritized low-cost strategies submitted by each State were combined and given scores based on their prioritized rank – ten points for the first priority, nine points for the second, eight for the third, and so on. For States submitting more than 10 low-cost strategies, one point was assigned to the tenth and higher. Total scores for each category and strategy were calculated, as well as the number of ballots on which each strategy appeared. Tables 35 and 36 present the ranking of the 20 low-cost improvement categories by *total score* and *number of ballots*, respectively.

Table 30. Category ranking of low-cost improvements by weighted score.

Rank	Improvement Category	Number of Ballots	Total Score
1	Pedestrians and bicycles	20	160
2	Traffic signals	22	159
3	Pavement markings	15	105
4	Intersection warning	10	80
5	Speed management	7	59
6	Roadside	9	55
6	Rumble strips / stripes	7	55
8	Intersection geometry / alternative intersection	10	47
9	Curves	8	46
9	Stop control	5	46
11	Pavement / roadway	5	35
12	Access management	4	21
13	Highway lighting	3	20
14	Wrong way	3	15
15	Flashing LED-bordered signs	2	14
16	Work zones	2	13
17	Weather-related	3	12
18	Intersection sight distance	1	10
19	Lane designation	2	7
20	Automated enforcement	2	5

Table 31. Category ranking of low-cost improvements by number of ballots.

Rank	Improvement Category	Number of Ballots	Total Score
1	Traffic signals	22	159
2	Pedestrians and bicycles	20	160
3	Pavement markings	15	105
4	Intersection warning	10	80
4	Intersection geometry / alternative intersection	10	47
6	Roadside	9	55
7	Curves	8	46
8	Speed management	7	59
8	Rumble strips / stripes	7	55
10	Stop control	5	46
10	Pavement / roadway	5	35
12	Access management	4	21
13	Highway lighting	3	20
13	Wrong way	3	15
13	Weather-related	3	12
16	Flashing LED-bordered signs	2	14
16	Work zones	2	13
16	Lane designation	2	7
16	Automated enforcement	2	5
20	Intersection sight distance	1	10

By grouping similar safety strategies together, the list of 140 low-cost strategies was compressed to 52, and these are ranked by **total score** and **number of ballots**, in Tables 37 and 38, respectively. The top four strategies by both total score and number of ballots were (1) *motorist alert systems (e.g., HAWK and RRFB)*, (2) *flashing yellow arrow signals*, (3) *active warning/dynamic signing intersection warning*, and (4) *centerline and/or edgeline rumble strips*, respectively.

Table 32. Strategy ranking of low-cost improvements by weighted score.

Rank	Strategy	Category	Number of Ballots	Total Score
1	Motorist alert systems (HAWK, RRFB, etc.)	Pedestrians and bicyclists	9	67
2	Flashing yellow arrow signal	Traffic signals	9	56
2	Active warning / dynamic signing	Intersection warning	7	56
4	Centerline and/or edgeline rumble strips	Rumble strips / stripes	7	55
5	Wider striping	Pavement markings	6	47
6	Delineation	Roadside	6	39
7	Signs and markings	Pedestrians and bicyclists	4	36
8	Signal timing / coordination	Traffic signals	4	35
9	Driver feedback signs	Speed management	4	32
10	Enhanced visibility of signal heads (backplates and/or LED indicators)	Traffic signals	4	28
11	Offset turn lanes	Intersection geometry / alternative intersection	4	25
12	Access management solutions	Access management	4	21
12	Innovative approaches (beyond chevrons)	Curves	4	21
12	Reflective beads in paint	Pavement markings	4	21
12	Safety Edge	Pavement / roadway	3	21
12	Pedestrian signals (including countdown heads)	Pedestrians and bicyclists	3	21
17	Highway lighting	Highway lighting	3	20
18	Systemic low-cost signing and marking improvements	Stop control	2	19
19	Lighting/illumination at crossings	Pedestrians and bicyclists	2	18
20	Signing	Curves	3	15
20	Wrong way safety improvements	Wrong way	3	15
20	Enhanced delineation and signing	Intersection warning	2	15

Table 37. Strategy ranking of low-cost improvements by weighted score (cont.).

Rank	Strategy	Category	Number of Ballots	Total Score
23	Flashing LED-bordered signs	Flashing LED-bordered signs	2	14
23	Surface friction	Pavement / roadway	2	14
25	Work zone safety improvements	Work zones	2	13
26	Weather-based ITS	Weather-related	3	12
26	Safety impacts of design of right-turn channelization	Intersection geometry / alternative intersection	2	12
26	Removal of objects	Roadside	2	12
29	Alternative intersections (J-turns, mini roundabouts)	Intersection geometry / alternative intersection	4	10
29	Striping at median openings	Pavement markings	2	10
29	6" or 8" edgeline pavement markings	Curves	1	10
29	Improve intersection sight lines for minor approach	Intersection sight distance	1	10
29	Speed reduction markings	Pavement markings	1	10
29	Bike lanes in urban areas	Pedestrians and bicyclists	1	10
29	Traffic calming	Speed management	1	10
29	Concrete island with stop signs	Stop control	1	10
29	Replace red/amber flashing overhead beacon with flashing red beacons on stop signs	Stop control	1	10
29	Use of double red indications on traffic signals	Traffic signals	1	10
29	Install systemic low-cost multiple improvements	Traffic signals	1	10
29	Install or upgrade traffic or pedestrian signals	Traffic signals	1	10

Table 37. Strategy ranking of low-cost improvements by weighted score (cont.).

Rank	Strategy	Category	Number of Ballots	Total Score
41	Provide speed reference point for side-road drivers	Intersection warning	1	9
41	Use of edgeline markings only	Pavement markings	1	9
41	Speed reduction markings	Speed management	1	9
41	Signal preemption for emergency vehicles	Traffic signals	1	9
45	Shadow striping on concrete	Pavement markings	1	8
45	Impacts of edgeline rumble strips on bicycle crashes	Pedestrians and bicyclists	1	8
45	Variable speed limit signs	Speed management	1	8
48	Signing and markings	Lane designation	2	7
48	LED flashing stop signs	Stop control	1	7
50	Automated enforcement	Automated enforcement	2	5
51	Guardrail upgrades	Roadside	1	4
52	Install street name signs on mast arms	Traffic signals	1	1

Table 33. Strategy ranking of low-cost improvements by number of ballots.

Rank	Strategy	Category	Number of Ballots	Total Score
1	Motorist alert systems (HAWK, RRFB, etc.)	Pedestrians and bicyclists	9	67
1	Flashing yellow arrow signal	Traffic signals	9	56
3	Active warning / dynamic signing	Intersection warning	7	56
3	Centerline and/or edgeline rumble strips	Rumble strips / stripes	7	55
5	Wider striping	Pavement markings	6	47
5	Delineation	Roadside	6	39
7	Signs and markings	Pedestrians and bicyclists	4	36
7	Signal timing / coordination	Traffic signals	4	35
7	Driver feedback signs	Speed management	4	32
7	Enhanced visibility of signal heads (backplates and/or LED indicators)	Traffic signals	4	28
7	Offset turn lanes	Intersection geometry / alternative intersection	4	25
7	Access management solutions	Access management	4	21
7	Innovative approaches (beyond chevrons)	Curves	4	21
7	Reflective beads in paint	Pavement markings	4	21
7	Alternative intersections (J-turns, mini roundabouts)	Intersection geometry / alternative intersection	4	10
16	Safety Edge	Pavement / roadway	3	21
16	Pedestrian signals (including countdown heads)	Pedestrians and bicyclists	3	21
16	Highway lighting	Highway lighting	3	20
16	Signing	Curves	3	15
16	Wrong way safety improvements	Wrong way	3	15
16	Weather-based ITS	Weather-related	3	12

Table 38. Strategy ranking of low-cost improvements by number of ballots (cont.).

Rank	Strategy	Category	Number of Ballots	Total Score
22	Systemic low-cost signing and marking improvements	Stop control	2	19
22	Lighting/illumination at crossings	Pedestrians and bicyclists	2	18
22	Enhanced delineation and signing	Intersection warning	2	15
22	Flashing LED-bordered signs	Flashing LED-bordered signs	2	14
22	Surface friction	Pavement / roadway	2	14
22	Work zone safety improvements	Work zones	2	13
22	Safety impacts of design of right-turn channelization	Intersection geometry / alternative intersection	2	12
22	Removal of objects	Roadside	2	12
22	Striping at median openings	Pavement markings	2	10
22	Signing and markings	Lane designation	2	7
22	Automated enforcement	Automated enforcement	2	5

Table 38. Strategy ranking of low-cost improvements by number of ballots (cont.).

Rank	Strategy	Category	Number of Ballots	Total Score
33	6" or 8" edgeline pavement markings	Curves	1	10
33	Improve intersection sight lines for minor approach	Intersection sight distance	1	10
33	Speed reduction markings	Pavement markings	1	10
33	Bike lanes in urban areas	Pedestrians and bicyclists	1	10
33	Traffic calming	Speed management	1	10
33	Concrete island with stop signs	Stop control	1	10
33	Replace red/amber flashing overhead beacon with flashing red beacons on stop signs	Stop control	1	10
33	Use of double red indications on traffic signals	Traffic signals	1	10
33	Install systemic low-cost multiple improvements	Traffic signals	1	10
33	Install or upgrade traffic or pedestrian signals	Traffic signals	1	10
33	Provide speed reference point for side-road drivers	Intersection warning	1	9
33	Use of edgeline markings only	Pavement markings	1	9
33	Speed reduction markings	Speed management	1	9
33	Signal preemption for emergency vehicles	Traffic signals	1	9
33	Shadow striping on concrete	Pavement markings	1	8
33	Impacts of edgeline rumble strips on bicycle crashes	Pedestrians and bicyclists	1	8
33	Variable speed limit signs	Speed management	1	8
33	LED flashing stop signs	Stop control	1	7
33	Guardrail upgrades	Roadside	1	4
33	Install street name signs on mast arms	Traffic signals	1	1

Appendix B—Weighted Results for Section 2 (Higher-Cost Improvements)

Each higher-cost strategy identified on a ballot was assigned an improvement category. The prioritized higher-cost strategies submitted by each State were combined and given scores based on their prioritized rank—ten points for the first priority, nine points for the second, eight for the third, and so on. Total scores for each category and strategy were calculated, as well as the number of ballots on which each strategy appeared. Tables 39 and 40 present the ranking of the 20 low-cost improvement categories by *total weighted score* and *number of ballots*, respectively.

Table 34. Category ranking of higher-cost improvements by weighted score.

Rank	Improvement Category	Number of Ballots	Total Score
1	Intersection geometry / alternative intersection	29	237
2	Roadside	7	67
3	Pavement / roadway	7	65
4	Highway lighting	3	27
5	Intersection warning	2	18
5	Rumble strips / stripes	2	18
7	Traffic signals	1	10
7	Work zones	1	10
9	Access management	1	7
10	Pavement markings	1	6
10	Speed management	1	6
12	Lane designation	1	5

Table 35. Category ranking of higher-cost improvements by number of ballots.

Rank	Improvement Category	Number of Ballots	Total Score
1	Intersection geometry / alternative intersection	29	237
2	Roadside	7	67
2	Pavement / roadway	7	65
4	Highway lighting	3	27
5	Intersection warning	2	18
5	Rumble strips / stripes	2	18
7	Traffic signals	1	10
7	Work zones	1	10
7	Access management	1	7
7	Pavement markings	1	6
7	Speed management	1	6
7	Lane designation	1	5

By grouping similar safety strategies together, the list of 56 higher-cost strategies was compressed to 23, and these have been ranked by **total score** and **number of ballots**, respectively, in Tables 41 and 42. The top three strategies by both total score and number of ballots were (1) *intersection geometry / alternative intersection* and (2) *pavement / roadway*, and (3) *roadside*, respectively.

Table 36. Strategy ranking of higher-cost improvements by weighted score.

Rank	Strategy	Category	Number of Ballots	Total Score
1	J-turns	Intersection geometry / alternative intersection	7	65
2	Roundabouts / mini roundabouts	Intersection geometry / alternative intersection	7	56
3	Miscellaneous alternative intersection	Intersection geometry / alternative intersection	5	38
3	Add shoulders	Pavement / roadway	4	38
5	Cable barrier	Roadside	4	37
6	Offset turn lanes	Intersection geometry / alternative intersection	4	32
7	Highway lighting (segment, tunnel, at-grade high-speed intersections)	Highway lighting	3	27
8	Miscellaneous intersection modifications (non alternative)	Intersection geometry / alternative intersection	3	25
9	Active warning / driver assist technology	Intersection warning	2	18
9	Add shoulders with rumble strips	Rumble strips/stripes	2	18
11	Animal exclusion fencing	Roadside	1	10
11	Fill roadside ditches	Roadside	1	10
11	Remove unwarranted signal	Traffic signals	1	10
11	Using ITS applications to increase safety of work zones	Work zones	1	10
15	Flatten vertical curve	Pavement / roadway	1	9
15	General superelevation improvements	Pavement / roadway	1	9
17	Median acceleration lane for left turns onto divided highways	Intersection geometry / alternative intersection	1	8
18	General access management	Access management	1	7
18	Offset intersections	Intersection geometry / alternative intersection	1	7
20	Right-turn lanes on high-speed divided highways	Intersection geometry / alternative intersection	1	6
20	Impacts of retroreflectivity degradation over time on crashes	Pavement markings	1	6
20	Variable speed limit signs	Speed management	1	6
23	Alternating passing zones (i.e., "shared four-lanes")	Lane designation	1	5

Table 37. Strategy ranking of higher-cost improvements by number of ballots.

Rank	Strategy	Category	Number of Ballots	Total Score
1	J-turns	Intersection geometry / alternative intersection	7	65
1	Roundabouts / mini roundabouts	Intersection geometry / alternative intersection	7	56
3	Miscellaneous alternative intersection	Intersection geometry / alternative intersection	5	38
4	Add shoulders	Pavement / roadway	4	38
4	Cable barrier	Roadside	4	37
4	Offset turn lanes	Intersection geometry / alternative intersection	4	32
7	Highway lighting (segment, tunnel, at-grade high-speed intersections)	Highway lighting	3	27
7	Miscellaneous intersection modifications (non alternative)	Intersection geometry / alternative intersection	3	25
9	Active warning / driver assist technology	Intersection warning	2	18
9	Add shoulders with rumble strips	Rumble strips/stripes	2	18
11	Animal exclusion fencing	Roadside	1	10
11	Fill roadside ditches	Roadside	1	10
11	Remove unwarranted signal	Traffic signals	1	10
11	Using ITS applications to increase safety of work zones	Work zones	1	10
11	Flatten vertical curve	Pavement / roadway	1	9
11	General superelevation improvements	Pavement / roadway	1	9
11	Median acceleration lane for left turns onto divided highways	Intersection geometry / alternative intersection	1	8
11	General access management	Access management	1	7
11	Offset intersections	Intersection geometry / alternative intersection	1	7
11	Right-turn lanes on high-speed divided highways	Intersection geometry / alternative intersection	1	6
11	Impacts of retroreflectivity degradation over time on crashes	Pavement markings	1	6
11	Variable speed limit signs	Speed management	1	6
11	Alternating passing zones (i.e., "shared four-lanes")	Lane designation	1	5