Appendix B:
Solutions Toolbox

Greater Minnesota
MOBILITY STUDY

TOOLBOX OF SOLUTIONS

Toolbox of Solutions

Intersections

- Signal Timing Optimization
- Signal Modifications
- Add Turn Lane
- Right In/Right Out
- Three Quarter
- Acceleration/Deceleration
- Roundabout
- Restricted Crossing U-Turn (RCUT)
- Median U-Turn
- Jughandle
- Displaced Left Turn
- Offset T
- Quadrant
- Green T

Segments

- Truck Climbing Lanes
- Shoulder Widening
- Passing Lanes
- Access Management
- 4 to 3-Lane Conversion

Construction Cost Ranges

Unconstrained		Constrained	
$	= 0 to 0.5 million	$	= 0 to 0.5 million
$$	= 0.5 to 2 million	$$	= 0.5 to 3 million
$$$	= 2 to 4+ million	$$$	= 3 to 7+ million

Unconstrained: Adjacent land largely undeveloped, substantial existing R/W available
Constrained: Adjacent land largely developed, limited existing R/W

Signal Timing Optimization

Pros

- Reduce overall delay
- Improve coordination
- Low cost improvement
- No construction/modification

Cons

- Limited improvement
- Short term solution

Best Applied

- If timing has not changed in > 5 years
- Poorly operating intersections
- Time of day issues

Cost $

City of San Jose Evergreen
Transportation Analysis

Signal Modifications

Pros

- Increase Safety
- Increase capacity
- Provide exclusive phases (protected/permitted/FYLA/ overlap)

Cons

- Limited improvement

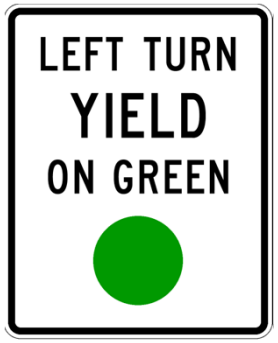
Best Applied

- Lacking protected phasing
- Lacking detection

Cost $

FYLA

Video Detection



Add Turn Lane

Pros

- Improves safety
- Improves sight lines
- Reduces “weaving” near intersections

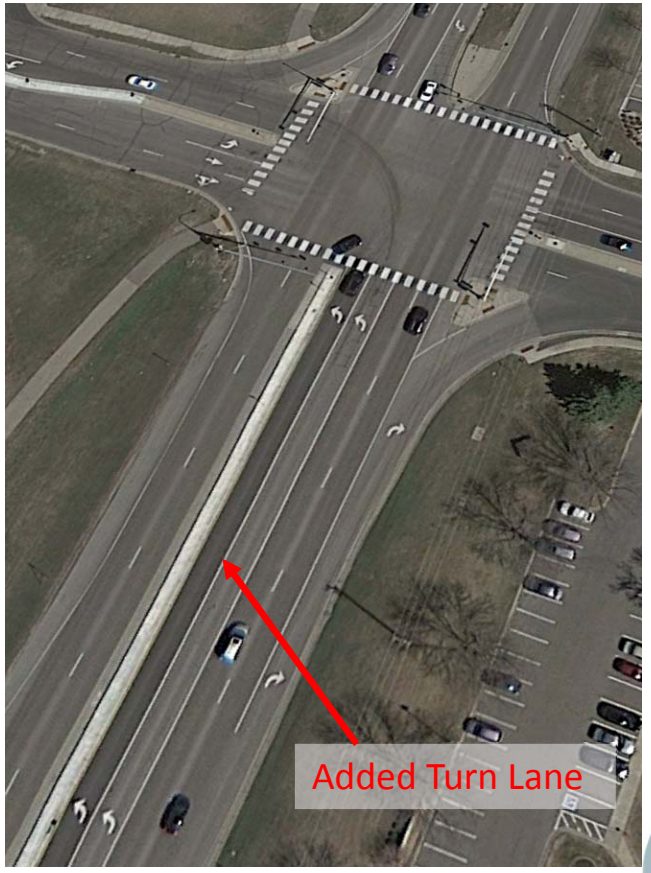
Cons

- Need adequate space
- Can requires signal modifications

Best Applied

- Intersections without turn lanes
- Where additional capacity is needed

Cost $$



TH 13 at Portland Ave in Burnsville, MN

Source: Google Maps

Right In/ Right Out

Pros

- Eliminates crossing maneuvers
- Continuous flow on mainline
- Access to and from one direction

Cons

- Need alternative routes
- Reduce access

Best Applied

- High mainline traffic volumes
- When alternate routes are available

Cost $

TH 65 south of 105th Avenue in Blaine, MN

Source: Google Maps

Three Quarter

Pros

- Eliminates crossing maneuvers from side street
- Continuous flow on mainline
- Enables access from mainline

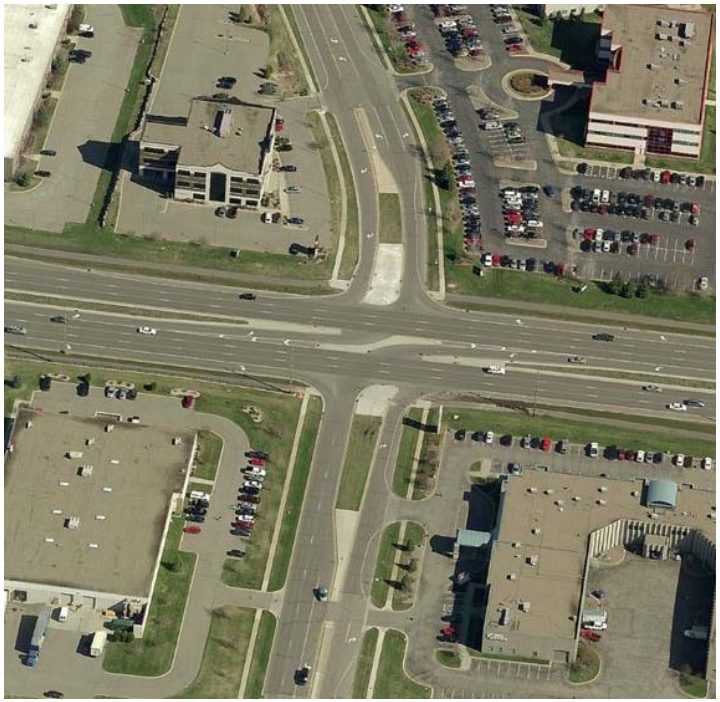
Cons

- Need alternative routes
- Reduce access from side street

Best Applied

- High mainline traffic volumes
- When alternate routes are available

Cost $



CSAH 42 at Southcross Drive in Burnsville, MN

Source: Google Maps

Acceleration/Deceleration Lanes

Pros

- Eliminates turns into mainline high speed traffic
- Allows vehicles to reach proper merging speed in separate lane
- Continuous flow on mainline

Cons

- Additional Pavement/ Construction needs

Best Applied

- High mainline traffic volumes
- Proper distance between intersections
- Divided roads (for left turn acceleration lane)

Cost $

Hwy 5 and 101 in Chanhassen, MN

Source: Google Maps

Roundabout

Pros

- Increase safety/reduces conflict points
- Minimizes serious/fatal injury crashes
- Improves delay/capacity
- Reduces lifecycle cost

Cons

- Initial Confusion
- Space requirements
- Not applicable to all intersections

Best Applied

- Proper traffic volumes for roundabout
- Presence of high severity crashes

Cost $$

TH 284 and CSAH 10 in Waconia, MN

TH 22 at Madison Ave in Mankato, MN

Source: Google Maps

Restricted Crossing U-Turn (RCUT)

Pros

- Eliminates left turns into high speed mainline traffic
- Continuous flow on mainline
- Eliminates need for traffic signal
- Beneficial for heavy vehicles on side street

Cons

- Initial Confusion
- Out of direction travel
- Reduce access from side street
- Requires wide median

Best Applied

- Rural 4-lane divided
- Low side street volume

Cost $$

TH 212 at TH 284 in Cologne, MN

Source: Google Maps

Median U-Turn

Pros

- Increase green time for mainline
- Eliminate Left Turn Crashes
- Reduce conflict points at intersection

Cons

- Initial Confusion
- Typically require wider medians

Best Applied

- High capacity intersections

Big Beaver Road at Rochester Road, Troy, MI

Cost $$

Jug Handle

Pros

- Increase green time for mainline
- Eliminate Left Turn Crashes on mainline
- Reduce conflict points at intersection

Cons

- Initial Confusion
- Typically require additional ROW
- Longer travel time and more stops for left turning vehicles

Best Applied

- High mainline through movements

US-1 at Franklin Corner Road, Lawrenceville, NJ

Cost $$

Source: Google Maps

Displaced Left Turn

Pros

- Increase green time for mainline
- Increase throughput by 25-30%
- Reduce conflict points at intersection

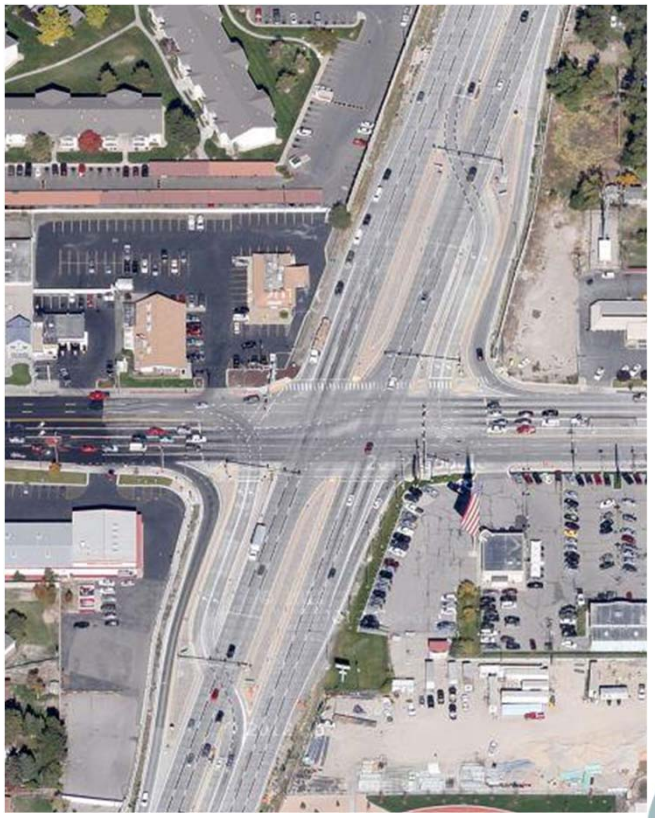
Cons

- Initial Confusion
- Typically require additional ROW
- Pedestrian accommodations
- Construction Cost

Best Applied

- High volume intersection

Cost $$$



West Valley City, UT

Source: UtahDOT

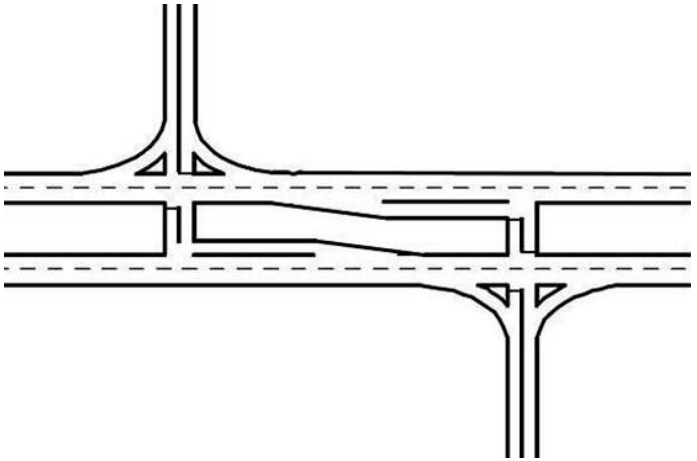
Offset T

Pros

- Eliminate intersection skew
- Spread out turning movements across multiple intersections

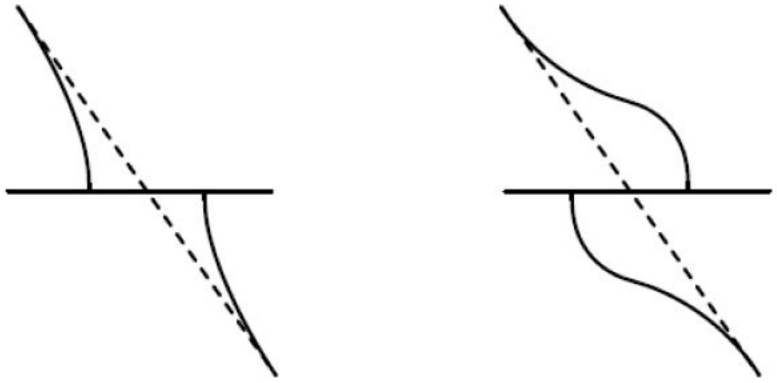
Cons

- Closely spaced intersections
- Potential weaving movement



Best Applied

- Skewed intersection
- Limited other options



Cost $$

Source: FHWA and IowaDOT

Quadrant

Pros

- Increase capacity
- Increase safety
- Removing turning traffic from primary intersection

Cons

- Initial Confusion
- Add traffic to “quadrant roadway”
- Out of direction travel
- Increase number of intersections

Best Applied

- Where quadrant street is already present
- Where there is adequate space for quadrant street

Cost $$

Source: FHWA

Green T

Pros

- Eliminates left turns into high speed mainline traffic
- Continuous flow on mainline for *one* direction
- Can be fully or partially signalized if needed

Cons

- Initial Confusion
- Requires channelization

Cost $$

Best Applied

- 3-leg intersections
- High mainline and/or side street left turning volume

Source: Google Maps

Shoulder Widening

Pros

- Reduces Run-of-Road crashes
- Can include rumble/mumble strips for increased safety
- Provide additional space for emergency stops

Cons

- Additional pavement to maintain

AASHTO Strategic Highway Safety Plan

Best Applied

- Rural roadways without shoulders
- Rural roadways with gravel shoulders

Cost $$ (based on length)

Source: Google Maps

Truck Climbing Lane

Pros

- Trucks do not impede on passenger cars traveling on inclines
- Avoids back-ups on highways

Cons

- Additional pavement to maintain

Best Applied

- Roadways with high truck volumes
- Areas with steep grade

Cost $$ (based on length)

Hwy 27 in Sparta, WI

Source: Google Maps

Passing Lanes

Pros

- Slower traffic can be passed
- Avoids back-ups on highways

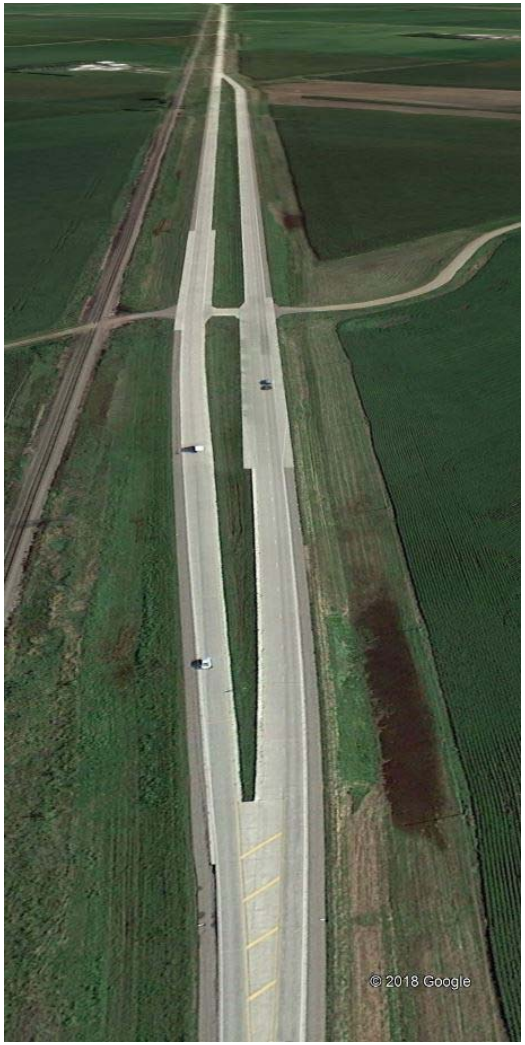
Cons

- Additional pavement to maintain

Best Applied

- Rural Roadways with high truck volumes

Cost $$ (based on length)



Hwy 23 between Green Valley and Cottonwood, MN

Source: Google Maps

Access Management

Pros

- Reduces conflict points
- Can allow for smoother operations by minimizing acceleration/deceleration needs

Cons

- Can be controversial
- May need alternative routes

Best Applied

- Roadways with high access density

Cost $$ (depends on extent)

Hwy 5 in Waconia, MN

Source: Google Maps

4 to 3-Lane Conversion

Pros

- Increase safety by providing dedicated area for left turns
- Can create easier/safer pedestrian crossings

Cons

- May need to widen for right turn lanes
- Potential for overlapping left turn movements

Best Applied

- 4-lane undivided roadways with locations of high turning traffic volumes

Cost $$ (based on length)

Nicollet Ave in Richfield, MN

Source: Google Maps