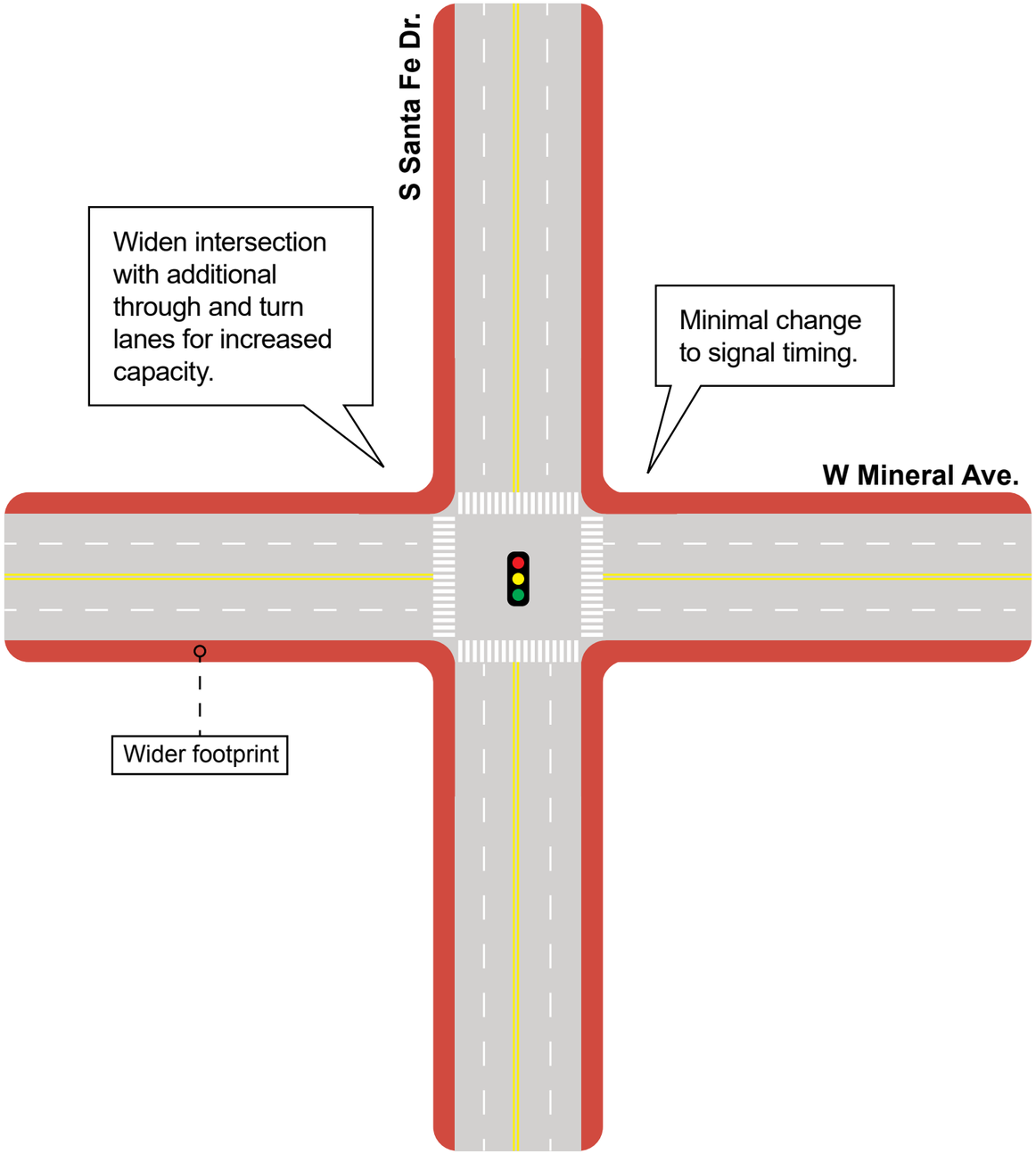
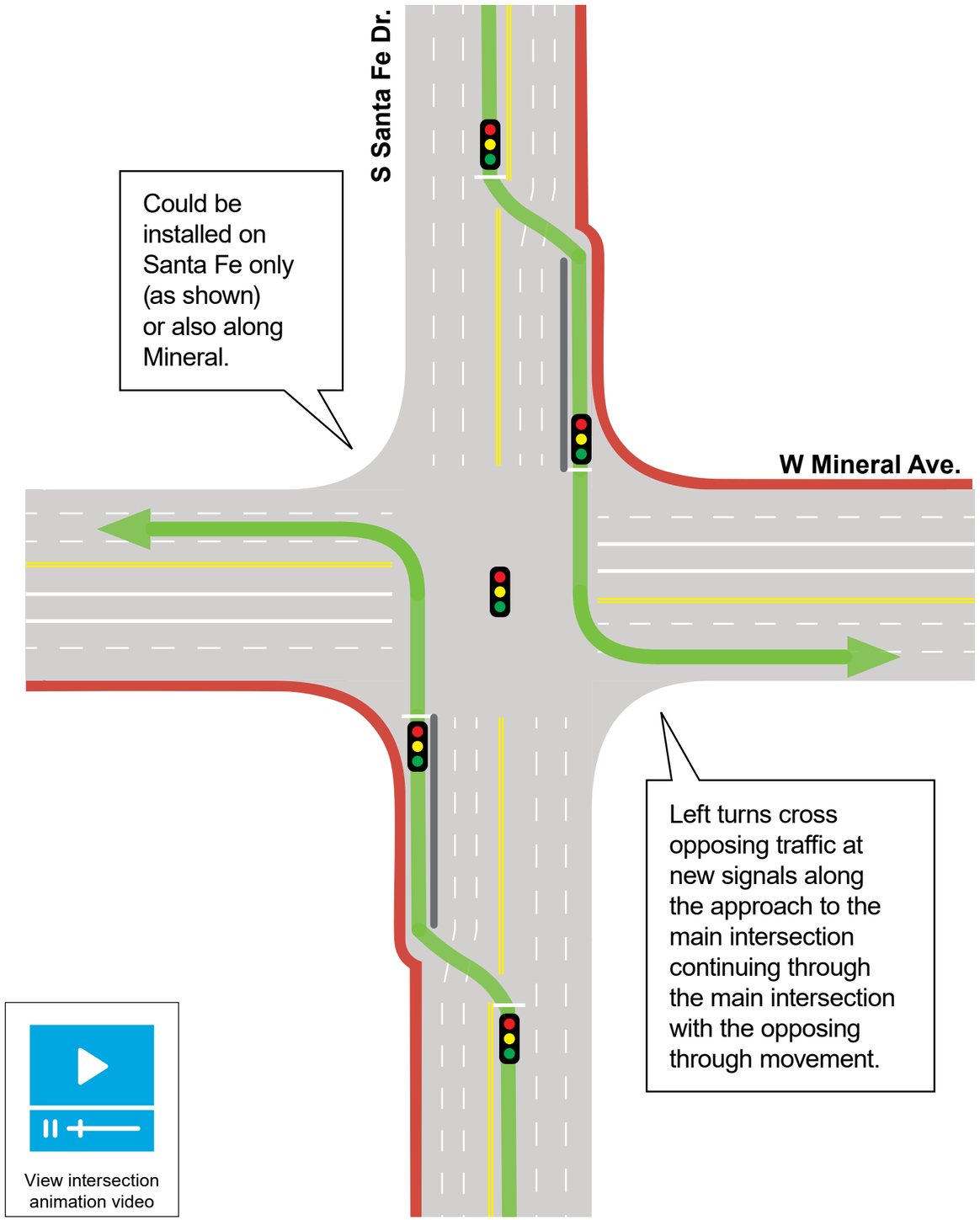
Expanded Traditional Intersection

Traditional intersection widening would maintain the existing configuration, but would provide additional lanes (either through lanes or turn lanes). These intersections are well-known, operate well at lower volumes and during off-peak periods. Signal timing can be complex, as each movement needs its own signal phase.



EVALUATION SUMMARY

- ⊕ Significantly improves traffic/ transit operations
- ⊕ Separates major traffic flow, improving safety for most users
- ⊖ Requires pedestrians/ bicyclists to cross free-flow ramps
- ⊖ Significant right-of-way impacts to development property and RTD lot
- ⊖ Long, multi-phased construction period
- ⊖ One of the highest-cost alternatives



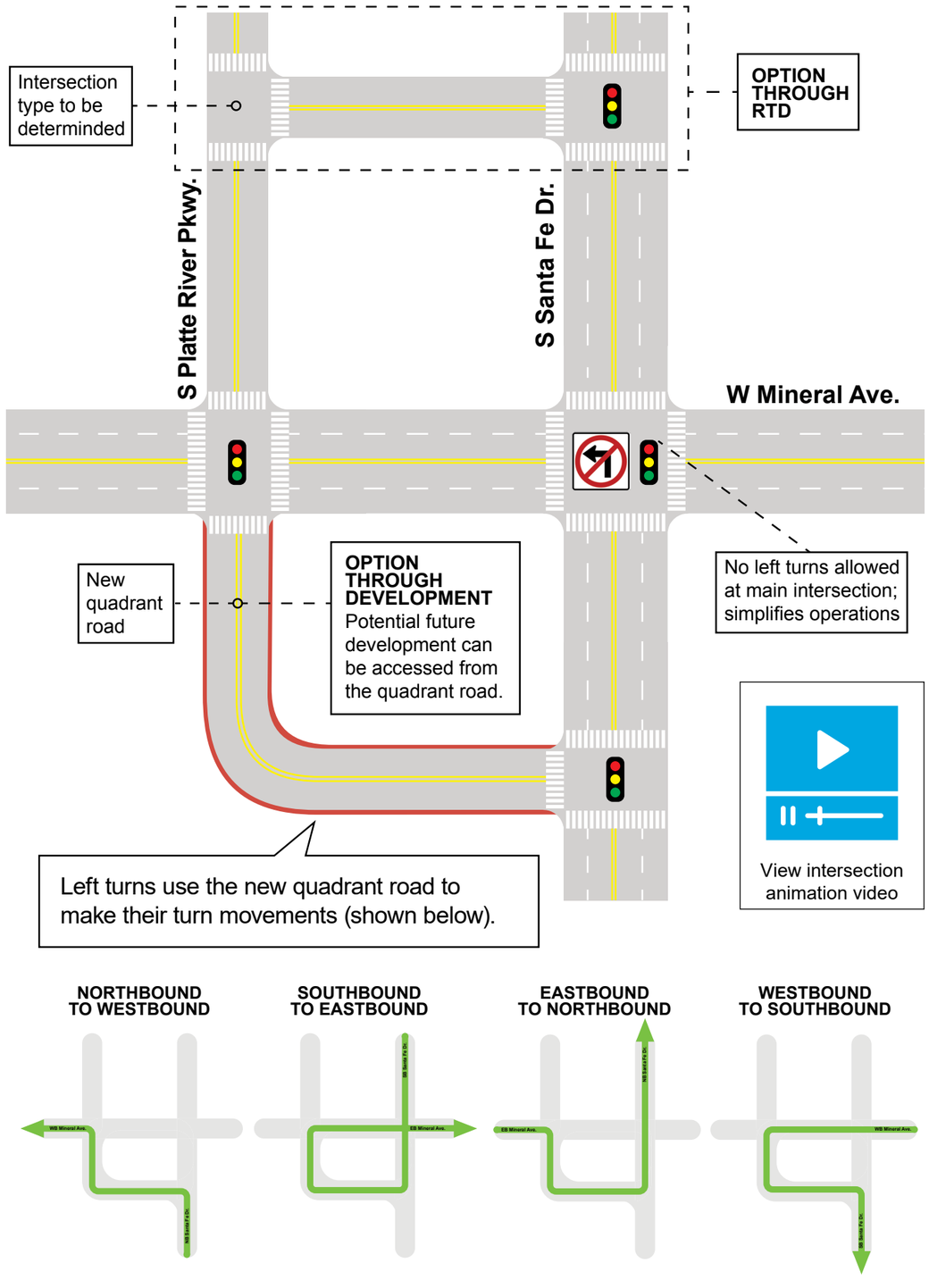
Continuous Flow Intersection

The main feature of this alternative intersection is the relocation of the left-turn movement on an approach to the other side of the opposing roadway, which consequently eliminates the left-turn signal phase for this approach at the main intersection. As shown in the illustration, traffic that would normally turn left at the main intersection first crosses the opposing through lanes at a signal-controlled intersection several hundred feet upstream of the main intersection. Left-turning vehicles then travel on a new roadway parallel to the opposing lanes and execute the left-turn maneuver simultaneously with the through traffic at the main intersection. Traffic signals are present at the main intersection and at the locations of the left-turn crossovers. The traffic signals are operated in a coordinated manner.

EVALUATION SUMMARY

- ⊕ Reduces number and severity of left-turn conflicts
- ⊕ Minimal impacts to adjacent property or RTD parking lot
- ⊕ Improves traffic operations with increased capacity
- ⊕ Improves transit operations due to lower congestion

- ⊖ Requires multi-stage pedestrian crossings
- ⊖ Large amount of “throwaway” infrastructure if future grade separation occurs



Quadrant Intersection

The primary objective of a Quadrant Intersection (QR) intersection is to reduce delay at a severely congested intersection and to reduce overall travel time by removing left-turn movements. A QR intersection can provide other benefits as well, such as making it shorter and quicker for most pedestrians at the intersection. A QR intersection can be among the least costly of the alternative intersections to construct and maintain.

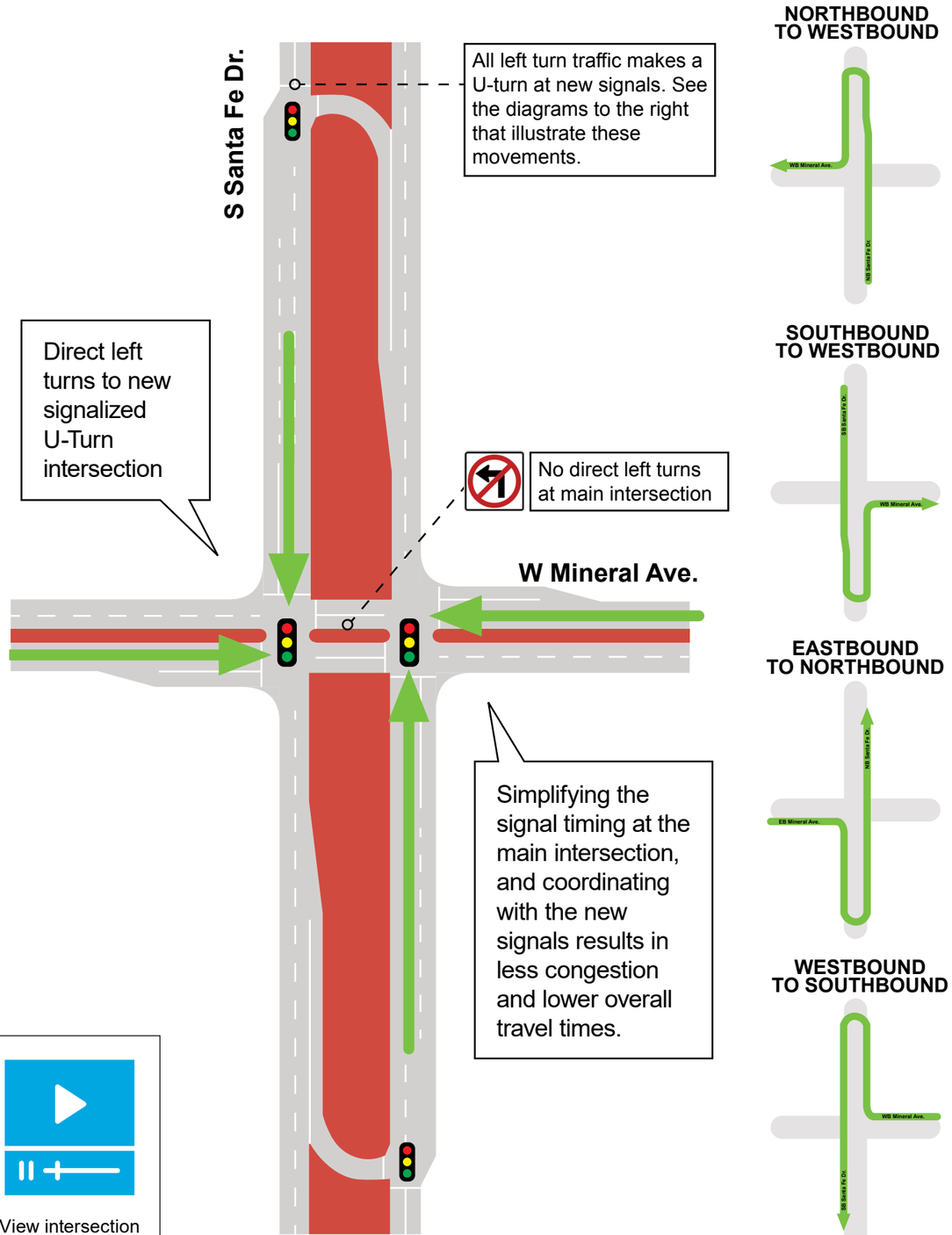
At a QR intersection, all four left-turn movements at a conventional four-legged intersection are rerouted to use a connector roadway in one quadrant. Left turns from all approaches are prohibited at the main intersection, which consequently allows a simple two-phase signal operation at the main intersection. Each terminus of the connector road is typically signalized. These two secondary signal-controlled intersections usually require three phases.

EVALUATION SUMMARY

- ⊕ Simple construction at low cost
- ⊕ Greatest improvement to traffic operations among at-grade alternatives
- ⊕ Improves transit operations due to lower congestion
- ⊕ Reduces left-turn conflicts
- ⊖ Requires longer travel distance for some left-turning vehicles especially when there is little to no congestion
- ⊖ Increases turning movement volumes at adjacent intersection
- ⊖ Requires right-of-way acquisition from RTD or development property

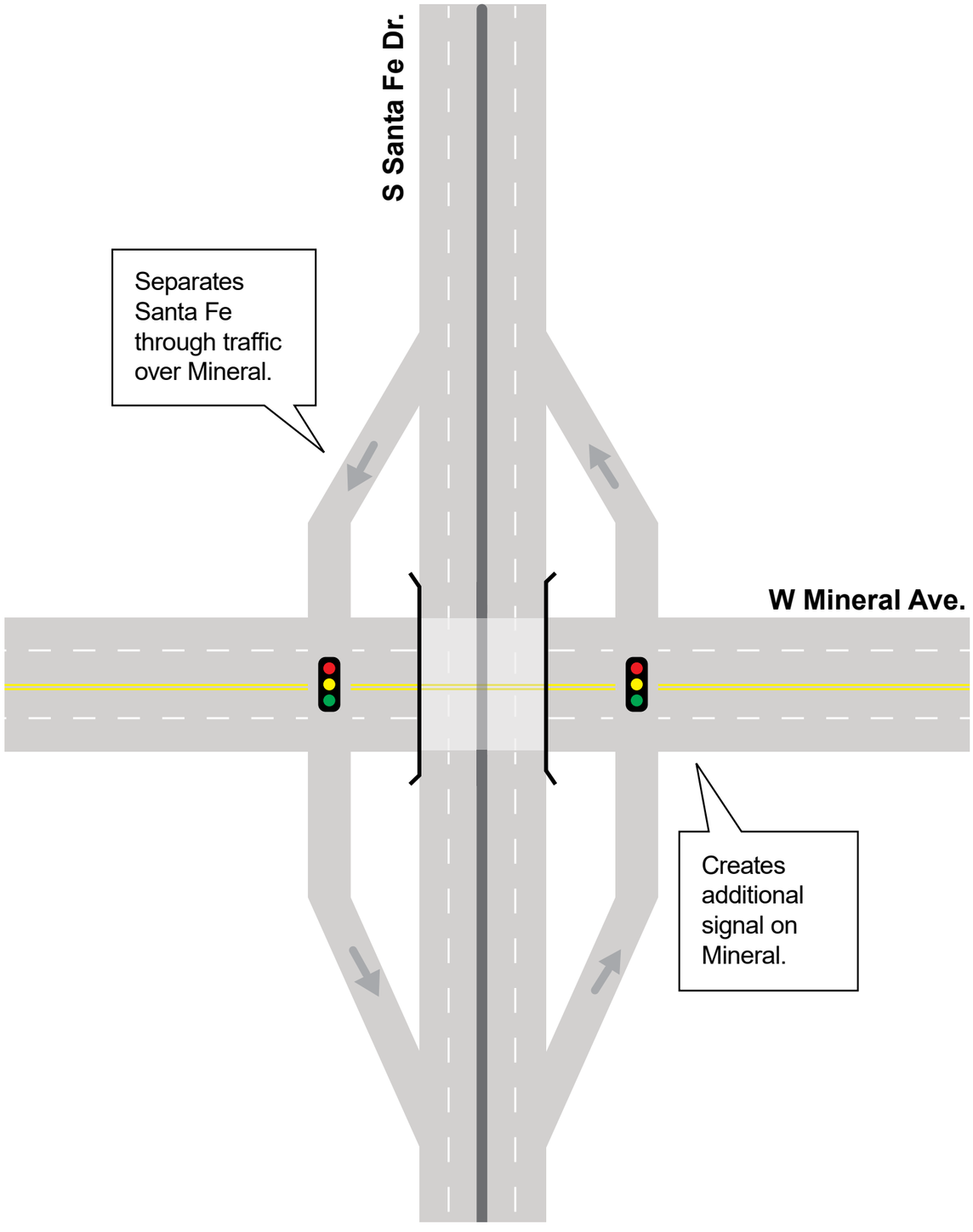
Median U-Turn Intersection

The Median U-Turn Intersection (MUT) intersection (also known as a “Michigan Left”) involves the elimination of direct left turns from major and/or minor approaches (usually both). Drivers desiring to turn left from the major road onto an intersecting cross street must first travel through the main intersection and then execute a U-turn at the median opening downstream of the intersection. These drivers then turn right at the cross street. Drivers on the minor street desiring to turn left onto the major road must first turn right at the main intersection, execute a U-turn at the downstream median opening, and proceed back through the main intersection. Elimination of left-turning traffic from the main intersection simplifies the signal operations at the intersection, which accounts for most of the benefits.



EVALUATION SUMMARY

- ⊕ Removes left-turn conflict points from main intersection
- ⊕ Relatively low cost for construction
- ⊕ Installs wide median which may be useful for future grade separation
- ⊖ Requires longer travel distance for left-turning vehicles
- ⊖ Requires significant roadway widening
- ⊖ Minimally increases capacity at main intersection

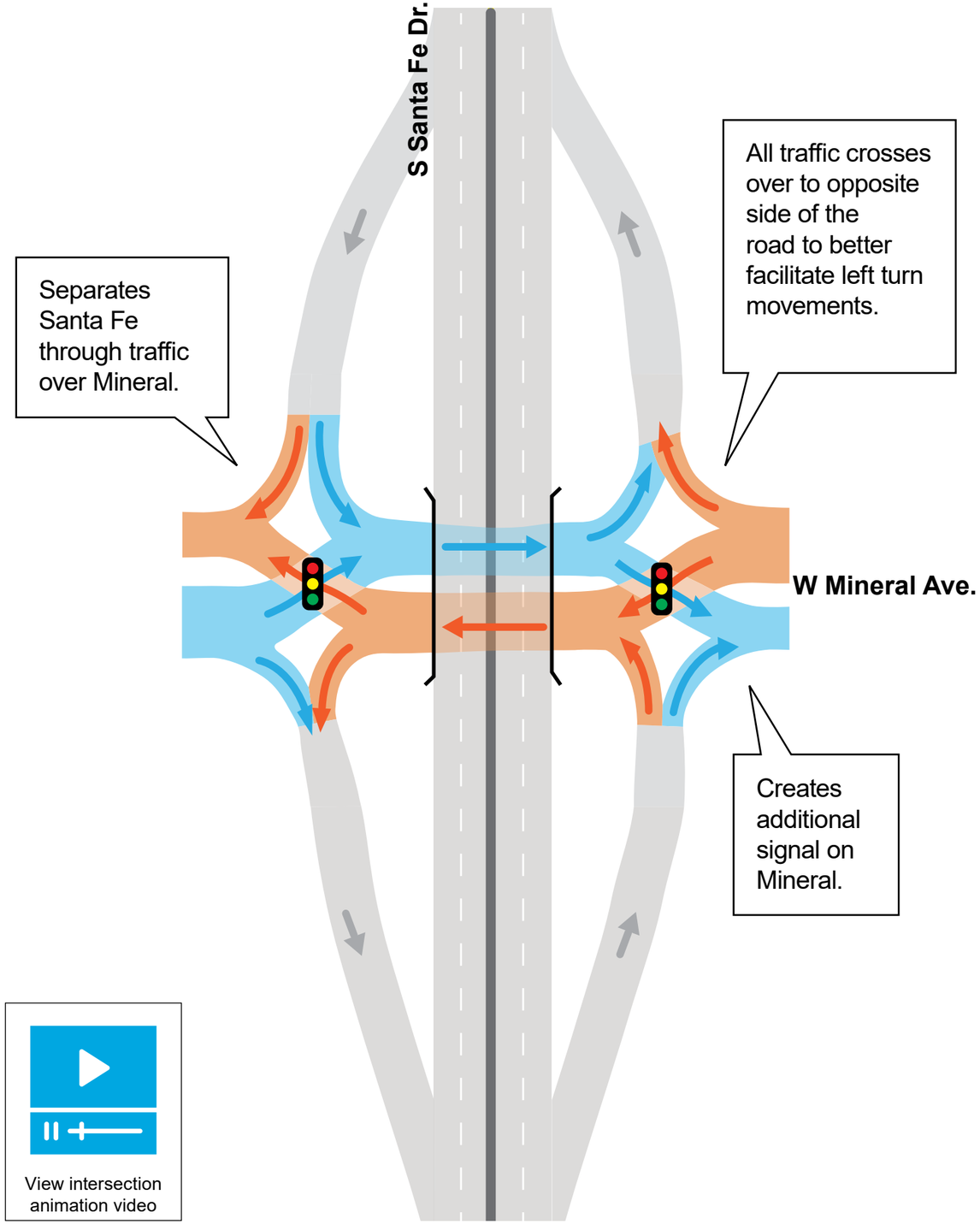


Diamond Interchange

The tight diamond interchange, a type of compressed diamond interchange, is used in urban and suburban areas where right-of-way is a constraint. As the illustration shows, a tight diamond has two closely spaced signalized intersections at the crossing of the ramp terminals and side street. Typical designs provide 200 to 400 ft. of separation between the signal-controlled intersections.

EVALUATION SUMMARY

- (+) Improves traffic/transit operations more than at-grade alternatives
- (+) Separates major traffic flow, improving safety for most users
- (+) Relatively minimal right-of-way requirements
- (−) Long, multi-phased construction period
- (−) Significantly higher cost than at-grade alternatives



View intersection animation video

Diverging Diamond Interchange

The Diverging Diamond Interchange (DDI) is a new interchange design that is slowly gaining recognition as a viable interchange form that can improve traffic flow and reduce congestion. Similar to the design of a conventional diamond interchange, the DDI differs in the way that the left and through movements navigate between the ramp terminals. The purpose of this interchange design is to accommodate left-turning movements onto arterials and limited-access highways while eliminating the need for a left-turn bay and signal phase at the signalized ramp terminals. The illustration shows the typical movements that are accommodated in a DDI. The highway is connected to the arterial cross street by two on-ramps and two off-ramps in a manner similar to a conventional diamond interchange. However, on the cross street, the traffic moves to the left side of the roadway between the ramp terminals. This allows the vehicles on the cross street that need to turn left onto the ramps to continue to the on-ramps without conflicting with the opposing through traffic.

EVALUATION SUMMARY

+

- Significantly improves traffic/ transit operations
- Separates major traffic flow, improving safety for most users

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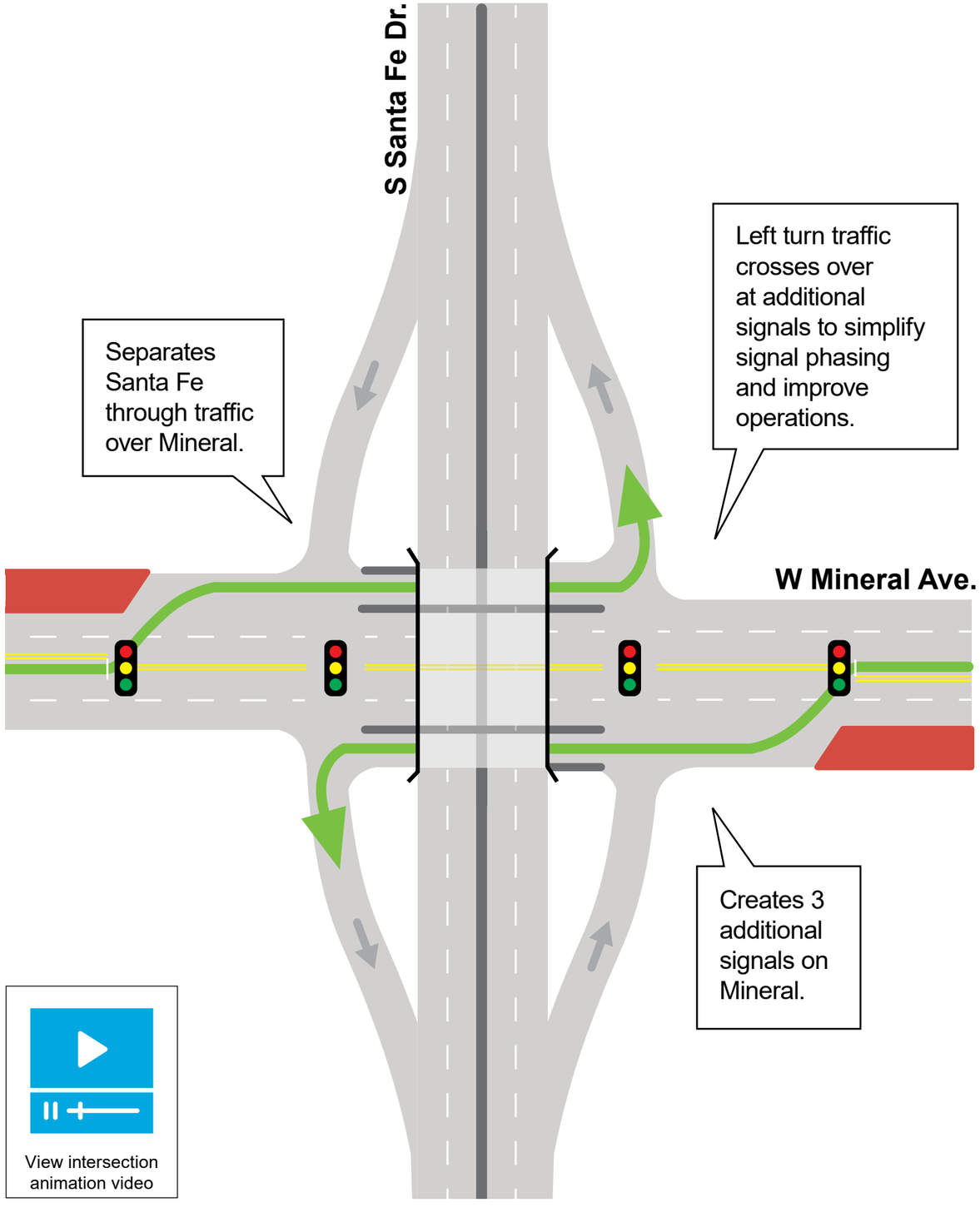
- Requires pedestrians/ bicyclists to cross free-flow ramps
- Significant right-of-way impacts to development property and RTD lot
- Long, multi-phased construction period
- One of the highest-cost alternatives

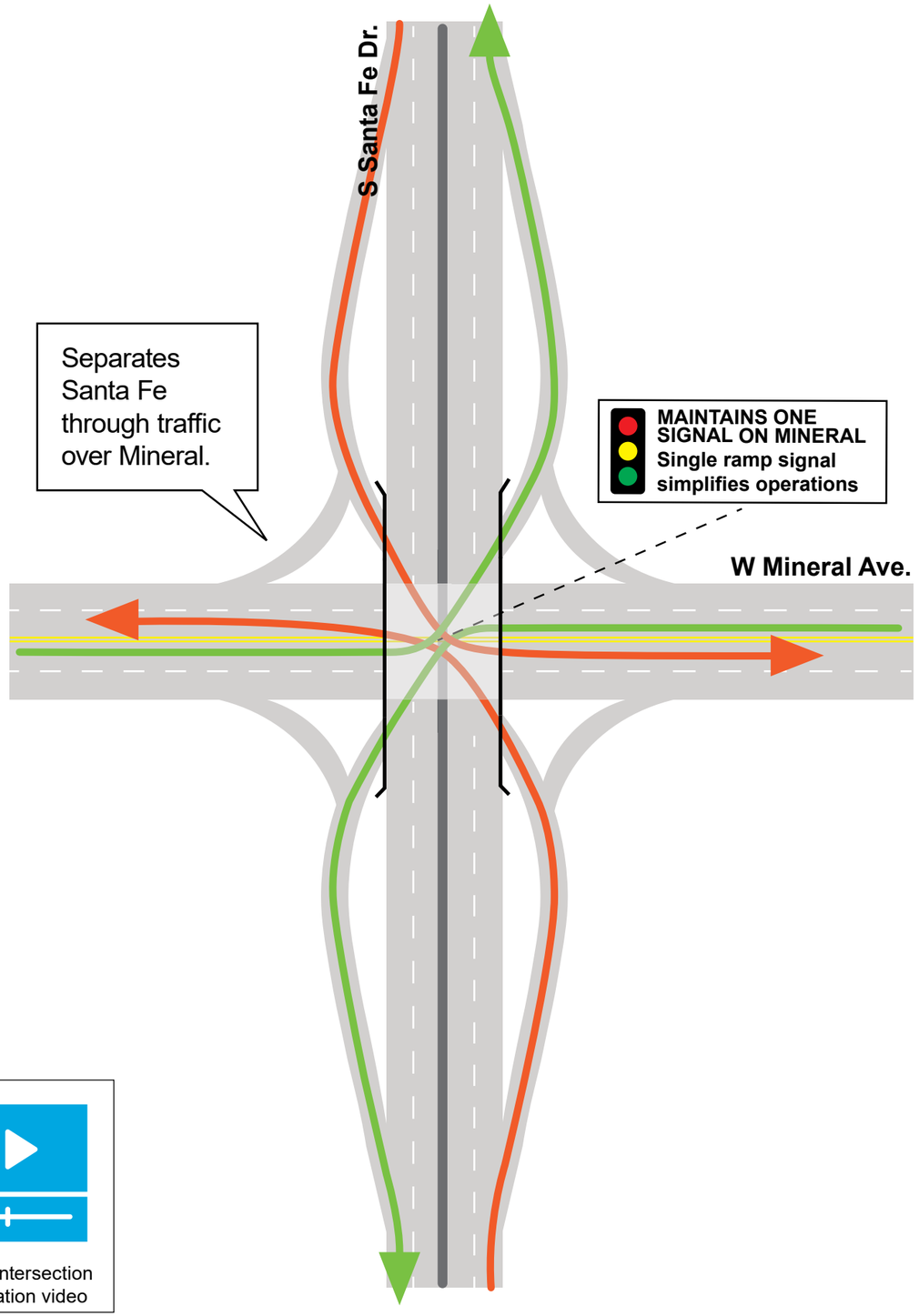


Displaced Left-Turn Interchange

The main feature of this alternative intersection is the relocation of the left-turn movement on an approach to the other side of the opposing roadway, which consequently eliminates the left-turn signal phase for this approach at the main intersection. As shown in the illustration, traffic that would normally turn left at the main intersection first crosses the opposing through lanes at a signal-controlled intersection several hundred feet upstream of the main intersection. Left-turning vehicles then travel on a new roadway parallel to the opposing lanes and execute the left-turn maneuver simultaneously with the through traffic at the main intersection. Traffic signals are present at the main intersection and at the locations of the left-turn crossovers. The traffic signals are operated in a coordinated manner.

EVALUATION SUMMARY

- ⊕ Significantly improves traffic/ transit operations
- ⊕ Separates major traffic flow, improving safety for most users
- ⊖ Requires pedestrians/ bicyclists to cross free-flow ramps
- ⊖ Significant right-of-way impacts to development property and RTD lot
- ⊖ Long, multi-phased construction period
- ⊖ One of the highest-cost alternatives



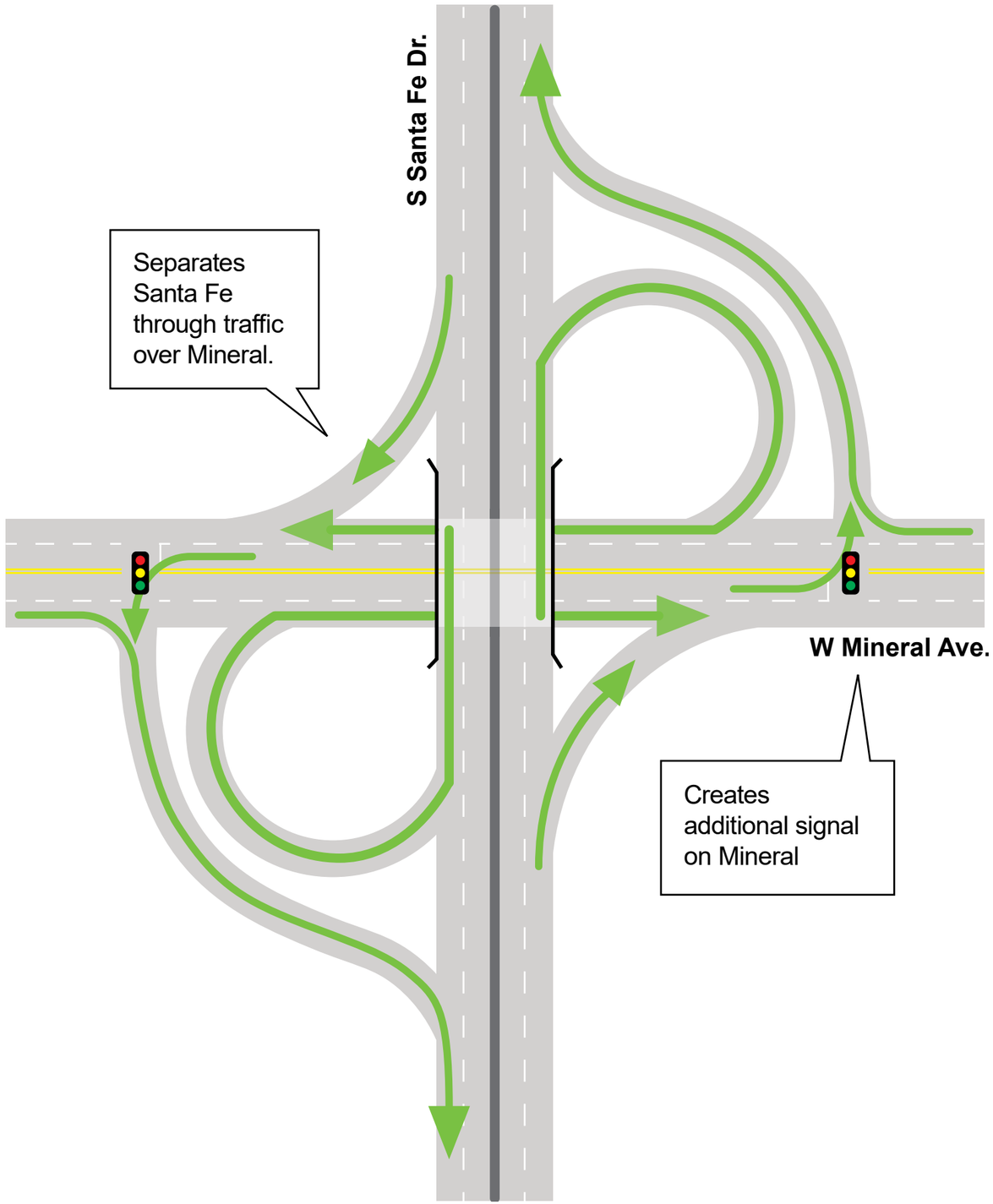
View intersection animation video

Single Point Urban Interchange

The Single Point Urban Interschange (SPUI), another variant of the compressed diamond interchange, was developed in 1970 to improve traffic capacity and operations while requiring less right-of-way than the standard diamond interchange. The configuration of a typical SPUI is shown in the illustration. The turning movements of the major road ramps and all the movements of the minor road are executed in one central area that is either on the overpass or underpass.

EVALUATION SUMMARY

- ⊕ Significantly improves traffic/ transit operations
- ⊕ Separates major traffic flow, improving safety for most users
- ⊕ Relatively minimal right-of-way requirements
- ⊖ Long, multi-phased construction period
- ⊖ Significantly higher cost than at-grade alternatives



Partial Cloverleaf Interchange

A partial cloverleaf is similar to a conventional diamond interchange, but provides loop ramps for left turn traffic that are free-flow. These loop ramps allow heavy left-turn traffic to flow through the intersection with less delay and simplify operations at the ramp terminals. Partial cloverleaf interchanges require significant right-of-way and are general higher cost – they are good options in less constrained, rural environments.

EVALUATION SUMMARY

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- Greatest improvement to traffic/transit operations among all alternatives
- Eliminates most severe left-turn conflicts with loop ramps

−

- Requires pedestrians/ bicyclists to cross free-flow ramps
- Greatest right-of-way impacts of all alternatives
- Long, multi-phased construction period
- Highest cost of all alternatives