



## BEST PRACTICES FOR INTERSECTIONS

**INTERSECTIONS ARE WHERE PEOPLE MEET, SOCIALIZE, AND EXCHANGE IDEAS. THEY ARE THE MOST CRITICAL SPACES IN CITIES.**

The book *Human Scale*<sup>2</sup> states it this way:

“Cities are meant to stop traffic. That is their point. That is why they are there. That is why traders put outposts there, merchants put shops there, hoteliers erected inns there. That is why factories locate there, why warehouses, assembly plants and distribution centers are established there. That is why people settle and cultural institutions grow there. No one wants to operate in a place that people are just passing through; everyone wants to settle where people will stop, and rest, and look around, and talk, and buy, and share.

Cities, in short, should be an end, not a means. Rationally one wants to have traffic stop there, not go through, one wants movement within it to be slow, not fast.”

2. Sale, Kirkpatrick. *Human Scale*. New Catalyst Books, 2007.

# III. INTERSECTIONS



Currently, however, intersections can be dangerous public places. This is due to the incredible number of potential conflicts points combined with the desire (by some) to reduce motor vehicle delay and enhance motor vehicle capacity above all other purposes and priorities.

**WE CAN, AND SHOULD, DO BETTER.**

Throughout Salt Lake City, intersections should, first, support and reinforce (rather than undermine) the City’s overall goal of creating people-friendly streets. Second, they should protect the safety of all users of the public right-of-way, in general, and vulnerable users, in particular. Third, intersections should support the critical functions of the rights-of-way in the city that each of the 17 street typologies prioritizes.



The following principles should be applied to all intersections, universally:

- Intersections should be safe, easy, and intuitive for all users to negotiate, regardless of their ability or transportation choice;
- Transportation modes and right-of-way functions prioritized on intersecting streets should be prioritized where they intersect;
- Intersections should use the smallest effective curb radii possible, consistent with desired design vehicles and turning speeds;
- Protect people walking, bicycling, and using mobility devices from potential injury or discomfort by increasing their visibility and physical protection or separation at and near conflict points and crossing locations, including reducing vehicle speeds and limiting potential conflict points with vehicles;
- Design intersections to discourage excess speeds, reduce crossing distances, and provide space for public realm enhancements.

## INTERSECTIONS AND PLACE TYPES

The 17 street typologies presented in this Guide can potentially intersect in many different combinations. This section of the Guide provides infrastructure recommendations for nine high-level intersection typologies, based on the general scale of the streets involved: major, medium, local, and shared.

Like the street typologies, these nine intersection typologies and their respective elements and recommendations should be considered as a starting point for designing intersections of different sizes and intensities. The matrix in Table 1 may need to be adapted further to complement specific transportation, land use, and urban design contexts, and supplemented with appropriate improvements from the Best Practices in Table 2 and the Additional Intersection Features list in Table 3. Recommendations from these tables may be reviewed, applied, and refined intersection-by-intersection, particularly as they relate to UDOT facilities.





# TABLE 1: INTERSECTION TYPOLOGIES

	MAJOR STREET	MEDIUM STREET	LOCAL STREET	
MAJOR STREET	<ul style="list-style-type: none"> <li>- Signalized intersection best practices*</li> <li>- "Look Before Crossing" signs/stencils</li> <li>- Protected intersection (see Table 3 for definition)</li> <li>- Centerline hardening</li> <li>- Bike boxes and/or colored paving through intersection</li> </ul>	<ul style="list-style-type: none"> <li>- Pedestrian refuge islands/medians</li> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Leading pedestrian and/or bicycle interval</li> <li>- Perpendicular curb cuts</li> <li>- Pull-out transit stops with queue jumps</li> </ul>		
MEDIUM STREET	<ul style="list-style-type: none"> <li>- Signalized intersection best practices*</li> <li>- "Look Before Crossing" signs/stencils</li> <li>- Protected intersection</li> <li>- Centerline hardening</li> <li>- Bike boxes and/or colored paving through intersection</li> <li>- Leading pedestrian and/or bicycle interval</li> </ul>	<ul style="list-style-type: none"> <li>- Perpendicular curb cuts</li> <li>- In-lane transit stops</li> <li>- Reduced curb radii**</li> </ul> <p><b>SPECIFIC TO MAJOR STREET:</b></p> <ul style="list-style-type: none"> <li>- Pedestrian refuge islands/medians</li> </ul> <p><b>SPECIFIC TO MEDIUM STREET:</b></p> <ul style="list-style-type: none"> <li>- Curb extensions</li> </ul>	<ul style="list-style-type: none"> <li>- Signalized intersection best practices*</li> <li>- Protected intersection</li> <li>- Centerline hardening</li> <li>- Bike boxes and/or colored paving through intersection</li> <li>- Pedestrian refuge islands/medians</li> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> </ul>	
LOCAL STREET	<ul style="list-style-type: none"> <li>- Stop controlled or signalized intersection best practices*</li> <li>- "Look Before Crossing" signs/stencils</li> <li>- Protected intersection</li> <li>- Bike boxes and/or colored paving through intersection</li> </ul>	<p><b>SPECIFIC TO LOCAL STREET:</b></p> <ul style="list-style-type: none"> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Traffic diverters</li> </ul>	<ul style="list-style-type: none"> <li>- Stop controlled or signalized intersection best practices*</li> <li>- Bike boxes and/or colored paving through intersection</li> <li>- Protected intersection</li> </ul> <p><b>SPECIFIC TO MEDIUM STREET:</b></p> <ul style="list-style-type: none"> <li>- Pedestrian refuge islands/medians</li> </ul> <p><b>SPECIFIC TO LOCAL STREET:</b></p> <ul style="list-style-type: none"> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Traffic diverters</li> </ul>	<ul style="list-style-type: none"> <li>- Stop controlled or signalized intersection best practices*</li> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Raised intersection</li> </ul>
SHARED STREET	<ul style="list-style-type: none"> <li>- Signalized intersection best practices* or mid-block crossing</li> <li>- "Look Before Crossing" signs/stencils</li> <li>- Protected intersection</li> <li>- Bike boxes and/or colored paving through intersection</li> </ul>	<p><b>SPECIFIC TO MAJOR STREET:</b></p> <ul style="list-style-type: none"> <li>- Pedestrian refuge islands/medians</li> </ul> <p><b>SPECIFIC TO SHARED STREET:</b></p> <ul style="list-style-type: none"> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Traffic diverters</li> </ul>	<ul style="list-style-type: none"> <li>- Signalized intersection best practices* or mid-block crossing</li> <li>- "Look Before Crossing" signs/stencils</li> <li>- Protected intersection</li> <li>- Bike boxes and/or colored paving through intersection</li> </ul> <p><b>SPECIFIC TO MEDIUM STREET:</b></p> <ul style="list-style-type: none"> <li>- Pedestrian refuge islands/medians</li> </ul> <p><b>SPECIFIC TO SHARED STREET:</b></p> <ul style="list-style-type: none"> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Traffic diverters</li> </ul>	<ul style="list-style-type: none"> <li>- Stop controlled intersection best practices*</li> <li>- Curb extensions</li> <li>- Reduced curb radii**</li> <li>- Raised intersection</li> <li>- Colored paving through intersection</li> <li>- Raised crosswalks</li> </ul>

Notes:

\*See Table 2 for signalized and stop-controlled intersection best practices

\*\*Reduced curb radii may vary depending on context, but could be as low as 10'-15'





**TABLE 2: INTERSECTION BEST PRACTICES**



IMPROVEMENT	NOTES
<b>SIGNALIZED INTERSECTION BEST PRACTICES</b>	
<b>ADEQUATE PEDESTRIAN CROSSING TIMES</b>	Assume no more than 3.5 feet/second for crossing time, and perhaps closer to 3.0 or less where slower and/or high concentrations of people walking are expected. This provides more time for people to get across the intersection.
<b>PEDESTRIAN COUNTDOWN TIMERS</b>	Include countdown timers in all new pedestrian signals.
<b>BICYCLE DETECTION</b>	Ensure loop, radar, or video detection is properly configured to detect people bicycling at logical stopping locations.
<b>SIGNAL POLE AND CABINET PLACEMENT</b>	Ensure pole and cabinet placements do not obstruct pedestrian areas.
<b>HIGH-VISIBILITY CROSSWALKS ON ALL APPROACHES</b>	High-visibility crosswalk designs improve driver compliance at crosswalks, and should be included on all legs of all intersections with marked crosswalks.
<b>DETECTABLE, ADA-COMPLIANT CURB RAMPS</b>	All curb ramps should use detectable warning surfaces (alerting visually-impaired people to the presence of a crosswalk) and be ADA compliant.
<b>PERPENDICULAR CURB CUTS</b>	Place pedestrian ramps perpendicular to the curb and roadway to align with crosswalk locations.
<b>ACCESSIBLE PEDESTRIAN ACTUATION BUTTONS</b>	Ensure that pedestrian push-buttons at crosswalks are accessible to all users, including people in mobility devices. Consider automatic rather than actuated pedestrian phases at high pedestrian volume intersections.
<b>PEDESTRIAN-SCALE LIGHTING</b>	Use pedestrian-scale street lighting to improve nighttime visibility at intersections. Ensure that changes in vegetation, buildings, etc., are considered. Refer to the <a href="#">Street Light Master Plan</a> for recommendations for vehicular lighting recommendations.
<b>UNSIGNALIZED INTERSECTION BEST PRACTICES</b>	
<b>MARKED CROSSWALKS AND CURB RAMPS</b>	Provide crosswalks and ramps at all legs of intersections that have sidewalks leading into them.
<b>REDUCED CURB RADII</b>	Reducing the curb radii encourages vehicles to slow down during turning movements. The desired effective curb radius will vary depending on the design vehicle, but 15' effective radii may be appropriate in many contexts.
<b>PEDESTRIAN-SCALE LIGHTING</b>	Use pedestrian-scale street lighting to improve nighttime visibility at intersections. Refer to the <a href="#">Street Light Master Plan</a> for recommendations for vehicular lighting recommendations.
<b>ROUNDBABOUTS</b>	Roundabouts may be appropriate treatments for some intersection typologies. In the right circumstances and when designed following best practices, roundabouts can reduce vehicle delay, crashes, and may provide safer conditions for people walking and bicycling. Design should provide splitter islands at approaches to provide a refuge for people crossing the street, and set crosswalks back from the yield line by at least one vehicle length to shorten the crossing distance, reduce conflict points, and improve pedestrian visibility. Detectable pavement surfaces can be used to guide people with visual impairments towards safe crossing locations. Bike lanes at roundabouts should always be raised and physically separated from the roadway. Bicycle ramps may be needed to guide people bicycling towards raised bike lanes, sidewalks, and bicycle crossing or crosswalk areas.



**TABLE 3: ADDITIONAL INTERSECTION FEATURES**

	<b>IMPROVEMENT</b>	<b>NOTES</b>
<b>WALKING</b> 	<b>"LOOK BEFORE CROSSING" STENCILS</b>	These stencils should be placed near pedestrian ramps in areas with high vehicle volumes, to encourage people to be aware of their surroundings.
	<b>LEADING PEDESTRIAN INTERVAL</b>	Leading Pedestrian Intervals provide a pedestrian "walk" signal before vehicles get a green signal, giving people walking a head start to cross the street and improving their visibility. These are preferred where there are high conflicting volumes of people walking and turning vehicles, and may be combined with a Leading Bike Interval.
	<b>PEDESTRIAN SCRAMBLE PHASE</b>	This provides a dedicated all-directions pedestrian-only phase, appropriate at the highest pedestrian volume intersections.
	<b>PEDESTRIAN REFUGE ISLANDS</b>	Islands are located in the middle of the street, allowing people walking to cross half the street at a time. These should be at least 6' wide to accommodate people bicycling as well as walking, and can be extended in locations of higher pedestrian crossing volumes or additional travel lanes.
	<b>CURB EXTENSIONS</b>	These bulb-out features at intersections slow traffic, shorten crossing distances, and improve pedestrian visibility.
	<b>CENTERLINE HARDENING</b>	Centerline hardening uses physical features such as bollards or curbs extending into the intersection at the centerline, requiring drivers to slow down and make a tighter curve when turning left. This improves safety for people in the crosswalk.
	<b>RAISED INTERSECTIONS</b>	The roadway can be raised at minor intersections, slowing vehicle traffic and providing better visibility of people walking and bicycling across the intersection. Raised intersection designs will need to account for functions such as target speed, design vehicle, drainage, and other needs.
	<b>COLORED PAVEMENT THROUGH INTERSECTIONS</b>	Colored pavement can highlight pedestrian or bicyclist zones within an intersection, or indicate the intersection of a "shared street" with a higher-level street and raise driver awareness of the presence of people in the street.
	<b>RAISED CROSSWALKS</b>	Raised crosswalks provide an elevated surface above the travel lane, encouraging slower speeds and making people walking more visible.
	<b>PEDESTRIAN BEACONS</b>	Pedestrian beacons can be used to highlight and regulate traffic at frequent pedestrian crossings in between signal locations. Beacon type will vary depending on the street and intersection context: post-mounted Rectangular Rapid Flashing Beacons can be used at small-medium and small-small intersections or mid-block locations, while HAWK Beacons should be used at crossings on major streets and some medium street intersections.
	<b>LAGGING LEFT TURNS</b>	Shifting left turns to end of signal phase allow people walking to clear the intersection prior to the left-turn green arrow, reducing conflicts.
<b>BICYCLES</b> 	<b>BICYCLE BOXES</b>	Bicycle boxes are marked on-street waiting areas near the crosswalk at intersections, so people bicycling can queue in front of vehicles as they wait for a green signal.
	<b>PROTECTED INTERSECTION</b>	A protected intersection gives people bicycling and walking a dedicated path through intersections, keeping them physically separate from vehicle traffic. These designs reduce vehicle turning speeds, improve visibility for people walking and bicycling, and reduce conflicts between cars and people.
	<b>LEADING BICYCLE INTERVAL</b>	Where high conflicting volumes of people bicycling and turning vehicles exist, a Leading Bicycle Interval provides a bicycle green indication before the green signal for vehicles. It is often combined with a Leading Pedestrian Interval.
	<b>PROTECTIVE/PERMISSIVE BICYCLE SIGNAL PHASE</b>	Where high conflicting volumes of people bicycling and turning vehicles exist, signals should provide separate through and right turn indications for the traffic lanes parallel to separated bicycle facilities. This allows bicycles making a through movement to clear the intersection prior to conflicting right turning vehicles.
	<b>PROTECTED BICYCLE SIGNAL</b>	This provides a separate signal phase specifically for bicycle traffic, and is appropriate on the highest priority bicycle routes.



		<b>IMPROVEMENT</b>	<b>NOTES</b>
<b>TRANSIT</b>		<b>BUS-ONLY LANES</b>	Bus-only lanes provide dedicated roadway space for transit, which can be continued through intersections to maximize travel time and reliability benefits, while avoiding congestion.
		<b>IN-LANE TRANSIT STOPS</b>	In-lane transit stops allow buses to use the travel lane to pick up and drop off passengers, eliminating the need for the bus to merge back into traffic after stopping. This improves travel time for transit and is appropriate for use on high-priority transit routes, but may be preferred on routes without major transfers where dwell time is likely to be lower.
		<b>PULL-OUT TRANSIT STOPS WITH QUEUE JUMPS</b>	Pull-out stops are appropriate on high-priority routes where passenger loading and unloading volumes may be higher than normal, due to transfers or other activity. When combined with a near-side stop and a separate signal phase at intersections, these can also function as queue jumps for transit vehicles.
		<b>TRANSIT SIGNAL PRIORITY</b>	This signal infrastructure prioritizes transit vehicles by detecting oncoming buses and providing them with extra green time, allowing them to clear the intersection and improve their travel time. Transit signal priority could also mean shortening red signals to accommodate approaching transit vehicles, or by adding a signal phase dedicated only to buses and/or trains. These are appropriate for use on high-priority transit routes.
		<b>QUEUE JUMP LANES OR QUEUE BYPASS LANES</b>	These provide separated lanes for buses to pass queued vehicles on the highest-priority bus routes.
		<b>FAR-SIDE BUS STOPS</b>	Far-side stops allow transit vehicles to clear the intersection before loading and unloading passengers, reducing their delay at intersections. These are preferred at signalized intersections.
<b>VEHICLES</b>		<b>DIFFERENTIAL STOP BAR LOCATIONS</b>	Placing through lane stop bars further back from intersection than right turn lane stop bars allows unobstructed sight lines for right-turning vehicles, which improves safety for everyone.
		<b>REDUCED CYCLE LENGTHS</b>	Reduced traffic signal cycle lengths can result in shorter wait and travel times, and increase compliance by people walking or bicycling who wish to cross the street.
		<b>RIGHT-TURN-ON-RED RESTRICTIONS</b>	Right-Turn-On-Red (ROTR) restrictions can reduce conflicts between turning vehicles and people in the crosswalk. These could be applied only during peak times or throughout the day, depending on pedestrian and turning vehicle volumes.
		<b>TRAFFIC DIVERTERS</b>	Traffic diverters physically block vehicles from passing through an intersection, and are generally used to calm traffic in residential areas. Diverters can block one or both lanes of traffic.

As street and intersection typologies are implemented, designers should rely on more than just crash history and signal and traffic performance (which often only tell part of the story) to determine needs and appropriate intervention strategies. Decisions should be made based on existing and planned land uses, existing and projected “mode share” by different transportation modes, field observations, community and citywide goals, and community input at intersections along each corridor, too.

If crash data indicate an existing or potential safety issue, the corridor and intersection designs should mitigate existing risk factors. In such cases, a safety study should be conducted to understand the specific conditions, users, and movements contributing to collisions or near-miss events. Measures to increase sightlines and visibility, reduce speeds of through and turning vehicles, increase separation and protection of vulnerable users, restrict or prohibit problematic turning movements, modify signal cycles, phases, and timing, and increase user compliance with traffic control devices should be considered and implemented.