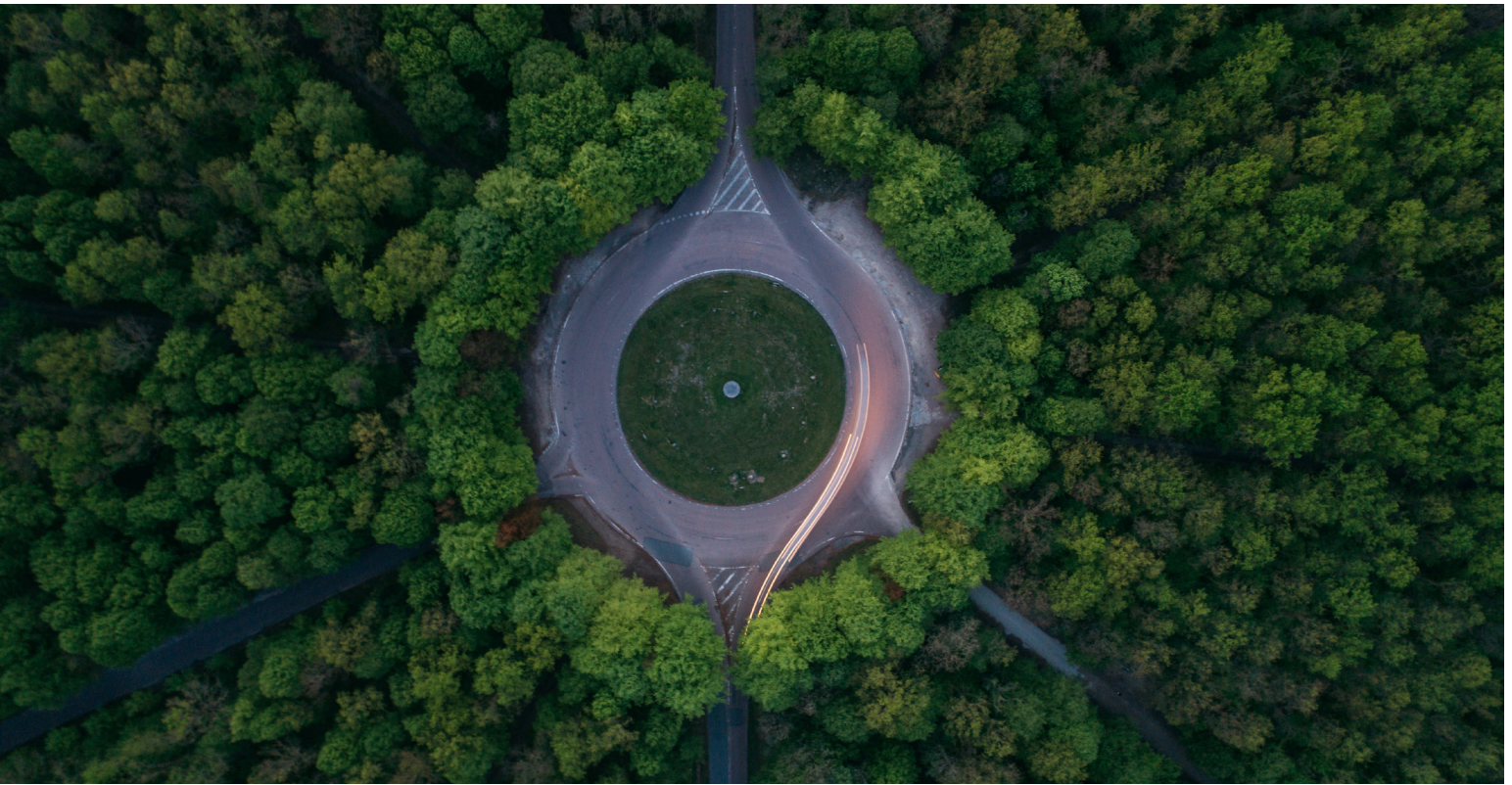
An aerial photograph of a modern roundabout intersection. A red car is driving clockwise around the roundabout. A white car is entering the roundabout from the left. The roundabout has a brick-paved center and a red and white striped curb. The surrounding area includes grassy medians and various road markings like dashed lines and arrows. A semi-transparent orange rectangle is overlaid on the right side of the image, containing white text.

**MODERN ROUNDABOUT  
INTERSECTIONS: A NEW  
TRAFFIC INTERSECTION  
TECHNOLOGY THAT'S  
ACTUALLY QUITE OLD.**





Let's start this off by setting the record straight. Roundabout intersections are not a new technology. Roundabouts have been around, in some form or another, for over 100 years. They were so poorly designed at their inception that by the 1950's they could not efficiently convey peak hour travel volumes, contained very serious safety concerns, and were ultimately dismissed from American culture. However, a brief look into history lets you know that most of the world has been designing and driving the Modern Roundabout Intersection for nearly 50 years!

## HISTORY

Way back in the day, think early 1900's, there were some half-cooked roundabout intersection designs put into construction and use in major U.S. cities on the east coast. However, these were not really roundabouts. These circular intersections are known today as either a Rotary or a Traffic Circle and had a drastically different geometric appearance than that of the Modern Roundabout Intersection. The two most notable Rotary or Traffic Circle locations still in use

in the U.S. today can be found at the Dupont Circle in Washington D.C. or Columbus Circle in New York City. Please note that these intersections are NOT roundabouts, don't let anyone tell you differently.

So what is the difference between the early Rotary or Traffic Circle intersections and the Modern Roundabout Intersection? This is a good question, and there are a number of differences. However, for sake of sanity and brevity, I'll only mention the most significant here. The Rotary/Traffic Circle design or operational elements that differ significantly from Modern Roundabout Intersections are as follows:

1. Vehicles entering the circle have the right-of-way
2. Entry points are tangent to the circulating traffic
3. Entry points into the circle are governed by stop signs or traffic signals
4. Circulating traffic are also governed by stop signs or traffic signals
5. Pedestrians are allowed to cross onto the central island
6. Parking is permitted within the circle itself





None of the above items are acceptable design or operational elements of the Modern Roundabout Intersection. Most of these items listed can cause serious impacts to operations which cause large delay times to the motoring public. Rotary and Traffic Circle intersections are known to gridlock when traffic volumes are at nominal levels. For the most part, the gridlocking can be directly attributed to the entering vehicles having right-of-way. If vehicles in the circle must stop for an entering car or truck, then traffic backs up in the circle. If vehicle volumes entering the intersection are substantial, large queues will form in the circle and entry points, and the intersection locks up without reprieve until local police come and sort traffic out. Vehicle parking, pedestrian crossings, and traffic controls (stop signs or signals) are all known to be detrimental to intersection capacity. Intersection capacity and intersection operations are often times directly related. By introducing one or more of these

elements to an intersection, significant reductions in traffic capacity and operations will be experienced. Reduced traffic operations lead to increased delays, and quite often to gridlock. The big take away is that the original circular intersection (Rotary and Traffic Circle) geometry and operations was doomed to fail as the ability to obtain a driver's license and own a car became easier.

Between 1950 and 1970, Great Britain reevaluated the traffic circle and revised geometric and operational concepts to ensure improved traffic operations and safety. The two main changes resulted in giving the right-of-way to vehicles already within the circle, and revising entering vehicle geometry with curvilinear elements that required a reduction in speed before the intersection. In the 1980s, the French government applied these revisions, and others, to their national highway facilities. Following these changes, the design and implementation of roundabout intersections soared within France's roadway network. Most of Europe also saw a substantial increase in roundabout intersection construction. The work Great Britain and France put into roundabout intersection design is how we ended up with the Modern Roundabout Intersection.

The following are typical design and operational elements of a Modern Roundabout Intersection:

1. Entering vehicles yield to all circulating traffic
2. Entry points are at an angle to the circulating traffic to force the driver to slow down and evaluate gaps in circulating traffic
3. Yield signs are the preferred method of traffic control and are applied to all entry points
4. Pedestrians are required to cross through the splitter islands. No fixed objects are typically allowed within the roundabout central island
5. Parking is not permitted within or near the roundabout intersection

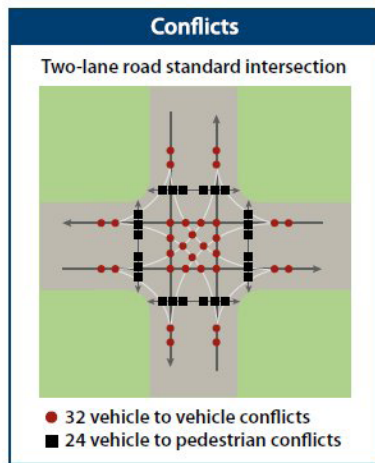


Figure 1: Typical Intersection Conflict Diagram

The National Cooperative Highway Research Program (NCHRP) developed a phenomenal report that goes into very great detail about Traffic Circles, Rotaries, and Modern Roundabout Intersections. For more information, please use the following link: [www.onlinepubs.trb.org/onlinepubs/nchrp\\_syn\\_264.pdf](http://www.onlinepubs.trb.org/onlinepubs/nchrp_syn_264.pdf)

## CONSTRUCTION COST

Costs to construct a Modern Roundabout Intersection is dependent on several factors such as: the state it resides in, the materials used to construct, the size of the roundabout's Inscribed Circle Diameter (the overall size of the roundabout circle), the amount of Right-of-Way (ROW) needed, the existing intersection conditions, etc. However, until only recently it was believed that the cost to construct a Modern Roundabout Intersection was comparable to the costs of a typical four-legged intersection complete with traffic signal controls. Actual intersection construction costs can have a large variance, but are generally between \$750,000 and \$1,500,000. Recently, the Transportation Research Board (TRB) has identified that the initial construction costs for Modern Roundabout Intersections are exceeding estimated construction costs across the nation. There isn't much in the way of research on this topic yet, but the main idea is that roundabouts are exceeding estimated costs and surpassing construction

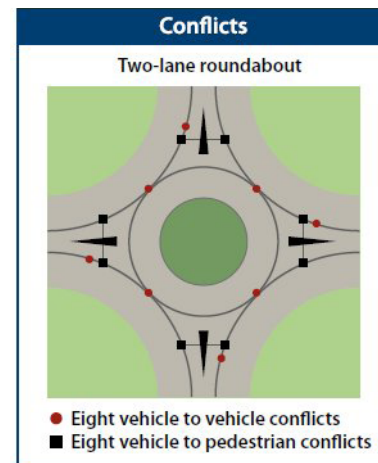


Figure 2 : Modern Roundabout Conflict Diagram

costs of a signalized intersection. Noting this, it is worth mentioning that the true evaluation of an intersection's construction costs must include a life cycle analysis. Signalized intersections require routine maintenance to traffic signals, and potentially traffic detection, that roundabout intersections are able to avoid. These maintenance costs can run an agency or public works department anywhere from \$5,000 to \$15,000 per intersection on a yearly basis. Over the course of 20 years, and noting inflation, that maintenance cost will surpass the added initial construction costs found with the Modern Roundabout Intersection.

## SAFETY

Vehicular, bicyclist, and pedestrian safety are vastly improved with Modern Roundabout Intersections. However, it is vehicular safety that has become the key selling point for the Modern Roundabout Intersection. A standard two-lane intersection, where the intersecting streets cross at a 90° angle, contain 32 conflict points (see Figure 1). A conflict point is essentially any location where vehicles have an opportunity to cross paths and collide. The real concern is the number of conflict points that can produce a head on or side impact (T-Bone) collision. It is widely accepted in the traffic engineering industry that head on and side impact collisions

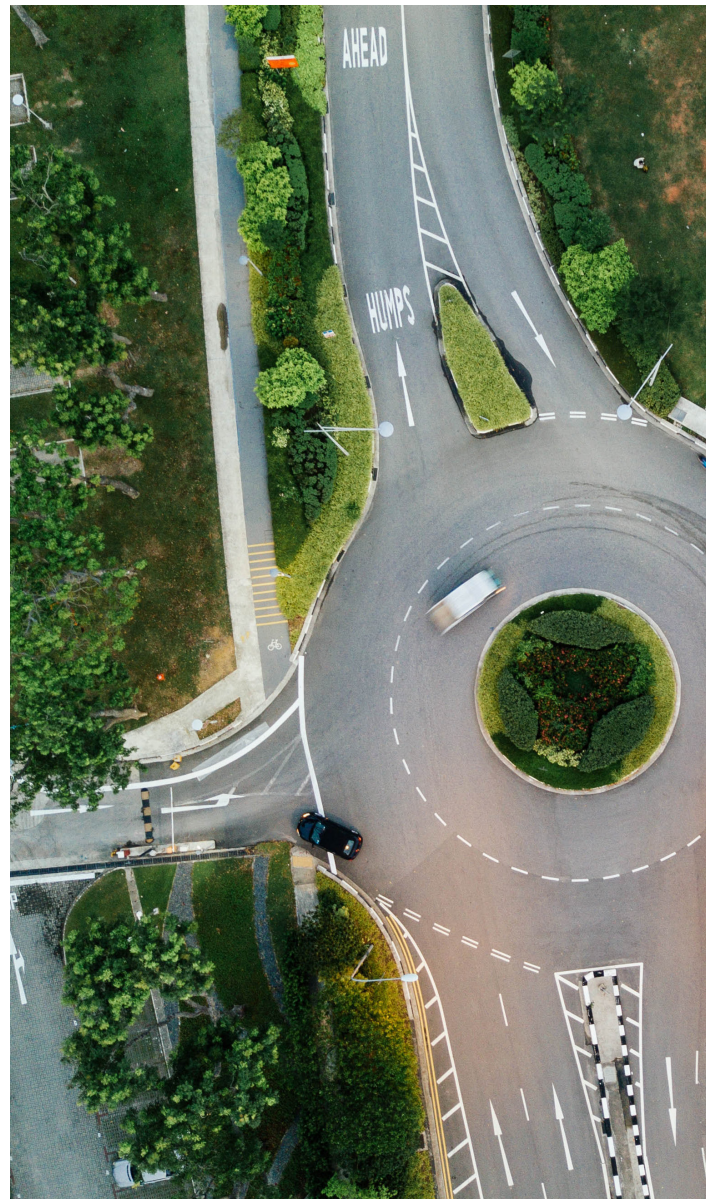


typically produce the greatest injuries and fatalities of almost all the other crash types. By comparison, the Modern Roundabout Intersection has only eight total conflict points and affords zero opportunities for head on or side impact collisions (see Figure 2). Add in that Modern Roundabout Intersections force vehicles to slow down before entering into, and while traveling through, the intersection and traffic safety has the potential to be significantly improved.

Roundabouts improve traffic safety, and in a day and age where distracted driving by way of cell phone usage and other allures, traffic safety has become a very difficult goal to attain. Regardless of how the collision was caused or who was responsible, the main idea is to reduce the severity of the crash, save lives, and reduce liabilities that can arise from collisions. To illustrate this point, I would like to discuss the KABCO scale, which is used to report injury severity on collision reports that are recorded by police. KABCO is defined in the Model Minimum Uniform Crash Criteria (MMUCC), a standardized set of data elements and attributes for crash reporting. The MMUCC provides the following definitions:

- K Severity: Fatal Injury
- A Severity: Suspected Serious Injury
- B Severity: Suspected Minor Injury
- C Severity: Possible Injury
- O Severity: No Apparent Injury. This is also known as a Property Damage Only (PDO) crash

The Federal Highway Administration (FHWA) Safety Program completed a report in 2016 that set dollar values for each injury type in order to help evaluate the benefit-cost of potential roadway improvements. The dollar values are an aggregate estimate based on data pulled from state and national resources. The values shown below are not intended to place a value on human lives, but more as reference point for costs required to mitigate liability that can arise from



specific injury types. The following is the injury type and affixed dollar value:

- K Severity - \$11,295,400
- A Severity - \$655,000
- B Severity - \$198,500
- C Severity - \$125,600
- O Severity - \$11,900

What we see is that loss of human life from a collision is extraordinarily costly. This should be expected given the subject matter. Please note that head-on and side impact collisions produce more severe injuries than most other collision types,

and that the Modern Roundabout Intersection has successfully eliminated these collision types. Based on this, it becomes clear that the Modern Roundabout Intersection is a safer intersection than the standard, two-lane intersection type.

## SHOULD ALL INTERSECTIONS BE ROUNDABOUTS?

This is not the correct question! Yes, the Modern Roundabout Intersection is less expensive over the course of its usable life. Yes, they show significant safety improvements. Yes, they improve operating conditions. These are great things but understand that with all these benefits a Modern Roundabout Intersection may not be the best choice for every single intersection. Installing a roundabout at intersections with low speed roads, low traffic volumes, low collision volumes, or low volumes of severe injury collisions may not make sense fiscally. In these instances, standard intersection geometry and traffic controls would be sufficient.

The correct question is: Will a Modern Roundabout Intersection resolve significant traffic operating or safety issues at a specified location? A thorough evaluation of the existing intersection to define all operational and safety issues must be performed before settling on the appropriate proposed intersection geometry. If there are few or no issues to resolve, then a standard intersection geometry and operation will be acceptable. **Bottom line, the roundabout must solve existing problems at the intersection, or it won't be worth the time to design and construct.**

## CLOSING

What we have learned is that the U.S. fell out of love with what was formerly known as a roundabout intersection around 1950. After Great Britain and France revised the intersection to what is standard today, the Modern Roundabout Intersection provides a safer and more cost-effective intersection at locations where significant traffic operation and safety concerns exist in present day or at a future time. The Modern Roundabout Intersection is back in the U.S to stay. However, the first installation wasn't until 1997 and by that time the Modern Roundabout Intersection technology was not new! Since then, they have steadily increased in popularity inside the U.S. and will continue to grow as more and more state Departments of Transportation implement their design and construction.



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## ABOUT THE AUTHOR

Chad Dillavou is a senior civil engineer and tasked with leading Primera's Cedar Rapids, Iowa office. His expertise is the result of more than 10 years of experience in the planning, design, and construction of transportation projects. He has significant knowledge of traffic engineering and management with a wide range of abilities in the transportation field. Chad has experience with traffic analysis software (HCS +, HCS 2010, Synchro) and applying the Context Sensitive Solutions process on projects. He also has substantial experience performing preliminary engineering studies, geometric design, and is well versed in traffic studies, and public involvement.