

Subject: U.S. 71 & U.S. 18 intersection

Mayor Steve Bomgaars and Chairman Barry Anderson,

Thank you for your May 12, joint letter regarding the proposed safety improvements at the U.S. 71 & U.S. 18 intersection. Below is a response to your letter with requested support information including links to additional relevant data.

Intersection Safety Comparisons (from City Letter and other similar intersections)

The table below shows some safety comparisons to the intersections referenced in the City/County letter. Iowa DOT has updated its intersection crash comparables method. This method uses statewide intersection crash data to develop predicted crashes based on entering traffic volumes for various intersection types (e.g. divided high-speed partial stop control, high-speed traffic signal control, all-way stop control, etc.), and compares this value with the intersection crash history. This comparison is called the Potential for Crash Reduction (PCR), and these PCR values are computed for ‘All’ crashes and for ‘Severe’ (fatal, major, minor injury severity) crashes. Intersection PCR values are assigned a Safety Tier: High, Medium, and Negligible PCR. High PCR and Medium PCR tier intersections are performing worse than expected, and they account for approximately 3% of paved intersections statewide (approximately 3,300 of 115,000), with the remaining in the Negligible PCR tier. This method is used to identify and prioritize intersections for further study and safety improvement funds.

The first row shows the US 71 & US 18 study intersection, which is in the High tier for PCR-All and PCR-Severe. The bold rows are the intersections mentioned in the City/County letter. The additional rows show some other comparable intersections that are discussed below, with some relevant notes.

Intersection	Traffic Control	Major AADT	Minor AADT	PCR-All PCR-Severe	Notes regarding comparison
US 71 & US 18 Spencer	Partial (Two-way) Stop	10,300	2,200	<i>High High</i>	<u>Category</u> ranking #13 for PCR-All crashes, #2 for PCR-Severe crashes
US 75 & Main St/C60 Hinton	Traffic Signal	16,500	1,700	<i>High High</i>	Undivided 4-lane 35 mph speed reduction zone
IA 141 & State St Granger	Traffic Signal	11,100	1,600	<i>Medium Negligible</i>	Intersection is in center of built-up/urban area vs edge of town
US 65 & Grant Street S Bondurant	Traffic Signal	14,500	4,000	<i>High High</i>	First signal encountered SB; more signals have followed
IA 163 through Pleasant Hill	Traffic Signals	18,000- 26,000	2,000- 4,000	Negligible to <i>High...</i>	High PCR intersections are on east end at the rural/high-speed transition
US 71 & IA 3 Buena Vista County	All-way Stop	3,500	1,300	Negligible Negligible	Lower volumes, two-lane undivided, simpler intersection for AWSC
US 20 & IA 140 Moville	All-way Stop	8,000	4,000	Negligible <i>Medium</i>	Four-lane divided 55 mph speed reduction zone
US 30 & S Story St Boone	All-way Stop	9,100	3,700	<i>High Negligible</i>	Four-lane divided 45 mph speed reduction zone

Traffic Signal vs Roundabout

If the City and County's primary objective is to reduce the incidence of severe crashes, then the RCUT and Roundabout options presented are nationally proven improvements for this goal. While the City/County letter declines to further consider the RCUT alternative, it is noted these continue to be constructed in surrounding states – including > 20 locations in Minnesota, 6 in Wisconsin, and >20 in Missouri. One is being constructed in Iowa this year on US 20 in Webster County east of Fort Dodge. Both the RCUT and roundabout alternatives have the potential to greatly reduce the high-speed collisions between mainline and left turning or crossing side street vehicles that most commonly lead to severe outcomes by reducing 'conflict points' where vehicle paths cross, re-routing left turns, and changing the angle of vehicle collisions.

Based on Iowa DOT experience, conversion from rural divided (median) two-way stop control to a high-speed traffic signal often results in a 0% reduction in fatal and injury crashes. The severe crashes instead shift from primarily broadside types to rear-end types, but the rear-end crashes can be severe due to high speeds, and 'ran traffic signal' and left turn type crashes can still result in severe broadside collisions.

At high-speed traffic signal control intersections, the most common crash types are rear-end (43%), broadside (front to side) (26%), and oncoming left turn (14%). These crash types involve a 0° rear-end or a 90° broadside crash angle with a large speed differential between the two vehicles, and therefore have the highest potential for severe injury. Conversely, at roundabouts, the most common crash types are broadside (36%, with roundabout broadside collisions at a much lower circulating speed, 25 mph, instead of at full mainline speed), sideswipe (24%), and rear-end (16%). These crash types occur at lower speeds, with less speed differential between vehicles, and result in lower-severity crashes. The difference in crash severity is summarized in the table below for High-Speed Traffic Signals on the Primary System in Iowa, All Roundabouts in Iowa, and 2-lane x 1-lane multi-lane roundabouts in Minnesota. Severity percentages are at least twice as high for high-speed traffic signal vs multilane roundabouts. (Minnesota roundabout study discussed more below).

Crash Severity	High-Speed Traffic Signal (Iowa)	All Roundabouts (Iowa)	Multi-lane (2x1) Roundabouts (Minnesota)
Fatality	0.2%	0 %	0%
Serious Injury	1.5%	0.6%	0.2%
Minor Injury	10%	6%	4%
Possible Injury	21%	11%	15%
Property Damage Only	67%	82%	82%

Approximately 3% of paved intersections statewide have a High or Medium PCR. Of 197 High-Speed Traffic Signal Control intersections statewide on the Iowa DOT Primary Road System, 54% are High or Medium PCR. Of all roundabout intersections statewide, 20% have a High or Medium PCR, and only 6% are in either the High or Medium tier for PCR-Severe crashes. There have been no fatalities at roundabouts in Iowa from 2012-2022, based on reports from 1,180 crashes at 117 roundabout intersections.

All-way Stop Control vs Roundabout

An all-way stop condition was not considered for several reasons; an all-way stop on a high-speed, 4-lane corridor does not increase safety because it does not meet driver expectation. A similar situation exists on U.S. 20 in Woodbury County at Merville. The intersection has several crashes including fatal crashes. Iowa DOT District 3 staff have identified this location as a candidate for intersection improvement that will include the removal of the stop sign. A similar situation exists on US 30 in Boone. Both intersections are noted in the intersection table with either a Medium or High PCR tier. With respect to driver expectation, both of these locations are at the main route into the City from the bypassing highway, whereas the study U.S. 71 & U.S. 18 intersection is less centrally located. The City/County letter notes the all-way stop at U.S. 71 & IA 3 in Buena Vista County. As noted in the table above, that location is not comparable as it has about 1/3 of the entering traffic volume and provides single lane approaches (with right turn lanes) and no left turn lanes.

When comparing the all-way stop control (AWSC) to a roundabout, the roundabout essentially operates as an "all-way yield". This provides benefits for operations and safety. For operations, a roundabout provides a significant benefit in reducing delay and increasing efficiency compared to an all-way stop for a couple of reasons. First, instead of all drivers stopping at all hours of the day, all drivers slow down but many will not need to stop, especially during the 20+ off-peak hours per day. Second, when an all-way stop is located at an intersection with multiple lanes such as U.S. 71, delay increases with driver uncertainty. For example, as drivers on the side street attempt to confirm they have the right-of-way from drivers arriving in multiple NB/SB through lanes and left turn lanes, this results in many false starts and lost time gaining assurance that the other direction is not going to go. Then after they proceed, the U.S. 71 left turn movements must ensure neither of the opposing through lanes are about to depart, etc. At the busiest times a roundabout may function similarly to the AWSC in that most approaching vehicles will stop, but those drivers have a simpler and quicker decision to make when it is their turn to proceed.

The most important distinction for safety is that with all-way stop control crashes due to driver error when a driver does not see or obey the stop sign. At an all-way stop they proceed as if it is a two-way stop. At a roundabout the approach island provides deflection to slow down entering traffic and change the potential angle of impact between two vehicles, reducing the risk of high severity rear-end and broadside/right-angle crashes. The multi-lane approaches on U.S. 71 would allow for potential sideswipe crashes, but these types of crashes tend to be lower severity.

Traffic Signal and All-way Stop Control Summary

Improvements like stop sign and traffic signals, while familiar, are not always a safe choice. With intersections representing one-quarter of annual traffic fatalities in the U.S. and half of all injury crashes, proven intersection safety counter measures, such as the treatments shown to the Spencer City Council and Clay County Board of Supervisors are the types of improvements the Iowa DOT feels the best applications for the U.S. 71 & U.S. 18 intersection. The U.S. 71 & U.S. 18 improvements completed on the intersection in 2015-16 have demonstrated a reduction in crashes from the years prior to the completion of the improvements. District staff feels leaving the intersection "as is" is a better solution than traffic signals or stop sign control.

For these reasons, if the City/County are committed to an all-way stop control or traffic signal at this US 71 & US 18 intersection, the DOT may be willing to approve a permit for installation but would have limited to no funding participation. With a roundabout, the project would likely be fully funded with State/Federal safety funds.

Corridor Speed Management

Another objective of the intersection improvement is to manage speed on U.S. 71, especially for southbound traffic entering the city from a rural roadway context. Roundabouts provide a gateway to slow down all drivers. They provide horizontal (lane shift, circulating island) and vertical (raised center island) elements to reinforce that transition. By comparison, stop signs require all vehicles to stop, but drivers quickly regain speed after their stop to make up for lost time. And drivers encountering traffic signals during a green signal phase enter the city at full highway speed.

The City/County letter inquired about “more signage, flashing lights, and rumble strips”. Rumble strips would only be utilized as part of a 4-way stop intersection configuration so they would not be considered as a stand-alone improvement. Motorists have an expectation of an upcoming stop sign with the presence of rumble strips. Additional signage and flashing beacons alone are unlikely to have a significant additional impact. The corridor is already visually ‘busy’ with signs and adjacent land uses, and mainline flashing warning lights have shown only modest benefits. Overall, signs and flashers are considered lower cost, incremental, temporary benefits vs. a permanent solution. With that said, we are open to adding intersection warning signs with flashing lights for northbound and southbound traffic. There are measures that you as a local government can do to improve safety at the intersection. One of the most effective tools to reduce speed is to increase law enforcement activities near the intersection. Nothing slows traffic like the presence of the threat of law enforcement action for speeding motorists.

Additional Comparable Roundabout Crash Data

Iowa does not have comparable divided high-speed *multi-lane* rural roundabout intersections for comparison of before/after data. The existing rural roundabouts in Iowa are operating well, but they are all single lane for all approaches. 37 of the existing 117 roundabouts in Iowa have a multi-lane approach, and most are in urban or suburban contexts. Some similar multi-lane roundabout examples are isolated (SW Irvinedale Drive & Polk City Drive, Ankeny, IA) or along a corridor (NE 62nd Street in Johnston or University Avenue in Cedar Falls). These are not suitable for before/after analysis as they were either developed either too recently for data or constructed concurrent with significant land use and traffic volume changes. For visual comparisons, some google maps links are provided below.

However, there have been several studies completed regarding the safety of rural roundabouts. An Insurance Institute of Highway Safety review of multi-lane roundabout conversions from signalized intersections or two-way stop control intersections showed safety improvements of a 90% reduction in fatal crashes and a 75% percent reduction in severe injury crashes.

The most relevant study was completed by Minnesota DOT (MnDOT) in 2017. It was one of the few that looked specifically at “unbalanced” multi-lane roundabouts (e.g. 2-lanes on each mainline approach, 1-lane for minor approaches). The findings in that study showed an overall **increase** in the number and frequency of crashes with the conversion of signalized or stop controlled intersections to roundabout control. However, the intersections reported no fatal crashes and a 78% reduction of serious injury crashes. Sideswipe crashes increased, as expected since that lower severity crash type is essentially non-existent at a two-way stop or traffic signal configuration.

Tabulated below are links to the multi-lane roundabouts and corridors mentioned. Note how the Ankeny, IA and Worthington, MN approach lanes have pavement markings to provide wider approach lanes to separate side by side large vehicle approaches and reduce sideswipe opportunities.

City	Intersection	Year Constructed	Google Maps Link
Ankeny	SW Irvinedale Drive & Polk City Drive	2012/13	Link
Johnston	NE 62 nd Street Corridor	2012	Link
Cedar Falls	University Avenue Corridor	2017/18	Link
Worthington, MN	US 59/MN 60 Corridor	2012/13	Link
Link: Iowa DOT roundabout page			
Link: Minnesota DOT roundabout page			
Link: Roundabout database index and map – searched with ‘Iowa’ + ‘multi-lane’			

Roundabouts and Truck Traffic

The Iowa DOT is aware of an issue at another nearby roundabout installation in Worthington, Minnesota on US 59/MN 60 that may be familiar to Clay County motorists. Three roundabouts were constructed along this corridor in 2012/13. This corridor had a few noteworthy crashes with low-speed trailers experiencing a load shift while turning or mounting the truck apron in the center island, resulting in the truck tipping over. One involved a trailer hauling cream ([link](#)), and the other a load of hogs ([link](#)). These two crashes resulted in no injury and one possible injury to the drivers, respectively, due to low speed, however they were disruptive for the freight vehicle and other public traffic. A 2021 MnDOT project modified the center island curbs to improve truck accommodation and reduce trailer load shift. ([link](#))

Iowa DOT is sensitive to the freight importance of the US 18/US 71 corridor and has multiple nationally recognized roundabout design consultants under on-call contract for either roundabout design or roundabout peer review for such design details. If a roundabout is constructed, Iowa DOT will work with our counterparts at MnDOT to understand their experience and incorporate the modifications constructed at these locations.

Additional Roundabout Support

The AARP has produced documents supporting the construction of roundabouts, especially related to reduced crash severity for older drivers. See here:

<https://www.aarp.org/content/dam/aarp/livable-communities/livable-documents/documents-2014/Livability%20Fact%20Sheets/AARPLivabilityFactSheet-Modern-Roundabouts-33116.pdf>

As noted above, Cedar Falls reconstructed University Avenue, serving >25,000 vehicles per day, with a series of roundabouts in 2017/18. In 2020 and 2021 the City Council approved additional roundabout corridor projects, including one just outside the Cedar Falls Public Safety Building, and one article included this quote from the police chief:

““Very few or no injuries at roundabout accidents, and if there are, they’re very minor. And that is in great contrast with signalized intersections, where if somebody blows a red light you possibly have a T-bone accident into a driver’s door or passenger’s door, often resulting in very severe injuries,” Cedar Falls Police Chief Craig Berte said.”

https://www.kwwl.com/archive/new-roundabout-in-cedar-falls-will-change-more-than-just-the-roads/article_b149bb04-d586-5eac-9e1d-1d62dbcd9f8d.html

If you have further questions or comments do not hesitate to contact me.

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