

September 18, 2025

**Troy Wilson
NCDOT Division 14, District 1
4142 Haywood Road
Mills River, NC 28759**

Reference: Upward Road Sheetz – Hendersonville, North Carolina

Subject: Traffic Impact Analysis Supplement

Dear Mr. Wilson,

This letter serves as a supplement to the Traffic Impact Analysis (TIA) and its addendum for the proposed Sheetz development on Upward Road, located opposite Ballenger Road in Hendersonville, North Carolina. Prepared in response to follow-up discussions with NCDOT and Town of Hendersonville staff, this supplement provides additional clarity on the recommended intersection configurations and control strategies, both in the near term and long term, at the Upward Road and Ballenger Road intersection. In addition to the previously presented capacity analysis results, this letter also evaluates the anticipated impacts on safety and carbon emissions under the various intersection layout alternatives.

Background Information

After further review of the TIA, NCDOT requested additional analysis to ensure acceptable operations along the southern leg of the intersection of Upward Road and Ballenger Road as well as to make sure the improvements associated with the proposed development adhere to NC Executive Orders 80, 246, and 271 and the NC Vision Zero initiative that focuses on eliminating traffic related death and injuries.

Improvement considerations have been made to ensure that with construction of our development, capacity impacts are mitigated while protecting the safety and the future plan for development of this corridor. Capacity at the intersection is largely considered in the immediate future as well as the distant future with potential development generating significant traffic.

Traffic Analysis Comparison

Traffic capacity analysis for the intersection of Upward Road and Ballenger was performed using Synchro 11.1 and SIDRA, which are comprehensive software packages that allow the user to model signalized intersections, unsignalized intersections, and roundabouts to determine levels-of-service based on the thresholds specified in the Highway Capacity Manual (HCM).

Refer to the table below for a summary of the capacity analysis of the subject intersection during the analysis scenarios under both signalized and roundabout control.

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
2024 Existing	EB WB SB	1 LT, 2 TH 2 TH, 1 RT 1 LT, 1 RT	B (14) ¹ -- C (23) ²	N/A	B (10) ¹ -- C (17) ²	N/A
2026 No-Build	EB WB SB	1 LT, 2 TH 2 TH, 1 RT 1 LT, 1 RT	C (16) ¹ -- D (29) ²	N/A	B (11) ¹ -- C (19) ²	N/A
2026 Build - Signal	EB WB NB SB	1 LT, 1 TH, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A (10) B (17) D (45) C (35)	B (19)	A (8) B (16) D (41) C (34)	B (16)
2026 Build - Signal (RTOR)	EB WB NB SB	1 LT, 1 TH, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A (10) B (16) D (40) B (12)	B (16)	A (8) B (15) C (34) B (16)	B (14)
2026 Build - Roundabout	EB WB NB SB	1 LT-TH, 1 TH-RT 1 LT-TH, 1 TH-RT 1 LT-TH-RT 1 LT-TH-RT	A (6) A (10) A (9) B (10)	A (8)	A (5) A (7) A (8) A (7)	A (6)

Analysis of the intersection constructed as a roundabout was requested in addition to analysis of the intersection under full-movement signalized control. As shown in table, the intersection is expected to operate at overall LOS B or better during the AM and PM peak hour when operating as a signalized intersection. Additionally, under field conditions, with right-turn-on-red (RTOR) allowed, even better operations are expected along the northbound leg of the intersection. It should be noted that higher delays along the minor-street are not uncommon as the majority of green time is given to the major-street. With the amount of capacity at the intersection, more green time could be given to the side

streets if desired to improve operations. Additionally, the intersection under roundabout configuration is expected to operate at overall LOS A during the AM and PM peak hours. The proposed improvements would allow for safe vehicular movement until a roundabout becomes more appropriate with future development that will trigger a need to upgrade the intersection. Based on our analysis, no significant queuing is expected with either option.

Intersection Configuration Safety Comparison

A signalized intersection at Upward Road and Ballenger Road represents a meaningful step forward from a safety perspective when compared to the unsignalized condition that exists today. Signalization improves predictability, reduces conflict points for side-street traffic, and safer crossings for pedestrians aligning with the NC Vision Zero initiative. While a roundabout remains the long-term preferred solution, the signalized intersections provides a safer alternative versus the existing condition.

In accordance with the NC Vision Zero initiative, the intersection configurations were evaluated from a high-level safety standpoint. According to published research information from the Federal Highway Administration (FHWA) and National Cooperative Highway Research Program (NCHRP), roundabouts are generally safer than signalized intersections because they reduce both the frequency and severity of crashes. Research shows that converting a signalized intersection to a roundabout can lower overall crashes by about 35–40% with injury crashes dropping by 70–80%.

This crash reduction is largely due to the elimination of high-speed right-angle and head-on collisions, since vehicles in roundabouts travel at lower speeds and in the same direction. Most crashes at roundabouts are minor sideswipes or entry collisions, whereas signals tend to experience more severe angle and rear-end crashes, oftentimes linked to red-light running. While roundabouts often provide substantial safety advantages, particularly in reducing severe crashes, signals are still beneficial in high-volume or pedestrian-heavy contexts.

Intersection Configuration Carbon Emissions Comparison

Vehicles are a major contributor to poor air quality because they emit a variety of pollutants into the atmosphere. Traffic congestion contributes to poor air quality in populated areas through increased emissions of harmful pollutants known as criteria pollutants, including Carbon Monoxide (CO), Nitrogen Oxides (NO_x), Particulate Matter (PM), and Ozone (O₃). Criteria pollutants are federally regulated due to their adverse impacts to human health and the environment. Certain transportation improvements,

such as the use of roundabouts in place of traditional intersections, reduce criteria pollutant emissions from motor vehicles and improve air quality, even along high-volume arterials.

It is noted that the increase in emissions from the existing unsignalized to signalized condition would be minor in nature given the lengthy amount of time that vehicles on the side-street would idle while waiting for gaps in traffic to exit.

Proposed Intersection Configuration Phasing

The intersection of Upward Road and Ballenger Road is proposed to be signalized by the Sheetz development. Signalization of the intersection is expected to greatly improve operations at the intersection compared to its current condition providing safe protected left-turn movements. In order to adhere to North Carolina initiatives and executive orders, the intersection in the long term is planned to be converted to a 2-circulating lane roundabout when traffic conditions trigger the need with future development. In the meantime, the proposed signalization of the intersection ensures that an acceptable level of service can be achieved at the intersection. The Sheetz development proposes to dedicate the appropriate right-of-way that the roundabout intersection improvement can be made in the future.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Seger", is displayed within a white rectangular box.

Cameron Seger, EI
Traffic Analysis Project Engineer

DRMP, Inc.