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April 1, 2005

Mr. Nestor Bottino, AIA
Bottino Grund Architects, LLP
1412 West 6th Street
Austin, Texas 78703

Re: Roundabout Traffic Issues
College Station City Center
College Station, Texas
WPM Project No. 23-05004-00

Dear Mr. Bottino:

This is a summary of traffic issues associated with the proposed roundabout at the interaction of Dartmouth at King Cole in College Station.

Dartmouth is classified as a Minor Arterial by the City of College Station. This street classification is intended to carry average daily traffic (ADT) up to 30,000 vehicles per day. King Cole is a local street that will primarily serve development in the immediate City Center area.

Mitchell and Morgan has designed Dartmouth street from Krenek Tap Road to FM 2818. The design includes a roundabout at the crossing of Dartmouth at King Cole. Analyses were conducted to estimate a range of traffic demands that could be accommodated by the roundabout. The study found that, for the expected range of traffic volumes, the roundabout will have a calming (speed-reducing) effect on traffic without the delays, inconvenience, and violations common at a four-way stops. It will also serve traffic beyond the time that traffic signal warrants would be met.

Before beginning analysis of operations, it is important to have a realistic estimate of the expected traffic volumes at the roundabout. Even though a Minor Arterial is intended to serve up to 30,000 vehicles per day, volumes this high are not expected on Dartmouth. The reasons lower volumes are expected are as follows. Very few existing streets of any type in College Station presently have such high volumes, and those that do are arterial streets. The ultimate buildout of Dartmouth is not one that will attract much cross-town traffic. Instead, most of the traffic on the street will have either an origin or destination on the street itself. It is not expected that there will ever be high concentrations of retail or other traffic-intensive land uses on this street. The land use types and intensities that are expected should generate traffic volumes below the maximum intended for the street classification.

Study Approach
To conduct the study, it is necessary to establish design hourly volumes. The following approach was used to determine volumes for analysis:

Short Range – Short range traffic volumes would be those expected after opening day but before extensive growth or redevelopment takes place in the area. To anchor the short range volumes to reality, Dartmouth and King Cole volumes corresponding to the minimum warrant volumes for 4-way stop control were used. These volumes correspond to ADT volumes of 3900 and 2560 vehicles/day of Dartmouth and King Cole respectively.

Mid Range – Volumes analyzed as mid range volumes correspond to the volumes that would be required to meet the vehicular volume warrants for a traffic signal. The corresponding ADT values are 10,700 and 5400 vehicles/day on Dartmouth and King Cole respectively.

Long Range – These are the volumes that correspond to the maximum volumes for which a single-lane roundabout is recommended to carry, using the same turning percentages as used for previous analyses.

Highest Dartmouth Design Volume – Tested a roundabout with peak hour volumes corresponding to 30,000 Dartmouth ADT.

Roundabout Shape

The Mitchell and Morgan roundabout has a round shape and is the basis of all the analysis in this report. An oval-shaped roundabout is also under consideration. The capacity and operating conditions of roundabouts are defined by the approach geometry, turning radii, width of turning roadway, and total volumes within the roundabout. All these parameters would be the same whether the round or oval shape is selected. Other than a miniscule increase in travel time (due to the slightly longer travel distance in the oval), there should be no detectable difference in operation between the two designs.

Intersection and Roundabout Configuration

For the short, medium, and long range scenarios, the conventional intersections were assumed to have two lanes per approach on Dartmouth and one lane on King Cole. For the ultimate scenario, the conventional intersections were assumed to have two approach lanes plus an exclusive left turn lane on all approaches. Except for the ultimate design, the roundabout was analyzed as a single lane roundabout, meaning that although the roadway remains 24 feet wide, there are no lane markings at the immediate approach or within the roundabout. This will allow easier merging and flow within the roundabout. For the ultimate design, a roundabout with two marked approach lanes and two marked turning lanes was assumed.

Findings

Table 1 explains signalized intersection level of service. Table 2 summarizes the assumptions made for analysis and the expected operating conditions.

Discussion

Table 2 demonstrates that for the assumptions used, the unmarked-lane roundabout is expected to meet peak hour demand up to a Dartmouth ADT of 15,000. It was calculated that a dual-lane roundabout will meet 85% of the demand that would be generated by a 30,000 ADT on Dartmouth. It does not appear that the roundabout could function if the very highest design volume and turning movements assumed for this exercise were to ever materialize.

The measures of effectiveness are not the same as those for conventional intersections. The widely used measure of effectiveness for conventional intersections is based on delay, whereas the measure of effectiveness for roundabouts is volume to capacity (v/c) ratio. The desirable v/c ratio for

TABLE 1
Level of Service Criteria For Signalized Intersections
College Station City Center
College Station, Texas

Level of Service	Stopped Delay (sec/veh)	Description
A	≤ 10	At a single intersection most vehicles do not stop at all. When linked with other signals, vehicles progress through intersections without stopping.
B	> 10 and ≤ 20	At a single intersection some vehicles stop before getting a green signal. When linked with other signals, some cars may have to stop but most progress through the intersection without stopping.
C	> 20 and ≤ 35	At a single intersection, a significant number of vehicles must stop and wait for a green signal. Some vehicles may have to wait through one full signal cycle before being able to move through the intersection.
D	> 35 and ≤ 55	At this level, congestion is noticeable. Many vehicles have to stop while waiting for a green signal. A noticeable number of vehicles have to wait through one full cycle before being able to continue through the intersection.
E	> 55 and ≤ 80	At this level, almost all vehicles have to wait through one or more full signal cycles before moving through the intersection. When linked with other signals, progression is slow.
F	> 80	At this level, the number of vehicles entering the intersection exceeds its capacity. Vehicles have to wait through multiple full signal cycles before moving through the intersection.

roundabout design is 0.85, meaning that good operation is expected at v/c ratios below 0.85. Theoretically, this gives a 15 per cent cushion between the design volumes and the capacity of the roundabout.

It is felt that the likelihood of an ADT of 30,000 ever appearing on Dartmouth is low, for several reasons: Very few existing streets of any type in College Station presently have such high volumes, and those that do are arterial streets. The ultimate buildout of Dartmouth will attract some short cross-town trips between Texas Avenue and SH 30, but far less that that carried by the main north-south streets. Instead, most of the traffic on the street will have either an origin or destination on the street itself. The small-scale retail and other land uses intended for Dartmouth will not generate traffic at the levels for a typical Minor Arterial classification. It is therefore concluded that it is very likely that the proposed roundabout will serve the needs of Dartmouth and King Cole through any reasonable development scenarios and that such scenarios will generate traffic volumes well below

TABLE 2
Comparison of Conventional Intersection and Roundabout Operating Conditions
College Station City Center
College Station, Texas

		Conventional Intersection		Roundabout
Scenario	**Dartmouth ADT**	Configuration and Control	Design Hour Level of Service	Design Hour v/c ratio
Short Range	3900	2 approach lanes on Dartmouth; one on King Cole. 4-way stop control	A	0.17 to 0.21 (unmarked-lane roundabout)
Medium Range	10,700	2 approach lanes on Dartmouth; one on King Cole. Signal control	B	0.55 to 0.68 (unmarked-lane roundabout)
Long Range	15,000	2 approach lanes on Dartmouth; one on King Cole. Signal control	B	0.85 to 1.05 (unmarked-lane roundabout)
Ultimate Dartmouth Design	30,000	2 approach lanes and an exclusive left turn lane on all approaches. Signal control	D	v/c ratio above 1.0. (marked, two-lane roundabout)

the maximum intended for the street classification. It is noted that the highest volumes capable of being handled by a marked, two-lane roundabout are approximately 15% below the highest intended volume for a minor arterial street in College Station.

Very truly yours,

WALTER P. MOORE AND ASSOCIATES, INC.

R. V. Schulze

Randolph V. Schulze, P.E., P.T.O.E.
Principal