



June 29, 2018

Mr. Tristan Charlesworth, Development Associate - Arizona
Trinsic Residential Group
4040 East Camelback Road, Suite 160
Phoenix, Arizona 85018



RE: Traffic Impact Statement for Aura Apartments – Flagstaff, Arizona

Dear Mr. Charlesworth:

Thank you for choosing CivTech Inc. to prepare this Traffic Impact Statement for the proposed Aura Apartments located west of Lake Mary Road south of High Country Trail in Flagstaff, Arizona. The proposed site plan, which also shows the vicinity, is included as **Attachment A**.

This Traffic Impact Statement has been completed in accordance with the requirements of City of Flagstaff guidelines. This statement provides detailed trip generation calculations, an analysis of the impact of additional traffic on operation of the existing signalized intersection of Lake Mary Road and High Country Trail, a sight distance analysis of the proposed site driveways, and a turn-lane analysis at site access points. The study area includes the two (2) proposed site driveways, and the intersection of Lake Mary Road and High Country Trail.

BACKGROUND

The existing Auza homestead consists of four Coconino County Assessor parcels, one of which is divided in two by High Country Trail. (See **Figure 1**.) A change in zoning is being sought for the four parcels to allow a maximum of 174 dwelling units, consisting of the existing home and a 173-dwelling unit multi-family rental community. The existing home and homestead will remain north of High Country Trail. The new multi-family community will front the south side of the street. Access to the multi-family community will be provided by two (2) full movement access points along High Country Trail.



Figure 1 – Parcel Map

EXISTING CONDITIONS

This section provides information on the land uses and roadway network surrounding the proposed development.

SURROUNDING LAND USE

The Aura Apartments development is proposed for the south side of High Country Trail west of Lake Mary Road. The development site is approximately 9 acres. Overhead utility lines pass over the northern portion of the development site. While parking spaces are being shown beneath the utility lines, all apartment buildings will be constructed south of them.

Directly north of the homestead site that will remain is Interstate 17. To the northeast is state-owned land for Northern Arizona University (NAU), Interstate 40, and the NAU campus. Directly east of the site are The Lodge Luxury Apartments and Tablerock Apartments. South and west of the site are Ponderosa Trails, a community of single-family detached residences, and Timber Trails Apartments.

ROADWAY NETWORK

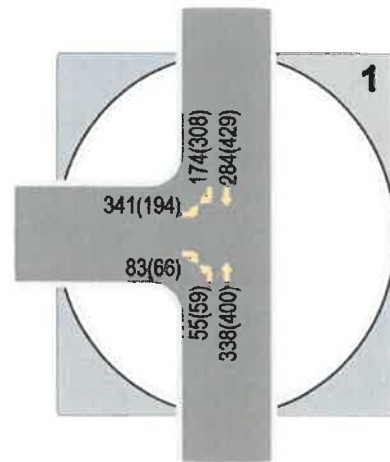
The existing roadway network in the vicinity of the development includes Lake Mary Road and High Country Trail.

Lake Mary Road functions as a north-south roadway within the vicinity of the site. Beginning in the north, West University Heights Drive becomes Lake Mary Road and continues south until it terminates at State Route 87 north of Payson. Lake Mary Road provides access to I-17 and State Route 89 along its route through the vicinity of the study area and to state Route 87 to the south. The City of Flagstaff classifies Lake Mary Road as a minor arterial roadway. The posted speed limit in the vicinity of the site is 45 mph.

High Country Trail functions as an east-west roadway in the vicinity of the proposed site. The roadway begins east at the intersection with Lake Mary Road and terminates to the south near Quartz Road where the pavements ends and is barricaded, but not before intersecting Pulliam Drive, which links High Country Trail to the Flagstaff Airport and I-17. The City of Flagstaff classifies High Country Trail as a major collector roadway. The posted speed limit within the vicinity of the site is 35 mph.

INTERSECTION CONFIGURATION

The intersection of **Lake Mary Road and High Country Trail** operates as a signalized "T" intersection with protected-permitted phasing in the northbound approach. The northbound approach consist of and exclusive left-turn lane, and one (1) through lane. The southbound approach consists of one (1) through lane, a shared through/right-turn lane and a bike lane. The eastbound approach consists of an exclusive left-turn lane, a bike lane, and a dedicated right-turn lane. CivTech conducted turning movement counts on Wednesday, May 23, 2018 from 7:00-9:00 AM and 4:00-6:00 PM at the intersection of Lake Mary Road and High Country Trail. The data sheets for the traffic counts are included as **Attachment B**. The peak hours determined from CivTech's counts are shown in **Figure 2**.



Lake Mary Rd. & High Country Trl.

Figure 2 – Existing AM (PM) Peak Hour Turning Movement Counts

PROPOSED DEVELOPMENT

The Aura Apartments will be a multi-family rental housing community of 173 dwelling units in two- and three-story buildings. The development will be located west of Lake Mary Road on the south side of High Country Trail. Access will be provided by two (2) full movement access points along High Country Trail. **Access A** is proposed approximately 515 feet (centerline to centerline along High Country Trail) west of Lake Mary Road. **Access B** is proposed approximately 1,125 feet (centerline to centerline along High Country Trail) west of Lake Mary Road or approximately 610 feet south of Access A.

TRIP GENERATION

The trips generated for this project are estimated using as a reference the latest (10th) edition of the Institute of Transportation Engineers’ (ITE) *Trip Generation Manual*. The manual provides trip generation data collected by various transportation professionals for a wide range of different land uses. The data summarized in the report includes average rates and equations that have been established correlating the relationship between an independent variable that describes the development size and trips generated for each categorized land use. The manual includes information for weekdays and for AM and PM peak hours. The AM peak hour is assumed to occur between 7:00-9:00 AM and the PM peak hour is between 4:00-6:00 PM.

The trip generation for the proposed 173-dwelling unit development is detailed in **Table 1**.

Table 1 – Trip Generation

| Land Use | ITE Code | ITE Land Use Name | Quantity Units* | AM Distribution | | PM Distribution | |
|---------------------------|----------|-------------------|-----------------|-----------------|-----|-----------------|-----|
| | | | | In | Out | In | Out |
| Multi-Story, Multi-Family | 220 | Apartments | 173 DUs | 23% | 77% | 63% | 37% |

| Land Use | ADT | | AM Peak Hour | | | PM Peak Hour | | | | |
|---------------------------|------------|-------|--------------|----|-----|--------------|------------|----|-----|-------|
| | Avg. Rate* | Total | Avg. Rate* | In | Out | Total | Avg. Rate* | In | Out | Total |
| Multi-Story, Multi-Family | 7.32 | 1,268 | 0.46 | 18 | 62 | 80 | 0.56 | 60 | 36 | 96 |

Notes: * All average rates were calculated by dividing total trips generated using regression equation by the number of dwelling units. (See below.)
* KSF = 1,000 square feet; DUs = Dwelling Units

| <i>CALCULATIONS (Equations shown only where applicable)</i> | | | |
|-------------------------------------------------------------|---------------------------------------------|------------------------------------------------|------------------------------------------------|
| Land Use [Units] | Daily | AM Peak Hour | PM Peak Hour |
| Apartments [102 DUs] | $T_{Day} = 173 \times 7.56 - 40.86 = 1,268$ | $Ln(T_{AM}) = Ln(173) \times 0.95 - 0.51 = 80$ | $Ln(T_{PM}) = Ln(173) \times 0.89 - 0.02 = 96$ |

A review of the detailed trip generation in **Table 1** reveals that the proposed development could generate a total of 1,268 trips per day with 80 trips (18 in/62 out) generated during the AM peak hour and 96 trips (60 in/36 out) generated during the PM peak hour.

TRIP DISTRIBUTION AND ASSIGNMENT

As a residential development, peak hour trips can be expected to be comprised primarily of commuters traveling to and from employment areas. Most of the employment opportunity in the area is located in Flagstaff; therefore the trips assignment will be weighted heavily to and from Flagstaff. The trip directional distribution percentages to be applied to the site-generated trips are shown in **Table 2**. The percentages shown in **Table 2** were applied to the site trips generated in **Table 1** and these site trips assigned to the internal and external roadway network. Site generated peak hour turning movements and distribution percentages are depicted **Figure 3**.

Table 2 – Trip Distribution

| Direction(s) (To/From) | Distribution Percentage |
|-----------------------------|----------------------------|
| North via Lake Mary Road | 85% |
| South via Lake Mary Road | 5% |
| West via High Country Trail | 10% |
| Total | 100% |

FUTURE TRAFFIC VOLUMES

The Flagstaff Metropolitan Planning Organization (FMPO) periodically publishes traffic volumes on-line. From reported 2013 and 2017 traffic volumes, CivTech calculated that an average annual growth rate (AAGR) on Lake Mary Road of 3.1 percent. On High Country Trail, the calculated AAGR was 0.8 percent. Therefore, CivTech applied a growth factor of 1.063 (=1.031²), which represents the 3.1 percent rate—a factor of 1.031 per year—applied for two years, to the existing peak hour traffic turning movements at the intersection of Lake Mary Road and High Country Trail. The AAGR of 0.8 percent, a factor of 1.016 (=1.008²), was applied to the volumes on High Country

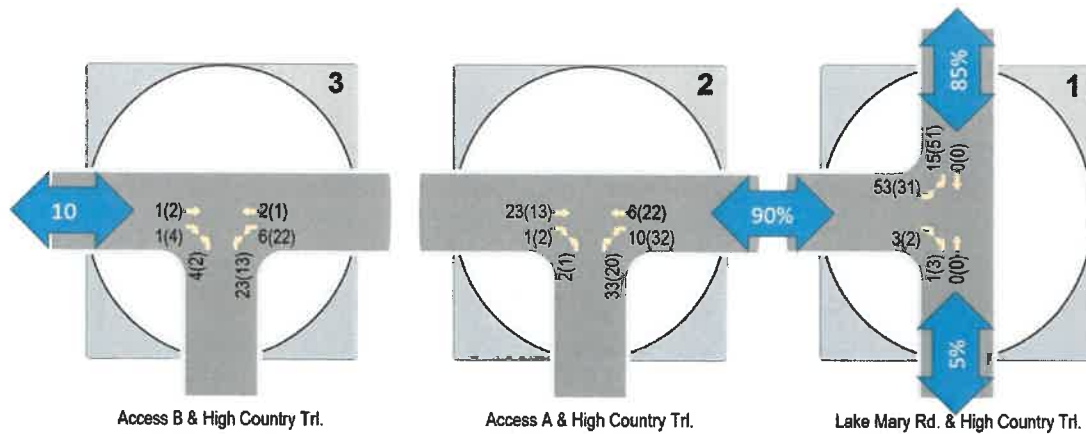


Figure 3 – Peak Hour Site Volumes with Trip Distribution Percentages

Trail for two years. Background growth rate calculations are included as **Attachment C**. The background (or without site) turning movement volumes are depicted in **Figure 4**.

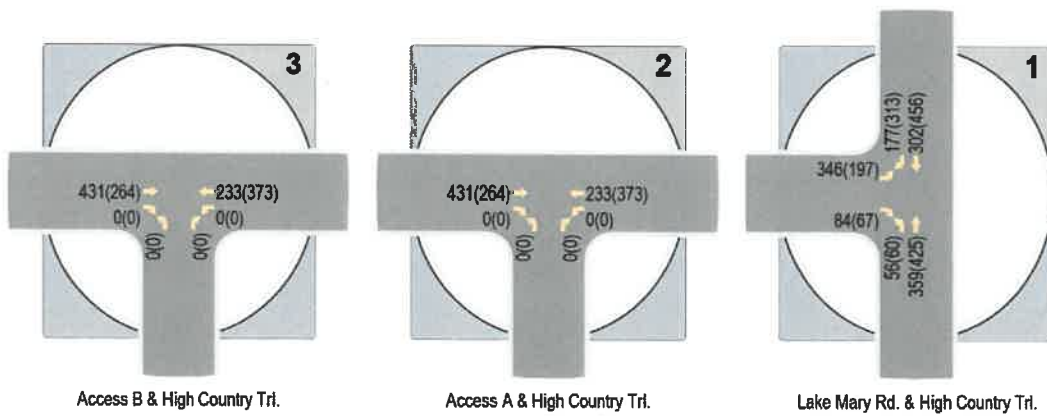


Figure 4 – 2020 Peak Hour Background Volumes

Total volumes were determined by adding the site traffic volumes in **Figure 3** to the 2020 background traffic volumes in **Figure 4**. Total volumes are depicted in **Figure 5**.

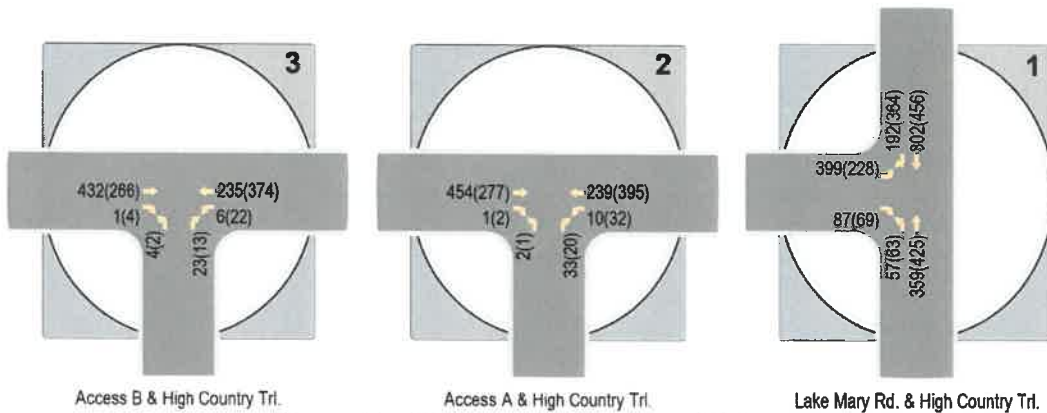


Figure 5 – 2020 Peak Hour Total Volumes

IMPROVEMENT AND MITIGATION ANALYSIS

CAPACITY ANALYSIS

The concept of level of service (LOS) uses qualitative measures that characterize operational conditions within the traffic stream. The individual levels of service are described by factors that include speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations A through F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions. Levels of service for intersections are defined within ranges of average control delay per vehicle, the number of seconds a vehicle can expect to wait due to the presence of a traffic control device. **Table 3** lists the level of service criteria for signalized and unsignalized intersections.

Table 3 – Intersection Level of Service Criteria

| Level of Service | Control Delay (sec/veh) | |
|------------------|-------------------------|-----------------|
| | Signalized | Unsignalized |
| A | ≤ 10 | ≤ 10 |
| B | > 10-20 | > 10-15 |
| C | > 20-35 | > 15-25 |
| D | > 35-55 | > 25-35 |
| E | > 55-80 | > 35-50 |
| F* | > 80 (or v/c>1) | > 50 (or v/c>1) |

Source: Exhibits 19-8, 20-2, 21-8, and 22-8, Highway Capacity Manual 2017

Synchro 10 software using the methodologies of the latest (6th) edition of the *Highway Capacity Manual* (HCM 2016) will be used to calculate average per-vehicle control delays, from which movement, approach, and overall intersection levels of service are determined. The signal timings used for the intersection of Lake Mary Road at High Country Trail were taken from the city-wide Synchro traffic model provided to CivTech in 2014 by the City's transportation staff for use in CivTech's Juniper Point traffic study. The results of the capacity analyses for the AM and PM peak hours under existing conditions, expected no build (Background) and build (total) conditions at the site accesses and the intersection of Lake Mary Road and High Country Trail are summarized in **Table 4**. The Synchro worksheets are included as **Attachment D**.

Table 4 – Intersection Level of Service Analysis Summary

| ID | Intersection | Intersection Control | Approach/Movement | 2018 Existing | 2020 LOS AM(PM) | |
|----|-------------------------------------|----------------------|-------------------|---------------|-----------------|--------------|
| | | | | LOS AM(PM) | No Build | Build |
| 1 | Lake Mary Road & High Country Trail | Signalized | NB | A (A) | A (A) | B (A) |
| | | | SB | A (A) | A (A) | A (A) |
| | | | EB Left | C (C) | C (C) | C (C) |
| | | | EB Right | C (C) | C (C) | B (C) |
| | | | Overall | B (A) | B (A) | B (B) |
| A | Access A & High Country Trail | 1-way Stop (NB) | NB Shared | - (-) | - (-) | B (B) |
| | | | WB Left | - (-) | - (-) | A (A) |
| B | Access B & High Country Trail | 1-way Stop (NB) | NB Shared | - (-) | - (-) | B (B) |
| | | | WB Left | - (-) | - (-) | A (A) |

A review of the results of the intersection capacity analysis summarized in **Table 4** for the study intersections reveals little change with the addition of site traffic at the intersection of Lake Mary Road and High Country Trail. The only notable change includes the northbound approach decrease from LOS A to LOS B in the PM peak hour at the signalized intersection due to the increase in left turn volume. Another change includes the change in level of service from LOS A to LOS B (an increase of only 1.2 seconds of average delay per vehicle) in the overall approach in the PM peak hour at the intersection of Lake Mary Road and High Country Trail. Though the level of service changes in both cases, the roadway and intersection should continue to operate at acceptable levels of service; therefore, no mitigation measures are warranted or recommended.

TURN LANE WARRANT AND QUEUE STORAGE ANALYSES

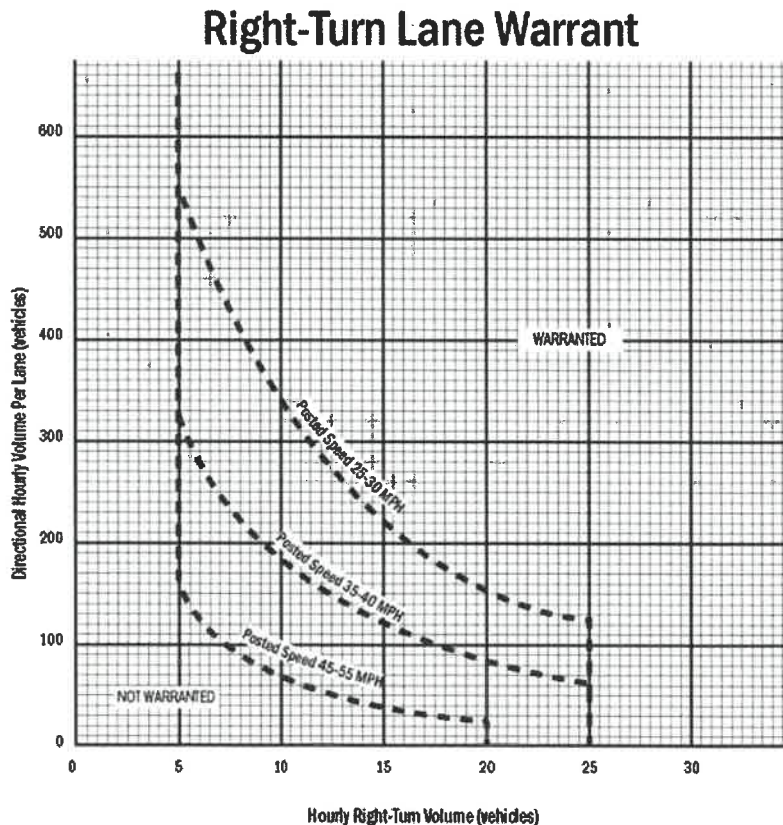
Turn Lane Warrant Analysis

Left Turn Lanes. There is an existing continuous two-way left-turn lane (CTWLTL) on High Country Trail. Therefore, no analysis is required here to determine if left turn lanes should be provided on High Country Trail approaching the proposed site driveways.

Right Turn Lanes. Right-turn deceleration lanes are often recommended on roadways where right-turning vehicles create delays or safety problems for other traffic movements. The need for a right turn lane at a site access depends upon the speed of traffic on the road, the volume of traffic turning right, and the through traffic volume in the same lane as the right turning traffic. Per the City of Flagstaff's *Engineering Design Standards Section 13-10-010 (Streets)*, right turn deceleration lanes are warranted based on the design peak hour (DPH) volume of the curb lane, DPH right turning volume and posted speed limits. **Figure 5** is a copy of a figure included in the City's Engineering Design Standards. A review of the figure shows that auxiliary right turn lanes are not warranted where hourly right-turning volumes are expected to be fewer than five turns per hour. As can be seen in **Figure 4**, not more than four (4) right turns per hour are expected at either site driveway during either peak hour. Therefore, eastbound right-turn lanes are not warranted on High Country Trail approaching either of the two proposed site accesses.

Figure 1 – City of Flagstaff Engineering Right Turn Lane Warrant Analysis

Figure 10-10-01



Source: *Albino Transportation Department "Traffic Manual"*
 Transportation Research Board, NCHRP Report 348, *Access Management Guidelines for Arterial Corridors*

Figure 5-2

Queue Storage Calculations

Adequate turn storage should be supplied on any approach where turn lanes are permitted and/or warranted. A queuing analysis was performed for all warranted/recommended and existing intersection turn lanes where site traffic is expected as well as left turn lanes adjacent to the site. According to the methodology documented in *A Policy on Geometric Design of Highways and Streets* (the AASHTO "Green Book"), the storage length for a turn lane is typically estimated as the length required to hold the average number of arriving vehicles per two minutes, where unsignalized, or per one-and-a half signal cycles, where signalized.* Since there are no auxiliary right turn lanes warranted at the site accesses and left turns will be accommodated by the existing CTWLTL on High Country Trail, CivTech will evaluate the sufficiency of the existing turn lanes at the signalized intersection of Lake Mary Road and High Country Trail using the following formula: Storage Length = (1.5 x No. turns per hour) ÷ (3,600 seconds per hour ÷ cycle length) x 25 feet. In this case, the signal cycle is 101 seconds.

Using the traffic volumes and lane configurations projected for the opening year 2020, turn lane storage requirements were calculated using the AASHTO guidelines for the intersection. They are summarized in **Table 6**. Calculations for the queue storage length recommendations are provided as **Attachment E**.

Table 2 – Queue Storage Length

| ID | Intersection | Stop Control | Approach | 2020 Queue Storage Lengths | | |
|----|-------------------------------------|--------------|----------|----------------------------|--------|---------------------|
| | | | | Existing ⁽¹⁾ | AASHTO | Recommended |
| 1 | Lake Mary Road & High Country Trail | Signal | NB Left | 100' | 75' | 100' ⁽³⁾ |
| | | | EB Left | 100' | 425' | 100' ⁽³⁾ |
| | | | EB Right | 100' | 100' | 100' ⁽²⁾ |

1. Measured from stop bar.
2. Queue storage cannot be mitigated due to lack of ROW
3. Extra storage is available in center two-way left-turn lane.

A review of the results of the queue storage calculations summarized in **Table 6** reveals that two of the existing three turn lanes at the intersection of Lake Mary Road and High Country Trail provide sufficient storage using the AASHTO method. The eastbound left turn movement from High Country Trail onto Lake Mary Road could require additional storage capacity. Drivers could use the existing CTWLTL on the approach as additional storage. If the CTWLTL on High Country Trail is re-striped to extend the existing left turn lane, CivTech recommends that it not be striped to provide more than 300 feet of storage, a typical maximum turn lane length. (Longer turn lanes may be perceived by approaching drivers as an additional through lane, which it is not.)

SIGHT DISTANCE ANALYSIS

Adequate sight distance must be provided at intersections and site access driveways to allow safe turning movements. There must be sufficient unobstructed sight distance along both approaches of a street/driveway intersection and across their included corners to allow operators of vehicles to see each other in time to prevent a collision. In the case of the proposed Aura Apartments, sight distance is an important issue for several reasons: High Country Trail is curved horizontally and the terrain slopes up from the curb to the south under the overhead utility lines.

* The American Association of Highway and Transportation Officials on pages 714-715 of its publication, *Geometric Design of Highways and Streets* ("AASHTO Green Book"), indicates that storage length for a turn lane, exclusive of taper, "should usually be based on one and one-half to two times the average number of vehicles that would store per cycle" at a signalized intersection.

The sight distance requirements as calculated using AASHTO methodology are summarized in **Table 7**. The sight lines are illustrated in **Attachment G**.

Table 3 – AASHTO Sight Distance Requirements

| Roadway | Posted Speed Limit (mph) | Design Speed (mph) | Sight Distance Along Roadway | | |
|--------------------|--------------------------|--------------------|-------------------------------|-----------------------------|------------------------|
| | | | Left of Driveway (Case B2/B3) | Right of Driveway (Case B1) | On Major Road (Case F) |
| High Country Trail | 35 | 45 | 530' | 465' | 400' |

The contractor/developer/civil engineer should ensure that sight visibility is provided at all proposed driveways according to the distances shown in **Table 7**. A review of **Attachment F** shows that sufficient sight distances to and from **Access B** appear to be available. However, due to the horizontal curvature of High Country Trail, to assure adequate sight distance at **Access A** would require the sight triangle highlighted in green. With the terrain sloping up, this may warrant extensive clearing and grading and, potentially, a retaining wall. Therefore, CivTech illustrates—in concept—in **Attachment G** a possible driveway location farther west within the limits of the curvature that could provide sight distance with less earthwork. Please note that this is only a concept and that a final, engineered location should be established and adequate sight distances demonstrated to the satisfaction of City staff by the civil engineer.

CivTech recommends that sight visibility triangles at the site driveway be provided per AASHTO guidelines. In addition, within designated sight visibility triangles, landscaping should be maintained at a maximum of two (2) feet in height. Tree branches lower than seven (7) feet should be trimmed and maintained to meet current acceptable landscape requirements.

CONCLUSIONS

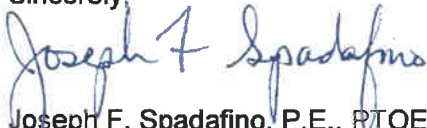
- The trip generations revealed that the proposed development could generate a total of 1,268 trips per day with 80 trips (18 in/62 out) generated during the AM peak hour and 96 trips (60 in/36 out) during the PM peak hour.
- The results of the intersection capacity analysis for the study intersection and the driveways revealed little change from the existing conditions with the addition of the site traffic. The level of service degrades in the overall approach at the signalized intersection of Lake Mary Road and High Country Trail, but the roadway and intersection should continue to operate at LOS B or better; therefore, no mitigation measures are warranted or recommended.
- Since not more than four (4) right turns per hour are expected at either site driveway during either peak hour, per the City of Flagstaff's *Engineering Design Standards Section 13-10-010 (Streets)*, eastbound right-turn lanes are not warranted on High Country Trail approaching either of the two proposed site accesses.
- Two of the existing three turn lanes at the intersection of Lake Mary Road and High Country Trail provide sufficient storage using the AASHTO method. The eastbound left turn movement from High Country Trail onto Lake Mary Road could require additional storage capacity. Drivers could use the existing CTWLTL on the approach as additional storage. If the CTWLTL on High Country Trail is re-striped to extend the existing left turn lane, CivTech recommends that it not be striped to provide more than 300 feet of storage, a typical maximum turn lane length.
- Sufficient sight distances to and from **Access B** appear to be available. However, due to the horizontal curvature of High Country Trail, to assure adequate sight distance at

Access A would require a sight triangle that may warrant extensive clearing and grading and, potentially, a retaining wall. A possible driveway location farther west within the limits of the curvature could provide sight distance with less earthwork. Please note that this is only a concept and that a final, engineered location should be established and adequate sight distances demonstrated to the satisfaction of City staff by the civil engineer.

- CivTech recommends that sight visibility triangles at the site driveway be provided per AASHTO guidelines. In addition, within designated sight visibility triangles, landscaping should be maintained at a maximum of two (2) feet in height. Tree branches lower than seven (7) feet should be trimmed and maintained to meet current acceptable landscape requirements.

Thank you for allowing CivTech to assist you on this project. Please contact me with any questions you may have.

Sincerely,



Joseph F. Spadafino, P.E., RTOE, PTP
Project Manager/Senior Traffic Engineer

Attachments (7)

- Attachment A – Site Plan and Access
- Attachment B – Traffic Counts
- Attachment C – Background Growth Rates
- Attachment D – Synchro Analyses Results
- Attachment E – Queue Storage Analysis
- Attachment F – Sight Distances
- Attachment G – Sight Lines