

**Auxiliary Turn Lane Assessment  
Transportation Impact Study  
for**

**Belden Place Subdivision  
Minturn, Colorado**



**October 28, 2020**

PREPARED FOR:  
**Vail Land Company, LLC**  
PO Box 4691  
Eagle, CO 81631, United States  
Contact: Alison Perry

PREPARED BY:  
**McDowell Engineering, LLC**  
PO Box 4259  
Eagle, CO 81631  
970.623.0788  
Contact: Kari J. McDowell Schroeder, PE, PTOE  
*Project Number: M1398*

## **Statement of Engineering Qualifications**

Kari J. McDowell Schroeder, PE, PTOE is a Transportation and Traffic Engineer for McDowell Engineering, LLC. Ms. McDowell Schroeder has over twenty-three years of extensive traffic and transportation engineering experience. She has completed numerous transportation studies and roadway design projects throughout the State of Colorado. Ms. McDowell Schroeder is a licensed Professional Engineer in the State of Colorado and has her certification as a Professional Traffic Operations Engineer from the Institute of Transportation Engineers.

# Traffic Impact Analysis for Belden Place Subdivision

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## 1.0 Background

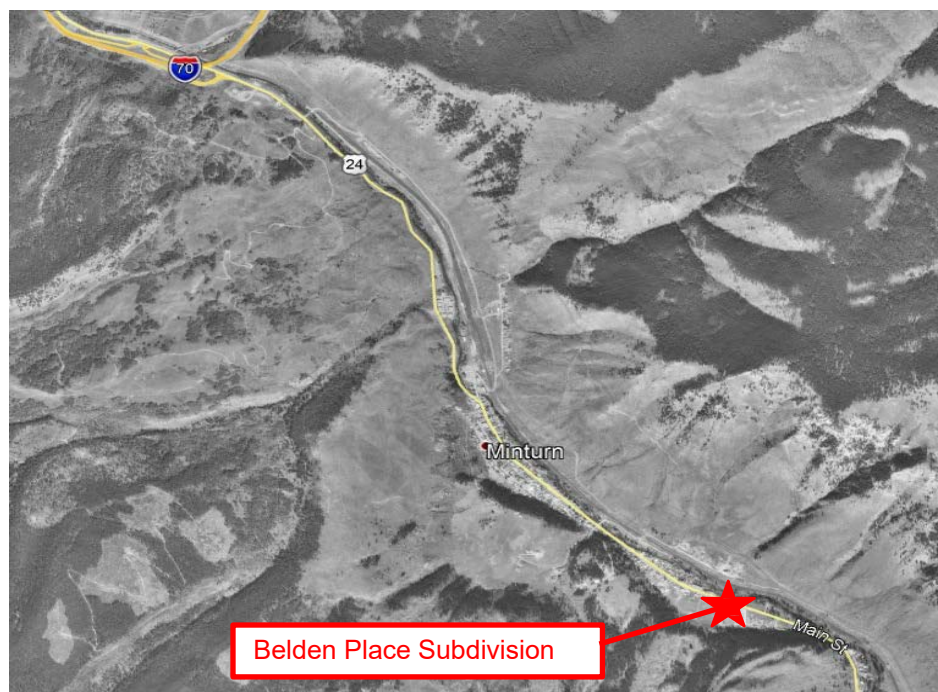
### 1.1 Project Description

McDowell Engineering has prepared this Level Two Auxiliary Turn Lane Assessment for the proposed Belden Place Subdivision located along Highway 24 in Minturn, Colorado. The purpose of this transportation impact analysis is to forecast and analyze the impacts of the additional traffic volumes associated with this project on the surrounding roadway network. Recommendations to mitigate any traffic impacts are also included. The analysis complies with Colorado Department of Transportation's State Highway Access Code<sup>3</sup> (SHAC) and Town of Minturn standards.

The applicant is proposing to combine six parcels and develop a residential subdivision. The parcels previously had six houses and a small trailer park. All of those uses have or will be removed prior to the development of the subdivision. A new house was constructed at the northwest corner of the subdivision in 2019.

Refer to the Area Map in **Figure 1** and the Site Plan in **Figure 2**.

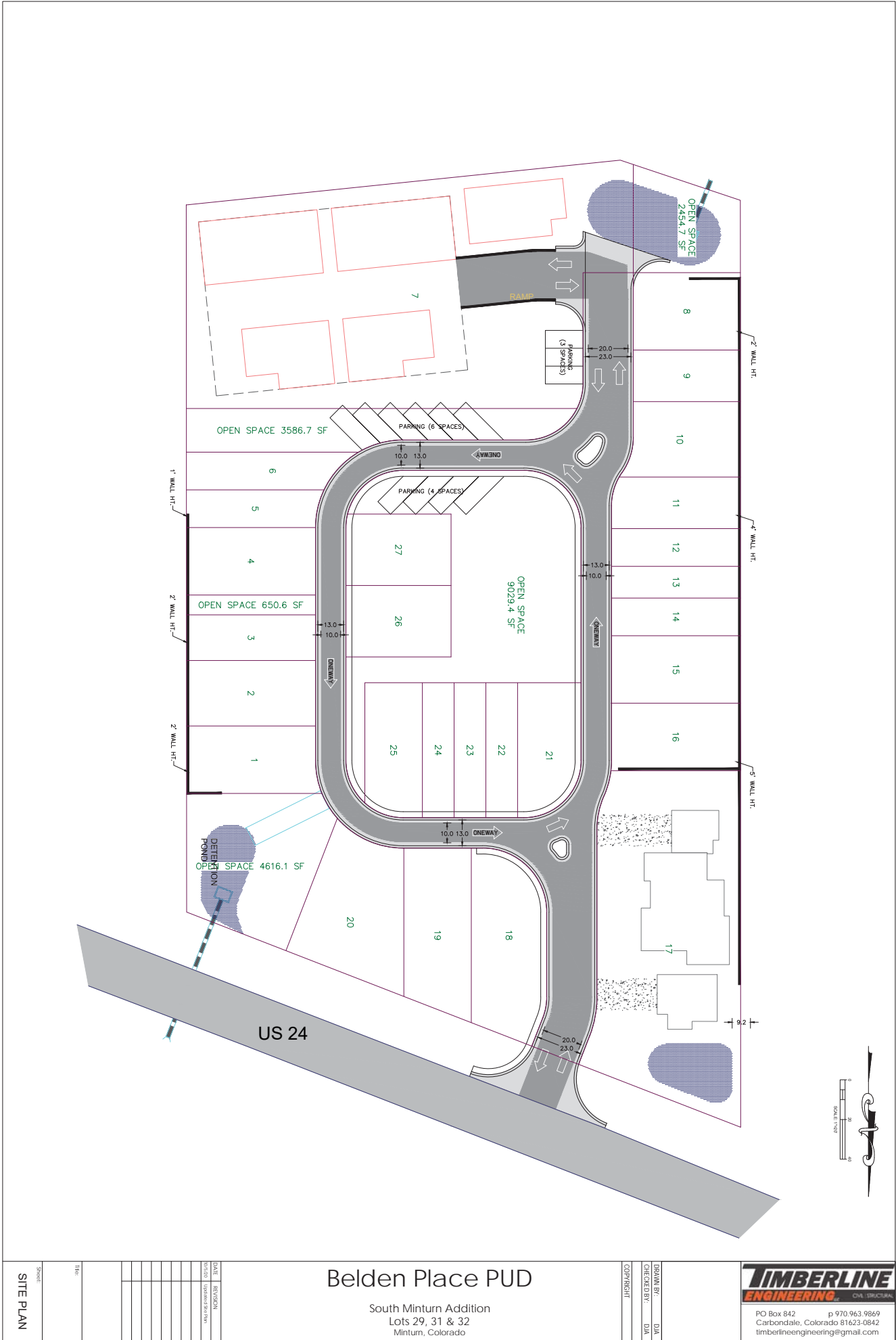
**Figure 1: Area Map**



### 1.2 Previous Study

This development was previously called Miner's Base Camp Subdivision. The developer has since acquired additional properties to be included in Belden Place Subdivision. A Level 2 traffic impact study, dated May 3, 2019, was prepared for that subdivision. This study replaces the previous study.

Figure 2: Site Plan



## 2.0 Existing Conditions

### 2.1 Description of Existing Transportation System

US Highway 24 serves as Main Street through Minturn. This paved two-lane highway connects the mountain communities of Leadville and Buena Vista to the Interstate 70 (I-70) corridor just north of Minturn. US 24 is posted at 35 mph in both directions at the site access, although the statutory speed limit for westbound traffic is 30 mph according to the CDOT straight-line diagram. The straight-line diagram can be seen in the **Appendix**. The segment of US 24 along the development's frontage is classified by the Colorado Department of Transportation as a regional highway with an access category of R-A.

### 2.2 Existing Site Access

Belden Place Subdivision will be developed by combining six properties as seen in **Figure 3**. The previously existing single-family houses shared a single access [A]. The eastern lot was a 12-space mobile home park that had its own driveway [C] along its eastern side. There is a small access [B] onto US 24, which is a secondary driveway to one of the single-family residences.

**Figure 3: Existing Site Accesses**



## 2.3 Traffic Data

Traffic data was taken from CDOT's *Online Transportation Information System*<sup>1</sup> (OTIS). Belden Place Subdivision is within the segment of US 24 covered by Traffic Counter Station 100776, which extends from Mile Marker 145.537 to Mile Marker 150.868. The most recent CDOT traffic counts at this station were taken on October 2-3, 2019, as seen in the **Appendix**. The 20-year factor for Sta. 100776 is 1.01, which equates to a yearly growth rate of 0.05% [  $1.01^{(1/20)} - 1 = 0.05$  ].

The morning peak hourly volume at Sta. 100776 occurred during the 7:00 a.m. hour, with a two-day average of 232 vph westbound and 42 vph eastbound. The afternoon peak hourly volume at Sta. 100776 occurred during the 5:00 p.m. hour, with a two-day average of 96 vph westbound and 233 vph eastbound.

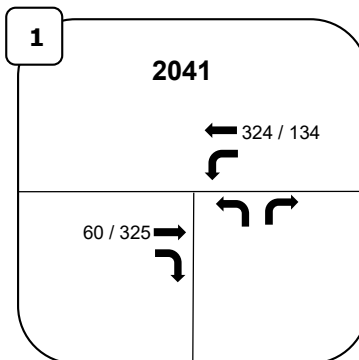
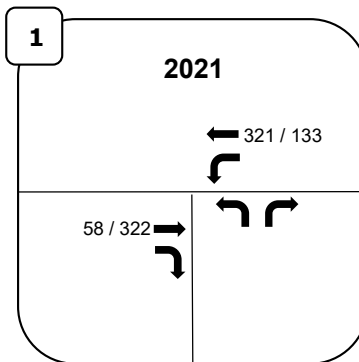
Since the counts were taken in October a seasonal adjustment factor was applied. The SAF of 1.30 was determined from the CDOT continuous counter on I-70 at West Vail. The calculation is shown in the **Appendix**.

To obtain the seasonally adjusted 2021 Initial Year Background Traffic the 2019 two-day average volumes were multiplied the seasonal adjustment factor and the annual growth rate of 0.05% per annum was applied for 2 years. To obtain the seasonally adjusted 2041 Design Year Background Traffic the 2019 two-day average volumes were multiplied by the seasonal adjustment factor and annual growth rate of 0.05% per annum was applied for 22 years.

The seasonally adjusted 2021 Initial Year and 2041 Design Year background traffic volumes are shown in **Figure 4**.



**Figure 4: Initial Year (2021) and Design Year (2041) background traffic  
(vehicles per hour)**



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Belden Place Subdivision  
Minturn, Colorado



**LEGEND**  
XX/XX = AM/PM Volumes (pce vph)

Turning Movements



## 3.0 Project Traffic

### 3.1 Trip Generation for Proposed Land Use

Belden Place Subdivision will be a residential subdivision consisting of twelve single-family detached dwelling units, two duplexes, two three-unit attached row houses, one five-unit attached row house, and five triplexes; making a total of 42 dwelling units. The Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10<sup>th</sup> Edition, 2017*<sup>4</sup>, was used to estimate the peak hour volumes of traffic that will be generated by the subdivision.

ITE Land Use 210 *Single-Family Detached Housing* was used for the single-family dwelling units, the three-unit row houses and the duplexes. ITE Land Use 220 *Multifamily Housing (Low-Rise)* was used for the five-unit row house and the triplexes.

A multi-modal reduction was applied because the subdivision is on the ECO Transit Minturn Route. It is anticipated that most of the residents in Belden Place Subdivision will be people working in the I-70 corridor from Gypsum to Vail. Because of the cost and inconvenience of driving to and finding parking in Vail and the other communities some will ride the bus to and from work.

The subdivision is anticipated to generate 32 vehicle trips in the a.m. peak hour (9 vph entering and 23 vph exiting). The subdivision is anticipated to generate 37 vehicle trips in the p.m. peak hour (23 vph entering and 14 vph exiting). The project trip generation information is shown in **Table 1**.

As a residential subdivision the project's design vehicle is a passenger car. No adjustment is needed for passenger car equivalents.

**Table 1: Project Trip Generation**

			AM Peak Hour of Generator [2]			PM Peak Hour of Generator [2]		
ITE Code	Land Use Description	Units	Average Rate Fitted Curve Equation	Enter (vph)	Exit (vph)	Average Rate Fitted Curve Equation	Enter (vph)	Exit (vph)
210	<div><div><div><div></div><div></div><div></div><div></div></div><div><div><div></div><div></div><div></div><div></div></div></div><div><b><u>Proposed</u></b></div><div>Single-Family Detached Housing</div></div></div>	22 Dwelling Units	Average Rate = 0.76 Ln(T) = 0.91Ln(X) + 0.20	26% 4 6	74% 12 16	Average Rate = 1.00 Ln(T) = 0.94Ln(X) + 0.34	64% 14 17	36% 8 10
220	<div><div><div><div></div><div></div><div></div><div></div></div><div><div><div></div><div></div><div></div><div></div></div></div><div><b><u>Proposed</u></b></div><div>Multifamily Housing (Low-Rise) [1]</div></div></div>	20 Dwelling Units	Average Rate = 0.56 Ln(T) = 0.94Ln(X)-0.29	28% 3 4	72% 8 10	Average Rate = 0.67 T = 0.66(X) + 1.41	59% 8 9	41% 5 6
Multi-modal reduction 10%				-1	-2		-2	-1
Total traffic from proposed Land Uses				9	23		23	14

[1] Data obtained from *Trip Generation Manual, 10th Edition*, Institute of Transportation Engineers, 2017

[2] The Average Rate or the Fitted Curve Equation is used based on the procedures in *ITE Trip Generation Handbook §4.4*.

### 3.2 Proposed and Closed Accesses

Belden Place Subdivision will have a single proposed access, as shown in Figure 2. The access will be a modification to existing driveway [A] in Figure 3. Driveway [B] and driveway [C] will be removed.

### 3.3 Directional Distribution

The distribution of project-generated traffic on the surrounding roadway network is influenced by several factors including the following:

- The location of the site relative to other facilities and the roadway network
- The configuration of the existing and proposed adjacent roadway network
- Relative location of neighboring population centers

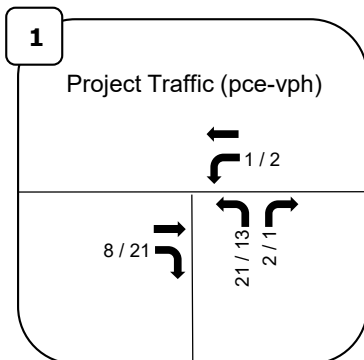
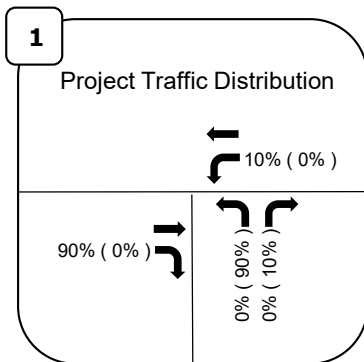
It is anticipated that most of the residents in Belden Place Subdivision will be people working in the I-70 corridor from Gypsum to Vail. As such the directional distribution is assumed to be 90% to and from the west on US 24 and 10% to and from the east.

The breakdown of the percentages for each of the movements is shown in **Figure 5**. Applying the movement percentages to the project-generated volumes from **Table 1** gives the a.m. and p.m. peak hour volumes for each of the movements; also shown in **Figure 5**.

### 3.4 Total Traffic

The total peak hour volumes are the sum of the project-generated volumes from **Figure 5** and background volumes from **Figure 4**. The total peak hour volumes for the Initial Year (2021) and Design Year (2041) are depicted in **Figure 6**.

Figure 5: Project Traffic Directional Distribution (%)  
Peak Hour Project Traffic (vehicles per hour)

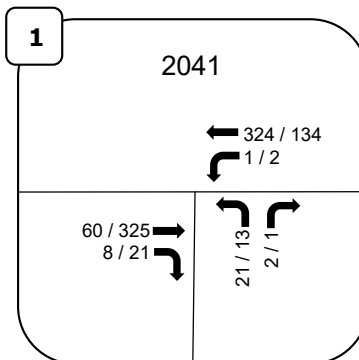
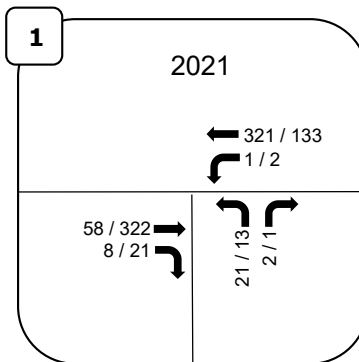


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**LEGEND**  
XX (XX) = Inbound (Outbound)  
Turning Movements

**Figure 6: Initial Year (2021) and Design Year (2041)  
Total Peak Hour Traffic (vehicles per hour)**



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**LEGEND**  
XX/XX = AM/PM Volumes (pce vph)

Turning Movements

## 4.0 Transportation Impact Analysis

### 4.1 State Highway Access Permits

Section 2.6(3) of the *State Highway Access Code*<sup>3</sup> (SHAC) requires a new access permit when there is a land-use change and/or the driveway volume is anticipated to increase by more than twenty percent. Therefore, new State Highway Access Permits will be required for Belden Place Subdivision's access. The access location is SH 024A, MM 146.42 R. The design hour volume for the permit is 37 vehicles per hour.

The two existing driveways that will be closed are at SH 024A, MM 146.44 R and SH 024A, MM 146.45 R. CDOT will issue a Form 138 to document these closures.

### 4.2 State Highway Turn Lane Analysis

The *State Highway Access Code* establishes turning volume thresholds above which auxiliary turn lanes are required. The traffic volume thresholds are based on the Access Category and the speed limit of the highway.

Per SHAC §3.8(5) for an R-A Access Category highway with a speed limit less than 45 mph, the traffic volumes generated by the proposed land use do not trigger the requirement for the construction of any auxiliary lanes.

**Table 2: Auxiliary Turn Lane Requirements**

Intersection	Type of lane	Weekday AM Peak Hour Volume (vph)	Weekday PM Peak Hour Volume (vph)	Trigger Volume [1] (vph)	Required by SHAC?
Main Street (US 24) and Belden Place Subdivision	Left turn decel.	1	2	>10	No
	Right turn decel.	8	21	>25	No
	Right turn accel.	2	1	S&O [2]	No
	Left turn accel.	21	13	S&O [2]	No

[1] Category R-B, <= 40 mph, SHAC §3.9(8)

[2] S&O = Safety and Operation triggers may apply. No traffic volume trigger.

Auxiliary lanes are not required because of the projected turning volumes. They are not recommended for operational or safety reasons.

### 4.3 Sight Distance

Table 4-2 of the *Access Code* specifies the required sight distance for vehicles entering the highway. The sight distances east and west at the proposed site accesses to US 24 exceed 1000 feet in both directions, which is greater than the 350-foot requirement for passenger cars at the 35 mph posted speed limit.

#### 4.4 Access Design Criteria

The configuration of the access shall be in accordance with Section 4 of the CDOT *State Highway Access Code*<sup>3</sup> (SHAC).

- SHAC §4.5(2): The minimum width of the traveled portion of the access is 16 feet. The “traveled portion” is the width from edge of gutter to edge of gutter, which excludes the curb and gutter. If space is available, wider entrance lane widths are recommended.
- SHAC §4.6(2): The access should have 25-foot radii.
- SHAC §4.9(4): The horizontal axis of an access to the highway shall be at a right angle to the centerline of the highway and extend a minimum of 40 feet from the edge of the roadway or to the right-of-way line, whichever is greater.
- SHAC §4.11 Drainage: Culverts under the driveways and other drainage improvements may be required.

Criteria from the Town of Minturn may also apply.

#### 5.0 Recommendations and Conclusions

The proposed Belden Place Subdivision is anticipated to be successfully accommodated into the greater Minturn roadway system.

##### Trip Generation:

Based upon the proposed land use, the project is anticipated to generate at project buildout 32 vehicles per hour during the morning peak hour and 37 vehicles per hour during the evening peak hour.

##### State Highway Access Permits:

A new State Highway Access Permits will be required for the proposed main site access. The access location is SH 024A, MM 146.45 R. The design hour volume for the permit is 37 vehicles per hour.

##### Auxiliary Turn Lanes:

Per Section 3.8(5) of the State Highway Access Code, the traffic volumes generated by the proposed land use do not trigger the construction of any auxiliary lanes on US 24.

##### Access Construction:

The proposed access shall be constructed in accordance with Section 4 of the *State Highway Access Code*. Minturn regulations will also apply.



## 6.0 Reference Documents

1. Colorado Department of Transportation, *Online Transportation Information System* (OTIS) <http://apps.coloradodot.info/dataaccess/>
2. *Highway Capacity Manual*. Transportation Research Board, 2010.
3. *State Highway Access Code*. State of Colorado, 2002.
4. *Trip Generation Handbook, Edition 10*. Institute of Transportation Engineers, 2017.

## 7.0 Appendices

1. CDOT OTIS Traffic Count
2. CDOT Straight-Line Diagram
3. Seasonal Adjustment Factor Calculations

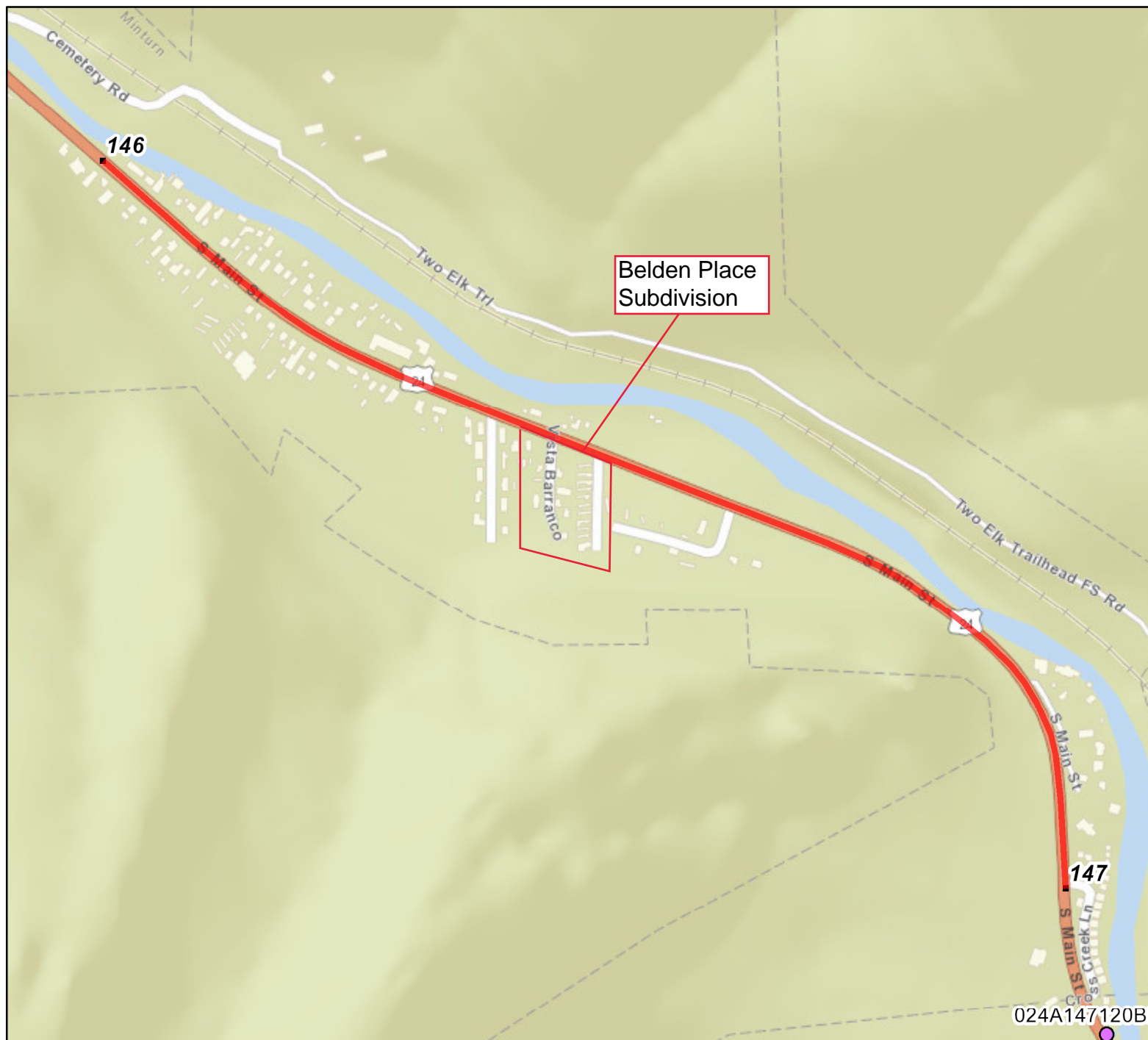


### Daily Traffic Volume for Station ID: 100776 from 10 / 2019

Count Date	Dir	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
10/02/2019	P	0	2	0	4	9	40	140	244	137	96	45	69	65	108	89	86	110	97	68	54	18	15	9	6
10/02/2019	S	1	3	4	2	2	6	20	48	61	72	116	104	92	98	111	95	206	219	111	60	33	32	18	7
10/03/2019	P	4	1	2	3	9	40	140	219	130	84	74	59	83	81	97	119	120	95	83	46	25	22	15	7
10/03/2019	S	4	1	2	0	6	11	27	36	68	87	110	101	110	98	109	102	182	247	113	63	43	45	16	14

Note: US 24 is a west-to-east highway, so the Primary (P) direction is eastbound and the Secondary (S) direction is westbound. The data for this Counter Station was entered incorrectly, so P is westbound and S is eastbound in this table.

# Route 024A From 146 to 147



## Legend

Route

Milepoint

## Structures

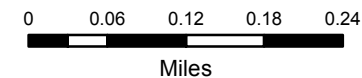
Major Structure

Minor Structure

Created:

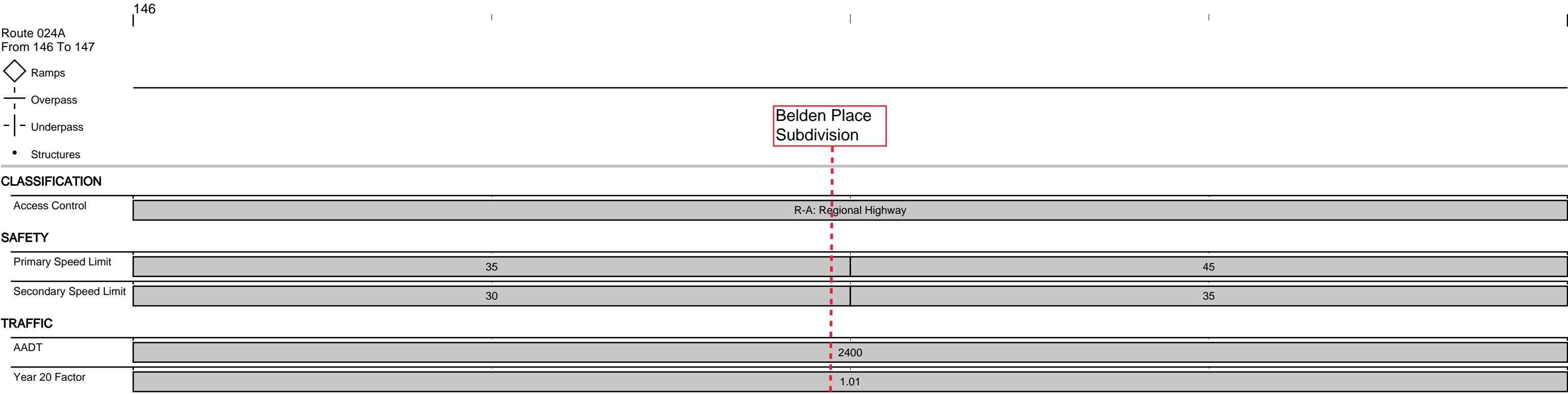
Date: 11/4/2020

Time: 2:34:40 PM



The information contained in this map is based on the most currently available data and has been checked for accuracy. CDOT does not guarantee the accuracy of any information presented, is not liable in any respect for any errors or omissions, and is not responsible for determining "fitness for use".

024A147120BR



It may appear that information is missing from the straight line diagram. If so, reduce the number of miles/page and re-submit the request.

ON I-70 W/O CHAONIX RD, WEST VAIL (Station Id: 000126)  
Eagle County  
West side of Exit 173 (West Vail)

Highway: 70 A  
Mile Marker: 173.1

Averages and factors from most recent 10 years with full years of record

Average	34,603	34,993	38,111	31,739	31,789	39,190	43,075	40,432	37,400	33,077	30,991	35,221
Factor	1.24	1.23	1.13	1.36	1.36	1.10	1.00	1.07	1.15	1.30	1.39	1.22

Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	41,455	41,396	42,697	37,746	37,416	46,296	44,809	42,307	41,242	36,884	32,897	37,243
2018	38,143	37,957	41,032	34,163	36,659	44,572	49,730	45,011	41,720	36,636	36,683	41,449
2017	37,153	38,223	41,936	35,019	35,389	43,675	47,565	44,362	40,864	36,131	34,745	38,405
2016	35,966	34,641	40,075	32,958	34,750	42,958	46,003	42,974	40,610	35,354	34,704	38,111
2015	34,496	36,977	39,373	32,244	31,137	39,361	44,505	41,088	38,059	33,999	31,251	35,646
2014	32,513	32,658	36,519	30,827	29,879	37,210	42,390	40,173	35,879	32,899	23,394	30,021
2013	32,509	33,609	36,104	28,374	29,208	36,321	40,767	38,678	33,704	30,470	29,498	33,673
2012	31,414	32,342	36,296	28,834	28,920	35,918	40,673	38,229	34,065	30,120	30,000	32,031
2011	30,967	30,694	34,411	28,579	26,662	31,112	34,760	34,120	33,952	29,232	28,986	33,666
2010	31,409	31,435	32,666	28,649	27,865	34,478	39,547	37,380	33,903	29,044	27,747	31,967