Sunriver Owners Association - Tunnel Evaluation Report

March 2021

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Project Overview

The Sunriver Owners Association (SROA) is in the planning stages of a program to replace existing bicycle and pedestrian tunnels throughout the Sunriver community. Century West Engineering analyzed eight of the existing tunnels to help SROA better understand the existing conditions and challenges that will be faced during construction. The following tunnels were analyzed as part of this project (See Figure 1 for tunnel locations):

1. Beaver Drive Tunnel
2. Circle 1 Tunnels (Double Tunnel)
3. Circle 3 Tunnel
4. Fort Rock Tunnel
5. Lodge Tunnels (Double Tunnel)
6. River Road Tunnel
7. Theater Tunnel
8. Wildflower Tunnel
9. Circle 2 Tunnel (New)
10. Cottonwood Tunnel (New)

Century West Engineering collaborated with SROA Public Works employees to identify a list of criteria in which to evaluate each tunnel. This report summarizes the findings of each tunnel location based on the criteria below. No utility locates were present during site visits and only above ground utilities are noted. Through conversation with SROA staff members, Brian Marcum of Marcum & Sons LLC, and multiple site visits to each tunnel location, the following criteria were used to evaluate each tunnel:

1. Emergency Vehicle Access
2. Vehicle Detour Route Availability
3. Bike/Pedestrian Detour Route Availability
4. Construction Crane Access
5. Stormwater & Flooding Issues
6. Geotechnical Conditions
7. Known Utility Conflicts
8. Preliminary Grade Concerns
9. Disruption to Businesses
10. Current Bike/Pedestrian Volume
11. Existing Tunnel Condition

Existing Tunnel

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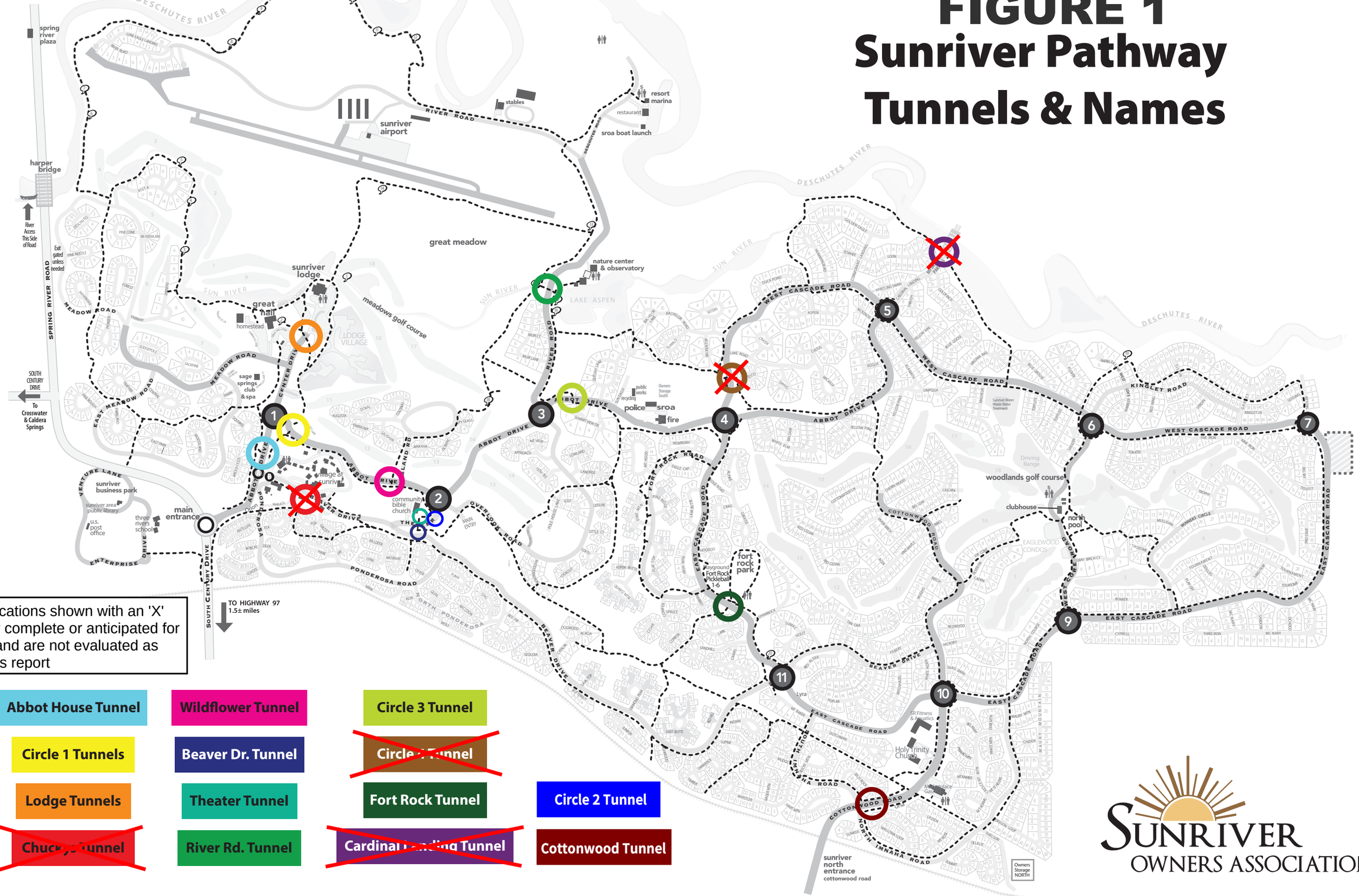
FIGURE 1
Sunriver Pathway Tunnels & Names



Tunnel locations shown with an 'X' are either complete or anticipated for removal and are not evaluated as part of this report

- Abbot House Tunnel
- Circle 1 Tunnels
- Lodge Tunnels
- ~~Chuckwagon Tunnel~~
- Wildflower Tunnel
- Beaver Dr. Tunnel
- Theater Tunnel
- River Rd. Tunnel
- Circle 3 Tunnel
- ~~Circle 4 Tunnel~~
- Fort Rock Tunnel
- ~~Cardinal Landing Tunnel~~
- Circle 2 Tunnel
- Cottonwood Tunnel

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Figure 2
Tunnel Evaluation Summary

Evaluation Criteria

Tunnel Name	#1 Emergency Vehicle Access	#2 Vehicle Detour Route Availability	#3 Bike/Ped. Detour Route Availability	#4 Construction Crane Access	#5 Stormwater & Flooding Issues	#6 Geotechnical Conditions	#7 Known Utility Conflicts	#8 Preliminary Grade Concerns	#9 Disruption to Businesses	#10 Current Ped/Bike Volume: 1= high volume	#11 Tunnel Condition	Notes:
Abbot House Tunnel	Tunnel Construction Complete - 2019											
Beaver Dr. Tunnel	1	1	2	2	1	✔	3	2	3	2	3	
Cardinal Landing Tunnel	Anticipated Tunnel Closure, Location Not Included In This Evaluation											
Chucky's Tunnel	Anticipated Tunnel Closure, Location Not Included In This Evaluation											
Circle 1 Tunnels	2	2	2	3	2		4	2	4	2	2	
Circle 3 Tunnel	3	3	4	1	4	✔	2	4	2	2	2	
Circle 4 Tunnel	Tunnel Construction Complete - 2018											
Fort Rock Tunnel	3	3	3	1	4	✔	3	2	1	1	2	2nd worst location for flooding
Lodge Tunnels	5	5	2	3	1		5	4	5	1	2	
River Rd. Tunnel	5	5	2	1	2	✔	3	4	4	2	3	
Theater Tunnel	1	1	1	1	1	✔	3	2	2	2	3	
Wildflower Tunnel	2	2	3	1	5		4	5	4	2	2	Worst location for flooding
Circle 2 Tunnel	4	3	1	1	2		3	1	2	1		New tunnel proposed to improve access to SHARC
Cottonwood Tunnel	3	2	1	1	1		4	1	1	4		New tunnel proposed to improve community connectivity

Evaluation Key:	
No Issue	1
Slight Issue	2
Moderate Issue	3
Significant Issue	4
Severe Issue	5

Note: Geotechnical field investigation performed for the locations with a check mark. See location-specific summary.

Beaver Dr. Tunnel

Evaluation Criteria Summary

East Approach to Tunnel

1. **Emergency Vehicle Access:**

   Emergency vehicle access is not an issue at this location. Emergency vehicles can detour around the work zone via Theater Drive with minimal delay.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone will not be problematic at this location. Similarly to the emergency vehicle detour, traffic can be rerouted to Theater Drive with minimal impacts.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians during construction can be easily achieved by providing a detour to the existing crosswalk to the north. A temporary path may be needed to provide access for pedestrians and cyclists approaching the site from the west in order to connect to existing asphalt pathways.

4. **Construction Crane Access:**

   Crane access is not anticipated to be a significant problem at this location. The site is located on a straight segment of roadway, however multiple surrounding trees could provide a challenge.

5. **Stormwater & Flooding Issues:**

   This location has minimal stormwater and flooding issues due to the gradual grades surrounding the tunnel.

6. **Geotechnical Conditions:**

   Geotechnical investigation found the depth to existing bedrock to be approximately 12’, and no diatomaceous material was encountered.

7. **Known Utility Conflicts:**

   An existing water main along with multiple other utilities in the vicinity may provide a challenge when designing and constructing a tunnel at this location. Existing power, gas, and water utilities are visible on the east side of the tunnel.

Existing Utilities

8. **Preliminary Grade Concerns:**

   The existing pathways and topography surrounding the tunnel on the west side are relatively flat and no issues with grade are anticipated. The existing pathway east of the tunnel is moderately steep and may provide a challenge during design.

9. **Disruption to Businesses:**

   Construction of the Beaver Drive tunnel will provide moderate disruption to surrounding businesses. Beaver Drive is a main route for vehicles accessing the Village at Sunriver. During construction, vehicles will be routed to an established detour route in order to access all businesses.

10. **Current Bike/Pedestrian Volume:**

    This location currently sees a significant amount of use from pedestrian and bicyclists. Providing a simple and effective detour route for pedestrians and bicyclists will be important during construction of the tunnel.

11. **Tunnel Condition:**

    The existing tunnel is in good condition overall, with the exception of minor damage to the interior of the tunnel.

West Approach to Tunnel

Circle 1 Double Tunnels

Evaluation Criteria Summary

East Approach to Tunnel

1. **Emergency Vehicle Access:**

   Emergency vehicle access is a slight issue at this location. Emergency vehicles can detour around the work zone via Beaver Drive, however this will create a small increase to the response time.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone presents a minor issue at this location. Similarly to the emergency vehicle detour, traffic can be rerouted to Beaver Drive, however it will increase travel time.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians during construction is expected to be achieved somewhat easily by routing them to surrounding existing asphalt pathways. The existing pathways will provide connectivity on both sides of the project, however pedestrians and bicyclists will need to travel further distances.

4. **Construction Crane Access:**

   Crane access is expected to be somewhat challenging at this location due to the numerous trees surrounding the project site. The tunnels are located on a curved section of roadway which may create additional difficulties for crane operation.

Abbot Drive crossing Tunnels from North

5. **Stormwater & Flooding Issues:**

   This location has minor stormwater and flooding issues. Pathways from both sides of the tunnel slope down to the tunnel, creating a potential for ponding and ice in the winter months.

6. **Geotechnical Conditions:**

   Geotechnical investigation has not been completed at this location.

7. **Known Utility Conflicts:**

   It is anticipated that existing utilities will provide a significant issue during design and construction of these tunnels, including existing power on the east side of the tunnels.

8. **Preliminary Grade Concerns:**

   The existing pathways and topography surrounding the tunnels are relatively flat and only minor issues with grade are anticipated.

9. **Disruption to Businesses:**

   Construction of the Circle 1 tunnels will provide a significant disruption to surrounding businesses due to the proximity to the Village at Sunriver. Vehicles will need to utilize Beaver Drive or Abbott Drive to access local businesses.

10. **Current Bike/Pedestrian Volume:**

    This location currently sees a significant amount of use from pedestrian and bicyclists. Providing a simple and effective detour route for pedestrians and bicyclists will be important during construction of the tunnel.

11. **Tunnel Condition:**

    The existing tunnels are in good condition overall, with no significant visible defects or damage.

West Approach to Tunnel

Circle 3 Tunnel

Evaluation Criteria Summary

East Approach to Tunnel

1. **Emergency Vehicle Access:**

   Emergency vehicle access is a notable issue at this location. While Abbot Drive is closed during construction, emergency vehicles will need to detour around the work zone via Cascade Road and Beaver Drive which will significantly increase response time.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone is required while a portion of Abbot Drive is closed. Similarly to the emergency vehicle detour, traffic will be rerouted to Cascade Road and Beaver Drive, which could impose a somewhat significant increase to travel times.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians away from this location during construction will be very difficult due to the lack of surrounding pathways. Pedestrians and bicyclists traveling in this area will need to travel a much further distance in order to get to their intended destination.

4. Construction Crane Access:

Crane access is not anticipated to be a problem at this location. The site is located on a straight segment of roadway with few surrounding trees except for one large pine tree on the west side of the tunnel.

5. Stormwater & Flooding Issues:

This location has significant stormwater and flooding issues. Pathways from both sides of the tunnel slope down to the tunnel, creating a ponding issue inside of the tunnel. Existing area drains have been placed on both ends of the tunnel to alleviate this issue.

Existing Area Drain

6. Geotechnical Conditions:

The geotechnical investigation at this location discovered the first 11’-13’ of soil consists primarily of silty sands. Diatomaceous materials were found beginning at a depth of approximately 11.5’ and continuing down until bedrock was discovered at a depth of approximately 25’-30’.

7. Known Utility Conflicts:

There are few existing utilities in the location of this tunnel and conflicts are expected to be minimal.

8. **Preliminary Grade Concerns:**

   The existing pathways and topography surrounding the tunnel are relatively steep and constructing a pathway with ADA compliant grades will be challenging. The existing pathway configuration includes sharp corners just outside of the tunnel on both ends.

9. **Disruption to Businesses:**

   Construction of the Circle 3 tunnel will not have a significant impact on local businesses due the proximity to existing businesses.

10. **Current Bike/Pedestrian Volume:**

    This location currently sees a significant amount of use from pedestrian and bicyclists. Providing a simple and effective detour route for pedestrians and bicyclists will be important during construction of the tunnel.

11. **Tunnel Condition:**

    The existing tunnel is in good condition with no apparent issues.

West Approach to Tunnel

Fort Rock Tunnel

Evaluation Criteria Summary

West Approach to Tunnel

1. **Emergency Vehicle Access:**

   Emergency vehicle access is a notable issue at this location. While Cascade Road is closed for construction, emergency vehicles will need to detour around the work zone via Core Road and Beaver Drive which will significantly increase response time.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone is required while a portion of Cascade Road is closed. Similarly to the emergency vehicle detour, traffic will be rerouted to Core Road and Beaver Drive, which could impose a somewhat significant increase to travel times.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians away from this location during construction will be moderately challenging due to the lack of surrounding pathways. Pedestrians and bicyclists traveling in this area will need to utilize existing pathways to the east and west in order to get to their intended destination, which will increase travel times.

4. Construction Crane Access:

Crane access is not anticipated to be a problem at this location. The site is located on a straight segment of roadway with few surrounding trees.

5. Stormwater & Flooding Issues:

This location has significant stormwater and flooding issues. Pathways from both sides of the tunnel slope down towards the tunnel, creating ponding concerns inside of the tunnel. This tunnel has been identified by SROA staff as the 2nd worst location for flooding throughout the community.

Flooding Outside Tunnel Entrance

6. Geotechnical Conditions:

The geotechnical investigation at this location discovered variance between test pits. Silty sand varied in depth between 2’ and 18.5’ before encountering bedrock. Diatomaceous materials were not present at this location.

7. **Known Utility Conflicts:**

   Unknown at this time.

8. **Preliminary Grade Concerns:**

   The topography and slopes of the existing pathways will present a slight challenge when designing the new pathways with desired slopes. The existing pathways enter the tunnel at a moderately steep slope, and the new pathways may have to extend a greater distance in order to achieve compliant slopes.

9. **Disruption to Businesses:**

   Construction of the Fort Rock tunnel will not have a significant impact on local businesses due the proximity to existing businesses.

10. **Current Bike/Pedestrian Volume:**

    Unknown at this time.

11. **Tunnel Condition:**

    The existing tunnel appears to be in good condition with no visible damage to the structure.

East Approach to Tunnel

Lodge Tunnels – Double Tunnel

Evaluation Criteria Summary

North Approach to Tunnels

1. **Emergency Vehicle Access:**

   Emergency vehicle access is a severe issue at this location. During construction, the only entrance to the lodge will be inaccessible. A temporary bridge may need to be installed in order to provide access to the lodge.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone will be extremely difficult during construction. Construction of the tunnel will impact the only entrance to the Sunriver Resort and will present severe impacts to travel.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians away from this location during construction is expected to be accomplished somewhat easily due to the availability of surrounding pathways. Pedestrians and bicyclists traveling in this area will need to utilize existing pathways to the east in order to get to their intended destination but will not severely increase travel times.

4. **Construction Crane Access:**

   Crane access is expected to be a problem at this location due to the numerous amount of existing trees in close proximity to the tunnel.

5. **Stormwater & Flooding Issues:**

   This location has minimal stormwater and flooding issues due to the existing topography. An existing storm drain is present on the north side of the tunnel to capture water as it enters the tunnel.

Center Drive over Tunnels with Surrounding Trees

6. **Geotechnical Conditions:**

   Unknown at this time.

7. **Known Utility Conflicts:**

   Due to the number of existing utilities in the area, it is anticipated that there will be multiple conflicts with existing utilities including power utilities on the south side of the road.

8. **Preliminary Grade Concerns:**

   The existing pathways and topography surrounding the project site will provide a significant challenge during design. Existing pathways and slopes are steep and will require regrading to achieve desired slopes, especially on the north side of the road.

9. **Disruption to Businesses:**

   Construction of the Lodge tunnel will result in a severe impact to the Sunriver Lodge. Construction of the tunnel will cause extreme disruption to vehicles accessing the lodge.

10. **Current Bike/Pedestrian Volume:**

    The current tunnel at this location sees a very high volume of traffic due to the proximity to the lodge.

11. **Tunnel Condition:**

    The existing tunnels are in relatively good condition with no substantial visible damage.

South Approach to Tunnels

River Rd Tunnel

Evaluation Criteria Summary

North Approach to Tunnel

1. **Emergency Vehicle Access:**
   Emergency vehicle access is a severe issue at this location. While River Road is closed at this location, there is no alternate access for emergency vehicles to access the airport, stables, marina, or homes in the area.

2. **Vehicle Detour Route Availability:**
   River Road is the only access for vehicles coming and going from the airport, stables, marina, or homes in the area. An alternative route for vehicles is a major issue during construction of the River Road tunnel.

3. **Bike/Pedestrian Detour Route Availability:**
   Detouring bicyclists and pedestrians away from this location during construction will be straight forward due to the availability of surrounding pathways. Pedestrians and bicyclists traveling in this area will need to utilize existing pathways to the east and west in order to get to their intended destination, which will only slightly increase travel times.

4. **Construction Crane Access:**

   Crane access is not anticipated to be a problem at this location. The site is located on a straight segment of roadway with minimal surrounding trees.

5. **Stormwater & Flooding Issues:**

   This location has significant stormwater and flooding issues. Ponding inside the tunnel is a common occurrence due to the steep grades entering the tunnel from the south.

Ponding & Steep Approach on South Side of Tunnel

6. **Geotechnical Conditions:**

   The geotechnical investigation at this location discovered approximately 9'-10' of silty sands and poorly graded sand with gravel. Beyond a depth of 9', diatomaceous material was encountered.

7. **Known Utility Conflicts:**

   Due to the existence of multiple utilities in the area, conflicts are expected to be moderately problematic. Existing gas and communication lines are located in close proximity to the pathway on the north side of the tunnel.

8. **Preliminary Grade Concerns:**

   Based on the existing topography and slope of the existing pathways, designing pathways with the desired slopes will be significantly challenging. Tie in locations to the existing pathways may need to be extended to achieve proper grades. The existing slope and proximity of an existing house on the south side of the tunnel will be challenging.

9. **Disruption to Businesses:**

   Construction of this tunnel will have significant impacts on local businesses along River Road due the access issues. The tunnel construction will close the only access to the Sunriver Airport, stables, and marina.

10. **Current Bike/Pedestrian Volume:**

    The existing tunnel at this location sees a moderate use of pedestrian and bicycle traffic. Detouring these users during construction will be important to maintain connectivity throughout the community.

11. **Tunnel Condition:**

    The existing tunnel has become “egg shaped” from exterior loads, however it appears to be in good condition.

South Approach to Tunnel

Theater Dr. Tunnel

Evaluation Criteria Summary

East Approach to Tunnel

1. **Emergency Vehicle Access:**

   Emergency vehicle access is not an issue at this location. Emergency vehicles can detour around the work zone via Beaver Drive with minimal delay.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone is not an issue at this location. Similarly to the emergency vehicle detour, traffic can be rerouted to Beaver Drive with minimal impacts.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians during construction is expected to be easily achieved by routing them to surrounding existing asphalt pathways. The existing pathways will provide connectivity on both sides of the project.

4. **Construction Crane Access:**

   Crane access is not anticipated to be a problem at this location. The site is located on a straight segment of roadway with few surrounding trees.

5. **Stormwater & Flooding Issues:**

   This location has minimal stormwater and flooding issues.

Theater Drive crossing over tunnel

6. **Geotechnical Conditions:**

   Geotechnical investigation found the depth to existing bedrock to be approximately 9.5', and no diatomaceous material was encountered.

7. **Known Utility Conflicts:**

   An existing water main along with multiple other utilities in the vicinity may provide a challenge when designing and constructing a tunnel at this location.

8. **Preliminary Grade Concerns:**

   The existing pathways and topography surround the tunnel are extremely flat and no issues with grade are anticipated.

9. **Disruption to Businesses:**

   Construction of the Theater Drive tunnel will provide minor disruption to surrounding businesses. The majority of vehicles will use Beaver Drive or Abbott Drive to access local businesses. During construction, vehicles will not be able to travel on Theatre Drive, however all local businesses will be accessible.

10. **Current Bike/Pedestrian Volume:**

    This location currently sees a significant amount of use from pedestrian and bicyclists. Providing a simple and effective detour route for pedestrians and bicyclists will be important during construction of the tunnel.

11. **Tunnel Condition**

    The existing tunnel is in good condition with only minor defects on the interior of the tunnel.

West Approach to Tunnel

Wildflower Tunnel

Evaluation Criteria Summary

West Approach to Tunnel

1. **Emergency Vehicle Access:**

   Emergency vehicle access is only a slight concern at this location. During construction, emergency vehicles will be able to detour on Beaver Road which will slightly increase response time.

2. **Vehicle Detour Route Availability:**

   Detouring traffic around the work zone will be a slight challenge during construction. Access to Island Road will be maintained, and vehicles wanting to use Abbot Drive will be detoured to Beaver Road to circumvent the work zone.

3. **Bike/Pedestrian Detour Route Availability:**

   Detouring bicyclists and pedestrians away from this location during construction is expected to be challenging due to lack pathways in the vicinity. Pedestrians and bicyclists traveling in this area will need to utilize the alternate pathways in order to get to their intended destination which will increase travel times.

4. **Construction Crane Access:**

   Crane access is not anticipated to be a problem at this location. The site is located on a straight segment of roadway with only a few surrounding trees.

5. **Stormwater & Flooding Issues:**

   This location has severe stormwater issues due to the existing topography and slope of the pathways. SROA staff has indicated this is the worst tunnel for flooding.

Flooding Inside Tunnel

6. **Geotechnical Conditions:**

   Unknown at this time.

7. **Known Utility Conflicts:**

   Due to the number of existing utilities in the area, it is anticipated that there will be multiple conflicts with existing utilities, including existing power on the east side of Abbot Drive.

8. **Preliminary Grade Concerns:**

   The existing pathways and topography surrounding the project site will provide a significant challenge during design. Existing pathways and slopes are steep as they enter and exit the tunnel and will need to be altered in order to achieve desired slopes. Alternative pathway alignments may be considered on the west side of Abbot Drive to avoid existing trees while achieving proper grades.

9. **Disruption to Businesses:**

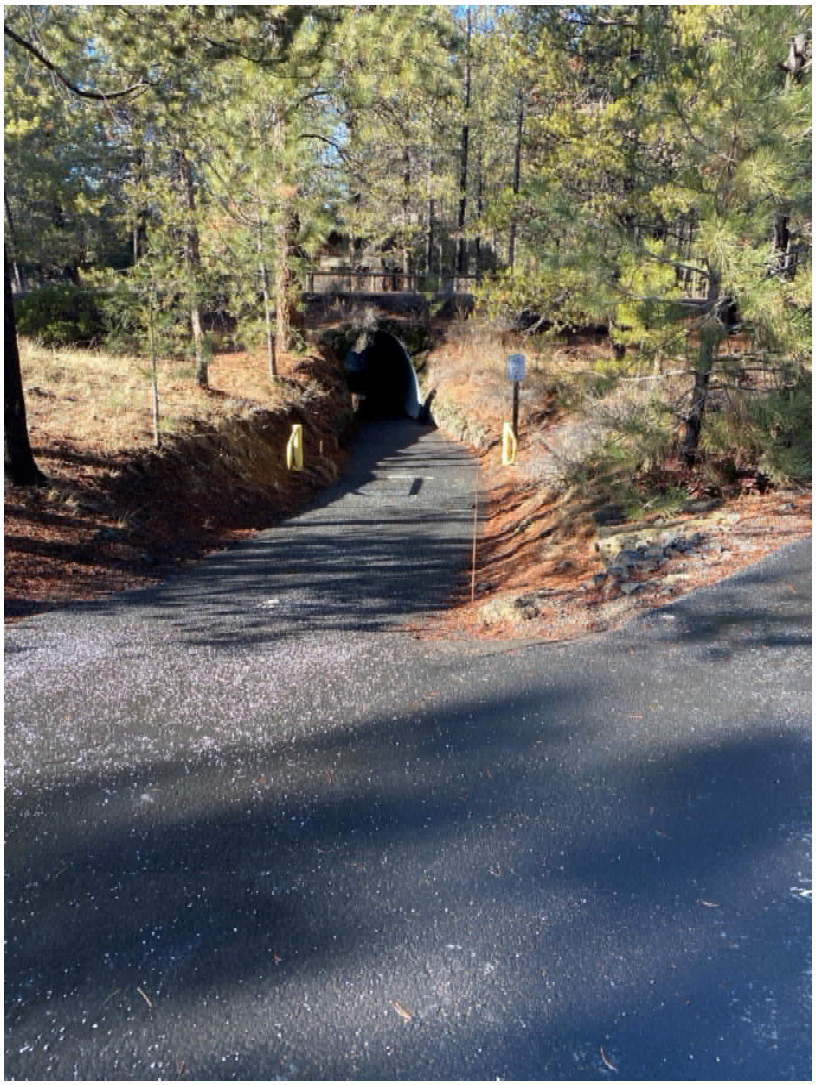
   Construction of this tunnel will result in significant impacts to surrounding businesses. Abbot Drive is a main route for customers accessing the Village at Sunriver.

10. **Current Bike/Pedestrian Volume:**

    The existing tunnel at this location sees a moderately high volume of traffic due to the proximity to the village. Bicyclists and pedestrians will need to utilize alternative routes to access homes and businesses in this area.

11. **Tunnel Condition:**

    The existing tunnel appears to be in good condition with no significant damage.



East Approach to Tunnel

Circle 2 Tunnel

Evaluation Criteria Summary

Facing Approximate Proposed Tunnel Location from Basketball Overflow Parking Access

1. **Emergency Vehicle Access:**
   Emergency vehicle access is not an issue at this location. Emergency vehicles can detour around the work zone via Beaver Drive with minimal delay.

2. **Vehicle Detour Route Availability:**
   Detouring traffic around the work zone is not an issue at this location. Similar to the emergency vehicle detour, traffic can be rerouted to Beaver Drive with minimal impacts.

3. **Bike/Pedestrian Detour Route Availability:**
   Detouring bicyclists and pedestrians during construction is expected to be easily achieved by routing them to surrounding existing asphalt pathways. The existing pathways will provide connectivity on both sides of the project.

4. **Construction Crane Access:**
   Crane access is not anticipated to be a management challenge at this location. The site is located on a curved segment of roadway with some surrounding trees.

5. Stormwater & Flooding Issues:

The south side of Theater appears to include a linear drainage swale adjacent the existing path. A similar small swale is included adjacent the vehicle access for the basketball overflow parking area. These drainage features would require replacement with a sedimentation manhole and drywell assembly, compliant with local and state stormwater management requirements.

Facing Approximate Proposed Tunnel Location from South Side of Theater

6. Geotechnical Conditions:

Nearby geotechnical investigation found the depth to existing bedrock to be approximately 9.5', and no diatomaceous material was encountered. However, site specific investigation is recommended.

7. Known Utility Conflicts:

An existing water main along with multiple other utilities in the vicinity may provide a challenge when designing and constructing a tunnel at this location. Further evaluation is warranted.

8. Preliminary Grade Concerns:

No tunnel currently exists in this location. Grades on the north and south side of Theater may present a challenge for accessible bike/pedestrian grades into and out of the proposed tunnel. Preliminary topographic evaluation is warranted for this vicinity to refine proposed tunnel crossing location.

9. **Disruption to Businesses:**

   Construction of the Circle 2 tunnel will provide minor disruption to surrounding businesses. The majority of vehicles will use Beaver Drive or Abbot Drive to access local businesses. During construction, vehicles will not be able to travel on Theatre Drive, however all local businesses will be accessible.

10. **Current Bike/Pedestrian Volume:**

    This area, and the nearby Theater and Beaver Drive Tunnels, currently sees a significant amount of use from pedestrians and bicyclists. Providing a simple and effective detour route for pedestrians and bicyclists will be important during connection of the proposed tunnel into the existing pathway system.

11. **Tunnel Condition**

    Currently no tunnel exists.

Facing Approximate Proposed Tunnel Location from North Side of Theater

Cottonwood Tunnel

Evaluation Criteria Summary

Southeast Cottonwood at S./N. Imnaha Intersection

1. **Emergency Vehicle Access:**
   Emergency vehicle access may be a minor issue at this location. Closing Cottonwood northwest of the Imnaha intersections would require emergency vehicles to route through Circle 10 via North and South Imnaha, increasing response time.

2. **Vehicle Detour Route Availability:**
   Good detour routes are available. Detouring traffic would be routed through Circle 10 via North and South Imnaha, increasing travel time somewhat.

3. **Bike/Pedestrian Detour Route Availability:**
   Since there is currently no bike or pedestrian crossing at this location, no detour is necessary beyond the time to connect to existing pathways on each side of Cottonwood. This can be achieved through temporary routing or use of pathways along North and South Imnaha.

4. **Construction Crane Access:**
   Crane access is not anticipated to be a problem at this location. The site is located on a straight segment of roadway with few surrounding trees.

5. **Stormwater & Flooding Issues:**

   Currently, no known flooding issues exist at this location. Introduction the new tunnel would create a regional low point for the collection of stormwater. A sedimentation manhole and drywell assembly would be required, compliant with local and state stormwater management requirements.

6. **Geotechnical Conditions:**

   No information is currently available. Geotechnical investigation is required to understand existing conditions.

7. **Known Utility Conflicts:**

   Unknown at this time. Cottonwood is a primary access to the north region of the Sunriver community so utility conflicts should be anticipated.

8. **Preliminary Grade Concerns:**

   Generally SROA appears to own adequate area on each side of Cottonwood, between the two paths proposed to be connected by the tunnel, to allow for accessible pathway grades. It is unlikely that Cottonwood's centerline elevation would be increased much due to the resulting need to adjust grades at the Imnaha intersection. The final location of the tunnel would likely be driven by the ability to achieve acceptable pathway grades into and out of the tunnel.

9. **Disruption to Businesses:**

   Construction of the Cottonwood tunnel would affect the direct access to the businesses of the Sunriver Marketplace. Patrons of these businesses would be required to use the Circle 10 detour for the duration of construction.

10. **Current Bike/Pedestrian Volume:**

    Currently no bike/pedestrian volume for this crossing. The at-grade crossing currently near the Marketplace could likely be replaced entirely with this tunnel if the location is shown to be feasible through further analysis.

11. **Tunnel Condition:**

    Currently no tunnel exists.