1.0 | Project Summary Information

1.1 Project Name (35 letters max) 1600 N 400 E Roundabout - Intersection and Murdock Trail Crossing Improvements

1.2 Project Type Intersection Work

1.3 Limits (descriptions should be identifiable. i.e: intersections, place names, landmarks, 35 characters max) 1600 North, 400 East, Murdock Canal Trail Intersection

1.4 Project Description (summary of project)
The construction of a Roundabout at the intersection will accomplish 3 goals:  
1. It will improve the safety of the Murdock Trail crossing and encourage more trail use in the area,  
2. Improve the LOS of the regionally significant intersection.  
3. CM/AQ Eligible: An air quality analysis has been provided by ALTA Engineering for converting the traffic signal to a roundabout.

1.5 Sponsor (jurisdiction, agency name) City of Orem

1.6 Contact Information
   Project Manager Paul Goodrich
   Office Phone 801-229-7320
   Cell Phone 801-592-4160
   Fax 801-229-7191
   Email prgoodrich@orem.org

1.7 Cost Estimate
   Total Project Cost (include matches, pledged funds, etc.) $1.35 Million
   MPO funding request (include any match) $1.26 Million
   PE Cost $198,000
   ROW Cost $47,000
   Construction Cost 1,100,000
   Soft Match proposed for project 90,045
1.8 Project Rank (rank this project compared to your other submittals)

3

1.9 Air Quality Benefit (summarize CM/AQ Report, NA for non-CM/AQ eligible projects)

Literature review of the impacts that roundabouts have on greenhouse gas emissions showed wide variation in the potential for roundabouts to improve air quality compared to non-signalized and signalized intersections. Localized factors that influence the potential for a roundabout to improve air quality include driver behavior and traffic flow, particularly speeds, pedestrian/bicyclist crossing movements, accelerations, and decelerations of the motor vehicles traveling through the roundabout (Handy). Seven studies were identified that measured changes in emissions rates at locations in which a signalized intersection was converted into a roundabout. Among these seven studies, four showed a decrease in greenhouse gas emissions, one showed little to no impact, one showed an increase, and one showed mixed results. See associated report for studies and citations. Assumptions: This analysis assumes the following conditions: 5% general decrease in all greenhouse gas emissions; No difference in future motor vehicle volumes at intersection with traffic signal or roundabout; 1% annual increase in motor vehicle volumes from a 2017 baseline to 2045; AM Peak Period: 2017 (1,795 vehicles resulting in 2,190 hours of intersection delay per year) to 2045 (2,372 estimated vehicles resulting in 2,920 estimated hours of intersection delay per year) MID Peak Period: 2017 (1,045 vehicles resulting in 1,095 hours of intersection delay per year) to 2045 (1,373 estimated vehicles resulting in 1,460 estimated hours of intersection delay per year) PM Peak Period: 2017 (1,376 vehicles resulting in 1,460 hours of intersection delay per year) to 2045 (1,812 estimated vehicles resulting in 2,190 estimated hours of intersection delay per year) Typical distribution of vehicle types (Federal Highway Administration); Average idle emission rates for Volatile Organic Compounds, Total Hydrocarbons, CO, and NOx (U.S. Environmental Protection Agency); Average idle emission rates for CO2 (Natural Resources Canada; EcoMobile); and No influence from unusual driver behavior or traffic flows. Air Quality Benefits

Based on the assumptions above, idling from signal delay at the study intersection would contribute to an estimated 0.613 metric tons of Volatile Organic Compound emissions, 0.610 metric tons of Total Hydrocarbons emissions, 12.651 metric tons of CO emissions, 0.590 metric tons of NOx emissions, and 44141 metric tons of CO2 emissions between 2018 and 2045.

If the signalized intersection was converted to a roundabout and the roundabout decreased all delay-related greenhouse gas and criteria pollutant emissions by roughly 5 percent, the estimated reduction in emissions between 2018 and 2045 would be approximately: Volatile Organic Compounds - 0.031 metric tons Total Hydrocarbons - 0.031 metric tons CO - 0.633 metric tons NOx - 0.030 metric tons CO2 - 22.062 metric tons
2.0 | Project Scope
Always enter “NA” rather than leave an answer blank...

2.1 Describe purpose and need of project.
The purpose of the project is twofold:
1. Improve the safety of the Murdock Canal Trail crossing at the intersection. Safety compliance of trail users crossing the intersection is very low. The concept design provides a more user friendly crossing.
2. The efficiency and air quality of the intersection will be improved when the current traffic signal is replaced with a roundabout.
The need is explained in the purpose - to make the intersection more safe and efficient.

2.2 Describe existing service/conditions
Safety compliance of trail users crossing the intersection is very low. Some trail users do not use the crosswalks. A very low crosswalk signal compliance is also a problem. 16% plus of trail users in this area are using the trail for work commute purposes. The LOS of the intersection can be improved with a roundabout.

2.3 Highway Project Information (for non-highway projects go to 2.4)

2.3.1 State Route # or Federal Aid Route #
1600 North Orem - Major Arterial
400 East Orem - Urban Collector
Murdock Canal Trail - the "I-15 of Utah County Trails"

2.3.2 Beginning Mile Post
NA

2.3.3 End Mile Post
NA

2.3.4 Length of project
NA

2.3.5 Existing and proposed number of Travel Lanes
NA

2.3.6 Current and proposed width of facility (detail ROW, lanes, shoulders, ped/planter).
NA

2.3.7 Facility surface type.
Asphalt

2.3.8 Describe how project is consistent with local or agency plans.
Improves the Murdock Canal Trail Crossing - and improves the LOS of a regionally
significant intersection.

2.3.9 Describe how project incorporates ITS needs.
NA

2.3.10 If phased or segmented, describe how the phase has logical termini and what will future phases consist of.
NA

2.3.11 Is project being coordinated with or constructed with a larger project?
NA

2.3.12 Describe how project will alleviate congestion on this or other facilities.
Replacing the traffic signal with a roundabout will improve the LOS of the intersection.

2.3.13 Describe any traffic improvements. (i.e lanes, signal coordination, ITS, turn lanes, bus pullouts, etc.)
Conversion of a traffic signal to a roundabout - and provides a safer trail crossing.

2.3.14 Describe any safety improvements for vehicular and pedestrian traffic. (i.e. raised median, channelization of turn movements, barriers, parkway strips, etc.)
The trail will be channelized around the intersection for a much safer trail crossing.

2.3.15 How are complete streets addressed with this project? (plan for pedestrians, bikes, transit, trails, ITS)
Safety compliance of trail users crossing the intersection is very low. Some trail users do not use the crosswalks. A very low crosswalk signal compliance is also a problem. 16% plus of trail users in this area are using the trail for work commute purposes. The LOS of the intersection can be improved with a roundabout. The trail will be channelized around the intersection for a much safer trail crossing. The intersection will be complete when both vehicular and trail improvements are provided.

2.3.16 Describe traffic control changes at intersections. (include info to warrant changes)
The traffic signal will be replaced with a roundabout.

2.3.17 What right-of-way is already secured?
Southwest corner and northwest corner.

2.3.18 What additional right-of-way is needed?
Very small ROW pieces on other intersection corners.

2.3.19 Describe utility work to be performed and indicate who will do the work.
Minimal

2.3.20 What type of environmental work will most likely be needed?
Categorical Exclusion

2.4 Non-Highway Projects (Transit / ITS / Active Transportation, Park and Ride, etc.)

2.4.1 Transit Route #
NA

2.4.2 Length of project
NA

2.4.3 What is the expected use of the facility or program?
NA

2.4.4 What services are provided in the operating of this project?
NA

2.4.5 Describe any equipment to be purchased (buses, ITS, etc.).
NA

2.4.6 Describe how project is consistent with local or agency plans.
NA

2.4.7 Describe how project incorporates ITS needs.
NA

2.4.8 If phased or segmented, describe how the phase has logical termini and what will future phases consist of.
NA

2.4.9 Is project being coordinated with or constructed with a larger project?
NA

2.4.10 Describe how project will alleviate congestion on this or other facilities.
NA

2.4.11 Describe any traffic improvements. (i.e lanes, signal coordination, ITS, turn lanes, bus pullouts, etc.)
NA

2.4.12 Describe any safety improvements for transit and pedestrian traffic. (i.e. raised median, channelization of turn movements, barriers, parkway strips, bridges, etc.)
NA

2.4.13 How are complete streets addressed with this project? (plan for pedestrians, bikes, transit, trails, ITS)
2.4.14 What right-of-way is already secured?
NA

2.4.15 What additional right-of-way is needed?
NA

2.4.16 Describe utility work to be performed and indicate who will do the work.
NA

2.4.17 What type of environmental work will most likely be needed?
Categorical Exclusion

2.5 Facility Design

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<th>Current Conditions</th>
<th>Design Year 2040</th>
<th>Design Year w/o Improvements</th>
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<tr>
<td>Average Daily Traffic</td>
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<td>20,000</td>
<td>18,000</td>
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<td>Level of Service</td>
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<tr>
<td>Functional Class</td>
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<td>Transit Ridership</td>
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<td>NA</td>
<td>NA</td>
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<tr>
<td>Ped/Trail Usage</td>
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<td>Enter Text 191,600 (trips/year)</td>
<td>201,400 (trips/year @ 2022)</td>
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<tr>
<td>Park and Ride Usage</td>
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</tr>
</tbody>
</table>
3.0 | Project Ranking

The following categories will be used by MPO staff to score each project. The points associated with each category show what total points MPO staff can give. MPO staff’s recommendations will be made available to the MPO TAC Committee for their use in making final project selection recommendations. MPO staff ranking is a tool to aid the MPO TAC Committee in their final selection. The committee is not required to pick projects solely on MPO staff ranks. **Please note, if questions pertinent to the project are not answered, zero points will be given.**

3.1 Congestion Relief (25 Points)

Explain if the project...

a) Provides an alternate transportation facility that corrects an identified congested problem? 
   Replacing the signal with a roundabout improves the intersection LOS.

b) Reduces congestion by reducing the number of vehicles. 
   The number of vehicles is not reduced - the intersection delay is reduced.

c) Reduces the need for additional highway lanes for peak hour capacity. 
   YES - The roundabout will permit 1600 North in this area to carry more traffic volume.

d) Increases the efficiency of transportation system through traffic management measures. 
   YES - see a-c.

e) Adds turning movements to relieve a congested intersection. 
   Reduces turning movements with the roundabout and improves safety and traffic queueing.

3.2 Mode Choice (25 points)

Explain if the project...

a) Benefits multiple transportation systems (transit and highway, pedestrian and transit). Highway 
   and trail crossing.

b) Promotes alternative transportation solution to SOV use. 
   YES - 16% plus trail users are using the trail to commute to work. With the trail crossing 
   improvements the commute percentage is expected to increase.

c) Creates or improves linkages between transportation modes. 
   Yes - highway, trail, and transit. The adjacent technology employment center is the icing on 
   the cake.

d) Reduces physical, psychological, or economic barriers to carpool, bike, walk, or transit use. 
   The safety issues and non-compliance with the pedestrian signal will reduce physical, 
   psychological, and other barriers.
e) Provides incentives to carpool, bike, walk, or transit use.
   Yes – see all of the above. Don’t forget the adjacent Technology Employment Center and multiple mobility choices.

3.3 Environmental Quality (15 points)
Explain if the project...

a) Provides cost effective emission reductions (air quality score).
The estimated reduction in intersection delay for the typical weekday morning (7:30 AM - 9:00 AM), midday (11:45 AM - 1:15 PM), and evening peak periods (4:00 - 6:00 PM) between 2018 and 2045 was 0.21 hours. The estimated number of motor vehicles through the intersection during the same typical weekday morning, midday, and evening peak periods between 2018 and 2045 was 4,880.

b) Minimizes environmental impacts or reduces existing impacts (e.g. air/water/noise pollution).
According to the U.S. Environmental Protection Agency’s Greenhouse Equivalences Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator), the estimated 22 metric ton reduction in CO2 emissions between 2018 and 2045 from converting the intersection at 1600 N and 400 E in Orem from a traffic signal to a roundabout is equivalent to approximately: 54,000 vehicle-miles reduced from average passenger vehicle, or 2,000 gallons of gasoline not consumed, or Carbon sequestered by 600 tree seedlings grown for ten years, or Carbon sequestered by 26 acres of US Forest in one year.

c) Enhances the natural, cultural, or historic environment.
   NA

d) Mitigates invasive impacts to existing neighborhoods/commercial areas (minimal relocations).
   NA

3.4 Safety (20 points)
Explain if the project...

a) Corrects/improves a verified or potential safety or accident problem.
   Safety compliance of trail users crossing the intersection is very low. The concept design provides a more user friendly crossing. Some trail users do not use the crosswalks. A very low crosswalk signal compliance is also a problem. 16% plus of trail users in this area are using the trail for work commute purposes.

b) Improves information/communications for traffic operations and emergency responders.
   NA

c) Reduces severity of crashes.
d) Enhances safe movement of pedestrian, bicycle traffic.
   YES - Some trail users do not use the crosswalks. A very low crosswalk signal compliance is also a problem.

e) Provides an intermodal safety improvement (e.g. separation of vehicles-trains, vehicles-pedestrian).
   YES - Channelization and separation of safety conflicts is enhanced by the design.

3.5 Other Considerations (15 points)
Explain if the project...

a) Effectively distributes funding throughout the MPO area.
   Yes - see the MAG tax chart

b) Phases project in a manner that the MPO can use limited funds efficiently.
   Yes - the roundabout can delay the need to widen 1600 North in this area for many years. In a best case scenario, 1600 North will never need to be widened in this area with the effective use of trading signals for roundabouts.

c) Additional funding above required match is pledged toward project (including any soft match).
   Our design time and costs far exceed soft and hard match agreements.

d) Project sponsor ranking of project.
   1

e) Project is numbered project within the current RTP.
   1600 North improvements... can delay or eliminate widening of 1600 North in this area.
4.0 | Air Quality Report
All projects that are eligible for CM/AQ and CM/AQ-PM2.5 funds must complete this report. These funds are eligible for projects and programs countywide. Contact Susan Hardy at Mountainland AOG if you need help completing 4.4 Quantitative Analysis below, 801/229-3842 or shardy@mountainland.org.

4.1 Eligibility
CM/AQ funds can only be used for projects and programs that a direct benefit to air quality can be demonstrated. Highway expansion, such as new single occupancy vehicle lanes, is not eligible. Turn lanes at congested intersections, transit programs, pedestrian and trail projects, signal modernization, ITS, and IM programs are typical eligible CM/AQ projects.

4.2 CM/AQ Program
The purpose of the CM/AQ program is to fund transportation projects or programs that will contribute to attainment or maintenance of the National Ambient Air Quality Standards (NAAQS) in Ozone (O₃), Carbon monoxide (CO), Particulate Matter – 10 microns (PM₁₀), and PM₂.₅ non-attainment and maintenance areas. The city of Provo is a maintenance area for CO and Utah County is a non-attainment area for PM₁₀ and PM₂.₅.

4.3 Completing this Report
All projects eligible for CM/AQ funds must complete this report. Completing this report can be quite technical, Susan Hardy, Air Quality Coordinator at Mountainland, can help with filling out this report. Contact her at 801/229-3842 or shardy@mountainland.org.

4.4 Quantitative Analyses
A quantitative assessment of how a proposed project or program is expected to reduce emissions is important to assist in selecting the most effective use of this fund. List below all travel benefits directly related to this project. Air quality benefit calculations must utilize Mobile 6. The air quality analysis should include assessing emission reductions of transit, traffic flow improvements, ITS programs and programs, ridesharing, bicycle and pedestrian improvements. Complete at least one of the sections below. If quantitative analyses cannot be done, do a qualitative assessment in 4.3.

a) Vehicle Miles Traveled
Number of Vehicle Miles Traveled reduced (VMT): ALTA assessment sections 1.9 and 3.3
Average distance of trips reduced: ALTA assessment sections 1.9 and 3.3
Emission reduction per average weekday: ALTA assessment sections 1.9 and 3.3

b) Idling Time
Average idling time per vehicle reduced: 6 seconds
Number of vehicles with reduced idling time: 12,000
Emission reduction per average weekday: NOX-0.0665 kg, VOC 0.0142 kg, PM2.5 0.0028 kg

C) Vehicle Speed
Average change in vehicle speed (speed before and after): ALTA assessment sections 1.9 and 3.3
Number of vehicles affected: ALTA assessment sections 1.9 and 3.3
Emission reduction per average workday: ALTA assessment sections 1.9 and 3.3
4.5 Qualitative Assessment
Although a quantitative analysis of air quality impacts is required whenever possible, some improvements may not lend themselves to rigorous quantitative analysis, because of the projects characteristics or because practical experience is lacking to adequately analyze the project. In these cases, a qualitative assessment based on a reason and logical examination of how the project or program will decrease emissions and contribute to attainment or maintenance of a NAAQS is appropriate.

Emission reductions: NOX-0.0665 kg, VOC 0.0142 kg, PM2.5 0.0028 kg
The estimated 22 metric ton reduction in CO2 emissions between 2018 and 2045 from converting the intersection at 1600 N and 400 E in Orem from a traffic signal to a roundabout is equivalent to approximately:
54,000 vehicle-miles reduced from average passenger vehicle, or
2,000 gallons of gasoline not consumed, or
Carbon sequestered by 600 tree seedlings grown for ten years, or
Carbon sequestered by 26 acres of US Forest in one year.
The estimated reduction in intersection delay for the typical weekday morning (7:30 AM - 9:00 AM), midday (11:45 AM - 1:15 PM), and evening peak periods (4:00 - 6:00 PM) between 2018 and 2045 was 0.21 hours. The estimated number of motor vehicles through the intersection during the same typical weekday morning, midday, and evening peak periods between 2018 and 2045 was 4,880.
See all information in sections 1.9 and 3.3.
5.0 | Project Cost Estimate

To develop a project cost estimate, please supply a detailed cost breakdown of your unit costs, inflation, equipment, right-of-way, contingency, etc. To do so, use the Concept Costs Estimate Excel form provided by UDOT (available on Mountainland.org website). Non-construction projects such as equipment purchases, operations, administration programs, studies, etc. can use other methods to show their estimated costs. All sheets or methods used should be submitted as part of the Supplemental Information accompanying the Concept Report.

5.1 Cost Summary

Summarize the information from the Costs Estimate Excel form or other method. Enter NA for items that do not apply to the project.

a) Preliminary Engineering $88,000
b) Environmental Work $20,000
c) Construction $1,100,000
d) UDOT Review (project cost <$500k = $5k, >500K = $10k) $10,000
e) Construction Engineering $110,000
f) Subtotal (in today’s dollars) $1,308,000
g) Inflated Cost Factor (inflated to 2022) 1.19
h) Total 2022 Cost $1,600,000
i) Non-MPO Funds Available to Project Click here to enter text.
j) MPO Funding Request (includes 6.77% local match) Click here to enter text.

6.0 | Supplemental Information

Please submit any supporting documentation including maps, diagrams, charts, cost estimates, etc. that will allow MPO and UDOT staff and any Technical Advisory Committee to make an informed decision regarding the proposed project. Keep Supplemental Information submittals to 8 pages total.

6.1 Concept Report Submittal

In order to facilitate the distribution of the Concept Reports and any supplemental information, all Concept Reports shall be combined with any supplemental information and saved in PDF format as one document. Please note that this might create a large data file that might be too large to emailed. Plan accordingly to submit your report in electronic format (CD, DVD, Flash Drive) by the required due date. Concept Reports are due by March 8, 2018 at 6pm.

6.2 Contacts, Questions

For help with the Concept Report or questions, please contact:

Bob Allen
801/229-3813
rallen@mountainland.org

Shawn Eliot, AICP
801/229-3841
1600 North 400 East Roundabout
Murdock Canal Trail Improvement