# Assessing Ohio's Detour Determination Reporting for Process Improvements

**(Ohio's Research Initiative for Locals Research On-Call Services 2021-ORIL6 Task #5)**

Prepared by Bhaven Naik, Deogratias Eustace, Saurav Prasai, and Mariam Saher.

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**16. Abstract**
Ohio's local public agencies (County Engineers, Township Trustees, Villages and Municipalities) often experience the burden of construction traffic when the Ohio DOT (ODOT) closes a state route for construction. ODOT typically provides the locals with a Detour Determination Report (DDR) that evaluates the length of a detour, duration of closure and costs associated with the closure. Though the locals often provide signature of acknowledgement, and the DDRs specify repairs for the Designated Local Detour Routes (in addition to repairs for the Official, Signed Detour), the damage to pavement, signs, private property, utilities, and overlap on other projects can be missed. By completing a series of tasks (detailed review of literature, interviews with CMV drivers and Ohio's local agencies, review of prior completed projects and also Ohio's current DDR process) this study gained insight on the topic area. Based on the insights, a systematic procedure/tool was developed by which more informed decisions on a detour can be completed. The proposed methodology is an iterative process (EXCEL-based spreadsheet) where decision makers (in this case ODOT) can request additional analyses, information, etc., from the applicant and continue refining the process before coming to a final decision of whether to go with the full road closure or otherwise. In addition, the proposed methodology was demonstrated on three sample projects as case studies.

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# Assessing Ohio's Detour Determination Reporting for Process Improvements

## Ohio's Research Initiative for Locals Research On-Call Services
## 2021-ORIL6 Task #5


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## Project Background.

To facilitate road construction, most Departments of Transportation (DOTs), including the Ohio Department of Transportation (ODOT), utilize either a full-road closure or a limited capacity (partial-width) road closure as suggested by the Federal Highway Administration (FHWA, 2003). However, road construction projects almost always necessitate the need to determine detour routes to divert traffic around a work zone.

Prior to the start of construction and in accordance with Standard Operations Procedure OPS-103, ODOT prepares a "Detour Need Determination Report" (DDR) that depicts a detour route around a proposed construction work zone. A DDR is provided to the local public agencies and evaluates the length of a proposed detour and its associated total cost. The detour construction costs are derived from project construction costs (i.e., estimated construction costs of critical work items, including factors such as duration of construction, additional expense for traffic control, and maintenance of current roadway conditions) and also the adjusted road user costs (i.e., calculated as stated in the ODOT innovative Contracting Manual). On the part of the locals, DDRs specify repairs for the designated detour routes.

An inherent problem with the current method of developing DDRs, especially for construction projects on state routes in the vicinity of local roads, is that the traffic is "pushed" onto the local road network. That is, while a designated detour is available, some traffic does not use it and instead uses local roads within the area – primarily because of factors such as drivers using GPS devices for directions, drivers having local knowledge of the area, etc. As such, there is a shifting of any traffic associated concerns – costs, safety concerns, noise, etc. – from the designated detour to the local routes (or other alternative local roads). The result is a "tussle" of shared responsibility – more so on monetary management purposes – between ODOT and Ohio's local jurisdictions (County Engineers, Township Trustees, Villages and Municipalities).

It is believed that damage to pavement, signage, private property, utilities, and overlap to other projects that occur on the local road network can be missed in the current DDR. To properly account for the associated costs to undesignated local detours (and assist local jurisdictions with the subsequent burden), ODOT/ORIL has to reconsider the content of their current DDRs. More importantly, there is a need to identify the concerns of the locals and how these can be included in a revised methodology and/or DDR.

## Objective.

The goal of Task #5 is to propose improvements to the detour determination reports (DDRs) issued by ODOT to local public agencies. The revisions are expected to properly account for the costs associated to local roads and thus alleviate the burden (of road construction projects) on Ohio's local jurisdictions. More specifically, this task aims to:

A. *Determine and investigate the costs associated with construction projects that utilize a full closure with detour vs. a part-width construction using existing data of bid history of pertinent repair bid items, road user costs, additional construction costs, right of way costs, input from local public agencies regarding impacts during construction*; and

B. *Make a recommendation, based on this work, on proposed improvements to the DDR, and additional considerations during project development before ODOT makes a formal decision on full closures for constructions*.

The findings are presented in this report along with any recommendations.

## Methodology.

In order to meet the overall objective of this task, the research team completed a set of four specific activities which included the following:

- Action Item #1: Project Inception and Startup Meeting
- Action Item #2: Literature Review
- Action Item #3: Reviewing Previous/Existing Construction Projects
- Action Item #4: Conduct Interviews with Truck Drivers
- Action Item #5: Development of a Systematic Decision Tool
- Action Item #6: Case Studies to Implement the Systematic Decision Tool
- Action Item #7: Recommendations and Task Deliverables

The main body of this report presents a summary of the completed tasks and their findings, after which a concise set of recommendations is compiled.

## Literature Review.

Road construction projects often need to determine alternate means of getting travelers around the work zone and onto their destinations. Most State Departments of Transportation (DOTs), including the Ohio Department of Transportation (ODOT) utilize either a full-road closure or a limited capacity (partial-width road closure) as suggested by the Federal Highway Administration (FHWA, 2003). DOTs have difficulty in documenting the proper reasons, conditions, impacts, and benefits of using the full-closure for reconstruction and rehabilitation of the road. Although there are frequent cases of using full-closure scenarios in the past by DOTs, there is still a need to establish an efficient decision framework to avoid ambiguity, and save time and resources. The literature reviewed here is meant to provide insight into various research work that has attempted to establish decision support tools and to review any case studies.

DeVries et al., (2014) used a freeway ramp closure (case study) and performed a strategic analysis over various purposes of closure such as “emergency closure, construction closure, and planned closures” and examined the impacts associated with these closures. As expected, the results indicate the impacts mainly include travel time delay, queuing, and high emissions. One of the ways to address these impacts to some extent could be provision of an alternative route. In fact, adopting a full closure of the road with a detour route could reduce the travel time, delay, queuing, and emissions (DeVries et al., 2014). While the results indicate full-closure with an alternate route to be an economically viable option in most cases, the study does not exclusively perform a cost estimation to compare the impacts, but only lays sufficient theoretical background. However, emphasis must also be given to the impact of the closure on the travel behavior of the road user.

Consequently, a recent study by Seilabi et al. (2022) delves into the idea of identifying an optimal closure scenario based upon the traveler’s behavior on route choice. The authors used a learning-based approach to create algorithm-backed computational experiments which divide the travelers into two categories of “rational travelers” who take construction work zones in consideration and “path-loyal travelers” who do not change their routes while construction is going on. This study provides a set of travelers who take a detour that helps the construction activity and speeds up the project and another set of travelers who stick to their pre-construction route creating travel delays. The results suggest that path-loyalty (percentage of travelers that are loyal to their usual path) is a decisive factor to determine

the optimal closure scenario. Hence, partial closure could be an ideal closure scenario if the percentage of "rational travelers" is significantly higher as it offers minimum emission costs. While, if the percentage of "path-loyal" travelers is significantly higher, then there would be compromises on safety and extended project duration when partial closure is adopted. In such a scenario, full closure would be more appropriate, as it offers short project duration without compromise to safety, although costs associated with emissions would be higher (Seilabi et al., 2022).

A study of asphalt overlays on urban highways compares night-time, daytime and weekend closures for overlay jobs and subsequently analyzes the data on the basis of productivity, worker safety, and number of lane closures (Dunston et al., 2000). This study concludes that the weekend closure not only favors the most productivity, but also ensures better worker safety and costs as opposed to night-time closures. Similarly, a study in Ontario, Canada evaluated work zone strategy by developing four models – work strategy (quality, methodology, accessibility, lane closure tactics), worker and user safety, user delay cost, and multi-variate decision model – all of which account for the optimization of construction activity and indicate that the lane closures have a significant impact on user delay cost (Huen et al., 2006). The estimation of closure impacts on road users could be troublesome as some of the impacts are quantitative while the others are qualitative in nature. Mallela and Sadavisam (2011) presented a framework for the Federal Highway Administration (FHWA) to estimate Work Zone Road User Costs (WZ RUC). Primarily, the WZ RUC comprises user delay cost, vehicle operating cost, crash costs and emission costs. Other impacts of work zones such as noise, local community and business impacts, etc. are difficult to monetize, and are termed as qualitative impacts. Another way to address the closure impacts is to adopt traffic management strategies such as "use of traffic control devices, flaggers, and message boards" efficiently and planning the project meticulously (Maze and Wiegand, 2007).

Research studies have been completed in the past with a focus on developing a decision tool framework using a broader spectrum of relevant information to decide the best closure scenario (Liu et al., 2013; Qian and Zhang, 2013; DeVries et al., 2014). Liu et al. (2013) developed a logistic detour decision tool (i.e., detour to be used or not to be used) for an urban freeway. The proposed decision model was calibrated using Maryland's incident data. The key experimental variables used for development and calibration of the decision model were variables related to freeways (e.g., flow rate, the number of lanes), incident related (e.g., duration, the number of lanes blocked), and detour route related (e.g., flow rate on various sections - freeway to the detour route, the parallel route, detour route back to the freeway and the number of lanes, and signals on the detour route). The benefit of the detour was also estimated using a benefit analysis procedure to validate the developed detour decision framework. The estimation included the cost savings from reduced delay, fuel, and emissions (i.e., HC, CO, NO, and $CO_2$).

Likewise, Qian and Zhang (2013) explored various construction plans of freeway reconstruction projects to analyze the impacts such as congestion, delay, vehicle miles traveled (VMT), system performance, and emissions using a work zone analysis tool - NetZone. This tool was used to compare the full closure scenario vs. partial closure scenario based on their impact. The analysis revealed that the full-closure plan would result in less overall system travel delay but higher VMT. On the other hand, partial closure reduced VMT and was slightly efficient in regard to emission and fuel consumption. Therefore, choice of appropriate detour plan also depends upon the ease of finding the best alternative route to divert the traffic away from the work zone. In addition to this, the cost of construction for both scenarios should be evaluated with the consideration of user costs, emissions costs, traffic maintenance costs, etc. (Qian and Zhang, 2013). Hanson and Noland (2015) estimated the amount of greenhouse gas (GHG) emissions associated with road construction activities by comparing full road closure versus partial road closure. The results showed that total full closure construction accounted for 26% of total emissions while partial closure accounted for only 2% of total emissions.

Similarly, DeVries et al. (2014) developed a systematic decision tool for full roadway closure to be used by the Colorado DOT. Three options were considered in developing the decision tool: basic checklist,

flow chart, and a step process. From the three options, the step process was chosen due to its simple logistic nature and flexibility. The various factors that could potentially affect the choice of full-closure were impact to traffic, impact to business, added travel distance, number of local agencies to coordinate, construction time saved, etc. The factors were categorized into favorable, fair, and unfavorable scenarios. One important thing to consider while applying full-closure is how many days in advance the public will be made aware of the closure. The decision tool also had a section to list all potential benefits of the proposed full-closure.

In order to determine the most efficient reconstruction strategy on high-volume urban freeways, Lee et al. (2005) compared "closure timings, duration and lane configuration" for various closure types by taking consideration of the factors such as "construction schedule, traffic inconvenience, road user cost, maximum delay, and agency costs." The study found that a full-closure scenario continuously for 3-4 weekdays is the optimal strategy as it offers moderate closure time (or construction duration) and better cost savings in comparison to partial-closure. The efficiency of the strategy also depends on how early the public are informed about the closure (Lee et al., 2005).

Michimoto et al., (1995) found that announcing road closures to the public in advance, efficient planning, and effective traffic management are likely to result in no significant issues on the roadway due to closure. The authors explain the steps taken to inform the public about the closure and the measures put in place to ensure smooth traffic flow while the road maintenance work is carried out. One of the most critical aspects of work zone management is Maintenance of Traffic (MOT). Padhye et al., (2021) analyzed various case studies in Indiana and other US states to establish 11 Key Performance Indicators for MOT using a survey questionnaire. The five most important indicators identified are safety, mobility, budget constraint, project duration, and the complexity of a project site. These performance indices – which reflected the need for a full-roadway closure with a detour route – were given scores or weights to compare among various MOT strategies.

DOTs usually prepare a report called a Detour Determination Report (DDR) which delineates the map for a signed official detour and also a local unsigned unofficial detour. Ude and Seal (1999) presented various guidelines about the unofficial detour. The unofficial detour is the local unsigned route that traffic is likely to take to avoid the official detour. Before routing traffic on the official detour, the state and local government must sign a letter of understanding, and the state will be responsible for damages on the unofficial detour route during the official detour's lifespan. The state is not liable for the existing damage prior to the use (Ude and Seal, 1999). Some DOTs have developed procedures/tools for evaluating detour needs that are systematic and easy to use once an analyst gathers detailed input data. These procedures/tools perform analysis that provide replicable and more informed decisions pertaining to detour choices. These DOTs include Colorado DOT (DeVries 2014), Connecticut DOT (CTDOT 2023), and Indiana DOT (INDOT 2023).

The literature review summarizes various case studies that presented a general idea that a full-closure scenario guided by effective construction and management plans and efficient traffic management strategies such as signage, availability of public transport, and consideration of behavior and purpose of commute could benefit more to the public as well as the governing body when alternative routes are readily available. The choice of partial-closure shall be backed by the presence of a significant number of rational travelers that reduces the traffic in the work zone. Prior information about the on-going construction activity could potentially encourage travelers to adopt different routes reducing the amount of traffic in the work zone, which favors the choice of the mixed closure scenario or the partial closure scenario.

# Interviews with Commercial Motor Vehicle Drivers and Ohio's Local Agencies.

The objective of this action item was to gain first hand insight from commercial motor vehicle (CMV) drivers and also from representatives of Ohio's local agencies. The interviews were meant to gain perspective from persons that use the detour routes (CMV drivers) and from those that experience the administrative onuses pertaining to establishing and maintaining detours on a frequent basis.

*Commercial Motor Vehicle Drivers*

For CMV drivers, an interview script and recruitment materials (see Appendix A) were developed and submitted for review with the Institutional Review Board under IRB protocol # 23-N-29. The interview script included a number of specific questions; however, the interviews were not limited to the scripted questions and allowed for open-ended discussion of the key aspects raised through the interview process. Of primary interest were questions that targeted the perceptions and experiences of CMV drivers as they navigated through detour routes, such as use of specialized route navigation equipment, compliance with detour signage, and concerns associated with using detour routes. The interview was intended to be conducted using one of two approaches:

**Approach A – Phone-Based Interview**. This approach started by identifying a select number of Ohio-based logistics/freight/hauling companies, then a recruitment email was sent to points-of-contact (POC) requesting participation in a phone-based interview. Once a POC(s) responded to the email, then a date/time would be scheduled for the interview.

**Approach B – Direct Approach Interview**. With this approach, three rest areas in close proximity to the Ohio University Athens campus – along US-33 between Logan and Lancaster, along US-50 between Athens and Albany, and along US-50 between Athens and Parkersburg, WV – were targeted. It was anticipated members of the research team would spend one day at each location (i.e., 4-5 hours) and directly approach CMV drivers that are parked/come to rest at the rest areas and seek their participation in the interview.

It was approach B – *Direct Approach Interviews* – that were the most effective in getting responses from drivers. A total of nine drivers were interviewed at the three locations described earlier. The findings from the interviews with the CMV drivers are summarized below.

*CMV Driver Findings*

- Driving Experience: In terms of driving experience, the number of years actively driving their CMV ranged from a minimum of 1 year to a maximum of 34 years, with an average of 16 years. Three out of the nine respondents (33%) drove short-haul distances in box trucks while six (66%) drove long-haul distances in semi-trucks (WB 67).
- Detour Signage:
    - The CMV drivers that were interviewed all stated that, in the last 5 years, they had each missed a detour sign when approaching a full-closure work zone. However, it was not easy to ascertain the frequency of these missed events from the drivers.
    - There were mixed responses among drivers to the ease of seeing and/or following detour signage. Additionally, even among the drivers that mentioned it was easy to see and/or follow signage, they did refer to some specific instances where it was not easy to see and/or follow including:
        - "… hard to see due to trees or due to signs being small,"
        - "… signs are inadequate,"
        - "Not enough signs on the detour, so not easy to see or follow;" and
        - "… signs are difficult to notice sometimes."

- There was a general agreement among drivers that their colleagues (other drivers) are likely missing/ignoring detour signs.
- All the CMV drivers indicated that they did not deliberately ignore detour signage.
- The following are insights/experiences/opinions provided with respect to location, placement, etc. of detour signage along roadways:
  - Selection of detour routes must be improved as some detours are difficult to get through and restrictive due to narrow lanes, low overhead clearances, and restrictive bridges;
  - Clear low-hanging trees and anything affecting the visibility of detour signage;
  - Detour routes are very lengthy;
  - Maintain a good physical condition of the detour route;
  - Update the detour route information in real time and on apps used by CMV drivers. It would be very beneficial if detour information was given beforehand;
  - Drivers have experienced detours lacking signage, especially for lengthy detours and suggest the need to clearly mark detour routes using extra signage; and
  - Drivers preferred partial-width closures over full-width closures. This was especially the case for WB-16 (semi-truck) drivers who claimed full width closures are time consuming, require more signage to keep them on route, and more attention and skill is required while driving through detours.

- Navigation: The CMV drivers all stated that they maintain and follow driving directions between their origins and destinations and will continue their trip(s) by driving along any marked detour routes. Also, each driver mentioned the use of either Google maps/Apple maps, or a specific company-based GPS system for their directions. In addition, drivers referenced the need to stick to their routes because their employees track them using in-vehicle video systems.

*Ohio's Local Agencies*

For Ohio's local agencies, the research team identified POCs based on the partial/full-width projects that were being reviewed as part of action item #3. The research team thought it would be best to discuss with engineers in the locations of these already completed projects as they would provide valuable insights based on their experiences. As such, an email was sent to POCs at the select agencies requesting participation in a phone-based discussion. Once a POC responded to the initial email, then a date/time was scheduled. The research team was only able to have a discussion with an engineer from one local agency. The highlights from this discussion with the engineer are summarized below.

*Local Agency Findings*

- Occurrences of Subject Detour Issues: The issues being addressed in this ROC task are not persistent on many state routes (SR's) given that there are not many detour options due to the spacing of the SRs. The problems exist where there are county roads/local streets in between state routes that provide alternate routes that can be adopted as potential detours.
- Concern(s) with Detour:
  - The primary problem is not that large trucks (semis) cannot use the detour – the assigned detour routes can take their size and weight, but the bigger concerns are the volume and repeated loadings.
  - Most often, the damage that has been witnessed is sign damage and shoulder damage.
- Provision of Detour Route:
  - The current DDR has a "guess-estimate" local detour, but this is not posted in reality. It would be beneficial (to the local agency) if this "guess-estimate" was posted as well – even if just for the local area traffic.

- For the most part, ODOT in the area (where the engineer works) is good at taking care of the damage but this is also dependent on the area engineers. In order to avoid lots of procedures (talking/reporting/etc.) it would be "better to just post the local (guess-estimate) detour."
- It would also be beneficial to perform repairs to the detour routes (both main and local) to prepare them prior to the start of actual construction work – ensuring ODOT and County work ahead of the project initiation.

# Development of a Systematic Decision Tool.

Based on the literature review of other states' detour methodologies, in conjunction with a review of the current ODOT detour determination report, the research team developed a proposed decision process to be adopted by ODOT while determining the choice of work zone maintenance strategy and deciding between full lane and part-lane closure strategies.

*Decision Process Methodology*

The methodology proposed was developed to assist in the decision process when determining the work zone closure strategy (i.e., evaluating whether full-roadway closures of construction and maintenance activities need to be implemented). The process consists of three stages, which are: (1) Data Collection, Analysis, and Initial Decision on Construction Strategy (2) Review of Analysis and Final Decision on Construction Strategy (3) Provide Guidance to Implement Full Closure. At the end of each of the first two stages, there is a decision that has to be made before moving to the next stage, and the guidance process involves data worksheets and a rubric that the analyst/applicant and the ODOT District review team can use to implement the process. The process is summarized in a flowchart depicted in Figure 1.

- Stage One - *Data Collection, Analysis, and Initial Decision on Construction Strategy*: Requires the analyst/applicant to gather all available information related to the proposed road segment/intersection where construction work is expected. The primary information – depicted in a worksheet shown in Table B.1 in Appendix B – is related to details of the closure scenario and must be collected by the applicant/analyst. Table 1 presents a scoring rubric to be used in all stage decision points in the process.

Data and information gathered and recorded in Table B.1 and using the rubric presented in Table 1, the applicant/analyst uses the evaluation form shown in Table B.2 (also available in Appendix B) to determine/assess the favorability of a road closure strategy.

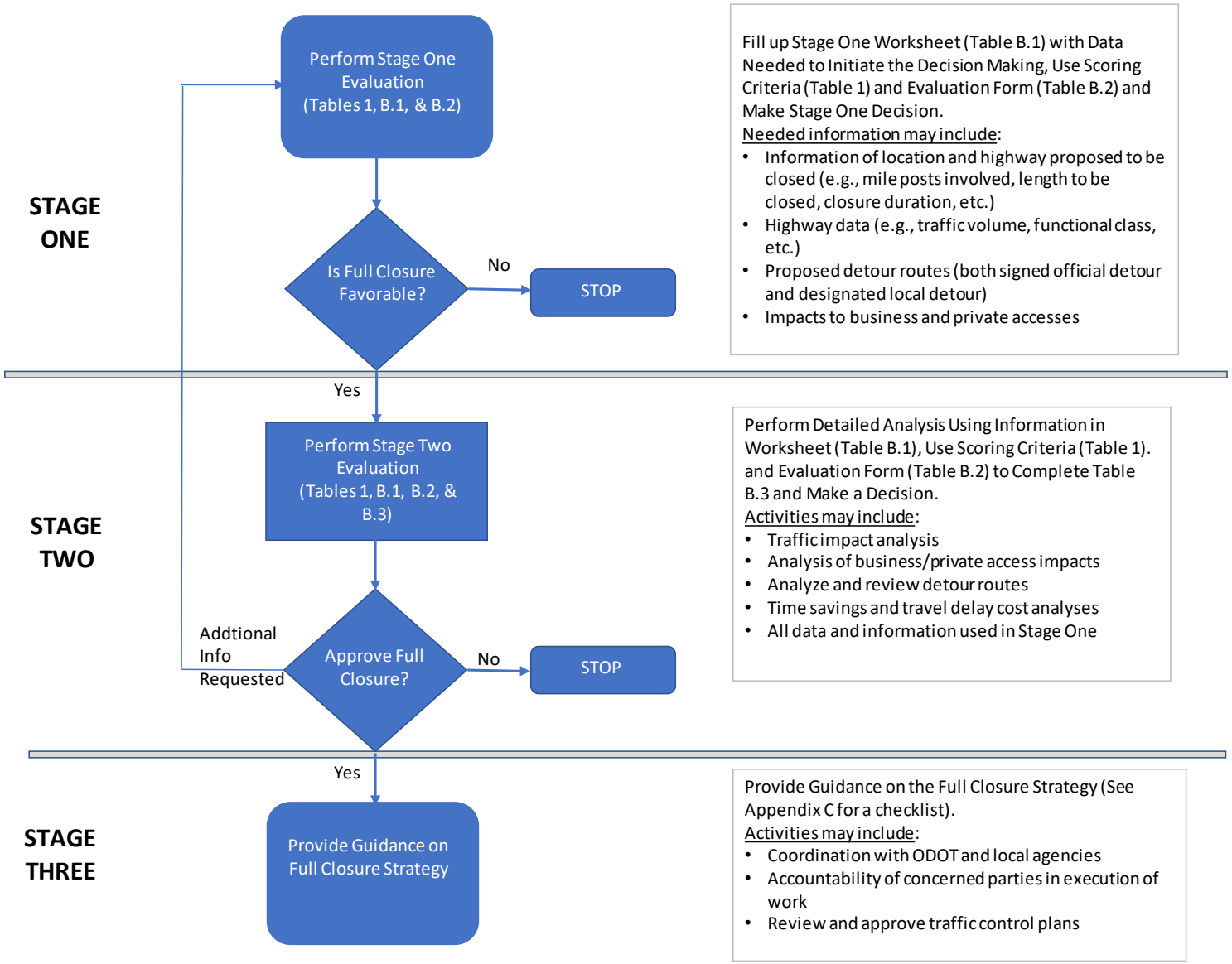


**Figure 1. Flowchart of Proposed Full Closure Analysis and Decision Process**

**Table 1. Full Closure Decision Rating Criteria Rubric**

| SN | Category | Favorable | Fair | Unfavorable |
|---|---|---|---|---|
| 1 | Impact to traffic (ADT x number of days closed) | < 50,000 vpd | 50,000 - 100,000 vpd | > 100,000 vpd |
| 2 | Functional equivalence of detour highways | Detour is the same or higher functional class as closed highway | Detour route is a different functional class, but will accommodate traffic in similar fashion | Detour route is of functional class below the closed highway |
| 3 | Signed detour route uses state highways | Detour route uses all state highways | Detour route uses mixture of state highways and non-state highways | Detour route uses all non-state highways |
| 4 | Impact to business and private accesses | No direct, exclusive local accesses to the closed highway segment | Local accesses to the closed highway can be accommodated by equivalent | One or more exclusive local accesses would be closed by the full closure |
| 5 | Travel distance added by signed detour | 3 x (travel distance) or less | 3 to 5 x (travel distance) | 5 x (travel distance) or more |
| 6 | Travel distance added by unsigned designated local detour route | 3 x (travel distance) or less | 3 to 5 x (travel distance) | 5 x (travel distance) or more |
| 7 | Potential for road users using the secondary unsigned designated local detour | Least probable | Probable | Most Probable |
| 8 | Construction cost savings | > 30% reduction | 0 to 30% reduction | No reduction |
| 9 | Construction time savings | > 30% reduction | 0 to 30% reduction | No reduction |
| 10 | Road user delay cost savings | > 30% reduction | 0 to 30% reduction | No reduction |
| 11 | Local agency coordination | No agency coordination required | 1 agency to coordinate with | 2 or more local agencies involved |
| 12 | Signed detour restricted by construction or special events | No | Yes, but restriction not of significant nature or duration | Yes, restriction is of significant nature or duration |
| 13 | Signed detour used as a detour for another project | No, no other known project | Yes, but the other project is minor and has short duration | Yes, the other project is major and has significant duration |
| 14 | Existing condition of signed detour route based on | PCR: 85 to 100 | PCR: 55 to 84 | PCR: < 55 |

| | | | | |
|---|---|---|---|---|
| | Pavement Condition Rating (PCR) | | | |
| 15 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | PCR: 85 to 100 | PCR: 55 to 84 | PCR: < 55 |
| 16 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | High Safety Concern | Moderate Safety Concern | No Safety Concern |

- Stage Two - *Review of Initial Analysis and Final Decision on Construction Strategy*: Once a decision is made in Stage One – as compiled in the evaluation form depicted in Table B.2, - the ODOT evaluation team would use the evaluation form depicted in Table B.3 (also provided in Appendix B) to evaluate the closure strategy submitted by the applicant/analyst. At this stage, the ODOT evaluating team can request additional information or analysis, some modifications, etc. At this stage, the full closure scenario can be rejected or accepted. Several iterations between the applicant/analyst and the ODOT review team are possible before the final decision is made.

- Stage Three - *Provide Guidance to Implement Full Closure*: This stage is only needed if ODOT's decision (in Stage Two) was to accept the use of a full-closure scenario. In this stage, additional guidance is provided to the applicant, ODOT, local agencies, and the contractor concerning the full closure work zone planning, coordination, implementation, and execution of the work.

### *Preliminary Activities After Road Closure is Confirmed*

After the decision is made that a detour (full-road closure) will be needed during construction, the ODOT team (which includes the district construction engineer, district work zone or maintenance engineer, etc.) and local agencies expected to be impacted by the road closure and detour routes (may include city engineer(s), county engineer(s), township engineer(s), etc.), are required to work together to review, and agree upon the proposed official signed detour route and the unofficial designated local detour route and then complete a field review of both routes. At a minimum, the field review and preliminary effort should involve the following activities:

A. Roadway widths, grades, and both horizontal and vertical curves
B. Turning radii at intersections
C. Vertical clearance restrictions along the routes
D. Weight restrictions
E. Pavement condition along the route
F. Signs and guardrails
G. Condition of drainage structures
H. Sidewalks and crosswalks along the routes
I. Determine if there are any other projects that may be in construction along the detour route during the same time period
J. Determine if the detour route will have the capacity to accommodate the additional detoured traffic
K. Determine if any of signals along the detour route will require retiming to accommodate additional diverted traffic
L. Determine if any transit or school routes will be affected by the road closure

M. Determine if any signs or pavement markings along the detour routes may need upgrades
N. Check with local emergency service providers (fire fighters and medical services) to determine how the road closure will affect their services

Therefore, the concerned team is required to complete the detour checklist as they gear up towards performing the actual road closures and construction activities. The traffic detour checklist provided above is also included in Appendix C.

# Case Studies to Implement the Systematic Decision Tool.

This section presents case studies to demonstrate the usage and implementation of the proposed decision tool developed under this study. The case studies used here are those studies that ODOT had previously determined as needing to be constructed under full-road closure. The projects used herewith for demonstration are:

1. US 62 replacement of Bridge over Deer Creek (MAD-62-2.79; PID # 102577).
2. Bridge Deck replacement of Sullivant Avenue over I-270 (FRA-270-6.17; PID # 104977).
3. Intersection of SR 29 and SR 38 in Deer Creek and Monroe Townships (MAD-29-5.87; PID # 110375).

The completed worksheets, evaluation forms with all pertinent data, information and description for each of the case studies are included in Appendix D. It is noteworthy to mention here that these case studies should be used as references only, as they do not represent any standard closure scenarios by ODOT.

# Conclusions and Recommendations.

In the course of this study, the research team completed a number of tasks including a focused literature review, interviews with commercial motor vehicle drivers and also with Ohio's local agencies, a review of Ohio's detour determination reporting, and development of a revised detour reporting system. The literature review enabled a review of some existing detour policies and guidelines from states including Colorado DOT (Devries et al. 2014), Connecticut DOT (CTDOT 2023), and Indiana DOT (INDOT 2023). Based on the findings of the literature review and also review of prior completed projects in Ohio, the main motivation was to develop an input-based systematic way by which informed decisions on a detour can be completed.

The proposed methodology is an iterative process where decision makers (in this case ODOT) can request additional analyses, information, etc., from the applicant and continue refining the process before coming to a final decision of whether to go with the full road closure or otherwise. In addition, as case studies, the research team demonstrated the application of the proposed methodology on three different construction projects that ODOT previously constructed using the full-closure strategy. The research team has also developed an Excel spreadsheet that can used to implement the decision tool by using the worksheets and decision tables as used in the case studies. Ultimately, the research team will produce the spreadsheet that can automate most of the decision process after the analyst has filled in all the needed input data.

Based also on the interviews with CMV drivers, Ohio's locals, and the review of previously executed construction projects, the research team makes the following conclusions and recommendations:

- Closure scenarios should be properly evaluated by a decision-making tool and rated accordingly to ensure the need for full or partial closure and be implemented after the approval from ODOT.
- ODOT and local agencies should complete a checklist for an officially signed detour route and also a designated local detour route to ensure the structure, capacity, clearances, safety, and response of local emergency service providers to access the routes to be viable for a detour.
- Detour routes (both official and designated local) after being determined must be repaired (if needed) before the initiation of the construction project in order to maintain a smooth completion of the construction project. However, it is noteworthy to mention that local roads are the responsibility of the local agencies, but they may not have the funds readily available to perform these repairs before the project begins. Thus, a conversation between ODOT and the local agencies may be needed to discuss funding and/or project coordination.
- The current DDR proposes an official detour and also the designated local detour however, only the official detour is adopted. It would be beneficial (to the local agencies) if this designated local detour was posted as well – at least for the local area traffic to use; with supplementary signage indicating that through trucks are restricted from using the designated local detour roads.
- CMV drivers do not deliberately ignore detour signage; however, those interviewed did mention the need for additional signage. It is important that ODOT emphasize that their detour routes are clearly marked with the appropriate (maybe additional) number of signs and markings. Additionally, there is need for a field crew to ensure the signage is maintained during the contract period. Whereas it is the responsibility of the contractor, the contractor must ensure signage is available, appropriate, and maintained. However, , ODOT Design staff may want to consult ODOT Construction staff to determine whether the plans contain sufficient signage. This is more important where the detour route is unreasonably long and there are minor roads and streets in between.
- It is important that a field crew physically evaluates a detour prior to approval. This will eliminate some of the concerns CMV drivers mentioned including: encountering narrow lanes, low overhead clearances, restrictive bridges, etc.

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**Appendix A: Recruitment Materials and Interview Script Developed for Commercial Motor Vehicle Driver Interviews.**

*Note: Recruitment E-mail requesting participation in interview will be sent via e-mail to trucking company representatives at select logistics/freight companies in and surrounding Columbus, Ohio. Recruitment e-mail will be customized as noted in italics.*

## Recruitment E-Mail

Dear <*Name of Contact*>:

Ohio University, in conjunction with the Research and Development Office at the Ohio Department of Transportation, are conducting a project evaluating roadway detours (and their signage) that are placed to avoid roadway construction zones. These detour routes redirect motorists to use other temporarily assigned roadways to avoid the construction zone. We are trying to improve detour routes to help drivers follow the detour routes more easily and to prevent or minimize damage to local roads that are not designed for some types of traffic, specifically large semi-trucks. The <Name of Trucking Company> has been selected on the premise that it is one of the companies in Ohio that conducts a fairly large amount of logistics/freight/transportation operations; and that any insights from your commercial truck drivers are likely to be valuable to this project. You are receiving this message because we identified you as an individual who would be able to provide us with the information needed for the study.

**Request:** We want to schedule an interview with you and/or your colleagues to learn about the experiences of your drivers with regards to roadway detours (and their signage). If you are interested in participating, please reply back to this email and I will schedule a date/time that works for you. The interview will be conducted via telephone and will take 20-30 minutes. You are welcome to include other colleagues in the interview if you wish.

If you feel that you are not the correct individual for this request, please contact me (see contact information below) and forward our message to the correct individual in your organization. Your participation in this project is voluntary and your responses will be kept in strict confidence. We are only interested in your company's practices and the research team will not identify you by name in any published reports.

We greatly appreciate your help and thank you for your time and efforts on our behalf and for your willingness to discuss with us your company's experiences on this topic and we look forward to speaking with you. If you have any questions regarding this project, please contact me at 740.593.4151 or via email at naik@ohio.edu.

Sincerely,

Bhaven Naik, PhD, PE, PTOE, RSP[1].
Principal Investigator
Department of Civil and Environmental Engineering
Ohio University

*Note: For direct recruitment – planned at select rest areas/truck stops in close proximity to Ohio University, Athens – Recruitment Approach Letter requesting participation in interview will be presented in-person to truck drivers.*

## Recruitment Approach Letter

Dear Sir/Madam:

Ohio University, in conjunction with the Research and Development Office at the Ohio Department of Transportation, are conducting a project evaluating roadway detours (and their signage) that are placed to avoid roadway construction zones. These detour routes redirect motorists to use other temporarily assigned roadways to avoid the construction zone. We are trying to improve detour routes to help commercial truck drivers (like yourself) follow the detour routes more easily and to prevent or minimize damage to local roads that are not designed for some types of traffic, specifically large semi-trucks. We are reaching out to you on the premise that any insights you share with us are likely to be valuable to this project.

**Request:** We want to ask you a few questions (interview-style) to learn about your experience(s) with regards to roadway detours (and their signage). This will take 20-30 minutes.

Your participation in this project is voluntary and your responses will be kept in strict confidence. We are only interested in your experiences and/or practices and the research team will not identify you by name in any published reports.

We greatly appreciate your help and thank you for your time and efforts on our behalf and for your willingness to discuss with us your experiences on this topic. If you have any questions regarding this project, please contact me at 740.593.4151 or via email at naik@ohio.edu.

Sincerely,

Bhaven Naik, PhD, PE, PTOE, RSP[1].
Principal Investigator
Department of Civil and Environmental Engineering
Ohio University

**Proposed questions for truck drivers for the Detour Determination Reporting Project**

We (research team) are evaluating roadway detours (and their signage) that are placed to avoid roadway construction zones. These detour routes redirect motorists to use other temporarily assigned roadways to avoid the construction zone. We are trying to improve detour routes to help drivers follow the detour routes more easily and to prevent or minimize damage to local roads that are not designed for some types of traffic, specifically large semi-trucks. We would appreciate your help by answering some questions based upon your experience driving a truck(s).

1. How long have you been driving a commercial motor vehicle (i.e., a truck(s)?
    a. Do you drive long-haul or short-haul? (*Trying to determine if most of their routes are defined to a region or if they are cross-country*)

2. In your driving experience, have you ever missed a detour sign when approaching a work zone where the roadway is completely closed? Yes ……. No …….
    a. *If participant responded "Yes" to Question 1*, How many times do you recall doing so in the past 5 years? …….
    b. If you missed one or more detour signs in the past, please explain what was the reason(s) for each time you missed it.
    ……
    ……
    ……

3. Do you think the detour signs are easy to see and/or follow? Yes ……. No. …….
    a. *If you answered "No" to Question 4*, Why do you think they are hard to see and/or follow?
    ……
    ……
    ……

4. Do you think some other drivers may be ignoring/missing the detour signs? Yes ……. No ……

5. Do you ignore the detour signs? Yes ……. No ……..
    a. *If your answer to Question 4 or 5 is "Yes,"* Why do some drivers or you ignore them?
    ……
    ……
    ……

6. Please provide any insight, experience, or opinions in regard with the location, placement, etc. of detour signs on the roadways

……
……
……

7. When using detour routes, do you always follow the assigned detour route/directions? As in, do you continue your trip by driving along the marked detour route? Yes ……. No …….

8. If your answer to Question 7 was "No," and you use a route that is an alternate to the detour route, how do you normally decide on what alternate route to follow?
   ___ Based on GPS?
   ___ Based on local knowledge of the area?
   ___ Other (please explain)
   ……
   ……

9. When you encounter a detour route do you communicate with other drivers to exchange information about the detour route? Yes …….. No ……..
   a. *If YES*, What means/methods of communication do you use regularly?
      ……
      ……

10. Which types of roads are you most often traveling, i.e., Interstate, four-lane highways, two-lane roads, municipal streets, or the Turnpike?
    ……
    ……

11. How often do you travel on these previously stated roadways?
    ……
    ……

12. Provide any insight regarding how satisfied you have been with previous detour routes.
    Very Satisfied
    Satisfied
    Neither Satisfied nor Dissatisfied
    Dissatisfied
    Very Dissatisfied

    Please explain your rating:
    ……
    ……

13. When using detour routes, have you experienced any of the following situations (mark all that apply):
    - Difficulty in navigating through the detour route – narrow lanes, narrow bridges, etc.
    - Used narrower, local streets in residential/local neighborhoods
    - Damaged street signage/postal boxes/etc. while navigating through a detour route - primarily due to narrower road etc.
    - Other (please explain)

Other general questions for discussion purposes only…

Q1. Are there any specialized software the drivers use to help them create a route that avoids certain routes due to various constraints (low bridges, narrow roadways or lanes, tight turning radii…etc) depending on their load/vehicle size? If so, does the software reroute you if there is a closure on their current route?

Q2. If we are passing this out to drivers maybe we should take the opportunity to point out that we set our state route detours to avoid the items Vi mentioned. Bridges with weight restrictions, low clearance, sharp turn, narrow lane, etc. you know to help driver realize why we may not be signing the shortest route.

## Appendix B: Full Closure Decision Worksheets and Evaluation Forms

### Table B.1. Full Closure Data Collection Worksheet

| Project Description | Information/Data |
|---|---|
| State highway road number of a road with a detoured location | |
| End mileposts of section to be closed | |
| Length of closed section (miles) | |
| Direction of closed section (for divided highway) | |
| ADT of detoured section | |
| Functional classification of detoured highway | |
| Duration of closure for full closure (days) | |
| Duration of closure for part-width closure (days) | |
| Number of business/private accesses within closed area | |
| Proposed signed detour roads to be used | |
| Length of signed detour route (miles) | |
| Length of unsigned designated local detour route (miles) | |
| Will signed detour route consist some of non-state highways (i.e., local roads)? | |
| Construction cost with full closure strategy | |
| Construction cost with part closure strategy | |
| Estimated total user delay cost for closure duration for full closure | |
| Estimated total user delay cost for closure duration for part closure | |
| Mention local agencies that could be involved | |
| Unsigned (secondary) local detour roads to be used | |
| Length of unsigned detour route (miles) | |
| Existing condition of signed detour route based on Pavement Condition Rating (PCR) | |
| Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | |
| Safety concerns of workers and travelers on work zone (if full closure is not adopted) | |
| Attach maps of highway to be closed and proposed detours (both official state detour route and local designated detour route) | |

**Table B.2. Full Closure evaluation form for applicant.**

| SN | Category | Favorable | Fair | Unfavorable | Notes |
|---|---|---|---|---|---|
| 1 | Impact to traffic | ☐ | ☐ | ☐ | |
| 2 | Functional equivalence of detour highways | ☐ | ☐ | ☐ | |
| 3 | Signed detour route uses state highways | ☐ | ☐ | ☐ | |
| 4 | Impact to business and private accesses | ☐ | ☐ | ☐ | |
| 5 | Travel distance added by signed detour | ☐ | ☐ | ☐ | |
| 6 | Travel distance added by unsigned designated local detour route | ☐ | ☐ | ☐ | |
| 7 | Potential for road users using the secondary unsigned designated local detour | ☐ | ☐ | ☐ | |
| 8 | Construction time savings | ☐ | ☐ | ☐ | |
| 9 | Road user delay cost savings | ☐ | ☐ | ☐ | |
| 10 | Local agency coordination | ☐ | ☐ | ☐ | |
| 11 | Signed detour restricted by construction or special events | ☐ | ☐ | ☐ | |
| 12 | Signed detour used as a detour for another project | ☐ | ☐ | ☐ | |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ | |
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ | |
| 15 | Safety Concerns of workers and travelers on work zone (if full closure is not adopted) | ☐ | ☐ | ☐ | |
| Applicant Evaluation Decision | | | | | |

**Table B.3. Full Closure evaluation form for ODOT review team.**

| SN | Category | Additional Analysis/Detail Required (Y/N) | If Additional Analysis Required, Provide Details |
|---|---|---|---|
| 1 | Impact to traffic (volume duration cross product) | Choose an item. | |
| 2 | Functional equivalence of detour highways | Choose an item. | |
| 3 | Signed detour route uses state highways | Choose an item. | |
| 4 | Impact to business and private accesses | Choose an item. | |
| 5 | Travel distance added by signed detour | Choose an item. | |
| 6 | Travel distance added by unsigned designated local detour route | Choose an item. | |
| 7 | Potential for road users using the secondary unsigned designated local detour | Choose an item. | |
| 8 | Construction time savings | Choose an item. | |
| 9 | Road user delay cost savings | Choose an item. | |
| 10 | Local agency coordination | Choose an item. | |
| 11 | Signed detour restricted by construction or special events | Choose an item. | |
| 12 | Signed detour used as a detour for another project | Choose an item. | |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | Choose an item. | |
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | Choose an item. | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | Choose an item. | |
| ODOT Evaluation Decision | | | |

**Appendix C: Checklist Form to Use for Surveying Detour Routes Prior to Signing and Operating the Detour Routes**

PROJECT NO. _____ CHECKLIST FOR PRELIMINARY ACTIVITIES PRIOR TO IMPLEMENTATION OF THE DETOUR

Adequacy of geometry and pavement quality to serve detoured traffic

☐ Roadway geometry is adequate to accommodate the detoured traffic
- ☐ Roadway width
- ☐ Horizontal curves
- ☐ Vertical grades
- ☐ Intersection turning radii
- ☐ Vertical restrictions on any bridges or utilities along the detour route

☐ Detour will have capacity to accommodate additional detoured traffic

☐ Condition of pavement on the detour route is adequate

☐ Signage, pavement markings, and guardrails along the detour route are adequate
- ☐ Any necessary work to upgrade the detour roadways is included in the contract to be completed prior to implementation of the detour

☐ Signal timing(s) at signalized intersection(s) along the detour route are adequate to accommodate additional traffic due to detour
- ☐ Some signal timing changes to be implemented during detour and are included in contract documents

☐ Determine if there will be other proposed construction projects along the detour route during the same time period

Detour review and local public agency coordination

☐ Detour plan has been presented and reviewed by officials from local public agency

☐ Proposed detour will not significantly impact city/county/township emergency services

☐ Proposed detour will not significantly impact city/county/township transit or school bus routes

☐ City/county/township public officials agree that ODOT's proposed mitigation measures are acceptable

Detour Plans and Preparations

☐ Prepare the sign summary table with numbers, quantities, dimensions and detail of each sign and where they will be used on the detour route and at the closure locations

☐ Construction signs or changeable message signs (CMS) should be paced at the closure locations ____ weeks in advance of the closure date to notify road users of dates and time of the closure

- ☐ Determine and ensure adequate and complete detour and guidance signs are provided and placed at all important locations to mitigate any confusion and misunderstandings that arise to road users
- ☐ Include pedestrian detour signs, business closed or detoured signs, etc., as needed

**Appendix D: Case Study Project Evaluation Worksheets**

**Case Study #1**: Closure Scenario for US 62 replacement of Bridge over Deer Creek (MAD-62-2.79; PID # 102577).

Stage One: ***Data Collection, Analysis, and Initial Decision on Construction Strategy***

| Project Description | Information/Data |
|---|---|
| State highway road number of a road with a detoured location | US 62 |
| End mileposts of section to be closed | |
| Length of closed section (miles) | 10.4 |
| Direction of closed section (for divided highway) | Both directions |
| ADT of detoured section (vpd) | 7,200 |
| Functional classification of detoured highway | Rural Minor Arterial |
| Duration of closure for full closure (days) | 180 |
| Duration of closure for part-width closure (days) | 540 |
| Number of business/private accesses within closed area | |
| Proposed signed detour roads to be used | IR-71, SR 56 |
| Length of signed detour route (miles) | 13.8 |
| Will signed detour route consist some of non-state highways (i.e., local roads)? | No |
| Construction cost with full closure strategy | $268,625 |
| Construction cost with part closure strategy | $847,838 |
| Estimated total user delay cost for closure duration for full closure | $1,971,251 |
| Estimated total user delay cost for closure duration for part closure | $3,188,789 |
| Mention local agencies that could be involved | Pickaway County, Madison County |
| Unsigned (secondary) local detour roads to be used | CR 100, CR 57, SR 56 |
| Length of unsigned detour route (miles) | 11.2 (only 2.8 on local roads) |
| Existing condition of signed detour route based on Pavement Condition Rating (PCR) | |
| Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | |
| Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | |
| Attach maps of highway to be closed and proposed detours (both state and local detours) | |

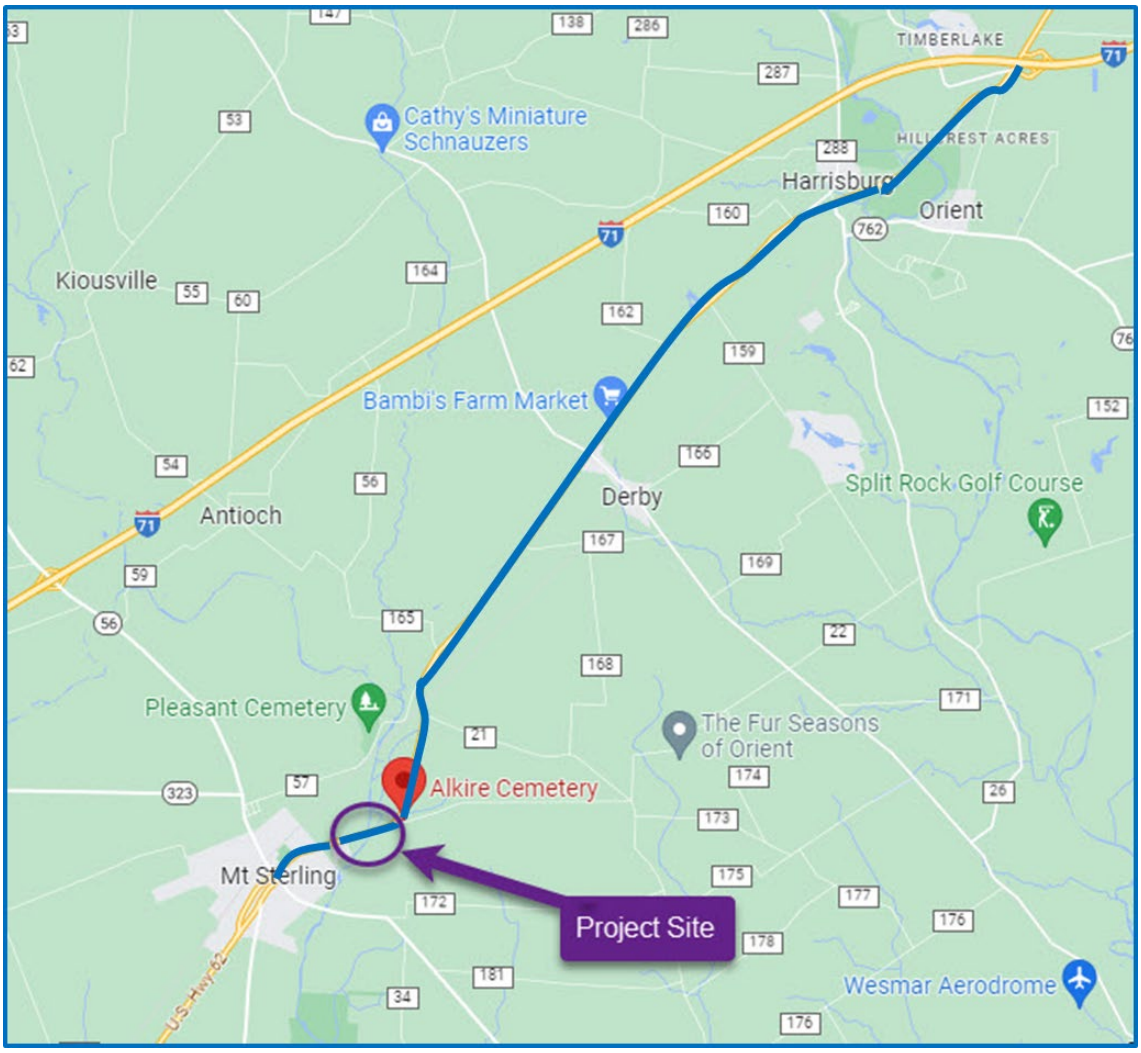


**Figure D.1: Map of State Highway Segment to be Closed for Case Study #1**

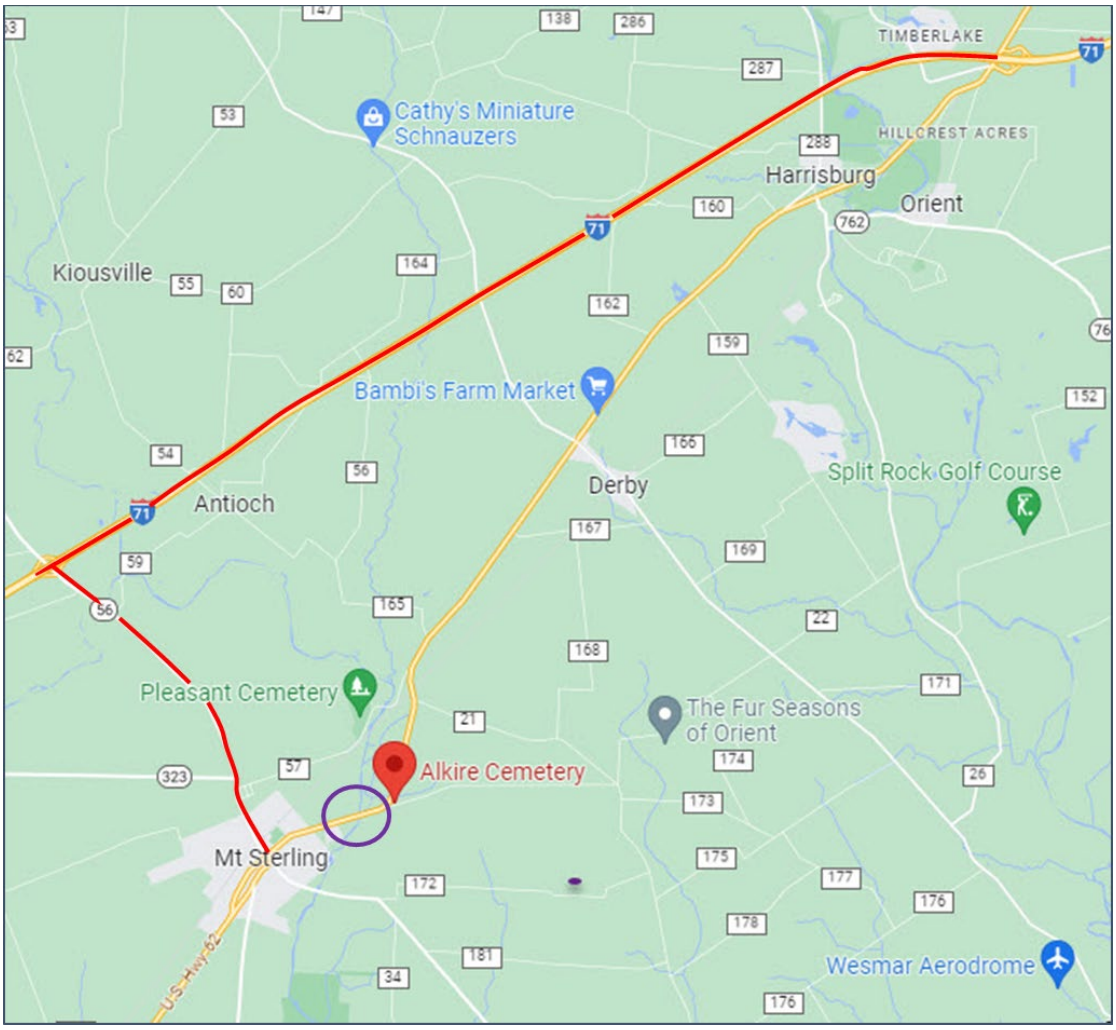


**Figure D.2: Map of Proposed Official Detour Route for Case Study #1**

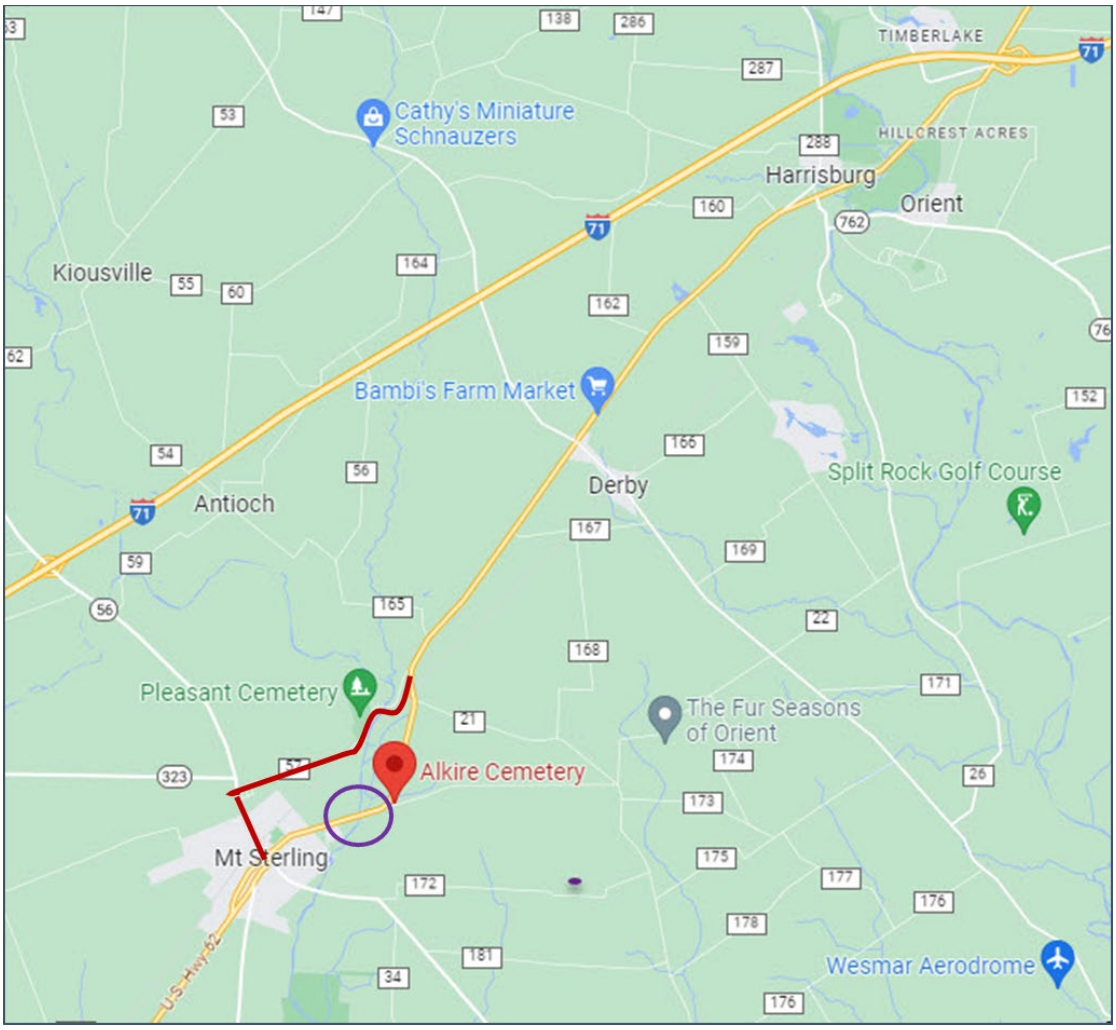


**Figure D.3: Map of Proposed Unofficial Detour Route for Case Study #1**

**Final Decision for Stage One**

| SN | Category | Favorable | Fair | Unfavorable | Notes |
|---|---|---|---|---|---|
| 1 | Impact to traffic | ☒ | ☒ | ☒ | 1,296,000 |
| 2 | Functional equivalence of detour highways | ☒ | ☐ | ☐ | Detour is the same or higher functional class as closed highway |
| 3 | Signed detour route uses state highways | ☒ | ☐ | ☐ | Yes |
| 4 | Impact to business and private accesses | ☒ | ☐ | ☐ | No accesses noted |
| 5 | Travel distance added by signed detour | ☒ | ☐ | ☐ | 1.3x |
| 6 | Travel distance added by unsigned designated local detour route | ☒ | ☐ | ☐ | 1.05x. Most of the route uses the original highway (US 62) and only about 2.78 miles on local roads |
| 7 | Potential for road users using the secondary unsigned designated local detour | ☐ | ☒ | ☐ | Because the designated local route is shorter by 2.6 miles, there is a chance it can used by some drivers |
| 8 | Construction cost savings | ☒ | ☐ | ☐ | 68% reduction in construction cost anticipated |
| | Construction time savings | ☒ | ☐ | ☐ | 67% reduction in construction time anticipated |
| 9 | Road user delay cost savings | ☒ | ☐ | ☐ | 38% reduction in total user delay cost during closure |
| 10 | Local agency coordination | ☒ | ☐ | ☐ | Technically no local agency needed because the official detour runs on state highways. However, with a possibility of some traffic using a local designated detour, there may be a minimum communication with local agencies |
| 11 | Signed detour restricted by construction or special events | ☒ | ☐ | ☐ | No |
| 12 | Signed detour used as a detour for another project | ☒ | ☐ | ☐ | No other project is known |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☒ | ☐ | ☐ | |
| 14 | Existing condition of unsigned detour route | ☐ | ☐ | ☐ | |

| | | | | | |
|---|---|---|---|---|---|
| | based on Pavement Condition Rating (PCR) | | | | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | ☒ | ☐ | ☐ | Removing vehicles from the adjacent lanes during construction will improve safety for workers |
| Applicant Evaluation Decision | | | Advance to Stage 2? ☒ Yes / ☐ No | | |

Stage Two - ***Review of Initial Analysis and Final Decision on Construction Strategy*:**

| SN | Category | Additional Analysis/Detail Required (Y/N) | If Additional Analysis Required, Provide Details |
|---|---|---|---|
| 1 | Impact to traffic (volume duration cross product) | N | |
| 2 | Functional equivalence of detour highways | N | |
| 3 | Signed detour route uses state highways | N | |
| 4 | Impact to business and private accesses | N | |
| 5 | Travel distance added by signed detour | N | |
| 6 | Travel distance added by unsigned designated local detour route | N | |
| 7 | Potential for road users using the secondary unsigned designated local detour | Y | Check speed limits, road geometry, and pavement condition for potential of sizable amount of traffic to divert to this route since it is shorter than the primary official detour route |
| 8 | Construction time savings | N | |
| 9 | Road user delay cost savings | N | |
| 10 | Local agency coordination | Y | Check with local agency for the potential of sizable amount of traffic to divert to this route. Assess the route road conditions |
| 11 | Signed detour restricted by construction or special events | Y | Confirm with local government officials for any planned special events |
| 12 | Signed detour used as a detour for another project | N | |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | N | |
| 14 | Existing condition of unsigned detour route based on | ☐ | |

| | | | |
|---|---|---|---|
| | Pavement Condition Rating (PCR) | | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | ☒ | |
| ODOT Evaluation Decision | | Advance to Stage 3? ☒ Yes / ☐ No | |

**Case Study #2**: Closure Scenario for Bridge Deck replacement of Sullivant Avenue over I-270 ( FRA-270-6.17;PID # 104977)

Stage One: ***Data Collection, Analysis, and Initial Decision on Construction Strategy***

| Project Description | Information/Data |
|---|---|
| State highway road number of a road with a detoured location | N/A |
| End mileposts of section to be closed | |
| Length of closed section (miles) | 1.6 |
| Direction of closed section (for divided highway) | Both directions |
| ADT of detoured section (vpd) | 10,787 |
| Functional classification of detoured highway | Urban Minor Arterial |
| Duration of closure for full closure (days) | 90 |
| Duration of closure for part-width closure (days) | 120 |
| Number of business/private accesses within closed area | |
| Proposed signed detour roads to be used | Georgesville Rd (CR 26), US 40, Norton Rd (CR 3) |
| Length of signed detour route (miles) | 3.1 |
| Will signed detour route consist some of non-state highways (i.e., local roads)? | Yes |
| Construction cost with full closure strategy | $1,300,000 |
| Construction cost with part closure strategy | $1,440,000 |
| Estimated total user delay cost for closure duration for full closure | $2,041,636 |
| Estimated total user delay cost for closure duration for part closure | $818,163 |
| Mention local agencies that could be involved | Franklin County |
| Unsigned (secondary) local detour roads to be used | Georgesville Rd (CR 26), Hall Rd, Norton Rd (CR 3) |
| Length of unsigned detour route (miles) | 3.0 |
| Existing condition of signed detour route based on Pavement Condition Rating (PCR) | |
| Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | |
| Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | |
| Attach maps of highway to be closed and proposed detours (both state and local detours) | |

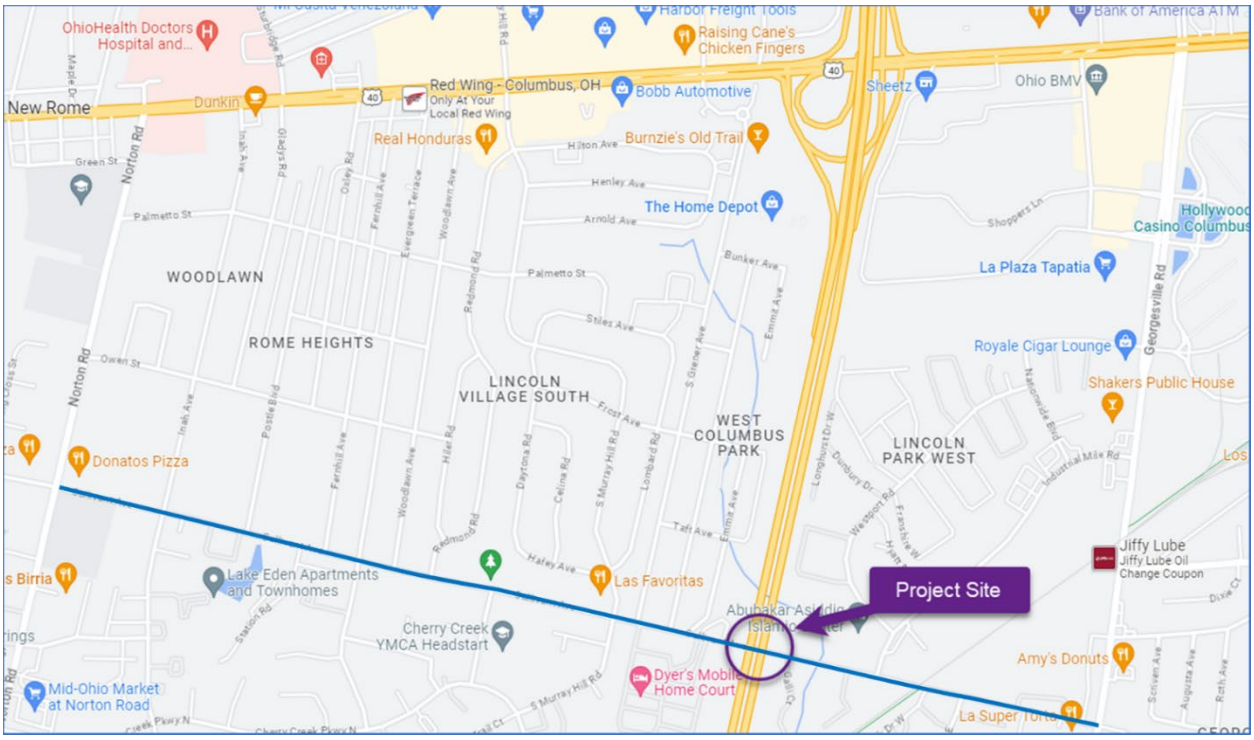


**Figure D.4: Map of Highway Segment to be Closed for Case Study #2**

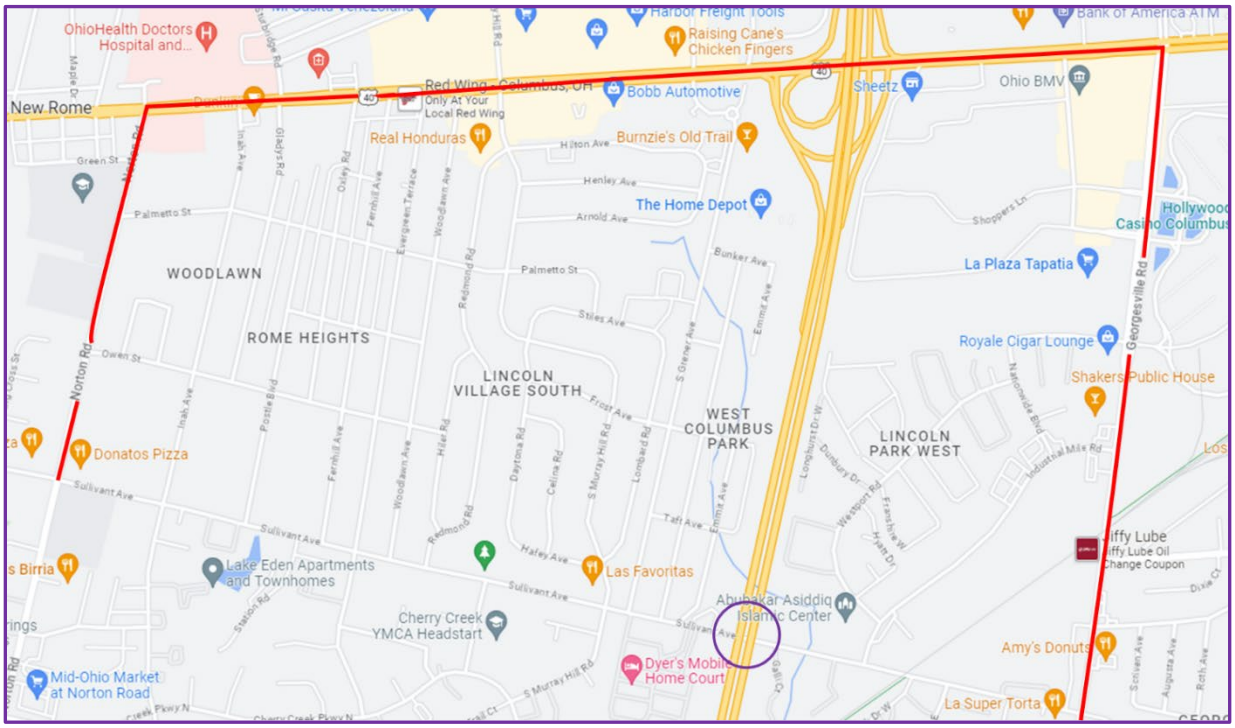


**Figure D.5: Map of Proposed Official Detour Route for Case Study #2**

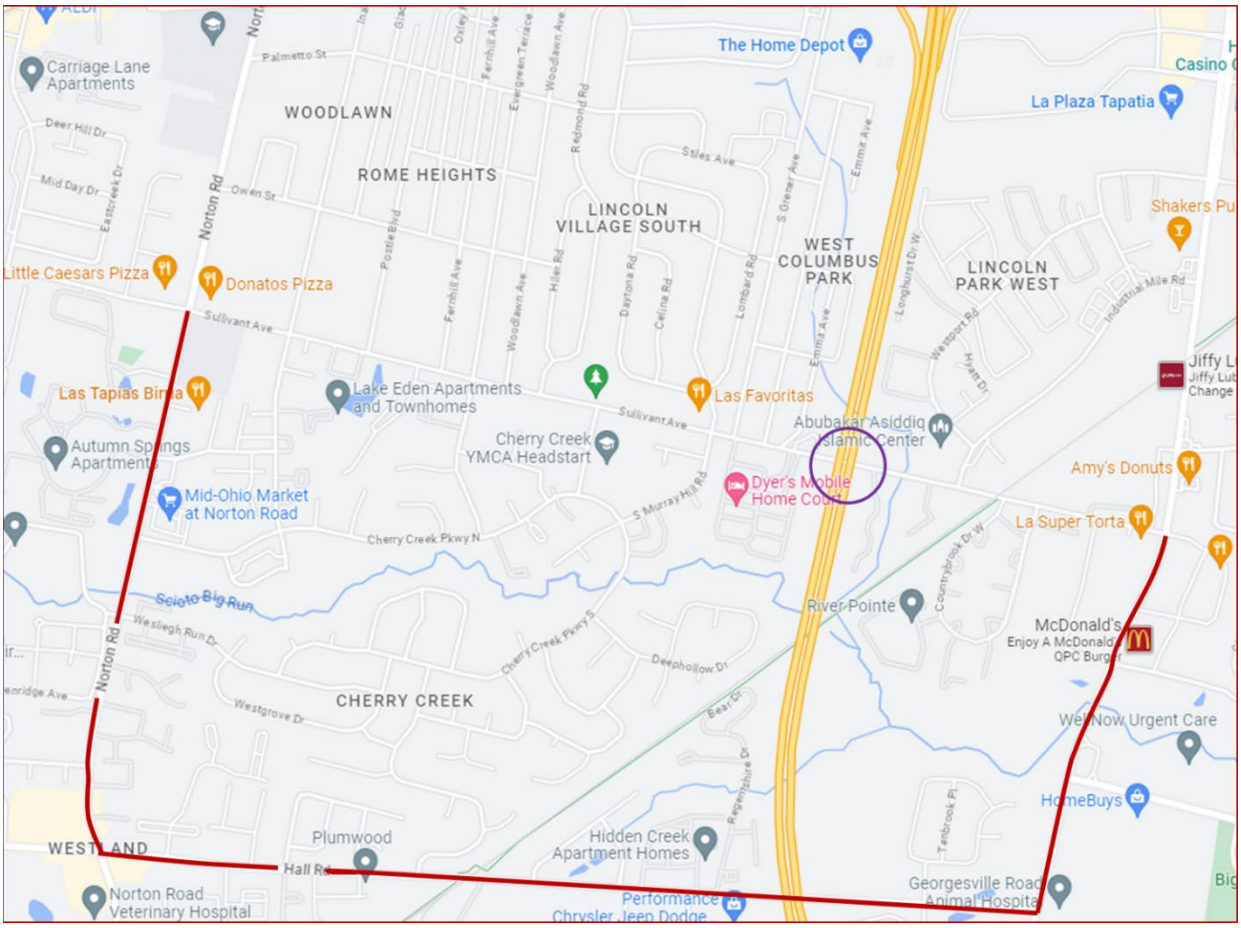


**Figure D.6: Map of Proposed Unofficial Detour Route for Case Study #2**

**Final Decision for Stage One**

| SN | Category | Favorable | Fair | Unfavorable | Notes |
|---|---|---|---|---|---|
| 1 | Impact to traffic | ☐ | ☐ | ☒ | 970,830 |
| 2 | Functional equivalence of detour highways | ☒ | ☐ | ☐ | Detour is the same or higher functional class as closed highway |
| 3 | Signed detour route uses state highways | ☒ | ☐ | ☐ | Yes |
| 4 | Impact to business and private accesses | ☒ | ☐ | ☐ | No accesses noted |
| 5 | Travel distance added by signed detour | ☒ | ☐ | ☐ | 1.9x |
| 6 | Travel distance added by unsigned designated local detour route | ☒ | ☐ | ☐ | 1.9x. There will be no benefit of drivers using local designated route |
| 7 | Potential for road users using the secondary unsigned designated local detour | ☐ | ☒ | ☐ | Very low |
| 8 | Construction cost savings | ☐ | ☒ | ☐ | 9.7% reduction in construction cost anticipated |
| | Construction time savings | ☐ | ☒ | ☐ | 25% reduction in construction time anticipated |
| 9 | Road user delay cost savings | ☐ | ☐ | ☒ | -149.5% reduction in total user delay cost during closure |
| 10 | Local agency coordination | ☐ | ☐ | ☐ | One local agency. Franklin County |
| 11 | Signed detour restricted by construction or special events | ☒ | ☐ | ☐ | No |
| 12 | Signed detour used as a detour for another project | ☒ | ☐ | ☐ | No other project is known |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ | |
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | ☒ | ☐ | ☐ | Removing vehicles from the adjacent lanes during construction will improve safety for workers |
| Applicant Evaluation Decision | | | Advance to Stage 2? ☒ Yes / ☐ No | | |

Stage Two - ***Review of Initial Analysis and Final Decision on Construction Strategy*:**

| SN | Category | Additional Analysis/Detail Required (Y/N) | If Additional Analysis Required, Provide Details |
|---|---|---|---|
| 1 | Impact to traffic (volume duration cross product) | N | |
| 2 | Functional equivalence of detour highways | N | |
| 3 | Signed detour route uses state highways | N | |
| 4 | Impact to business and private accesses | N | |
| 5 | Travel distance added by signed detour | N | |
| 6 | Travel distance added by unsigned designated local detour route | N | |
| 7 | Potential for road users using the secondary unsigned designated local detour | N | |
| 8 | Construction time savings | N | |
| 9 | Road user delay cost savings | N | |
| 10 | Local agency coordination | N | |
| 11 | Signed detour restricted by construction or special events | Y | Confirm with local government officials for any planned special events |
| 12 | Signed detour used as a detour for another project | N | |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | N | |
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | N | |
| 15 | Safety Concerns of workers and travelers on work zone (if full closure is not adopted) | N | |
| ODOT Evaluation Decision | | Advance to Stage 3? ☒ Yes / ☐ No | |

**Case Study #3**: Closure Scenario –Intersection of SR 29 and SR 38 in Deer Creek and Monroe Townships (MAD-29-5.87; PID # 110375)

Stage One: ***Data Collection, Analysis, and Initial Decision on Construction Strategy***

| Project Description | Information/Data |
|---|---|
| State highway road number of a road with a detoured location | SR 38 |
| End mileposts of section to be closed | |
| Length of closed section (miles) | 13.0 |
| Direction of closed section (for divided highway) | Both directions |
| ADT of detoured section (vpd) | 2,150 |
| Functional classification of detoured highway | Rural Minor Arterial |
| Duration of closure for full closure (days) | 90 |
| Duration of closure for part-width closure (days) | 150 |
| Number of business/private accesses within closed area | |
| Proposed signed detour roads to be used | SR 161, SR 42, US 40 |
| Length of signed detour route (miles) | 23.3 |
| Length of unsigned designated local detour route (miles) | 7.0 (adds 4.5 miles to the original closed road) |
| Will signed detour route consist some of non-state highways (i.e., local roads)? | No |
| Construction cost with full closure strategy | $2,114,056 |
| Construction cost with part closure strategy | $2,379,056 |
| Estimated total user delay cost for closure duration for full closure | $977,400 |
| Estimated total user delay cost for closure duration for part closure | $477,460 |
| Mention local agencies that could be involved | Deer Creek Township, Monroe Township |
| Unsigned (secondary) local detour roads to be used | CR 114 (Dun Rd), CR 5 (Lafayette Play City Rd), CR 132 (Arthur Bradley Rd) |
| Length of unsigned detour route (miles) | 11.2 (only 2.8 on local roads) |
| Existing condition of signed detour route based on Pavement Condition Rating (PCR) | |
| Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | |
| Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | |
| Attach maps of highway to be closed and proposed detours (both state and local detours) | |

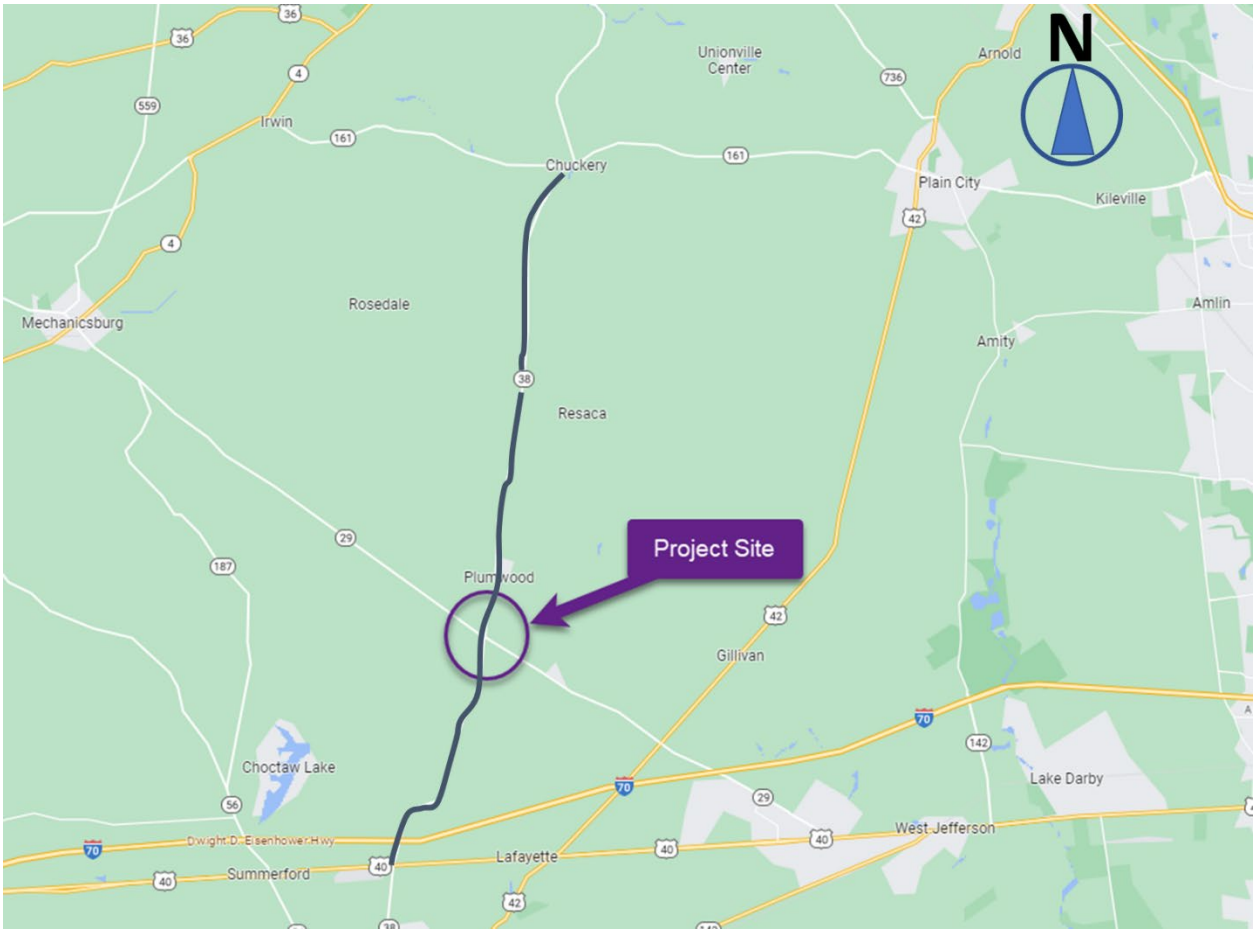


**Figure D.7: Map of State Highway Segment (SR 38) to be Closed for Case Study #3**

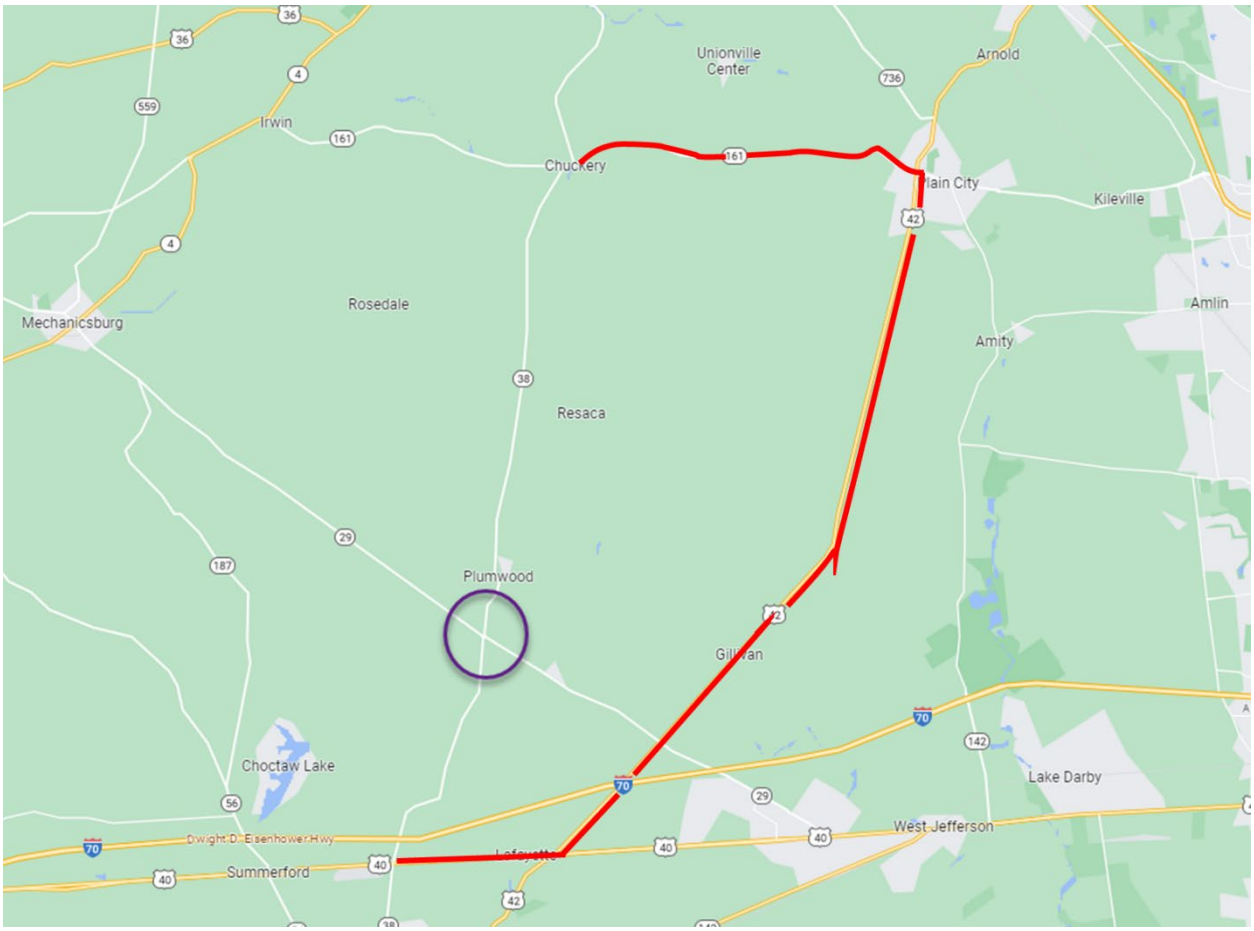


**Figure D.8: Map of Proposed Official Detour Route (for SR 38) for Case Study #3**

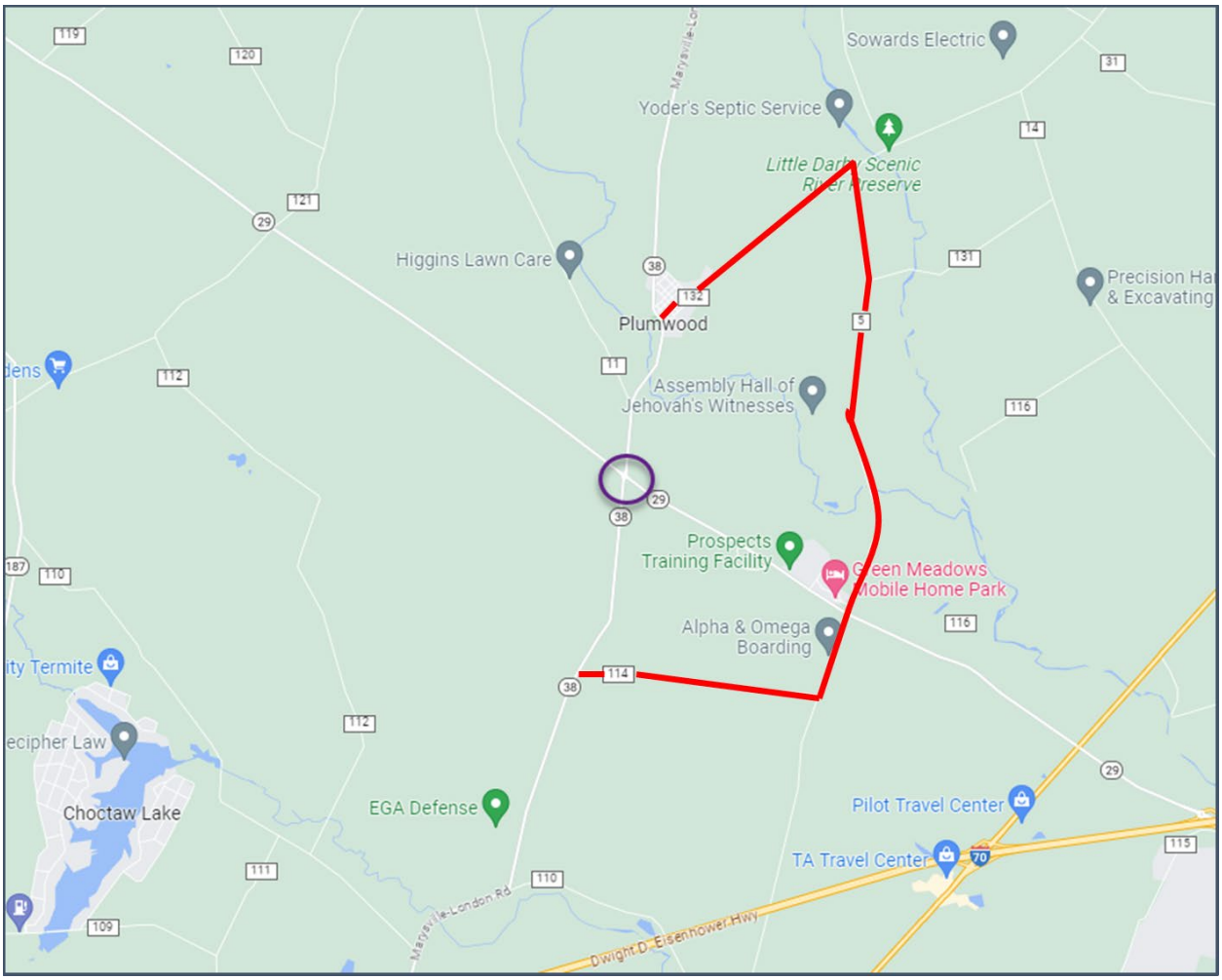


**Figure D.9 Map of Proposed Unofficial Detour Route (for SR 38) for Case Study #3**

**Final Decision for Stage One**

| SN | Category | Favorable | Fair | Unfavorable | Notes |
|---|---|---|---|---|---|
| 1 | Impact to traffic | ☐ | ☐ | ☒ | 193,500 |
| 2 | Functional equivalence of detour highways | ☒ | ☐ | ☐ | Detour is the same or higher functional class as closed highway |
| 3 | Signed detour route uses state highways | ☒ | ☐ | ☐ | Yes |
| 4 | Impact to business and private accesses | ☒ | ☒ | ☐ | No accesses noted |
| 5 | Travel distance added by signed detour | ☒ | ☐ | ☐ | 1.8x |
| 6 | Travel distance added by unsigned designated local detour route | ☒ | ☐ | ☐ | 1.3x |
| 7 | Potential for road users using the secondary unsigned designated local detour | ☐ | ☒ | ☐ | Because the designated local route is shorter by 5.8 miles, there is a chance it can be used by some drivers |
| 8 | Construction cost savings | ☐ | ☒ | ☐ | 11% reduction in construction cost anticipated |
|  | Construction time savings | ☒ | ☐ | ☐ | 40% reduction in construction time anticipated |
| 9 | Road user delay cost savings | ☐ | ☐ | ☒ | -51% reduction in total user delay cost during closure |
| 10 | Local agency coordination | ☒ | ☐ | ☐ | Technically no local agency needed because the official detour runs on state highways. However, with a possibility of some traffic using a local designated detour, there may be a minimum communication with local agencies |
| 11 | Signed detour restricted by construction or special events | ☒ | ☐ | ☐ | No |
| 12 | Signed detour used as a detour for another project | ☒ | ☐ | ☐ | No other project is known |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ |  |
| 14 | Existing condition of unsigned detour route | ☐ | ☐ | ☒ |  |

| | | | | | |
|---|---|---|---|---|---|
| | based on Pavement Condition Rating (PCR) | | | | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | ☒ | ☐ | ☐ | Removing vehicles from the adjacent lanes during construction will improve safety for workers |
| Applicant Evaluation Decision | | | Advance to Stage 2? ☒ Yes / ☐ No | | |

Stage Two - ***Review of Initial Analysis and Final Decision on Construction Strategy*:**

| SN | Category | Additional Analysis/Detail Required (Y/N) | If Additional Analysis Required, Provide Details |
|---|---|---|---|
| 1 | Impact to traffic (volume duration cross product) | N | |
| 2 | Functional equivalence of detour highways | N | |
| 3 | Signed detour route uses state highways | N | |
| 4 | Impact to business and private accesses | N | |
| 5 | Travel distance added by signed detour | N | |
| 6 | Travel distance added by unsigned designated local detour route | N | |
| 7 | Potential for road users using the secondary unsigned designated local detour | Y | Check speed limits, road geometry, and pavement condition for potential of substantial number of traffic to divert to this route since it is shorter than the primary official detour route |
| 8 | Construction time savings | N | |
| 9 | Road user delay cost savings | N | |
| 10 | Local agency coordination | Y | Check with local agency for the potential of sizable amount of traffic to divert to this route. Assess the route road conditions |
| 11 | Signed detour restricted by construction or special events | Y | Confirm with local government officials for any planned special events |
| 12 | Signed detour used as a detour for another project | N | |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☐ | |

| | | | |
|---|---|---|---|
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | ☐ | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | N | |
| ODOT Evaluation Decision | | Advance to Stage 3? ☒ Yes / ☐ No | |

**Case Study #3**: Closure Scenario for Intersection of SR 29 and SR 38 in Deer Creek and Monroe Townships (MAD-29-5.87; PID # 110375)

Stage One: ***Data Collection, Analysis, and Initial Decision on Construction Strategy***

| Project Description | Information/Data |
|---|---|
| State highway road number of a road with a detoured location | SR 29 |
| End mileposts of section to be closed | |
| Length of closed section (miles) | 12.6 |
| Direction of closed section (for divided highway) | Both directions |
| ADT of detoured section (vpd) | 3,450 |
| Functional classification of detoured highway | Rural Minor Arterial |
| Duration of closure for full closure (days) | 70 |
| Duration of closure for part-width closure (days) | 150 |
| Number of business/private accesses within closed area | |
| Proposed signed detour roads to be used | SR 4, SR 56, I-70, US 42 |
| Length of signed detour route (miles) | 21.1 |
| Length of unsigned designated local detour route (miles) | 11.3 (adds 4.5 miles to the original closed road) |
| Will signed detour route consist some of non-state highways (i.e., local roads)? | No |
| Construction cost with full closure strategy | $2,114,056 |
| Construction cost with part closure strategy | $2,379,056 |
| Estimated total user delay cost for closure duration for full closure | $1,006,678 |
| Estimated total user delay cost for closure duration for part closure | $761,353 |
| Mention local agencies that could be involved | Deer Creek Township, Monroe Township |
| Unsigned (secondary) local detour roads to be used | TR 121 (Thomas Rd), Rosedale-Milford Rd, CR 132 (Arthur Bradley Rd), CR 5 (Lafayette Play City Rd) |
| Length of unsigned detour route (miles) | 6.6 |

| | |
|---|---|
| Existing condition of signed detour route based on Pavement Condition Rating (PCR) | |
| Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | |
| Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | |
| Attach maps of highway to be closed and proposed detours (both state and local detours) | |

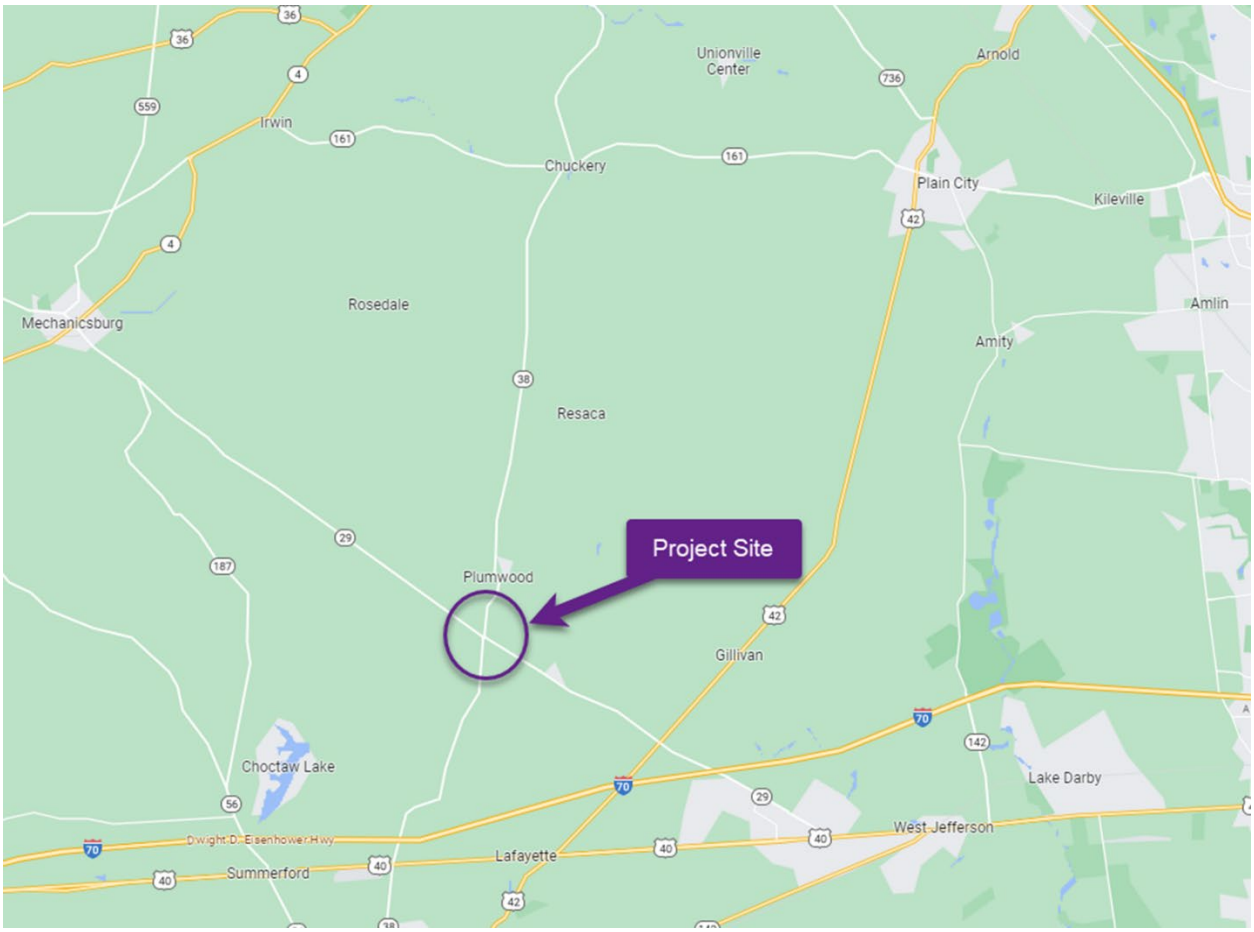


**Figure D.10: Map of State Highway Segment (SR 29) to be Closed for Case Study #3**

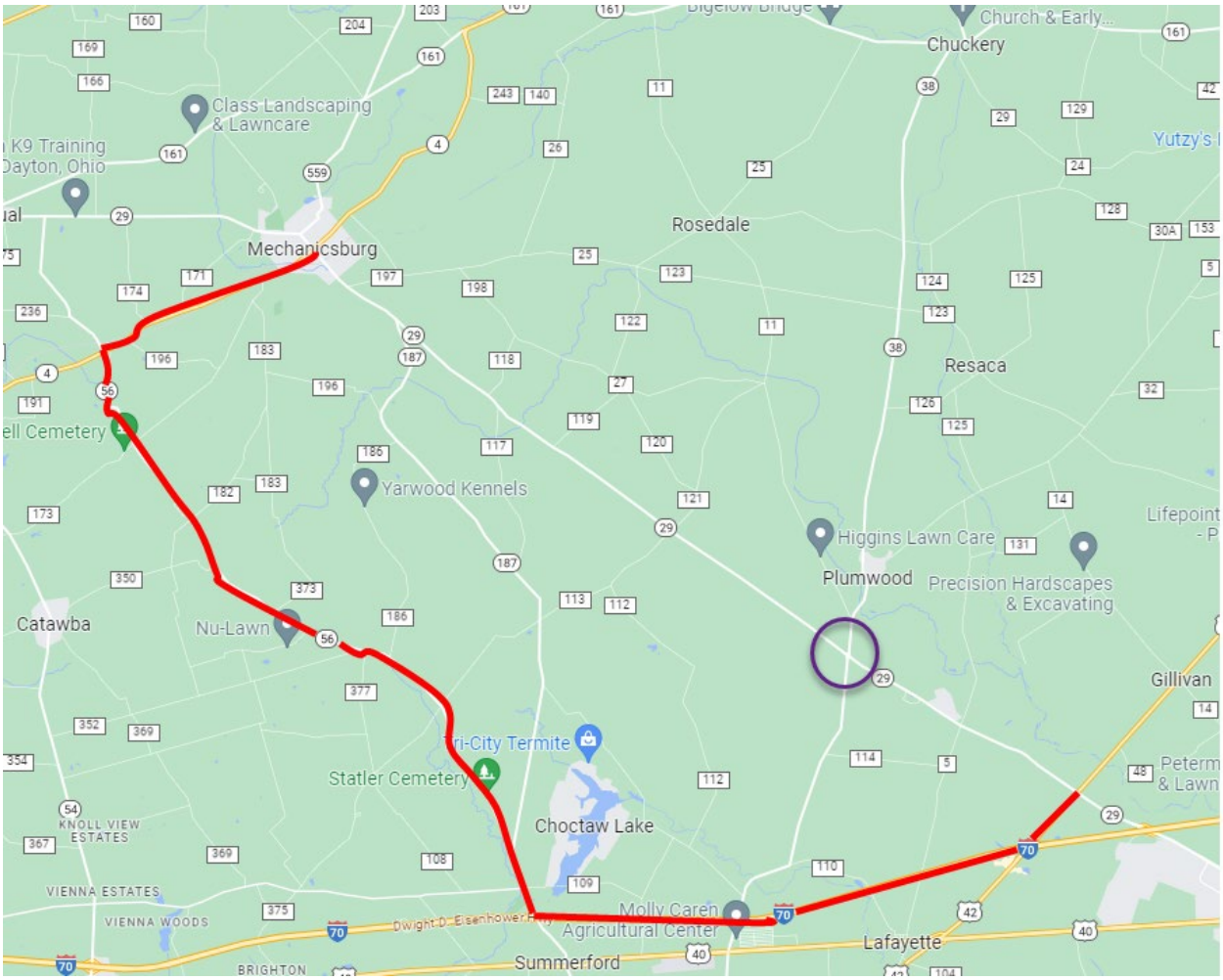


**Figure D.11: Map of Proposed Official Detour Route (for SR 29) for Case Study #3**

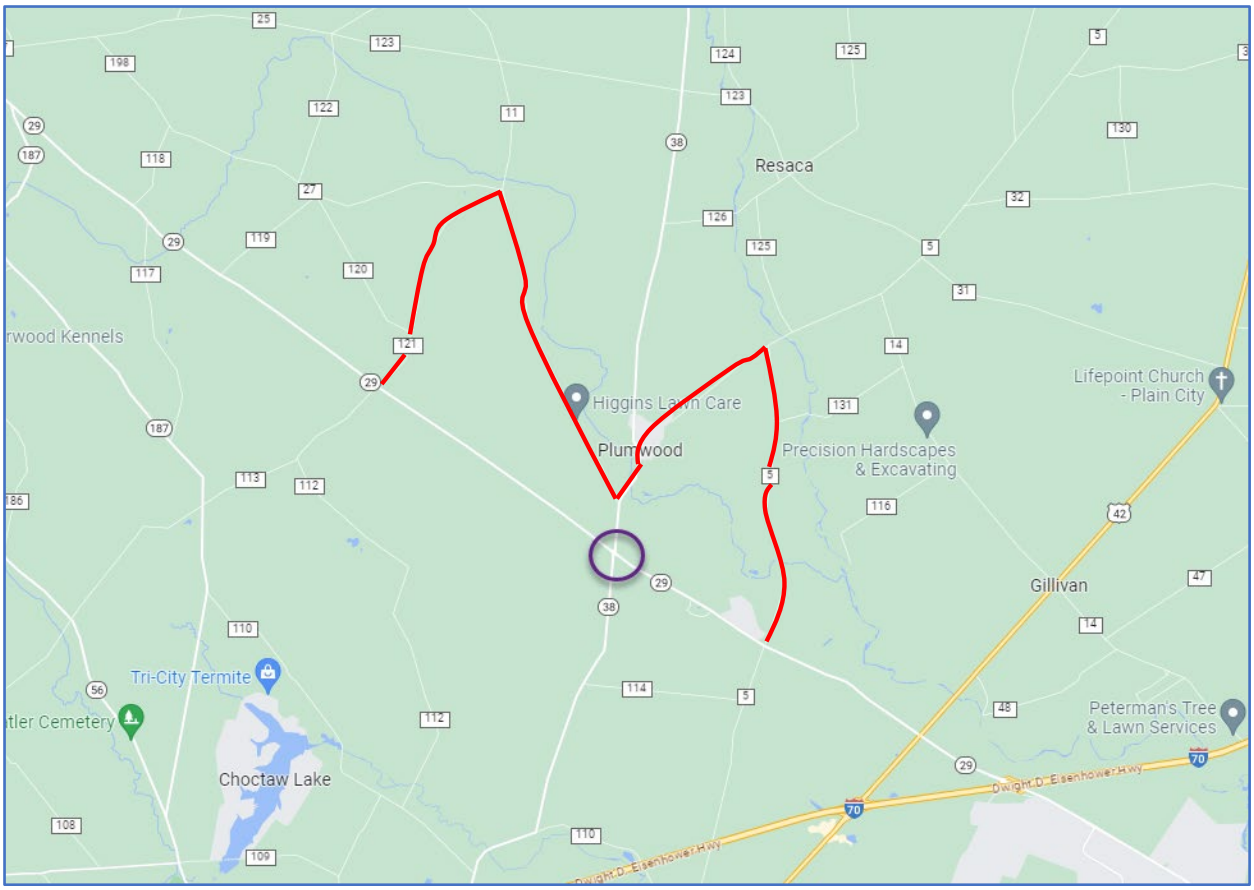


**Figure D.12 Map of Proposed Unofficial Detour Route (for SR 29) for Case Study #3**

**Final Decision for Stage One**

| SN | Category | Favorable | Fair | Unfavorable | Notes |
|---|---|---|---|---|---|
| 1 | Impact to traffic | ☐ | ☐ | ☒ | 241,500 |
| 2 | Functional equivalence of detour highways | ☒ | ☐ | ☐ | Detour is the same or higher functional class as closed highway |
| 3 | Signed detour route uses state highways | ☒ | ☐ | ☐ | Yes |
| 4 | Impact to business and private accesses | ☒ | ☐ | ☐ | No accesses noted |
| 5 | Travel distance added by signed detour | ☒ | ☐ | ☐ | 1.7x |
| 6 | Travel distance added by unsigned designated local detour route | ☒ | ☐ | ☐ | 1.2x (11.2 miles run on local roads) |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Potential for road users using the secondary unsigned designated local detour | ☐ | ☒ | ☐ | Because the designated local route is shorter by 3.6 miles, there is a chance it can be used by some drivers |
| 8 | Construction cost savings | ☐ | ☒ | ☐ | 11% reduction in construction cost anticipated |
| | Construction time savings | ☒ | ☐ | ☐ | 40% reduction in construction time anticipated |
| 9 | Road user delay cost savings | ☐ | ☐ | ☒ | -24% reduction in total user delay cost during closure |
| 10 | Local agency coordination | ☒ | ☐ | ☐ | Technically no local agency needed because the official detour runs on state highways. However, with a possibility of some traffic using a local designated detour, there may be a minimum communication with local agencies |
| 11 | Signed detour restricted by construction or special events | ☒ | ☐ | ☐ | No |
| 12 | Signed detour used as a detour for another project | ☒ | ☐ | ☐ | No other project is known |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ | |
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | ☐ | ☐ | ☐ | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | ☒ | ☐ | ☐ | Removing vehicles from the adjacent lanes during construction will improve safety for workers |
| Applicant Evaluation Decision | | | Advance to Stage 2? ☒ Yes / ☐ No | | |

Stage Two - ***Review of Initial Analysis and Final Decision on Construction Strategy*:**

| SN | Category | Additional Analysis/Detail Required (Y/N) | If Additional Analysis Required, Provide Details |
|---|---|---|---|
| 1 | Impact to traffic (volume duration cross product) | N | |
| 2 | Functional equivalence of detour highways | N | |
| 3 | Signed detour route uses state highways | N | |
| 4 | Impact to business and private accesses | N | |
| 5 | Travel distance added by signed detour | N ☐ | |
| 6 | Travel distance added by unsigned designated local detour route | N | |
| 7 | Potential for road users using the secondary unsigned designated local detour | Y | Check speed limits, road geometry, and pavement condition for potential of substantial number of traffic to divert to this route since it is shorter than the primary official detour route |
| 8 | Construction time savings | N | |
| 9 | Road user delay cost savings | N | |
| 10 | Local agency coordination | Y | Check with local agency for the potential of substantial traffic to divert to this route. Assess the route road conditions |
| 11 | Signed detour restricted by construction or special events | Y | Confirm with local government officials for any planned special events |
| 12 | Signed detour used as a detour for another project | N | |
| 13 | Existing condition of signed detour route based on Pavement Condition Rating (PCR) | ☐ | |
| 14 | Existing condition of unsigned detour route based on Pavement Condition Rating (PCR) | ☐ | |
| 15 | Safety concerns of workers and travelers on work zone (**if full closure is not adopted**) | N | |
| ODOT Evaluation Decision | | Advance to Stage 3? ☒ Yes / ☐ No | |