Manual For
Abandoned Underground Mine Inventory and Risk Assessment

PREPARED BY:
THE OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL ENGINEERING
1980 WEST BROAD STREET
COLUMBUS, OHIO 43223
# TABLE OF CONTENTS

100 INTRODUCTION ................................................................................. 1-1

101 GENERAL DISCUSSION ..................................................................... 1-2

102 OVERVIEW ...................................................................................... 1-2

102.1 Notification..................................................................................... 1-3

102.2 Establishing an Inventory of Sites .................................................. 1-3

102.3 Site Monitoring ............................................................................ 1-3

102.4 Risk Assessment .......................................................................... 1-4

102.5 Remediation ................................................................................. 1-5

103 GOVERNING PRINCIPLES ............................................................... 1-5

104 CLOSING ......................................................................................... 1-6

200 INITIAL INFORMATION REVIEW .................................................. 2-1

201 UNDERGROUND MINE MAPS ......................................................... 2-1

201.1 ODNR Underground Mine Information ....................................... 2-1

201.2 Mine Map Data .......................................................................... 2-4

202 ESTABLISHING SITE LIMITS .......................................................... 2-12

203 ESTABLISHING SITE LOCATION .................................................. 2-13

203.1 Location Data ............................................................................. 2-14

203.2 Site Location .............................................................................. 2-14

203.3 Roadway Elevation .................................................................. 2-15

203.4 Structures .................................................................................. 2-15

204 ADDITIONAL AVAILABLE INFORMATION .................................... 2-1

204.1 Geological Reference ................................................................. 2-1

205 TRAFFIC INFORMATION ............................................................... 2-3

205.1 Posted Speed Limit ................................................................... 2-3

205.2 Traffic Reports .......................................................................... 2-3

300 INITIAL SITE VISIT ....................................................................... 3-4

300.1 Establish Field Limits ................................................................. 3-4

300.2 Geological Information ............................................................. 3-5

300.3 Surface Deformation Features ................................................... 3-5

300.4 Mine Entries ............................................................................. 3-7
300.5 Mine Related Structures and Features .......................................................... 3-10
300.6 Site Sketch and Photographs ..................................................................... 3-13

400 INITIAL SITE EVALUATION ................................................................. 4-1
401 RISK ASSESSMENT SITE GROUPS ..................................................... 4-1
401.1 Detailed Site Evaluation Site Groups ..................................................... 4-2
401.2 Low Rating & High Rating Site Groups .............................................. 4-2
401.3 Eliminated Sites Group .................................................................... 4-2

402 INITIAL SITE EVALUATION CRITERIA ........................................... 4-3
402.1 Evidence of Surface Deformation ......................................................... 4-4
402.2 Presence of Mine Opening(s) .............................................................. 4-4
402.3 Ratio of Unconsolidated Material to Intact Bedrock in the Overburden Interval .... 4-5
402.4 Minimum Overburden Thickness (Approx.) ....................................... 4-6
402.5 Maximum Mined Interval Thickness (Approx.) .................................. 4-7
402.6 Ratio of Minimum Overburden Thickness to Maximum Mined Interval Thickness (Approx.) ............................................................ 4-7
402.7 Secondary Mining. ............................................................................ 4-7
402.8 Special Mine Features ...................................................................... 4-8
402.9 Problems Reported During Active Mining ........................................ 4-8
402.10 Average Daily Volume of Traffic (ADT) ......................................... 4-8

403 SITE EVALUATION CRITERIA WEIGHTING FACTORS ...................... 4-9
404 INITIAL SITE EVALUATION FORM ............................................... 4-9

500 DETAILED SITE EVALUATION .......................................................... 5-1
501 DETAILED SITE EVALUATION CRITERIA ....................................... 5-1
501.1 Number of Subsidence ..................................................................... 5-1
501.2 Average Daily Volume of Traffic (ADT) .......................................... 5-1
501.3 Average Daily Volume of Truck Traffic (ADTT) .............................. 5-2
501.4 Traffic Speed ................................................................................. 5-2
501.5 Ratio of Unconsolidated Materials to Bedrock in the Overburden Interval 5-2
501.6 Structures in Roadway ..................................................................... 5-2
501.7 Minimum Overburden Thickness (Approx.) ...................................... 5-3
501.8 Method of Shaft or Mine Opening Closure ....................................... 5-3

AUMIRA (January 2018) ii
501.9 Type of Cribbing................................................................. 5-4
501.10 Shaft or Mine Opening Location......................................... 5-4
501.11 Plan Area of Shaft or Mine Opening (Approx.).................... 5-5
501.12 Age of Mining................................................................. 5-5
501.13 Minimum Overburden Above Mine Opening ..................... 5-5
501.14 Type of Mine Opening....................................................... 5-6
502 DETAILED SITE EVALUATION WEIGHTING FACTORS........ 5-6
503 DETAILED SITE EVALUATION FORMS............................... 5-7
600 SITE MONITORING and INSPECTION FREQUENCY............... 6-1
INTRODUCTION
The Abandoned Underground Mine Inventory and Risk Assessment (AUMIRA) process was developed in 1998 as a response to a collapse of an abandoned underground mine (AUM) which resulted in the closure of Interstate Route 70 in Guernsey County, Ohio. Since the implementation of the AUMIRA process, the Ohio Department of Transportation (ODOT) has completed a statewide inventory of all known AUMs and the relative risk they pose to the statewide transportation network within Ohio. The resulting inventory is part of a larger geotechnical data management system (GeoMS) implemented by ODOT. The GeoMS has two primary components related to the AUMIRA:

1) Geologic Hazard Management System (GHMS);
2) Falcon Document Management System for Historical Records.

The GHMS is a listing of geologic hazards which have potential to impact the traffic network and consists of AUMIRA sites, rockfall locations, and landslide locations. The Falcon system includes photos of geohazard sites and historical records of geotechnical explorations. This information is accessed within ODOT’s Transportation Information Management System (TIMS). The TIMS makes available the most current data and information on Ohio’s transportation system and can be accessed via the internet through an interactive website.

Since the establishment of the original AUMIRA process in 1998, much has changed in terms of both available information and the methods of information retrieval. The Ohio Department of Natural Resources (ODNR) has expanded its inventory of AUM maps. ODNR manages a website where a user can view the limits of the underground mines in plan view and download pdf documents of the mine maps directly. High resolution tiff images of the mine maps are also available, by request. Most of the mine map images have been georeferenced, allowing for nearly seamless and immediate creation of mine map overlays with current or historic ODOT construction plans. Much of the geologic information needed to complete an AUMIRA evaluation is also now available in GIS layers from ODNR. This makes a GIS platform invaluable for evaluating AUMIRA sites.

Despite the improved availability of information, there are still instances where ODOT encounters unmapped underground mine workings.

This revision to the AUMIRA process is intended to reflect the current state of the practice. As such, references to AUMIRA being a “paper process” have been removed, as have much of the details for creating an “initial site listing.” The principles behind the original process remain intact, but the process is now impacted by the technological changes over the past two decades, the maturation of ODOT’s AUMIRA, and the subsequent initiation of inventories and risk assessments for other geohazards. Key sections of the original manual have been moved to Appendices so that the AUMIRA manual is more consistent with the format and style of ODOT’s other geohazard inventory manuals.
101 GENERAL DISCUSSION
The ODOT AUMIRA process was conceived as a proactive effort to locate and assess the risk of all ODOT operated roadway sites beneath which AUMs exist, are mapped or are otherwise identified. The scope of such an undertaking is extremely formidable. Hundreds of such roadway sites exist in Ohio. The ages of the majority of AUMs associated with these sites range from 50 to 200 years. Available records for these mines can vary greatly between the different sites.

The process documented in this manual is a logical and practical approach to establishing and maintaining such an inventory. Due to the large number of sites, it is not logistically or financially responsible to commit limited forces and funding to exploration and remediation of random sites. A cornerstone of this inventory and risk assessment process is the concept of “being as informed as possible” before committing limited resources to individual sites for detailed investigations and, when necessary, remediation. The sites which pose the greatest risk to public safety should be assessed as having the highest priority.

This document is not a design manual. The purpose of this manual is to provide a means of site inventory, monitoring and risk assessment. English units of measurement are utilized in this manual. Detailed design work and construction documents which might be undertaken as a result of the site inventory and risk assessment process documented in this manual should be prepared in accordance with the current ODOT Location & Design Manuals and CADD Standards Manual.

102 OVERVIEW
The process documented in this manual is comprised of three basic activities:

1) Creation of a new inventory site;
2) Periodic site monitoring and updating of existing inventory sites;
3) Assessment of the risk each site presents to the safety of the traveling public.
A process flow chart is presented as Figure 100-1. The definitions of commonly used terms in this manual are provided in Appendix A: Glossary of Terms.

Figure 100 - 1: Process Flow Chart

102.1 Notification
If a location along the transportation network is suspected of being underlain by an AUM, a notification should be sent to the District Geotechnical Engineer (DGE).

102.2 Establishing an Inventory of Sites
Upon receipt of the notification, the DGE should determine if the location already exists within the AUMIRA inventory. If not, a new AUMIRA site should be established. The process for establishing a new site is presented in Section 200.

102.3 Site Monitoring
For new sites and for rated sites located within the AUMIRA, periodic monitoring will be required. The frequency and extent of required monitoring activities will depend on site conditions. All rated sites will be periodically monitored on a permanent basis. Frequency of monitoring will be determined by the highest priority Site Group that the site falls under or on a site-specific basis.
102.4 Risk Assessment

The risk assessment process takes into account two basic factors:

1) Existing site conditions;
2) Level of the traveling public’s exposure to existing site conditions.

102.4.1 Initial Site Evaluation

An Initial Site Evaluation of all sites in the established inventory will be performed by applying applicable site evaluation criteria to available information and field observations. This Initial Site Evaluation process will generate an Initial Site Evaluation Rating Score for all sites (not otherwise eliminated) and will determine into which of the risk assessment site groups each site will be placed. The Eliminated Sites Group will become inactive permanent record files in the inventory system.

102.4.2 Detailed Site Evaluation

Detailed Site Evaluations will be performed on sites placed into the Surface Deformation, Vertical Shaft, and Mine Opening Site Groups as determined by the Initial Site Evaluation process. It is possible for one site to fall into more than one Site Group. This will result in evaluating the site under the criteria for each applicable Site Group. This work will be performed for each Site Group in order of the group’s priority level of risk; see Table 100-1. All sites within a site group will be evaluated using site evaluation criteria considered pertinent to the nature of the sites within the group. The Detailed Site Evaluation will be completed utilizing existing information and information gathered during the initial inventory site visit. The result of the Detailed Site Evaluation process will be a site evaluation score for the sites in the Surface Deformation, Vertical Shaft, and Mine Opening Site Groups.

<table>
<thead>
<tr>
<th>Tier</th>
<th>Site Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Surface Deformation *</td>
</tr>
<tr>
<td>4</td>
<td>Vertical Shafts*</td>
</tr>
<tr>
<td>3</td>
<td>Mine Opening *</td>
</tr>
<tr>
<td>2</td>
<td>High Rating</td>
</tr>
<tr>
<td>1</td>
<td>Low Rating</td>
</tr>
<tr>
<td>0</td>
<td>Eliminated Sites</td>
</tr>
</tbody>
</table>

* Indicates Detailed Site Evaluation Groups.

The Detailed Site Evaluation rating scores are used to generate a prioritized list of sites for each Site Group, highest score to lowest score. Sites that do not otherwise fall into one of the Detailed Site Evaluation Groups shall be placed in the Low Rating Group and prioritized by their Initial...
Site Evaluation Rating Score. The ten (10) highest individually rated sites in the Low Rating Group in each District shall constitute the High Rating Group.

102.5 Remediation
Locations which become a severe enough risk may require remedial activities. If remedial activities are required, consider the following items.

102.5.1 Development of Construction Documents
Construction drawings, specifications and special provisions shall be developed for each individual site where remediation is planned. Regardless of the extent of explorations performed, the actual site conditions cannot be fully determined prior to construction. Remediation guidance must emphasize flexibility of methods, quantities and project limits.

Site conditions may change during the period of time required for contract document development. Guidance is included in Section 600 and the Appendix for continued site monitoring during development of Construction Contract documents.

102.5.2 Remedial Construction
For sites which require remedial construction activities close inspection of the work, monitoring of time and materials usage, and accurate record keeping are important during construction. Accurate records will be invaluable for post-construction monitoring and reference in the case of future subsidence conditions occurring in or adjacent to the project area.

Site conditions may change or new conditions may develop during remedial construction. Certain forms of remediation may unintentionally induce additional mine related settlement. Site monitoring to detect possible changes during remedial construction must be performed.

Further details on remediation actions can be found in the Appendix.

103 GOVERNING PRINCIPLES
Basic principles governing this process include:

1) Maintaining a list of sites prioritized by level of risk to the travelling public, highest risk to lowest risk for each ODOT District;
2) Being as informed as possible before committing resources to a site;
3) Being prepared to encounter “worst case” conditions for the nature of the site being investigated or remediated.
104 CLOSING
The AUMIRA process is being performed and maintained for the state transportation network. This inventory includes all known underground mines, generally discovered through the use of underground mine maps, or from observed point features (such as mine openings, subsidence features, etc.) which do not have associated underground mine maps. The field portion of the inventory process shall be completed by personnel who are experienced in evaluating features associated with underground mining.
200 INITIAL INFORMATION REVIEW

The Office of Geotechnical Engineering (OGE) has established an inventory of AUMIRA sites within the GHMS. As with the other geohazard inventories, the AUMIRA process is dynamic in that scoring values can change as site conditions change and new/updated information becomes available. Thus, periodic updating of the data for individual sites is required.

It will be necessary on occasion to create a new AUMIRA site in the GHMS. Some of the possible reasons that a new site would need to be created are:

- Discovery of a new mine map or recent georeferencing of a known mine map;
- Report of a newly observed suspect feature in or adjacent to the ODOT right-of-way (R/W);
- Construction of new roadway.

Two divisions of Ohio Department of Natural Resources (ODNR) maintain, and can provide, the majority of information currently available regarding underground mines in Ohio. The ODNR, Division of Geological Survey (DGS) is the repository for the AUM maps and associated information. The ODNR, Division of Mineral Resource Management (MRM) is the repository for the active underground mine maps.

The mine map should be the primary Initial Information source for populating the GHMS. If no map is available or the mine map does not provide adequate information to populate the necessary fields, utilize resources identified in Section 204.

201 UNDERGROUND MINE MAPS

201.1 ODNR Underground Mine Information

The first step in the process is to obtain AUM maps associated with the roadway locations of interest. Mine maps represent the extent of the mine workings at the time they were prepared. The maps available may not represent the extent of mine workings after the prepared date of the mine map, or historical workings prior to the initiation of the mine map (i.e., “Work Out”). Additional mining may have occurred after the date of the mine map.

ODNR maintains a website, *Mines of Ohio* showing the approximate limits of known underground and surface mining in Ohio in plan view. Low resolution pdf files of the AUM maps can be downloaded directly from the website as can GIS layers for most of the information shown there.
Figure 200 - 1: Large Scale View of Example Site on Mines of Ohio Website

Figure 200 - 2: Zoomed In View of Example Site from Figure 200-1
Figure 200 - 3: Low Resolution PDF Mine Map from *Mines of Ohio* Website

Some of the available AUM maps are not shown on the website because they do not contain enough information to be accurately located. In cases of suspect features in areas without a known underground mine map, ODNR should be contacted directly for additional information.

High resolution tiff images of the AUM maps are also available from ODNR, most of which have been georeferenced. These high resolution tiff images and their associated georeferencing files should be obtained and used for the AUMIRA process.

These georeferenced mine maps represent a best fit of the tiff image given the time and informational resources available to ODNR-DGS. All apparent property lines, roads, etc. on mine maps may not match the same feature exactly on the base mapping layers. Even with this limitation they are considered to be of an acceptable level of accuracy for performing field and office work to develop data for the evaluation of an AUMIRA site.
The user of this manual should become familiar with the symbology used on the ODNR mine maps and GIS layers.

201.2 Mine Map Data
Mine map data should be collected for population into the GHMS based upon high resolution tiff images of the AUM maps. The following data is included under the Mining Info tab:

1) Type of mine opening  
2) Mined seam elevation point (floor elevation)  
3) Thickness of mined seam  
4) Dates of operation and abandonment  
5) Special Mine Features  
6) Visual estimate of the percentage of extraction  
7) Problems reported during mine operations

Also, note mine feature locations to determine inspection points during field reconnaissance. Common features which may be found on a mine map and need to be inspected during site visits are:

- mine openings  
- vertical shafts  
- tipple  
- hoist locations

Note the following on the mine map example in Figure 200-4:

- Vertical Shafts locations at the “AIR SHAFT” and “FAN” locations.  
- Area of mining not detailed on the mine map, noted as “Worked Out”.
Note the following on the mine map example in Figure 200-5:

- Vertical Shafts locations beneath the “Tipple” location
- Coal Thickness noted at the ends of the removed area in feet (‘) and inches (“)
201.2.1 *Type of Mine Opening*

Based upon the mine map, the type of mine opening could be either an entry or a shaft location established for primary or secondary mining efforts. Openings connect the mine workings with the ground surface and would be utilized for ventilation, drainage, and/or access for personnel and materials. Different mine openings are presented in Figure 200-6. Record the mine opening type(s) in the GHMS.

![Types of Underground Mines](image)

*Figure 200 - 6: Types of Underground Mines (From Crowell 1995)*

The following mine opening options are available for selection within the GHMS:

1. **Drift Entry:** An entry above the regional drainage, generally found within the hillside. The entry is generally horizontal, or near horizontal, and follows the mined seam.

![Drift Entry](image)

*Figure 200 - 7: Drift Entry*

2. **Slope Entry:** An entry located either above or below the mined seam which is accessed through an inclined opening.
3. Vertical Shaft: An entry accessing the mined seam through a vertical or near vertical shaft from the ground surface.
4. Unknown: No documentation about the mine openings are available.
   For Drift, Slope and Unknown mine openings, record the mine opening type within
   the Mine Opening Tab. For Shaft mine openings a separate category has been
   established due to the potentially higher risk to the roadway.

201.2.2 Mine Seam Elevation
The mine seam elevation should be recorded within the GHMS in the Overburden Tab as
Base Elevation Void. Some mine maps will provide at least one floor elevation for the mined
seam. For newer maps, elevations may be provided at the intersection of major haulageways.
Also, elevations may be provided at the mine opening or shaft locations. When multiple
elevations are provided, utilize the lowest point relative to the roadway for the mine seam
elevation. These elevations may be set to a local datum not referencing Mean Sea Level
(MSL).

![Figure 200 - 10: Mine Seam Elevation](image)

201.2.3 Thickness of Mined Seam
The thickness of the mined seam should be recorded within the GHMS in the Overburden
Tab as Thickness of Void. Mine maps may provide the thickness of the mined seam. If drill
holes from the mine exploration are shown, the thickness of the mineral resource is
sometimes noted.
201.2.4 Age of Mining
The date for Age of Mining should be recorded within the GHMS within the Mine Infotab. The mine maps should provide the dates of operation for the mine. A listing of date(s) of survey may be provided, indicating updates to the mine maps. Additionally, there may be a Certificate of Surveyor and a Certificate of Mine Foreman for the last revision presented on the map. Age of mining should be reported as the year of the last survey and certification of the map. Figure 200-13 shows an example of a listing of mine map updates provided on the map itself. The age of mining would be reported as being 1951 since that is the last date entered onto the map.
After reviewing available mine maps and additional resources identified in Section 204, if no indication for the age of mining is present on the mine maps, record “Unknown”.

201.2.5 Special Mine Features
A special mine feature is an indicator of the presence of larger unsupported mine roof areas that may be more likely to collapse. The source of this information will primarily be the individual mine maps. The following are some examples of features typically encountered:

• Intersecting Haulageways: This is a condition where multiple Haulageways (mine workings which were utilized as a passageway for movement of mined material, personnel or equipment) intersect each other.
• Large Room: May be noted as a storage area or equipment repair area.

If a Special Mine Feature is identified, select “Yes” within the Mining Info tab, and provide a description of the special mine feature within the Comment Section.

201.2.6 Problems Reported During Mining
Problems reported during mining are an indication of potential AUM instability related to geologic conditions. These conditions are any confirmed report of mine instability or significant ground water problems during active mining.

Some examples of problems reported during mining are presented as follows:

• Mud Flow
• Bad Roof
• Bad Top
• Collapse
Figure 200 - 14: Problems Reported During Mining

If problems were reported, select “Yes” under the Mine Info tab and provide a description in the Comment box.
202 ESTABLISHING SITE LIMITS

The accuracy and quality of original mine maps are highly variable, and, as stated above, there are limitations regarding the accuracy of the georeferencing effort. Due to these limitations, a 500-foot buffer should be applied around the limits of the mapped mines and/or point features to create the site limits of the inventory site. All existing sites found within the GHMS already have this buffer applied.

To create the buffered limits, load the georeferenced mine map, the ODOT roadway inventory layer (Linear Referencing System or LRS), best available elevation data, and other appropriate base mapping layers into a GIS platform. This GIS information should then be utilized to establish the site limits.

The end points of the AUMIRA site represent where the 500-foot buffer intersects the LRS of the roadway. The intersection points should reference the straight line mileage (SLM) for the roadway segment. The lowest SLM value should be designated the Beginning Mileage Point (BMP), and the highest SLM value should be designated the Ending Mileage Point (EMP). After the BMP and EMP points have been determined, coordinates (latitude and longitude) should be established for both points utilizing the georeferenced documents and GIS layers.

![Figure 200 - 15: Establishing the AUMIRA site limits in GIS](image)

---

AUMIRA (January 2018)

2-12
When establishing site limits, consider the following:

- Significant changes in risk exposure can represent separate sites.
- Sites should not extend across County boundaries.
- Sites should not exceed a length of one mile.

For a site where the AUM extends past one mile, break the site into multiple sites based upon significant changes in physical characteristics, or at public land survey system (PLSS) lines. ODNR historic underground mine records are indexed by PLSS Section numbers.

A new AUMIRA site should be created every time the roadway extends over a different mine map. The different mine maps represent different sites. This rule applies even when available mine maps are contiguous and represent mining in the same mineral interval beneath a given roadway segment. For conditions where contiguous AUMs are present, create a common BMP/EMP point where the maps intersect. If no points intersect, establish the BMP and EMP at the site as established above.

For sites where the 500-foot buffer overlaps, merge the buffers to create a common BMP/EMP point between the two sites.

An AUMIRA site encompasses the entire roadway including any associated ramps and median, not just the Cardinal or Non-cardinal directions as found in the Rockfall and Landslide Inventories.

**203 ESTABLISHING SITE LOCATION**

Record the site location (Latitude and Longitude) and locations of any mine openings shown on the mine map for inspection during the Initial Site Visit. Initially, these points are only for reference during the visit and do not need to be recorded within the GHMS. If no evidence of the mine opening(s) is observed in the field then the coordinates from the map will be entered in the GHMS as the location of the opening. Additionally, develop coordinates for any other features that should be evaluated during the site visit, such as:

- rail spurs
- anticipated low point of the roadway
- tipple, hoist houses or mine structures
- ODOT or roadway structures
Upload feature coordinates into the GPS unit to locate for inspection during the Initial Site Visit.

203.1 Location Data
The location data should be recorded into the GHMS based upon georeferenced documents and GIS layers. The following data is included under the Location & GPS tab:

1) BMP (County-Route-Section)
2) BMP coordinate (latitude and longitude)
3) EMP (County-Route-Section)
4) EMP coordinate (latitude and longitude)

This information is used to establish the site limits during the site visit and will include the 500-foot buffer as presented in Section 202.

203.2 Site Location
The following data should be entered as Basic Information under the Location & GPS tab within the GHMS Section Site Location:

1) District
2) County
3) Route System
4) Route Number (5-digit ODOT designated route number)
5) Jurisdiction Code:
   (C-County, H-Turnpike Commission, M-Municipal, S-State, T-Township)
The Network Linear Feature Identification Code (NLFID Code) will be auto-generated for the location (update button). The NLFID designation (see Figure 200-17) is a tracking code consisting of:

1) Jurisdiction Code
2) County
3) Classification Code
4) Route Number
5) Default code to complete the NLFID Code (**C)

![NLFDICODE STUSUS00250**C](image)

Where:
A is the Jurisdiction Code
B is the County Code
C is the Classification Code
D is the Route Number
E is the default code

Figure 200 - 17: NLFID Code Standard Example

203.3 Roadway Elevation
Based on best available mapping (project plans, OSIP, USGS Quad sheet, etc.) determine the coordinates for the anticipated lowest elevation of the roadway surface within the Inventory Site, considered to be the Roadway Elevation.

203.4 Structures
Within the TIMS known structures are provided through the Assets layer. Once this layer has been selected, individual asset types can be selected which will provide a positional location on the mapping service. Structures of note may include:

- Bridges
- Culverts
- Walls
- Facilities

The coordinate data is available for each structure and can be used to locate the structure during the site visit.
204 ADDITIONAL AVAILABLE INFORMATION

ODNR DGS has several geologic references which are helpful in determining the geologic information, including the following:

- Geologic Bulletins
- Information Circulars
- Bedrock Topography Map
- Bedrock Geology Map
- Bedrock Structure Maps
- Measured Sections

Additional resources which should be explored are:

- ODNR Mineral Resources (ODNR-MR): Mine map data sheets
- Ohio Mine Subsidence Insurance Program
- U.S. Department of Interior, Office of Surface Mining (OSM): Mine maps and data sheets
- County Recorder’s Office
- ODOT OGE Historical Records
- ODOT Construction and Maintenance records
- ODNR Division of Water Resources: Water Well Inventory

Record the resources referenced on the Info Source tab within the GHMS. The Info Source has a check list with the specific reference, such as the Bulletin title, recorded with the other pertinent information text box. This data does not replace site specific data available on the mine maps, or direct observations made during the site visit(s).

204.1 Geological Reference

General geological data shall be reviewed and collected for each site. Site specific data is necessary for completion of the AUMIRA process. The following is a brief discussion of predominate means of collecting this data.

204.1.1 ODNR Geologic Information

ODNR can provide geologic information on varying scales. Basic information about geologic units or county surveys can be found within the Geological Bulletins, Report of Investigations and Information Circulars. Additionally, ODNR maintains open files which are not published, but are open for review by the public, which include measured stratigraphic sections, core logs, and engineering data files which may provide the site specific geologic information needed.
204.1.2 Bedrock Geologic and Topographic Mapping
Reconnaissance bedrock geology mapping (BG-2a) and Bedrock topographic mapping (BG-4a) are available based on the 7.5-minute quadrangle series statewide. This information is also available as a statewide GIS layer. The mapping was developed utilizing field data, water well logs, oil and gas records and geotechnical data points. The scale is proportional to the mapping scale with most contour intervals at 20 or 50 feet. These contour elevations may not be sufficient for the site specific needs for the AUMIRA process. Two of the primary resources used to develop these maps are the Ohio water well inventory and the Oil and Gas well inventory, both of which are maintained by ODNR. Individual data points, consisting of specific well reports are presented within the mapping and can provide a depth to bedrock and bedrock type encountered within or immediately adjacent to the AUMIRA Site.

The Bedrock Surface Elevation should be recorded within the GHMS in the Overburden tab. If multiple elevations are present, record the lowest elevation within the site limits.

204.1.3 Geologic Structure Mapping
Geologic structure mapping is available through ODNR as a GIS layer for a limited number of marker beds or coal seams. The mapping is based on known points at the base of the coal seams throughout the state. The following coal seams have structure mapping:

- Lower Kittanning (No. 5) Coal
- Middle Kittanning (No.6) Coal
- Lower Freeport (No. 6a) Coal
- Pittsburgh (No. 8) Coal

204.1.4 Water Well Inventory
The water well inventory is a data set of reports provided by drilling firms after installation of a potable water well. These reports provide a generalized geologic profile and ground water levels encountered during the drilling process.

204.1.5 OGE Historical Records
Geotechnical records are maintained and are available through the Transportation Information Mapping System (TIMS). These records can provide a wide range of details, but will typically provide soil and/or bedrock types and ground water information within the vicinity where previous explorations were completed.

204.1.6 ODOT Construction and Maintenance records
ODOT maintains various construction records and maintenance records for the entire statewide transportation network. These records can be accessed through electronic databases (e.g. Site Manager) and through District archives (e.g. microfilm). To access construction records contact the DGE, and to access maintenance records contact the County Manager.
204.1.7 USGS Quadrangle
Find the site on USGS quadrangle map(s) and record the quadrangle name on the Location & GPS tab.

205 TRAFFIC INFORMATION
Within the GHMS, Traffic Information is collected and reported on the Traffic tab. Four data fields need to be reported within the GHMS Traffic tab as outlined in the following paragraphs.

205.1 Posted Speed Limit
The designated posted speed limit can be determined by observing the posted speed limit signage along the roadway. Alternatively, this data can be obtained through the ODOT TIMS within the Roadway Information layer by selecting Speed Zones. The TIMS mapping will provide selectable map segments which will provide the posted speed limit. These values are also available in the LRS layer of TIMS.

205.2 Traffic Reports
Record the Average Daily Traffic (ADT) and Average Daily Truck Traffic (ADTT) values, for the section of roadway which contains the Inventory Site. These values can be obtained from the current Traffic Survey Reports which can be accessed from the ODOT website as the MS2 (traffic count database) reports. Each Route is subdivided based on straight line miles within a “Traffic Section”, which gives a general description of where the data was recorded, section length in miles, and columns for passenger & Type A commercial vehicles, Type B & C commercial vehicles, and total vehicular traffic. The passenger & Type A commercial vehicle column refers to the AVT value, Type B & C commercial traffic column refers to the ATT value, and the total vehicular traffic column refers to the ADT. The most recent survey should be utilized to determine the individual counts. No “adjustment” to the values shall be made to bring them up to the current year.

Additionally, these values are reported in the TIMS based on linear segments within the mapping by selecting the segment and Traffic AADT (Average Annual Daily Traffic). FAC_AADT_yr provides the calendar year the traffic counts were completed. FAC_AADT_Total_NBR provides the ADT or total traffic count for the segment. FAC_AADT_Type_BC_Truck_NBR provides the ADTT or total truck traffic count for the segment.

Where there are multiple linear segments for a site with unique ADT & ADTT values, use the maximum values for the ADT & ADTT, even if they are referenced to different segments.
### 300 INITIAL SITE VISIT

After completion of the Initial Information Review, perform an Initial Site Visit. Field personnel should have a good understanding of the anticipated site conditions and features from the Initial Information Review. All relevant features identified in the Initial Information Review should be loaded into a GPS unit to aid in the location and collection of site data during the Initial Site Visit. The Initial Site Visit is performed to accomplish the following:

- Become familiar with the site.
- Field verification of site characteristics and conditions
- Create a permanent record of site characteristics and conditions which will be utilized for Initial and Detailed Site Evaluation.
- Determine if a Detailed Site Evaluation is necessary, and, if so, in which Site Group the site will be.
- Determine if the site is an Eliminated Site.

After the Initial Site Visit, if it is determined that the site has no potential for a current or future threat to the safety of the traveling public related to past mining activities, the site is labeled An Eliminated Site.

When multiple Initial Site Visits are to be completed, these visits shall be conducted in the following priority order by classification of roadway:

1. Interstate;
2. NHS other than Interstate;
3. Arterial, and;

Prior to performing the Initial Site Visit, contact the County Manager to notify them of the visit and invite them to attend. Ask them for any information about the site, including any maintenance or construction performed. The goal for the Initial Site Visit is to collect the required field information which will be necessary to complete an Initial Site Evaluation and Detailed Site Evaluation. While conducting the site visit, the coordinating DGE should also communicate with local individuals previously identified as possible sources of past mining information.

County Garage personnel should be canvassed for local knowledge of underground mining information, including past or present roadway construction or maintenance problems. These employees may also know of local private individuals who might have information regarding past underground mining. Local individuals who may be of help include mine employees (present day and retired), local historians, etc.

#### 300.1 Establish Field Limits

Upon arrival at the site establish the limits of the anticipated AUMIRA site utilizing the positional data developed during completion of Section 202 Establishing Site Limits. Utilizing a GPS unit, locate the BMP and EMP in the field. These locations should be marked on the pavement with white paint noting the feature (e.g. BMP or EMP) and an offset lath with the AUMIRA Site...
number and feature recorded on it. Both the paint and the lath should be placed on the cardinal direction side of the roadway.

The field team should first walk the limits of the site to familiarize themselves with the area, including all roadway and area between roadway and R/W (R/W) limits. While walking the site the field team should make notes about existing site features for data collection. These features may include:

- Evidence of past mining
- Mine features
- Structures within the R/W
- Geological conditions
- Features beyond R/W (as observed from within the R/W) – contact ODOT DGE for additional review/access request

300.2 Geological Information
During the site visit document any geological features which may influence the site rating. Note any bedrock exposures including recognizable marker beds and outcropping coal seams. Record the location of the marker bed or coal seam relative to the roadway elevation. Note any soil/bedrock contact points. For observable coal outcroppings, measure the interval thickness and attempt to identify which coal seam it is.

300.3 Surface Deformation Features
Features which may be evidence of mine-related surface deformation include:

- unusual crack patterns or dips in the roadway;
- deformation or distress to structures;
- unusual vegetation;
- pavement patches;
- dips in guardrail;
- dips in flowline of ditches;
- low spots which retain water;
- ponds, unusual water formations, impoundments, etc.;
- surface topography anomalies;
- unusual drainage, seepage, or disappearing surface water.
Figure 300 - 1: Surface Deformation Example

Figure 300 - 2: Surface Deformation Example
300.4 Mine Entries
Look for and document evidence of AUM entries within and adjacent to the site. Inspect any
mine entries identified in the Initial Information Review (type and location) and document any
evidence (of the entry) observed.

For suspected drift entries look for the presence of mine seals, cribbing, or depressions within the
hillside. Look for evidence of acid mine drainage (AMD) or orange-colored water discharging
from the suspected drift entry. Drift entries can be either above or below the roadway and will be
in the vicinity of the mined interval elevation. Examples of drift entries are shown in Figure 300-
4.
<table>
<thead>
<tr>
<th>Open drift entry with AMD</th>
<th>Collapsed drift entry with AMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift entry with bat gate</td>
<td>Drift entry within hillside</td>
</tr>
</tbody>
</table>

**Figure 300 - 4: Drift Entry Examples**

Slope entries have all the same evidence as drift entries. Examples of slope entries are presented in Figure 300-5.
Evidence of a shaft entry may include mine seals, cribbing, structures, depressions or depressed wet areas. Examples of a shaft entry and a suspected entry are presented in Figures 300-6 and 300-7.
300.5 Mine Related Structures and Features
Mine openings may not be evident, but remnant structures may indicate the location of past mine activities (see Figures 300-8 and 300-9). Some related structures to look for include:

- Rail spurs
- Wash houses
- Hoist houses
- Tipples
- Fan houses
Figure 300 - 8: Wash House Foundation

Figure 300 - 9: Abandoned Coal Tipple

Mine related features may include:

- Coal refuse (gob) (see Figure 300-10)
- Abandoned surface (strip) mining pits
- Orange-colored water discharging from the ground (AMD) (see Figures 300-10 and 300-11)
Figure 300 - 10: Coal refuse disposal along stream with orange water flowing within stream

Figure 300 - 11: Orange water discharging at a spring location from the base of a hillside
300.6 Site Sketch and Photographs

As part of the field data collection, create a site sketch, showing all pertinent features. The site sketch should be completed on either a road or project mapping, roadway plan set, or graph paper. The site sketch should at least include the following:

1. Topographic anomalies
2. All features recorded as part of Section 300
3. Elevations relative to the roadway
4. Dimensions of recorded features.

Take photographs of all pertinent features. For significant features take photographs from multiple angles. On the site sketch, make note of the photograph camera angle and what is being shown in the photograph.
400 INITIAL SITE EVALUATION

The Initial Site Evaluation process is the first level of risk assessment for the inventory of sites. The Initial Site Evaluation process applies weighted criteria to gathered existing information and information from the Initial Site Visit. The Initial Site Evaluation process will result in the elimination of some sites from further evaluation, the generation of an Initial Site Evaluation rating score for all remaining, sites and sorting of those sites into the appropriate risk assessment site group(s). Sites sorted into one or more risk assessment site groups shall undergo more detailed evaluation and scoring through the Detailed Site Evaluation process.

The Initial Site Evaluation process is designed to develop an overall rating score for all of the inventory sites which are not screened as Eliminated sites. The Initial Site Evaluation rating score is based on the totaling of rating values for all of the criteria listed in Section 403. Each of the individual criterion rating values is calculated by multiplying a criterion weighting factor times a rating value which represents a site condition or characteristic. The weighting factors reflect the importance of the different criteria as related to one another.

Initial Site Evaluation information for all rated sites will be maintained as active permanent records in the GHMS.

401 RISK ASSESSMENT SITE GROUPS

The completion of the Initial Site Evaluation process for all sites will result in the sorting of the entire inventory of sites into one or more prioritized risk assessment site groups. These subgroupings of sites will be based on categories of risk determined by the completed Initial Site Evaluation process. These risk assessment site groups are listed in Table 400-1 in order of priority:
Table 400 - 1: Risk Assessment Site Groups

<table>
<thead>
<tr>
<th>Tier</th>
<th>Group Designation:</th>
<th>Group Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Surface Deformation Group</td>
<td>Sites with evidence of surface deformation, such as areas of surface settlement and subsidence or irregular drainage conditions which may be mine-related, and may exist or may have historically been observed in the R/W or within view of the R/W.</td>
</tr>
<tr>
<td>4</td>
<td>Vertical Shaft Group</td>
<td>Sites with evidence that Vertical Shaft mine opening(s) exist or have historically been observed or recorded as being in the R/W or within view of the R/W.</td>
</tr>
<tr>
<td>3</td>
<td>Mine Opening Group</td>
<td>Sites with evidence that Slope or Drift mine opening(s) exist or have historically been observed or recorded as being in the R/W or within view of the R/W.</td>
</tr>
<tr>
<td>2</td>
<td>High Rating Group</td>
<td>The ten sites per District having the highest Initial Site Evaluation rating score not already in one of the higher priority site groups.</td>
</tr>
<tr>
<td>1</td>
<td>Low Rating Group</td>
<td>All other rated sites.</td>
</tr>
<tr>
<td>0</td>
<td>Eliminated Sites Group</td>
<td>Sites eliminated (screened) from further evaluation through the verification that an AUM does not exist in the area in question.</td>
</tr>
</tbody>
</table>

401.1 Detailed Site Evaluation Site Groups
The Surface Deformation Group, the Vertical Shaft Group, and the Mine Opening Group comprise the Detailed Site Evaluation site groups. Sites in the Detailed Site Evaluation site groups will proceed to be further studied through the process outlined in Section 500.

401.2 Low Rating & High Rating Site Groups
Sites not otherwise sorted into one of the Detailed Site Evaluation site groups shall be placed in the Low Rating Group. The Initial Site Evaluation rating score provides a risk assessment for each site relative to all the other sites in the Low Rating Group. Sorting the sites in the Low Rating group by Initial Site Evaluation rating score, highest to lowest, provides a prioritized listing of the sites, highest risk to lowest risk, for the sites in this group. The ten sites per District in the Low Rating group having the highest Initial Site Evaluation rating score shall be placed in the High Rating Group for site monitoring.

401.3 Eliminated Sites Group
The last Site Group is the Eliminated Sites Group. If it is conclusively shown that an AUM does not exist under the R/W (i.e., within the R/W and beneath the road elevation) or in the vicinity of the R/W, then the site shall be placed in the Eliminated Sites Group. Although no further review will be conducted on these sites, a permanent, inactive record shall be made and maintained for
each of these sites, as questions about the site may arise again in the future and the records will be necessary to avoid repetition of the initial evaluation.

This record should contain documentation of all information gathered and used to declare the site an eliminated site.

One example of an eliminated site would be where an AUM appeared to be under or nearby the R/W during the initial informational review, but upon completion of the Initial Site Evaluation it was determined that the AUM or mineral seam, is actually located above the roadway.

Another example of an eliminated site is, upon completion of the Initial Site Evaluation for a suspect feature reported in the R/W, in an area where no mine map exists, it is conclusively shown that the feature is not AUM related. This is considered an eliminated site, and a record of all information reviewed to make the determination that the site is not a threat would be maintained for the site, as questions about the site may arise again in the future.

Of course there are other cases where a site can be declared eliminated, however, extreme caution should be exercised to avoid prematurely declaring a site eliminated. If the available information for a given site does not provide conclusive proof that an AUM is not beneath the R/W or in the vicinity of the R/W, then the site should not be placed in the Eliminated Sites Group, but should remain an active site.

402 INITIAL SITE EVALUATION CRITERIA
The Initial Site Evaluation process begins with information from three sources. The first source of information is a list of all roadway sites suspected of overlying an AUM either by review of AUM maps or by observation of suspect features in the field. The second source of information is all information gathered during the Initial Site Visit. The third source of information is the Initial Site Evaluation Criteria presented in this section.

The Initial Site Evaluation Criteria are utilized to evaluate site conditions and the public’s exposure to those conditions. This is accomplished by applying scoring criteria to the geologic characteristics of each site and the traffic volume travelling over a site to generate an Initial Site Evaluation rating score. The Initial Site Evaluation rating score requires:

1. top of rock elevation,
2. elevation of the mined mineral seam,
3. thickness of the mineral seam.

The geologic setting information of the mined interval may be estimated through review of several forms of information available from ODNR, including individual AUM maps and their associated data sheets, bedrock topography and geological structure maps, measured geological sections, and water well records. Much of this information is now available online or can be obtained from ODNR in the form of GIS based electronic files. The more commonly available forms of geologic topographic information utilize coarse
incremental values, which will only allow for an informed “best guess” estimation of the depth to bedrock and mineral seam in the overburden interval. Direct field observations may also be used to determine geologic information. ODOT historic boring records in the ODOT TIMS should also be reviewed to help determine the geologic setting of a site.

402.1 Evidence of Surface Deformation
This criterion is utilized to give an indication of current or past subsidence observed in the R/W or within view of the right- of-way. Some examples might include: open subsidence features, evidence of fill placement, localized differences in vegetation, puddles and standing water, wet spots, sags in roadway profiles evidenced by oil spot areas on the pavement, patches in the roadway surface, etc.

Table 400 - 2: Rating Values for Evidence of Surface Deformation

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Confirmation of this site condition automatically places a given site in the Surface Deformation Group, which is the highest priority site group.</td>
</tr>
<tr>
<td>No</td>
<td>A “No” response to this condition will result in the site being placed in one of the site groups other than the Surface Deformation Group.</td>
</tr>
</tbody>
</table>

402.2 Presence of Mine Opening(s)
This criterion is utilized to report that a mine opening(s) is (are) observed or recorded as being in the R/W or within view of the right- of-way. Primary sources of mine opening information at this level of site evaluation will probably be ODNR individual AUM maps and associated GIS based files, ODOT field reports, ODOT historic roadway construction plans, County Managers, individuals with knowledge of local, historical mining operations, etc. Some examples of field indicators of such conditions might include: defined geometric depressions in the existing grade; and remnants of headframe above the shaft, hoist foundations, mine waste on the ground surface, point source(s) of ground water expression, etc.
Table 400 - 3: Rating Values for Presence of Mine Opening(s)

<table>
<thead>
<tr>
<th>Opening Type</th>
<th>Site Condition</th>
<th>Rating Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Shaft(s)</td>
<td>Yes</td>
<td>Confirmation of this site condition automatically places a given site in the Vertical Shaft Group, which is the second highest priority site group after the Surface Deformation Group.</td>
</tr>
<tr>
<td>Slope Entry(s)</td>
<td>Yes</td>
<td>Confirmation of a slope entry automatically places a given site in the Mine Opening Group.</td>
</tr>
<tr>
<td>Drift Entry(s)</td>
<td>Yes</td>
<td>Confirmation of a drift entry automatically places a given site in the Mine Opening Group.</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>A “No” response to this condition will result in the site being placed in one of the other site groups</td>
</tr>
</tbody>
</table>

402.3 Ratio of Unconsolidated Material to Intact Bedrock in the Overburden Interval

This criterion is utilized as an indicator of the potential for mine subsidence to occur. For purposes of the AUMIRA process, overburden is considered to be all material above the mined mineral seam, unconsolidated material (soil) and bedrock. The potential for mine subsidence will be relatively greater for sites where a larger portion of the overburden is comprised of unconsolidated materials. The scoring criterion is expressed as the ratio of unconsolidated materials to intact bedrock.

Sites where this ratio is greater than one are comprised of a larger portion of unconsolidated material, and can be screened for higher risk of subsidence through the use of this criterion. If the unconsolidated material to intact bedrock ratio is approximately equal to one, then the site condition will be rated the same as if the ratio was greater than one.

Table 400 - 4: Rating Values for Ratio of Unconsolidated Material to Intact Bedrock in the Overburden Interval

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio ≥ 1</td>
<td>10 points</td>
</tr>
<tr>
<td>Ratio &lt; 1</td>
<td>1 point</td>
</tr>
</tbody>
</table>
An example of determining the unconsolidated material to intact bedrock ratio for a site is presented as follows:

- elevation of roadway is 760,
- elevation of mine floor is 725,
- thickness of mined interval is 5 feet, and
- the elevation of the bedrock topographic surface is 740.

The unconsolidated materials to intact bedrock ratio is calculated as follows:

1. Top of Mined interval » mine floor + thickness of mined interval = 725+5 =730
2. Full depth of Overburden » 760-730 = 30 feet
3. Thickness of Unconsolidated Material in the Overburden » 760-740 = 20 feet
4. Thickness of Bedrock in the Overburden » 740-730 = 10
5. Site Condition » Ratio of Unconsolidated Material to Intact Bedrock = 20 feet / 10 feet = 2
6. Rating Value » 10 points

![Diagram of roadway, overburden, unconsolidated materials, top of rock, bedrock, and mine floor elevations.]

**Figure 400 - 1: Example of Determining Unconsolidated Material to Intact Bedrock Ratio**

**402.4 Minimum Overburden Thickness (Approx.)**
This criterion is utilized to give an indication of the potential for subsidence. The site condition is the minimum vertical interval of overburden between the roadway surface elevation and the top of the AUM void.

**Table 400 - 5: Rating Values for Minimum Overburden Thickness**

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25 Feet</td>
<td>10 Points</td>
</tr>
<tr>
<td>25 Feet to 50 Feet</td>
<td>8 Points</td>
</tr>
<tr>
<td>50 Feet to 100 Feet</td>
<td>5 Points</td>
</tr>
<tr>
<td>&gt;100 Feet</td>
<td>1 Point</td>
</tr>
</tbody>
</table>
402.5 Maximum Mined Interval Thickness (Approx.)
Thicker mined seams are considered to have a higher likelihood of causing surface deformation.

Table 400 - 6: Rating Values for Maximum Mined Interval Thickness

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;6 Feet</td>
<td>10 Points</td>
</tr>
<tr>
<td>3 Feet to 6 Feet</td>
<td>5 Points</td>
</tr>
<tr>
<td>0 Feet to 3 Feet</td>
<td>1 Point</td>
</tr>
</tbody>
</table>

402.6 Ratio of Minimum Overburden Thickness to Maximum Mined Interval Thickness (Approx.)
This criterion is utilized to give an indication of the potential for highly differential subsidence features at the surface. The site condition is the estimated ratio of overburden thickness (h) to mining height (m), or “h/m” (Matheson and Eckert-Clift, 1986; Peng, 1992).

The overburden thickness (h) is the minimum vertical interval between the roadway surface elevation and the top of the AUM void existing below the roadway. The thickness of mined interval (m) is the approximate maximum void height of the AUM.

Table 400 - 7: Rating Values for Ratio of Minimum Overburden Thickness to Maximum Mined Interval Thickness

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio &lt; 5</td>
<td>10 Points</td>
</tr>
<tr>
<td>Ratio = 5 to 11</td>
<td>5 Points</td>
</tr>
<tr>
<td>Ratio &gt; 11</td>
<td>1 Point</td>
</tr>
</tbody>
</table>

402.7 Secondary Mining
This criterion is utilized as an indicator of the probability of the existence of large areas of unsupported mine roof. Evidence of the secondary removal of supporting blocks or pillars left by the original mining operation for roof support may be obtained for some sites. This information will probably be determined primarily through review of individual AUM maps, historic records from the ODNR, Division of Geological Survey and information obtained from local individuals who are, or have been, involved in the mining of the mineral seam.

Table 400 - 8: Rating Values for Secondary Mining

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>10 Points</td>
</tr>
<tr>
<td>No</td>
<td>0 Point</td>
</tr>
</tbody>
</table>
402.8 Special Mine Features
This criterion is an indicator of the presence of larger unsupported mine roof areas, such as, intersecting haulage ways, large rooms, equipment staging areas, etc., that are more likely to collapse beneath the right-of-way. The source of this information will primarily be individual AUM maps and historic records from the ODNR, Division of Geological Survey.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>10 Points</td>
</tr>
<tr>
<td>No</td>
<td>0 Point</td>
</tr>
</tbody>
</table>

402.9 Problems Reported During Active Mining
This criterion is a measure of potential AUM instability related to geological conditions. Some of these conditions may include the vertical movement of ground water and soil (mud flow), down through the overburden, horizontal ground water movements through the mined mineral seam and unstable mine conditions, such as mine fires, indicating inherent or induced instability in the mined strata and associated geologic units overlying the mined interval. The condition is any confirmed report of problems during active mining.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>10 Points</td>
</tr>
<tr>
<td>No</td>
<td>0 Point</td>
</tr>
</tbody>
</table>

402.10 Average Daily Volume of Traffic (ADT)
This criterion is utilized as a measure of the traveling public’s exposure to the site. The site condition is the total average 24-hour traffic volume for a given site as determined by the most recent Traffic Survey Report. The site ADT collection is presented in Section 205.2 Traffic Report, and can be found in the GHMS Traffic Tab.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30,000 Vehicles</td>
<td>10 Points</td>
</tr>
<tr>
<td>&gt;20,000 to 30,000 Vehicles</td>
<td>8 Points</td>
</tr>
<tr>
<td>&gt;10,000 to 20,000 Vehicles</td>
<td>6 Points</td>
</tr>
<tr>
<td>5,000 to 10,000 Vehicles</td>
<td>4 Points</td>
</tr>
<tr>
<td>&lt;5,000 Vehicles</td>
<td>2 Points</td>
</tr>
</tbody>
</table>
403 SITE EVALUATION CRITERIA WEIGHTING FACTORS
The Initial Site Evaluation rating score is based on the totaling of rating values for all of the criteria. Each of the individual criterion rating values are calculated by multiplying a criterion weighting factor times a rating value which represents a site condition or characteristic. The weighting factors reflect the importance of the different criteria as related to one another. The weighting factors for the Initial Site Evaluation criteria are listed below.

**Table 400 - 12: Weighing Factors for Initial Site Evaluation Criteria**

<table>
<thead>
<tr>
<th>Criteria:</th>
<th>Criteria Weighting Factor:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence of Surface Deformation</td>
<td>Automatic placement in the Surface Deformation Group for Detailed Site Evaluation.</td>
</tr>
<tr>
<td>Presence of Slope or Drift Mine Opening(s)</td>
<td>Automatic placement in the Mine Opening Group for Detailed Site Evaluation.</td>
</tr>
<tr>
<td>Ratio of Unconsolidated Material to Bedrock In the Overburden Interval</td>
<td>9x</td>
</tr>
<tr>
<td>Average Daily Volume of Traffic (ADT)</td>
<td>9x</td>
</tr>
<tr>
<td>Minimum Overburden Thickness (Approx.)</td>
<td>4x</td>
</tr>
<tr>
<td>Maximum Mined Interval Thickness (Approx.)</td>
<td>4x</td>
</tr>
<tr>
<td>Ratio of Minimum Overburden Thickness to Maximum Mined Interval Thickness (Approx.)</td>
<td>6x</td>
</tr>
<tr>
<td>Secondary Mining</td>
<td>4x</td>
</tr>
<tr>
<td>Special Mine Features</td>
<td>2x</td>
</tr>
<tr>
<td>Problems Reported During Active Mining</td>
<td>2x</td>
</tr>
</tbody>
</table>

404 INITIAL SITE EVALUATION FORM
An Initial Site Evaluation Form is provided in the Appendix. This form is structured with a beginning section of site information, an Eliminated Sites Screening section, and then the section listing the Initial Site Evaluation Criteria. A sample completed form is also provided in the Appendix.
500 DETAILED SITE EVALUATION

Begin the Detailed Site Evaluation process by evaluating the sites in the Surface Deformation Group, the Vertical Shaft Group, and the Mine Opening Group in order of their Initial Site Evaluation risk assessment. This second level of site evaluation will reconsider, in some cases, some of the criteria considered during the Initial Site Evaluation, along with additional criteria related to the nature of the particular site group. Separate Detailed Site Evaluation Forms are provided for the Surface Deformation Group, the Vertical Shaft Group, and the Mine Opening Groups. Some sites may require reevaluation and possible placement into a different risk assessment site group as the result of site information reviewed during the Detailed Site Evaluation.

501 DETAILED SITE EVALUATION CRITERIA

The Detailed Site Evaluation Criteria are utilized to evaluate site conditions and the public’s exposure to those conditions.

501.1 Number of Subsidesces

This criterion is an indicator of the likelihood of current, or past, subsidence activity on the site. The rating value shall be the number of areas of surface settlement, subsidence, or irregular drainage conditions, which may be mine-related, and exist or have historically been observed in the R/W or within view of the R/W.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Yes” for all sites in the Detailed Site Evaluation Surface Deformation Group</td>
<td>Number of subsidence features on site</td>
</tr>
</tbody>
</table>

501.2 Average Daily Volume of Traffic (ADT)

This data is collected as part of the Initial Site Evaluation. Refer to Section 402.10 for additional information.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30,000 Vehicles</td>
<td>10 Points</td>
</tr>
<tr>
<td>&gt;20,000 to 30,000 Vehicles</td>
<td>8 Points</td>
</tr>
<tr>
<td>&gt;10,000 to 20,000 Vehicles</td>
<td>6 Points</td>
</tr>
<tr>
<td>5,000 to 10,000 Vehicles</td>
<td>4 Points</td>
</tr>
<tr>
<td>&lt;5,000 Vehicles</td>
<td>2 Points</td>
</tr>
</tbody>
</table>
501.3 Average Daily Volume of Truck Traffic (ADTT)
This criterion is a measure of a possible sudden collapse of the pavement due to impact loading. The site condition is the average 24-hour total volume of “B” and “C” commercial traffic for a given site as determined by the most recent Traffic Survey Report.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;10,000 Vehicles</td>
<td>10 Points</td>
</tr>
<tr>
<td>&gt;6,000 to 10,000 Vehicles</td>
<td>8 Points</td>
</tr>
<tr>
<td>&gt;4,000 to 6,000 Vehicles</td>
<td>6 Points</td>
</tr>
<tr>
<td>2,000 to 4,000 Vehicles</td>
<td>4 Points</td>
</tr>
<tr>
<td>&lt;2,000 Vehicles</td>
<td>2 Points</td>
</tr>
</tbody>
</table>

501.4 Traffic Speed
This criterion is an indicator of a driver’s ability to perceive and avoid a roadway subsidence area. The site condition is the maximum legal speed limit within the section of roadway defining the site.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥60 MPH</td>
<td>10 Points</td>
</tr>
<tr>
<td>40 to ≤55 MPH</td>
<td>5 Points</td>
</tr>
<tr>
<td>≤35 MPH</td>
<td>1 Point</td>
</tr>
</tbody>
</table>

501.5 Ratio of Unconsolidated Materials to Bedrock in the Overburden Interval
This data is collected as part of the Initial Site Evaluation. Refer to Section 402.3 for additional information.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio ≥ 1</td>
<td>10 points</td>
</tr>
<tr>
<td>Ratio &lt; 1</td>
<td>1 point</td>
</tr>
</tbody>
</table>

501.6 Structures in Roadway
This criterion is an indicator of the presence of structures, including those as defined by the ODOT Manual of Bridge Inspection, which could be affected by a subsidence event. The definition of “bridge”, as defined in this referenced publication, states:
“The definition of a bridge in Ohio is a structure with a clear span greater than or equal to ten-feet.”

The span of all bridges, except culverts regarded as bridges, shall be measured along the centerline of the highway. Culvert span(s) shall be measured normal to the axis of the culvert.

For AUMIRA, the definition of a structure is expanded to include culverts, walls, and ODOT facilities.

Worst case conditions should be assumed in determining if a structure will be affected by a subsidence event. This information is considered significant because structures sensitive to differential settlement, if they were to become unstable, would pose a threat to the safety of the traveling public and a significant financial loss to the State if damaged.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>10 Points</td>
</tr>
<tr>
<td>No</td>
<td>0 Points</td>
</tr>
</tbody>
</table>

**Table 500 - 6: Rating Values for Structures in Roadway**

501.7 **Minimum Overburden Thickness (Approx.)**

This data is collected as part of the Initial Site Evaluation. Refer to Section 402.4 for additional information.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25 Feet</td>
<td>10 Points</td>
</tr>
<tr>
<td>25 Feet to 50 Feet</td>
<td>8 Points</td>
</tr>
<tr>
<td>50 Feet to 100 Feet</td>
<td>5 Points</td>
</tr>
<tr>
<td>&gt;100 Feet</td>
<td>1 Point</td>
</tr>
</tbody>
</table>

**Table 500 - 7: Rating Values for Minimum Overburden Thickness**

501.8 **Method of Shaft or Mine Opening Closure**

This criterion is an indicator of the current stability of any material originally placed to seal the mine opening. In the case of multiple mine openings, the overall site condition rating value should be calculated as the sum of the individual site condition rating values for each of the mine openings on the site.
Table 500 - 8: Rating Values for Method of Shaft or Mine Opening Closure

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Rating Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Information</td>
<td>10 Points</td>
</tr>
<tr>
<td>Timber Decking</td>
<td>10 Points</td>
</tr>
<tr>
<td>Uncontrolled Random Backfill</td>
<td>6 Points</td>
</tr>
<tr>
<td>Concrete Cap</td>
<td>4 Points</td>
</tr>
<tr>
<td>Controlled Backfill</td>
<td>2 Points</td>
</tr>
</tbody>
</table>

501.9 Type of Cribbing
This criterion is an indicator of the current stability of material originally placed to provide vertical or lateral support of the mine opening. In the case of multiple mine openings, the overall site condition rating value should be calculated as the sum of the individual site condition rating values for each of the mine openings on the site.

Table 500 - 9: Rating Values for Type of Cribbing

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Rating Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Information</td>
<td>10 Points</td>
</tr>
<tr>
<td>Timbers</td>
<td>10 Points</td>
</tr>
<tr>
<td>Brick</td>
<td>7 Points</td>
</tr>
<tr>
<td>Concrete</td>
<td>4 Points</td>
</tr>
</tbody>
</table>

501.10 Shaft or Mine Opening Location
This criterion is an indicator of the relative risk to the safety of the traveling public. The site condition is the location of the mine opening relative to the roadway. In the case of multiple mine openings, the overall site condition rating value should be calculated as the sum of the individual site condition rating values for each of the mine openings on the site. The highest potential rating value should be used when a mine opening’s location is not conclusively known.

Table 500 - 10: Rating Values for Shaft or Mine Opening Location

<table>
<thead>
<tr>
<th>Site Condition</th>
<th>Rating Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location not Conclusively Known</td>
<td>10 Points</td>
</tr>
<tr>
<td>Between the Two Outer-Most Edge of Shoulders</td>
<td>10 Points</td>
</tr>
<tr>
<td>&lt;50’ Outside the Edge of Shoulder</td>
<td>8 Points</td>
</tr>
<tr>
<td>Between 50’ and 100’ Outside the Edge of Shoulder</td>
<td>2 Points</td>
</tr>
<tr>
<td>Within Sight From Edge of Outside Shoulder</td>
<td>1 Point</td>
</tr>
</tbody>
</table>
501.11 Plan Area of Shaft or Mine Opening (Approx.)
This criterion is an indicator of the potential size of surface feature which could occur and the volume of material which could be drawn into the mine opening in the case of a catastrophic collapse. Such a collapse might occur due to failure of the existing backfill, cribbing, and/or closure at the mine opening entrance. The site condition is the plan area of the original mine opening. In the case of multiple mine openings, the overall site condition rating value should be calculated as the sum of the individual site condition rating values for each of the mine openings on the site.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;750 Sq. Ft.</td>
<td>10 Points</td>
</tr>
<tr>
<td>≥500 to 750 Sq. Ft</td>
<td>8 Points</td>
</tr>
<tr>
<td>≥250 to 500 Sq. Ft</td>
<td>6 Points</td>
</tr>
<tr>
<td>Size Unknown</td>
<td>5 Points</td>
</tr>
<tr>
<td>≥150 to 250 Sq. Ft</td>
<td>4 Points</td>
</tr>
<tr>
<td>&lt;150 Sq. Ft</td>
<td>2 Points</td>
</tr>
</tbody>
</table>

Table 500 - 11: Rating Values for Plan Area of Shaft or Mine Opening

501.12 Age of Mining
This criterion is an indicator of the mining methods utilized and the condition of the mine due to length of time elapsed since abandonment. The site condition is the year of abandonment. This criterion reflects relative differences in mining methods, probable deterioration due to age, and the possibility of unrecorded mining.

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1900, or unknown</td>
<td>10 Points</td>
</tr>
<tr>
<td>1900 to 1930</td>
<td>9 Points</td>
</tr>
<tr>
<td>1931 to 1945</td>
<td>7 Points</td>
</tr>
<tr>
<td>1946 to 1968</td>
<td>5 Points</td>
</tr>
<tr>
<td>&gt;1968</td>
<td>1 Point</td>
</tr>
</tbody>
</table>

Table 500 - 12: Rating Values for Age of Mining

501.13 Minimum Overburden Above Mine Opening
This criterion is an indicator of the potential for subsidence. The site condition is the minimum vertical interval of overburden between the elevation of roadway surface or flowlines of drainage structures, and the top of the AUM opening existing below the roadway.
Table 500 - 13: Rating Values for Minimum Overburden Above Mine Opening

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft / Cover = 0 Feet</td>
<td>10 Points</td>
</tr>
<tr>
<td>Slope/Drift: Cover &lt; 25 Feet</td>
<td>9 Points</td>
</tr>
<tr>
<td>Slope/Drift: Cover = 25 Feet to 50 Feet</td>
<td>8 Points</td>
</tr>
<tr>
<td>Slope/Drift: Cover = 50 Feet to 100 Feet</td>
<td>5 Points</td>
</tr>
<tr>
<td>Slope/Drift: Cover &gt;100 Feet</td>
<td>1 Point</td>
</tr>
</tbody>
</table>

501.14 Type of Mine Opening
This criterion is an indicator of the relative danger posed to the safety of the traveling public by the original type of mine opening. In the case of multiple mine openings, the overall site condition rating value should be calculated as the sum of the individual site condition rating values for each of the mine openings on the site.

Table 500 - 14: Rating Values for Type of Mine Opening

<table>
<thead>
<tr>
<th>Site Condition:</th>
<th>Rating Value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope Entry</td>
<td>8 Points</td>
</tr>
<tr>
<td>Drift (Horizontal) Entry</td>
<td>6 Points</td>
</tr>
</tbody>
</table>

502 DETAILED SITE EVALUATION WEIGHTING FACTORS
The weighting factors for each site group are indicated in Table 500-15. The numbers indicate the weighting factor values utilized for the particular site groups.
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Surface Deformation Group</th>
<th>Vertical Shaft Group</th>
<th>Mine Opening Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Subsidences</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Daily Traffic (ADT)</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Average Daily Truck Traffic (ADTT)</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Traffic Speed</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Ratio of Unconsolidated Materials to Bedrock in the Overburden Interval</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structures in Roadway</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Min. Overburden Thickness (Approx.)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of Shaft or Mine Closure</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Type of Cribbing</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Shaft or Mine Opening Location</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Plan Area of Shaft or Mine Opening (Approx.)</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Age of Mining</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Min. Overburden above Mine Opening</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Type of Mine Opening</td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

503 DETAILED SITE EVALUATION FORMS
A Detailed Site Evaluation Form shall be completed for each site determined to be in either the Surface Deformation Group, the Vertical Shaft Group, or the Mine Opening Group. A blank Detailed Site Evaluation form is provided for each of these three site groups in the Appendix. These forms are structured with a beginning section of site information, an Eliminated Sites Screening section, and then the main section listing the site evaluation criteria pertinent to the nature of the site. Corresponding examples of completed forms are provided in the Appendix.
These forms are designed to develop an overall Detailed Site Evaluation rating based on the totaling of rating values for each listed individual site evaluation criterion. Each individual criterion rating value is calculated by multiplying a weighting factor times a rating value which represents a site condition. The weighting factors reflect the importance of the different criteria as related to one another for the given type of site. The completion of these forms will produce a prioritized site listing for each site group.
600SITE MONITORING and INSPECTION FREQUENCY

Periodic monitoring of all rated sites will be conducted in order to detect any changed site conditions. This monitoring may indicate a need to take immediate action or to perform a site reevaluation. A reevaluation of a site with changed conditions may move the site to a risk assessment site group having a higher priority rating.

Each Inventory Site will require periodic inspection to determine if the site’s risk is remaining relatively stable, or progressing as an increased risk relative to the public safety. The frequency of inspection will be based on the Initial Site Rating of the previous inspection as presented in Table 600-1.

<table>
<thead>
<tr>
<th>Tier</th>
<th>Site Group</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Surface Deformation</td>
<td>Annually</td>
</tr>
<tr>
<td>4</td>
<td>Vertical Shafts</td>
<td>Annually</td>
</tr>
<tr>
<td>3</td>
<td>Mine Opening</td>
<td>2 years</td>
</tr>
<tr>
<td>2</td>
<td>High Rating</td>
<td>3 years</td>
</tr>
<tr>
<td>1</td>
<td>Low Rating</td>
<td>3 years</td>
</tr>
<tr>
<td>0</td>
<td>Eliminated Sites</td>
<td>N/A</td>
</tr>
<tr>
<td>*</td>
<td>Remediated Site</td>
<td>3 years</td>
</tr>
</tbody>
</table>

*After site has been verified as remediated, Tier remains same but inspection frequency changes.

Inspection will be required outside of the prescribed schedule if one of the following events occur:

1. Observations made within the ODOT R/W of possible surface deformation features (including those described in Section 300.3).
2. Observations made adjacent to the ODOT R/W of possible surface deformation features.
3. Major project work is proposed within site limits (i.e., pavement replacement).
4. Remedial activities to the site, partial or full, are performed to reduce the overall relative risk: The site should be re-inspected within one year upon completion of construction activities.
Appendix A
Glossary of Terms
### Appendix A- Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUMIRA</td>
<td>Abandoned Underground Mine Inventory and Risk Assessment: process through which an inventory and relative risk assessment to the statewide transportation network is established and maintained.</td>
</tr>
<tr>
<td>AUM</td>
<td>Abandoned Underground Mine. Area where mineral extraction has occurred through subterranean methods.</td>
</tr>
<tr>
<td>BMP</td>
<td>Beginning Mile Point: lowest SLM point where the mine buffer intersects the LRS roadway.</td>
</tr>
<tr>
<td>DGE</td>
<td>District Geotechnical Engineer: Engineer assigned to an ODOT District and is responsible for geotechnical operations.</td>
</tr>
<tr>
<td>Detailed Site Evaluations</td>
<td>Collection and population of information and data relative to an underground mine location based on an assigned site group of Surface Deformation, Vertical Shaft, or Mine Opening.</td>
</tr>
<tr>
<td>Drift Entry</td>
<td>Mine entry is above the regional drainage, generally found within the hillside.</td>
</tr>
<tr>
<td>EMP</td>
<td>Ending Mile Point: Highest SLM point where the mine buffer intersect the LRS roadway.</td>
</tr>
<tr>
<td>Falcon Document Management System</td>
<td>Geotechnical Document Archive; includes boring logs, soil profiles, reports, and test results from archived projects. Also includes photos and other field documentation collected during geohazard inspections.</td>
</tr>
<tr>
<td>GeoMS</td>
<td>Geotechnical Data Management System: electronic system housing records relative to geologic hazards and historical geotechnical information.</td>
</tr>
<tr>
<td>GHMS</td>
<td>Geologic Hazard Management System: system which maintains records and data relative to abandoned underground mines, landslides and rockfall locations which have potential to impact the statewide transportation network.</td>
</tr>
<tr>
<td>Initial Site Evaluation</td>
<td>Collection and population of information and data relative to a suspected or confirmed underground mine location.</td>
</tr>
<tr>
<td>LRS</td>
<td>Linear Referencing System: Referenced roadway inventory layer.</td>
</tr>
<tr>
<td>ODOT</td>
<td>Ohio Department of Transportation</td>
</tr>
<tr>
<td>ODNR</td>
<td>Ohio Department of Natural Resources</td>
</tr>
<tr>
<td>ODNR DGS</td>
<td>Ohio Department of Natural Resources, Division of Geological Survey</td>
</tr>
<tr>
<td>ODNR MRM</td>
<td>Ohio Department of Natural Resources, Division of Mineral Resource Management</td>
</tr>
<tr>
<td>Slope Entry</td>
<td>Mine entry is located either above or below the mined seam which is accessed through an inclined opening.</td>
</tr>
<tr>
<td>SLM</td>
<td>Straight Line Mileage reference for roadway</td>
</tr>
<tr>
<td>Site Group</td>
<td>Risk designated category based on site condition consisting of Site Deformations, Vertical Shaft, Mine Opening, High Risk, Low Risk or Eliminated.</td>
</tr>
<tr>
<td>Site Monitoring</td>
<td>Testing and/or verification of site conditions using visual, intrusive, and non-intrusive methods.</td>
</tr>
<tr>
<td>TIMS</td>
<td>Transportation Information Management System: A web enabled system through which users are able to access information and data relative to the statewide transportation network.</td>
</tr>
<tr>
<td>Vertical Shaft</td>
<td>Mine entry accessed through vertical, or near vertical, openings from the ground surface.</td>
</tr>
</tbody>
</table>
Appendix B
Field Inspection Forms
Ohio Department of Transportation
Abandoned Underground Mine Inventory and Risk Assessment
Site Data Form

C/R/S: _________________________ GHMS Site No.: _______________________________

Site Description: _________________________________________________________________
___________________________________________________________________________

O.D.N.R., DGS Individual Abandoned Underground Mine Map Index No. (If known): ________________

Name of Site Evaluator: _____________________________________________________________

Evaluation Date: __________________________________________________________________

NOTE: Circle applicable items, and provide comments and site sketch. Use back of forms or attach additional sheets as required.

A. Surface Deformation Features

Number of Surface Deformation Features  

Crack Patterns and Dips in Roadway

Damaged or Displaced Drainage Structures

Effects on Bridges, Structures, Poles, Culverts, etc.

Unusual Vegetation

Drag Patches

Dips in Guard Rail

Dips in Flowline of Ditches

Low Spots Holding Water

Ponds (unusual water formations on surface, impoundments)
B. Evidence of Past Mining Activities

Mine Openings

Mine Structures (ruins/foundations of tipples, fan houses, scale houses, wash houses, etc.)

Gob Piles

Strip Pits

Railroad Spurs

Orange water/seeps/springs

C. Mining and Geologic Information

- Record Type and Apparent Minimum Overburden Thickness to Top of Mined Interval (if visible).
  - Estimate as one of the following:
    
    < 25'  25' - 50'  50' - 100'  > 100'

- Record Maximum Mined Interval (seam(s)) Thickness, if outcrop is observable in site vicinity.
  
  >6'  3' - 6'  0' - 3'

- Record Mine Opening Information:
  - Type(s) and Number(s) of Mine Opening(s).
    Types include: Drift (Horizontal), Slope, and Shaft (Vertical)

    Drift (Horizontal)_________Slope_________Shaft (Vertical)_________

- Mine Opening Location(s) Relative to Roadway:

<table>
<thead>
<tr>
<th>Location</th>
<th>Less Than</th>
<th>Between</th>
<th>Within</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Conclusively Known</td>
<td>Between The 50 Feet</td>
<td>Between 50' and 100'</td>
<td>Within Sight</td>
</tr>
<tr>
<td></td>
<td>Two Outer- From</td>
<td>From</td>
<td>From</td>
</tr>
<tr>
<td></td>
<td>Most Edge of Shoulder</td>
<td>Edge of Shoulder</td>
<td>Edge of Shoulder</td>
</tr>
<tr>
<td></td>
<td>Shoulders</td>
<td>Shoulder</td>
<td>Shoulder</td>
</tr>
</tbody>
</table>

- Method of Mine Opening Closure, if Observable.

<table>
<thead>
<tr>
<th>No Information</th>
<th>Timber Decking</th>
<th>Random Backfill</th>
<th>Concrete Cap</th>
<th>Controlled Backfill</th>
</tr>
</thead>
</table>

- Type of Mine Opening Cribbing, if Observable

<table>
<thead>
<tr>
<th>No Information</th>
<th>Timbers</th>
<th>Brick</th>
<th>Concrete</th>
</tr>
</thead>
</table>
- Plan Area of Mine Opening(s), if observable and safe to measure.

<table>
<thead>
<tr>
<th>Size</th>
<th>From &gt;750 S. F.</th>
<th>From 500 to 750 S. F.</th>
<th>From 250 to 500 S. F.</th>
<th>From 150 to 250 S. F.</th>
<th>From &lt;150 S. F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Record Field Observations of any other unique site features and describe the general site setting.

- Record information provided by Local Contacts (if any), including any Information about secondary mining or problems reported during mining.

**D. Roadway Information:**

- Record Structures in the Roadway.
  - Note type and condition of structure(s), including materials used in their construction.

  YES       NO

- Record Posted Speed Limit within the Site Limits

- Record Evidence that the Mine is not under the Roadway or R/W.

**E. Create Site Sketch**

**F. Take Photographs**

- Reference the Camera Position if Possible.

- Photograph Multiple Angles of Significant Features.
Ohio Department of Transportation
Abandoned Underground Mine Inventory and Risk Assessment
Detailed Surface Deformation Site Evaluation

C/R/S _____________________________________________________ GHMS Site No.: _________________________________

Site Description: ____________________________________________________________________________________________
_____________________________________________________________________________________________________

O.D.N.R., DGS Individual Abandoned Underground Mine Map Index No. (If known.): ________________________________________________

Name of Site Evaluator: ______________________________________________ Evaluation Date: _______________________

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Weighting Factor</th>
<th>Site Condition / Rating Value</th>
<th>Individual Criterion Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Subsidence Features on Site</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Average Daily Traffic (ADT)</td>
<td>10</td>
<td>&gt;30K</td>
<td></td>
</tr>
<tr>
<td>Average Daily Truck Traffic (ADTT)</td>
<td>9</td>
<td>&gt;10K</td>
<td></td>
</tr>
</tbody>
</table>
### Detailed Surface Deformation Site Evaluation Rating:

#### COMMENTS (Attach additional sheets if necessary):

01/01/2018
Ohio Department of Transportation

Abandoned Underground Mine Inventory and Risk Assessment

Detailed Vertical Shaft Site Evaluation

C/R/S __________________________________________________________________________

GHMS Site No.: _________________________________________________

Site Description: ________________________________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________________________________
O.D.N.R.,DGS Individual Abandoned Underground Mine Map Index No. (If known.): ______________________________________________________________________________

Name of Site Evaluator: ______________________________________
Evaluation Date: __________________________________________________

<table>
<thead>
<tr>
<th>Criterion Weighting Factor</th>
<th>Site Condition / Rating Value</th>
<th>Individual Criterion Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion</td>
<td>No Information</td>
<td>Timber Decking</td>
</tr>
<tr>
<td>1) Method of Vertical Shaft Closure (NOTE: For Multiple Vertical Shafts See Implementation Manual)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2) Type of Side Cribbing (NOTE: For Multiple Vertical Shafts and/or Multiple Forms of Cribbing See Implementation Manual)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>&gt;30K</td>
<td>20K to 30K</td>
</tr>
<tr>
<td>----------------</td>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>3) Average Daily Traffic (ADT)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4) Average Daily Truck Traffic (ADTT)</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>&gt;6K</td>
<td>4K to 6K</td>
</tr>
<tr>
<td>5) Vertical Shaft Location</td>
<td>Location</td>
<td>Between The</td>
</tr>
<tr>
<td></td>
<td>Not</td>
<td>Two Outer-Most Edge of</td>
</tr>
<tr>
<td></td>
<td>Conclusively</td>
<td>Known</td>
</tr>
<tr>
<td></td>
<td>Known</td>
<td>Shoulders</td>
</tr>
<tr>
<td>6) Structures in Roadway</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>7) Traffic Speed</td>
<td>≥ 60 MPH</td>
<td>≥ 40 mph to ≤ 55 mph</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>8) Plan Area of Vertical Shaft (Approx.)</td>
<td>&gt;750</td>
<td>From</td>
</tr>
<tr>
<td>(NOTE: For Multiple Vertical Shafts)</td>
<td>Sq. Ft.</td>
<td>500 to 750</td>
</tr>
<tr>
<td>(See Implementation Manual)</td>
<td>Sq. Ft.</td>
<td>Sq. Ft.</td>
</tr>
<tr>
<td></td>
<td>&gt;1900</td>
<td>Unknown</td>
</tr>
<tr>
<td>9) Age of Mining</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

**Detailed Mine Opening Site Evaluation Rating:**
Ohio Department of Transportation  
Abandoned Underground Mine Inventory and Risk Assessment  
Detailed Mine Opening Site Evaluation

C/R/S __________________________________________________________________________  GHMS Site No.: _________________________________________________

Site Description: ________________________________________________________________________________________________________________________________________  
________________________________________________________________________________________________________________________________________________________

O.D.N.R., DGS Individual Abandoned Underground Mine Map Index No. (If known.): _________________________________________________

Name of Site Evaluator: ______________________________________  
Evaluation Date: __________________________________________________

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Weighting Factor</th>
<th>Site Condition / Rating Value</th>
<th>Individual Criterion Rating</th>
</tr>
</thead>
</table>
| 1) Method of Mine Closure  
( NOTE: For Multiple Mine Openings See Implementation Manual) | No Information  
Timber Decking  
Random Backfill  
Concrete Cap  
Controlled Backfill | 10  
10  
6  
4  
2 | |
| 2) Type of Cribbing  
( NOTE: For Multiple Mine Openings and/or Multiple Forms of Cribbing See Implementation Manual) | No Information  
Timbers  
Brick  
Concrete | 10  
10  
7  
4 | |
### 3) Average Daily Traffic (ADT)

<table>
<thead>
<tr>
<th>ADT</th>
<th>&gt;30K</th>
<th>20K to 30K</th>
<th>10K to 20K</th>
<th>5K to 10K</th>
<th>&lt; 5K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

### 4) Average Daily Truck Traffic (ADTT)

<table>
<thead>
<tr>
<th>ADTT</th>
<th>&gt;6K</th>
<th>4K to 6K</th>
<th>2K to 4K</th>
<th>1K to 2K</th>
<th>&lt; 1K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

### 5) Mine Opening Location

- **Location**
  - Not Conclusively Known
  - Between The Two Outer-Most Edge of Shoulders
- **Distance**
  - Less Than 50 Feet
  - Between 50' and 100'
  - Within Sight

### 6) Minimum Overburden above Mine Opening

<table>
<thead>
<tr>
<th>Overburden</th>
<th>&gt;100'</th>
<th>50' - 100'</th>
<th>25' - 50'</th>
<th>&lt; 25'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>8</td>
<td>5</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

### 7) Structures in Roadway

<table>
<thead>
<tr>
<th>Structures</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

### 8) Traffic Speed

<table>
<thead>
<tr>
<th>Speed</th>
<th>≥ 60 MPH</th>
<th>≥ 40 mph to ≤ 55 mph</th>
<th>≤ 35 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

### 9) Type of Mine Opening

- **Slope/Drift**
- **Horizontal**

### Additional Notes
- **NOTES:** For Multiple Mine Openings Known
- See Implementation Manual
10) Plan Area of Mine Opening (Approx.)
   (NOTE: For Multiple Mine Openings)
   See Implementation Manual)

<table>
<thead>
<tr>
<th>Mine Opening Size</th>
<th>150 to 250 Sq. Ft.</th>
<th>From</th>
<th>250 to 500 Sq. Ft.</th>
<th>From</th>
<th>500 to 750 Sq. Ft.</th>
<th>From</th>
<th>&gt;750 Sq. Ft.</th>
<th>From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Unknown</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11) Age of Mining

<table>
<thead>
<tr>
<th>Age Range</th>
<th>1946-1968</th>
<th>&gt; 1968</th>
<th>1931-1945</th>
<th>1900-1930</th>
<th>Unknown</th>
<th>&lt;1900, or Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>10</td>
<td>9</td>
<td>6</td>
<td>10</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**Detailed Mine Opening Site Evaluation Rating:**

**COMMENTS (Attach additional sheets if necessary):**

01/01/2018