MSHA HANDBOOK SERIES

ROOF CONTROL PLAN APPROVAL AND REVIEW PROCEDURES: APPENDICES

UBB Internal Review

"The Administrator should direct that a Roof Control Plan Approval handbook be developed to consolidate the numerous PILs, PIBs, and CMS&H memoranda. This will provide plan reviewers with a discrete set of guidelines and instructions for evaluating and processing roof control plans."

Appendices To Handbook

- Incorporates and supersedes PIBs, PILs, PPLs, and HQ memos for policy guidance.
- Provide background technical information for all aspects of plan evaluation.
- All are readily accessible electronically.

Appendices: Guidance for Plan Reviewers

B. Checklists for Use in Plan Reviews

C. Approval of Complex and/or Non-Typical Roof Control Plans and Revisions

D. Guidelines for Conducting Pillar Stability Analyses

Appendices: Guidance for Plan Reviewers

I. Guidelines for Evaluating a Mine's Historical Record (roof falls, injuries, bursts, accident reports, citations, and past review forms)

J. Underground Inspections For Roof Control Plan Approvals and Reviews

Appendices: Background Material

E. Precautions for the Use of the NIOSH Pillar Analysis Computer Programs

F. General Guidelines for the Use of Numerical Modeling to Evaluate Ground Control Aspects of Proposed Coal Mining Plans

G. Pillar Recovery Design, Technologies, and Procedures in Roof Control Plan Reviews

K. Tensioned Cable Bolts

Appendices: Background Material

L. Best Practices for Turning Crosscuts with Remote Controlled Continuous Mining Machines

M. Use of Mobile Roof Supports for Retreat Mining

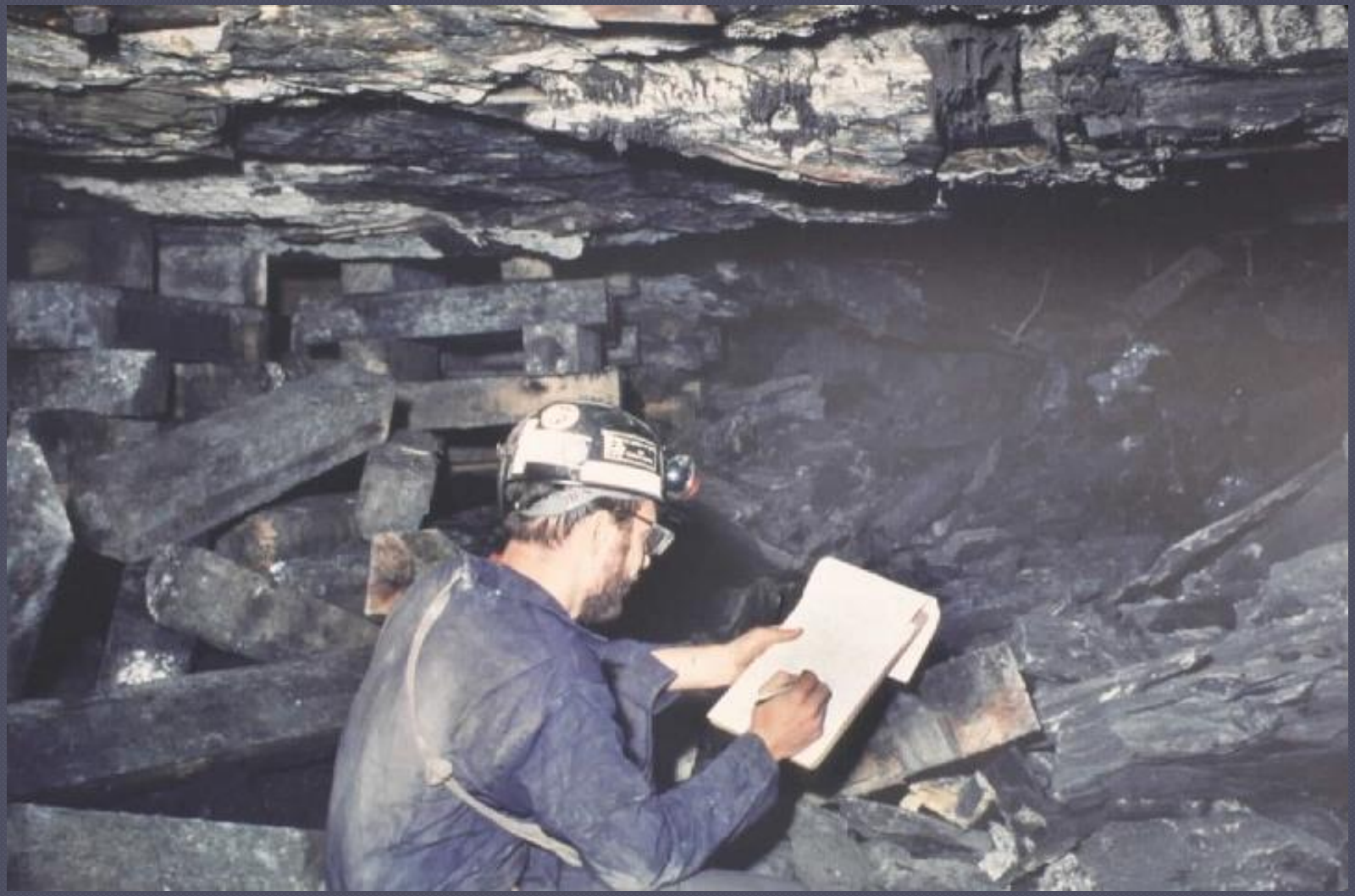
O. Protecting Miners from Hazards Related to Rib Falls

Appendices: Background Material (NEW)

H. Guidelines for Geotechnical Assessments Prior to Retreat Mining

N. Essential Elements of a Roof Fall Accident Investigation

Checklists



Revised Checklists

- Help ensure that all required information is submitted
- Include regulatory requirements, safety precautions and best practices
- Provide documentation explaining the rationale behind the approval of roof control plans.

Revised Checklists

Checklists contain three types of items:

- Mandatory standards
- Items that should be addressed in the plan on a mine-by-mine basis
- Suggested plan language (to be considered on a mine-by-mine basis)

Only those checklists that are appropriate to a given review need be completed. Items that are not applicable may be marked N/A.

Checklist Topics

- Active Mine Plan Review Preliminary Items
- New Mine Openings
- General Plan Information
- Mine Layout
- Roof Support (General)
- Tensioned Roof Bolts
- Resin Grouted Roof Bolts

Checklist Topics

- Supplemental Support
- Mining Equipment
- Extended Cuts
- Pillar Retreat Mining
- Mobile Roof Supports
- Longwall Mining (new)

New Checklist Topic: Longwall Mining

Mandatory Standards

- **30 CFR 75.215 (a) and (b)** requires that the roof control plan specify "[t]he methods that will be used to maintain a safe travelway out of the section through the tailgate side of the longwall," and"[t]he procedures that will be followed if a ground failure prevents travel out of the section through the tailgate side of the longwall."

New Checklist Topic: Longwall Mining

In addition, the following items should be addressed in the roof control plan on a mine by-mine basis:

- Specify the support installation sequences and the supplemental supports to be used in the:
  - setup room,
  - recovery room,
  - adjoining crosscuts, and
  - notches mined for conveyor drives and other equipment.

New Checklist Topic: Longwall Mining

- Specify the maximum widths of the setup and recovery rooms.

- Specify the procedures that will be used during longwall face recovery, including:
  - Meshing prior to the recovery point
  - Shield recovery
  - Safety precautions for wire ropes, slings, chains, fastenings, fittings, and attachments

New Checklist Topic: Longwall Mining

- Specify procedures to be used when a shield cannot be pressurized against the mine roof due to cavities. It should also specify procedures to be used when a shield cannot be pressurized against the mine roof due to hydraulic or other problems.

- Specify safety precautions for using internal controls to advance and reposition shields.

New Checklist Topic: Longwall Mining

A geological assessment of the headgate and tailgate entries should be conducted prior to longwall mining, to include (a) a review of past experience and geological data, and (b) underground mapping of geologic features, existing ground conditions, roof support installed, and unusual mining dimensions. The assessment should result in a hazard map that identifies actions to be taken prior to during longwall mining, such as monitoring more closely or installing extra support.

Complex and/or Non-Typical Roof Control Plans

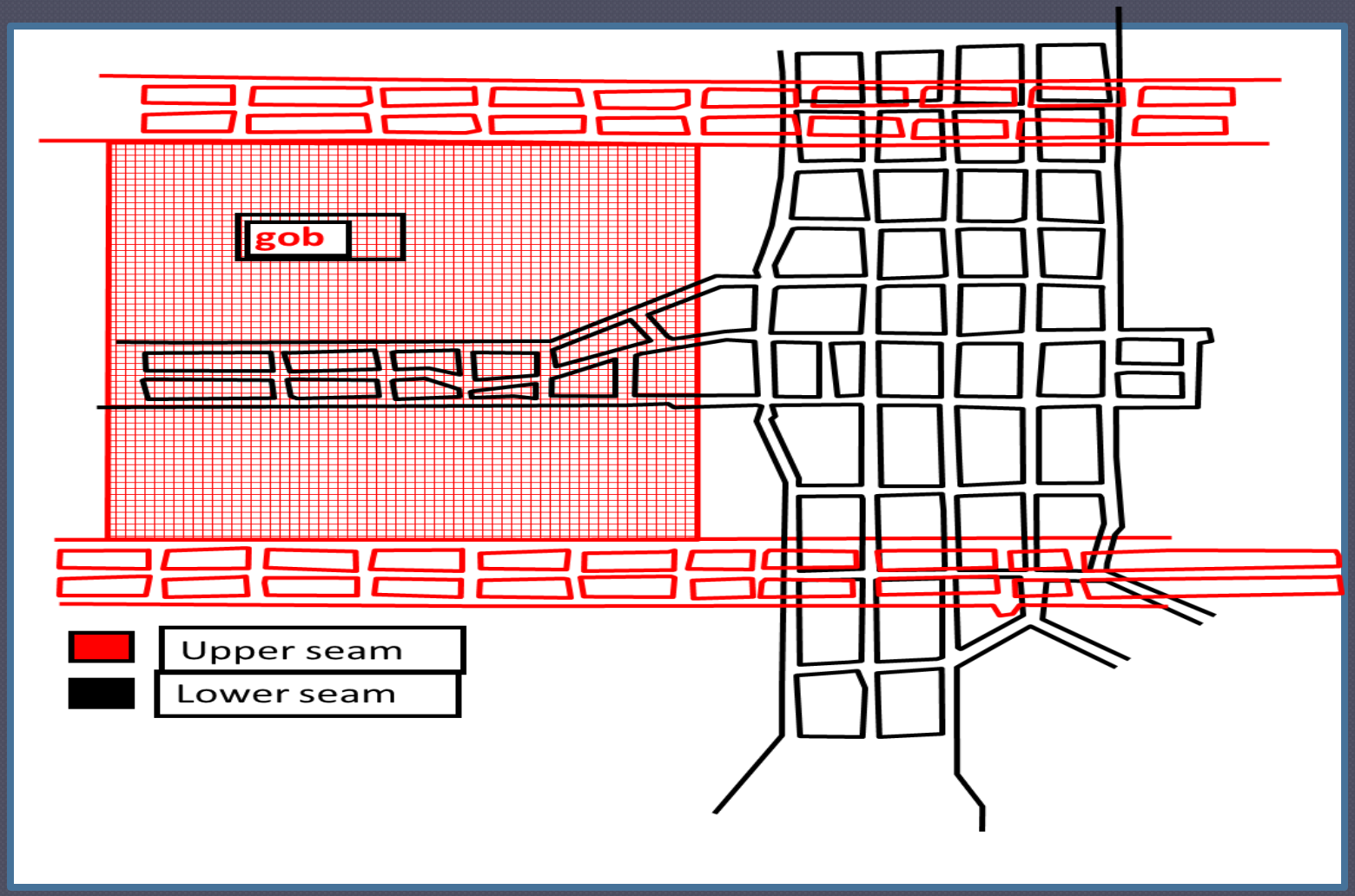
Complex and/or Non-Typical Roof Control Plans

- Room and pillar retreat mining at overburden depths of 1,000 feet or greater.
- Design criteria that do not meet or exceed the stability factors calculated using one of the three NIOSH software programs, or do not meet or exceed minimum safety criteria for other computer models used.
- Mines with a history of bounces or bumps, regardless of the amount of overburden cover.
- Other criteria considered unusual by the District Manager.

Complex and/or Non-Typical Roof Control Plans

- The assistance of MSHA's Technical Support Roof Control Division should be sought and their recommendations considered in all complex or non-typical plan approvals and revisions.
- The District Manager should not approve the proposed plan or revision until the operator has provided the data and evaluation supporting the proposal and MSHA has completed a confirming evaluation.

GUIDELINES FOR CONDUCTING PILLAR STABILITY ANALYSES



30 CFR 75.203 (a)

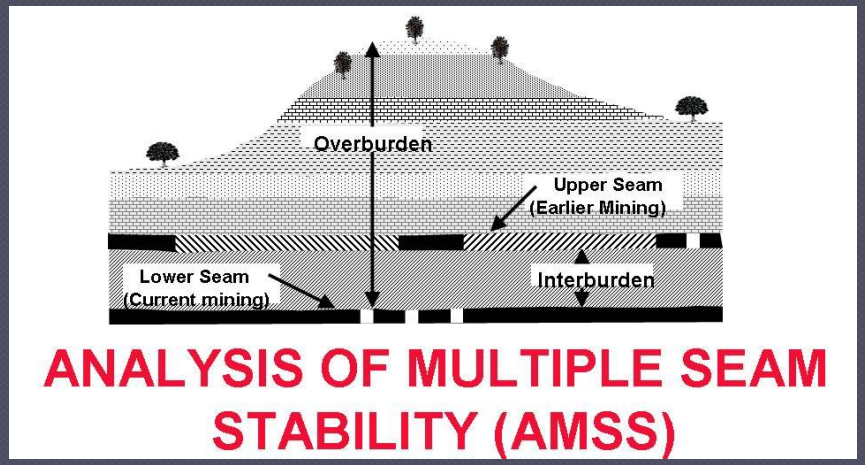
"Pillar dimensions shall be compatible with effective control of the roof, face and ribs and coal or rock bursts."

To comply with this standard, the retreat mining portion of the roof control plan submittal should include an engineering design and supporting analysis. The analysis method is at the discretion of the mine operator.

Submitted roof control plans should include:

- The pillar design analysis method used,
- The calculated pillar stability factors (SF),
- A pillar design that meets or exceeds the generally accepted design criteria, or
- Meets mine-specific design criteria that is supported by sufficient documentation and mining history.

NIOSH Pillar Design Software



NIOSH Pillar Design Software

- ARMPS is used for any development mining, retreat mining, and most bleeder pillar analyses.
- ALPS is used only for the tailgate corner of longwall panels.
- AMSS is for multiple seam interactions, and it incorporates ARMPS and ALPS evaluations.
- Other pillar analysis programs…call Technical Support.

Review Operator's Analyses

- To check that an analysis submitted by an operator was conducted properly, it may only be necessary to ensure that the proper input data was employed.

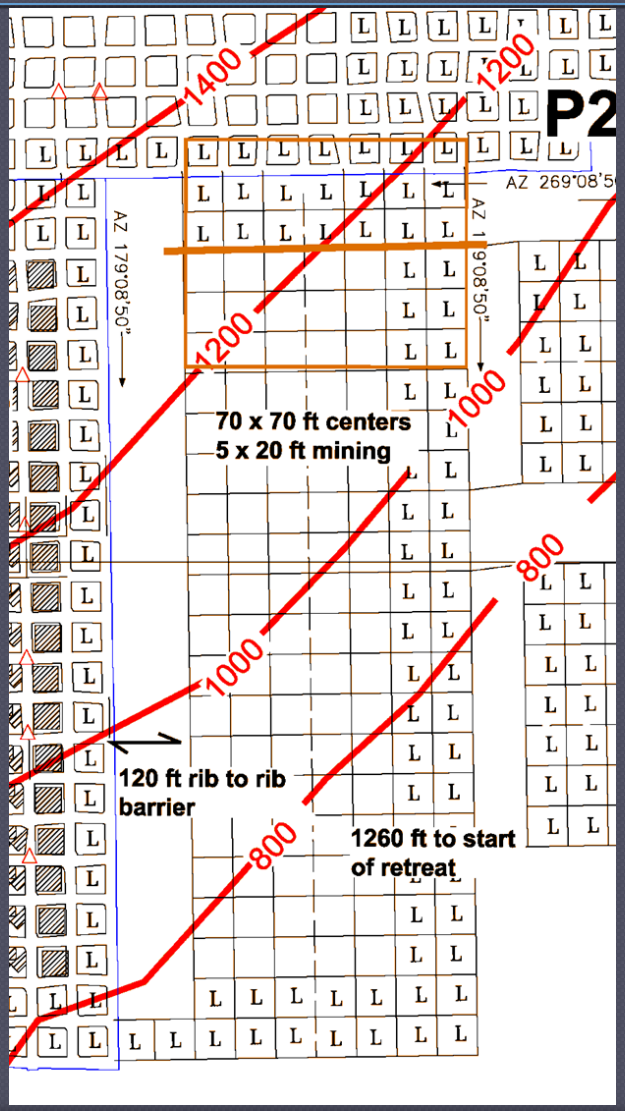
- If a previous analysis shows that a satisfactory stability factor was obtained where the depth of cover was greater than it is now, and no other parameters have changed significantly, then MSHA need not conduct a new analysis.

Look for the lowest SF ("most severe conditions")

- Deepest cover
- Greatest mining height
- Smaller pillars
- Greatest abutment loads
- Thinnest interburden
- Isolated remnant pillars

Often, the Reviewer should select several sites to analyze because it may not be immediately evident which condition is the "most severe."

Check Input Data: Mining projections on mine maps



- Mine map should include depth of cover contours
- Mining projections show pillar dimensions, ARMPS loading condition, barrier pillar widths, the type of remnant pillar, gob dimensions, and other such parameters.

Check Input Data: Mining projections on mine maps

Use 30 CFR 75.372 ventilation map, the 30 CFR 75.1200 mine map, or other documented sources. If necessary, the District Manager should exercise his authority under 30 CFR 75.1203 to require an operator to furnish a current 30 CFR 75.1200 mine map with mining projections and depth of cover contours.

Check Input Data: Mining height

- Inspectors' notes can be a very valuable source of data, since the "total mining height" should be measured at the site of each air reading.
- "Coal sections" from mine map that provide information on the thicknesses of the coal and rock layers mined underground.

Check Input Data: Mining height

The ARMPS Help file provides guidance determining the input mining height when rock is mined with the coal. Also, it is normally appropriate to input the *average* mining height over the area to be analyzed.

Evaluation

- If MSHA's analysis of mining projections indicates that the calculated SF do not meet the NIOSH design criteria, then the results of the analysis should be discussed with the operator.
- If the operator subsequently proposes changed mining projections, then MSHA should analyze those new projections.
- If the operator does not propose new projections, then the procedures for "Complex and/or Non-Typical Roof Control Plans and Addendums," should be followed.

Documentation

Documentation of pillar stability analyses should be maintained by:

- Printing the output file and including it in the mine file,
- Saving the input file to a network drive,
- Entering the information into a spreadsheet, or
- Some other method.

Documentation

If MSHA conducted a pillar stability analysis concurrently with the review of the ventilation plan at any time during the six months prior to the roof control plan review, then it is not necessary to conduct another analysis, but in every case the results of the pillar stability analysis should be documented.

UNDERGROUND INSPECTIONS FOR SIX-MONTH PLAN REVIEWS

UNDERGROUND INSPECTIONS FOR SIX-MONTH PLAN REVIEWS

A thorough underground safety inspection is normally an essential part of the six-month roof control plan review. The inspection is designed to evaluate the effectiveness of a proposed or approved plan, and to ascertain compliance with an approved plan. This inspection may be a limited inspection (E20) or it may be conducted as part of a regular inspection (E01).

Pre-Inspection Conference Discussion Items

- The accident and injury experience at the mine.
- The roof control violation history.
- Preshift and on-shift examinations.
- Roof control plan content and revisions since the last review, if any.

Pre-Inspection Conference Discussion Items

- Roof and rib conditions.
- Issues with current support systems.
- Training issues.

Current mine maps on which roof falls are plotted should be reviewed. In addition, the plan should be discussed with a representative of the miners.

Where to Inspect

At least one section that is representative of each of the different mining systems used at the mine should be inspected:

- CM section on advance
- CM section on retreat
- Longwall section

The inspection should focus on those sections known to have adverse roof conditions or a recent history of roof and rib falls, both injury and non-injury.

Underground Inspections

- Evaluate compliance with MSHA's standards and with any approved roof control plan.
- Evaluate the suitability of the plan to the prevailing geological conditions and the mining method in use.
- Conditions at critical areas (such as longwall tailgates, pillar retreat sections, and long-term entries) are particularly important.

Underground Inspections: Items to Check

Roof conditions and the adequacy of roof support, including skin control.

Underground Inspections: Items to Check

- Rib conditions and the adequacy of rib support.
- Opening dimensions, including entry heights, entry widths, and intersection diagonals as applicable.
- Sequence of advance mining.
- Sequence of retreat mining and dimensions of final stumps.

Underground Inspections: Items to Check

- Mobile Roof Support operation.
- Longwall support system.
- Roof bolting pattern.
- Supplemental roof support materials.
- ATRS and canopies.

Underground Inspections: Roof Bolting Items to Check

- Roof bolt assemblies.
- Material specifications.
- Installation sequence.
- Resin bolt installation practice.
- Torque on tensioned bolts.

Discussions with Miners

The MSHA CMI should discuss and question miners on current mining activities and conditions, and ask them questions to determine their understanding of the existing roof control plan protections.

Discussions with Miners: Roof Bolters

Does the mine's roof control plan address:

- Soft layers or cracks while drilling the roof,
- Bolts that don't anchor properly, or
- Groundwater dripping or running out of holes during bolt installation

If not, should it?

Does the plan provide skin control and protect them from loose rocks?

Discussions with Miners: Training

Ensure that training with respect to the roof control plans is completed and adequate, focusing especially on training involving retreat mining activities.

Guidelines For Evaluating A Mine's Historical Record

Guidelines For Evaluating A Mine's Historical Record

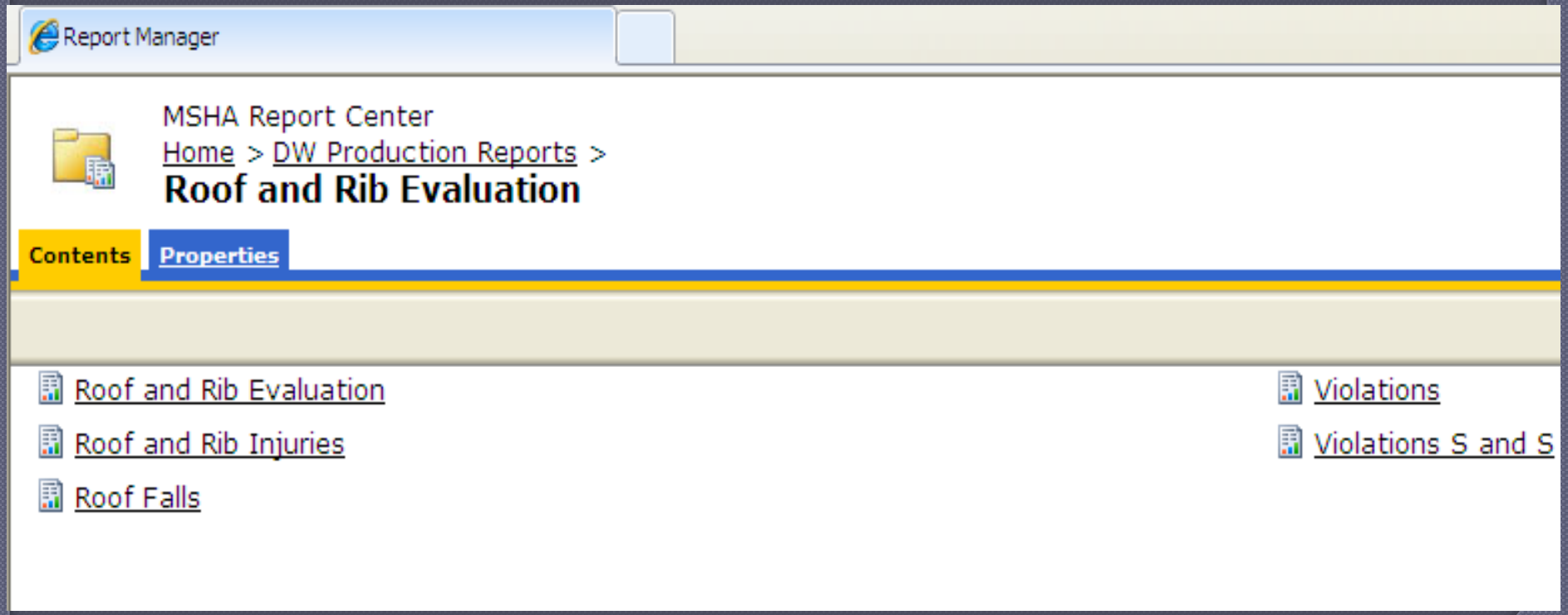
MSHA standard **30 CFR 75.223 (d)** requires that the six-month review "shall take into consideration any falls of the roof, face and ribs and the adequacy of the support systems used at the time."

Historical Record: Elements to be Considered

- Roof falls,
- Injuries,
- Bursts,
- Accident reports,
- Citations, and
- Past review forms

Guidelines for Evaluating a Mine's Historical Record

"Roof Rib Evaluation Report Manager" is available on the MSHA Intranet.



http://mshanet.msha.gov/

MSHA Intranet Home Page

MSHA.GOV | PROGRAM AREAS | FAQ'S | TOOLS | RULES/REGS | 30 CFR | PIBS/PILS/PPM | OTHER WEBSITES | PHONE INFO | RESOURCES

MSHAnet

The Intranet Site for the Employees of MSHA

mshanet.msha.gov

Search MSHAnet | Search | * Advanced Searching Options *

Quick Links

- Fatality Information
- Local Emergency Info. Includes OEP and SIP
- Mine Emergency Ops.
- Newsclips
- Part 50 Reports
- What's New

Program Area Home Pages

- Assistant Secretary
- A&M
- Assessments
- Coal
- EPD
- Metal/Nonmetal
- OSRV
- PEIR
- Technical Support

General Information

- Office of Employee Safety and Health
- General Reference
- Inspector IDP Plans
- Information Security Office
- ITC Data Warehouse
- Job Task Analysis (JTAs)
- Monthly Data Reports
- MSHA-Related Acronyms
- MSHA WorX Forms
- MSIS/Common Platform
- Bi-Query Data Dictionary
- Web Coordinators

Labor-Management Relations

- **Executive Order 13522 of December 9, 2009**
  Creating Labor-Management

News Items and Hot Topics

MSHA at Work - January 2014

A newsletter for and about you, the employee.

- *Current Issue* -

- *Archives* -

HR Works

HRWORKS People Make it Work.

Announcing the new DOL Time &Attendance and HR System - HR Works

Goodbye PeopleTime... Hello webTA! So Long PeoplePower... Hello HR Connect! DOL's migration to these new HR systems is only one month away! To ensure that you are fully prepared for Go Live in February, get to know the systems by reviewing fact sheets, job aids, information about web-based training, and a schedule of upcoming webinars on our LaborNet site: http://www.labornet.dol.gov/me/hrworks

Find Out the Top 10 Things You Need to Know About HR Works!
*The countdown is on for the launch of DOL's new HR systems during Pay Period 3 (February 9 - 22, 2014). Join an upcoming webinar to learn more about each system as well as the training opportunities available for you. Each session will last approximately one hour. Register for the date and time that works best for you using **this link**.*

Current Date

Tuesday, February 4, 2014

Employee Resources

- PeopleTime Login
- Benefits Corner
- Learning Link
- National Finance Center
- Thrift Savings Plan
- DOL/MSHA Jobs

DOL Resources

- Autos
- DOL RegionNet
- eCPIC
- E-Procurement (EPS)
- E-Travel (E^2 Solutions)
- E-Property
- Labornet
- Labornet Blogs
- NCFMS
- Official Personnel Folder (e-OPF)
- SHIMS
- SIMS
- WebPARS
- Wirtz Labor Library

MSHA Resources

- Academy Training Reporting Center
- Application Monitoring
- Centralized IT Project
- Contractor Database
- Directives
- Ethics Home Page
- FAQ's
- Forms
- FRRS
- IPAL
- IT Help Desk
- MSHA Academy
- MSHA Employee Locator
- MSHA Library
- MSHA Report Center
- MSHA Security Branch
- MSIS

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2/4/2014

http://lakweb2/Reports/Pages/Folder.aspx

Home - Report Manager

MSHA Reporting Services

Home

Report Builder | Folder Settings

DW Production Reports

DW Test Reports

Mine Profile

OAASEI
Office of Assessments, A

Statistical Reports

http://lakweb2/Reports/Pages/Folder.aspx?ItemPath=%2fDW+Production+Reports&ViewM

DW Production Reports - R...

Home

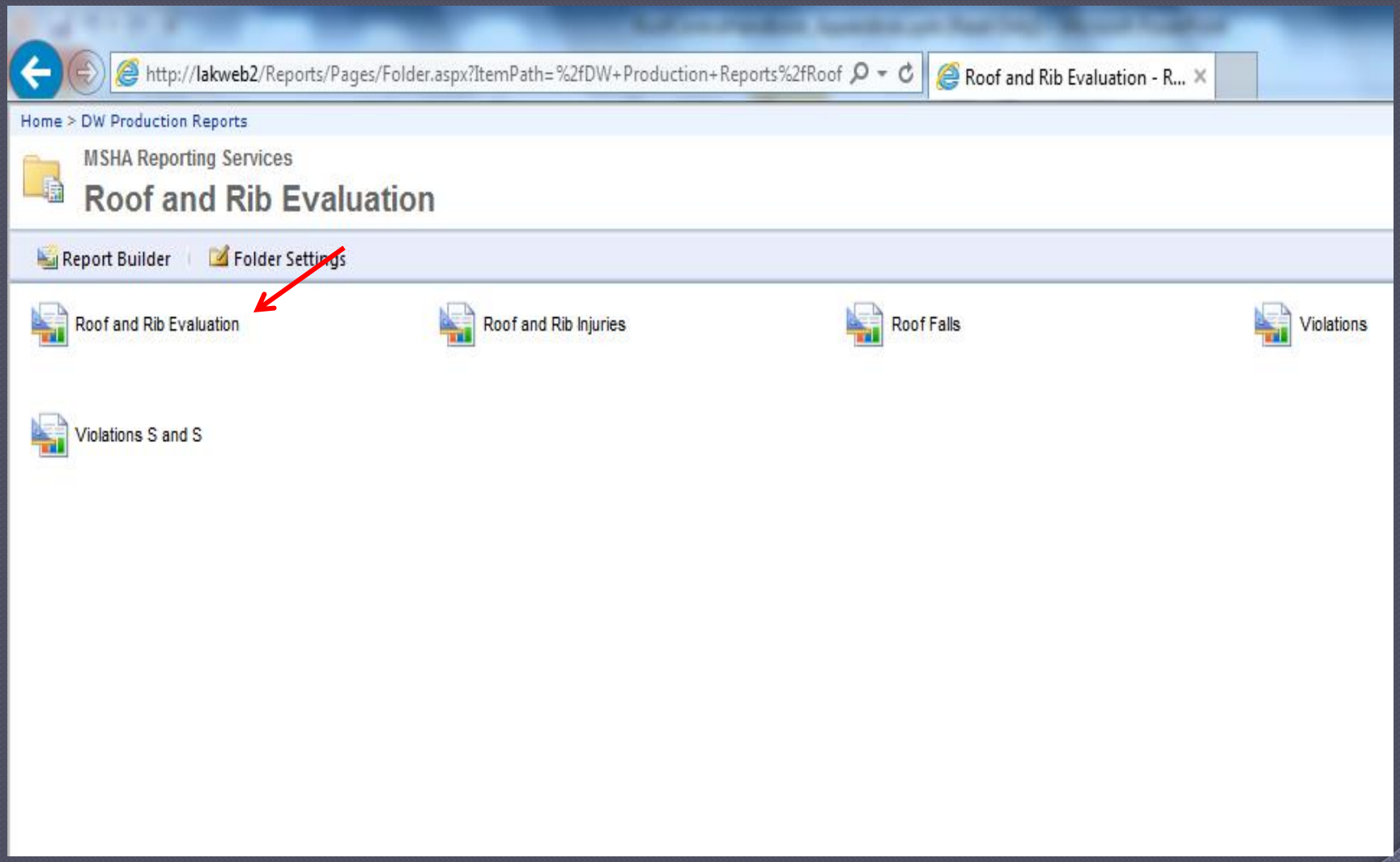
MSHA Reporting Services

DW Production Reports

Report Builder | Folder Settings

- Contested Case Backlog
- Enforcement
- GPRA Reports
- Instructor Monitore
- Issuance Details
- Methane Liberation
- Mine Plan Approval
- MMU Reports
- Part 50 Reports
- POV
- Roof and Rib Evaluation
- Samples
- Special Investigations
- Technical Support

Historical Record: Report Manager Overview



Historical Record: Report Manager Overview

Roof and Rib Evaluation

Mine Id: 1102632

Operator: Springfield Coal Company LLC

Mine Name: Crown III Mine

Report Date: 1/22/2014

	Number of Incidents		Mine Rates		District Rates		National Rates	
	6 Months	2 Years	Last 2 Qtrs	Last 4 Qtrs	Last 2 Qtrs	Last 4 Qtrs	Last 2 Qtrs	Last 4 Qtrs
Roof Injuries	1	6	2.33	2.79	0.47	0.62	0.41	0.46
Rib Injuries	0	0						
Roof Falls (non injury)	0	17	0	1.12	0.91	0.83	0.61	0.67
Violations (all Subpart C)	14	94	9.32	12.82	3.28	4.35	5.24	6.88
Violations (S&S Subpart C)	6	47	5.83	6.13	1.06	1.49	2.95	3.90

Roof/Rib fatal injuries at mine since 1995: 0

Customize Data Parameters

Incidents		Rates	Year	Qtr
Start_Date		Beginning		
End_Date		Ending		

Data Parameters

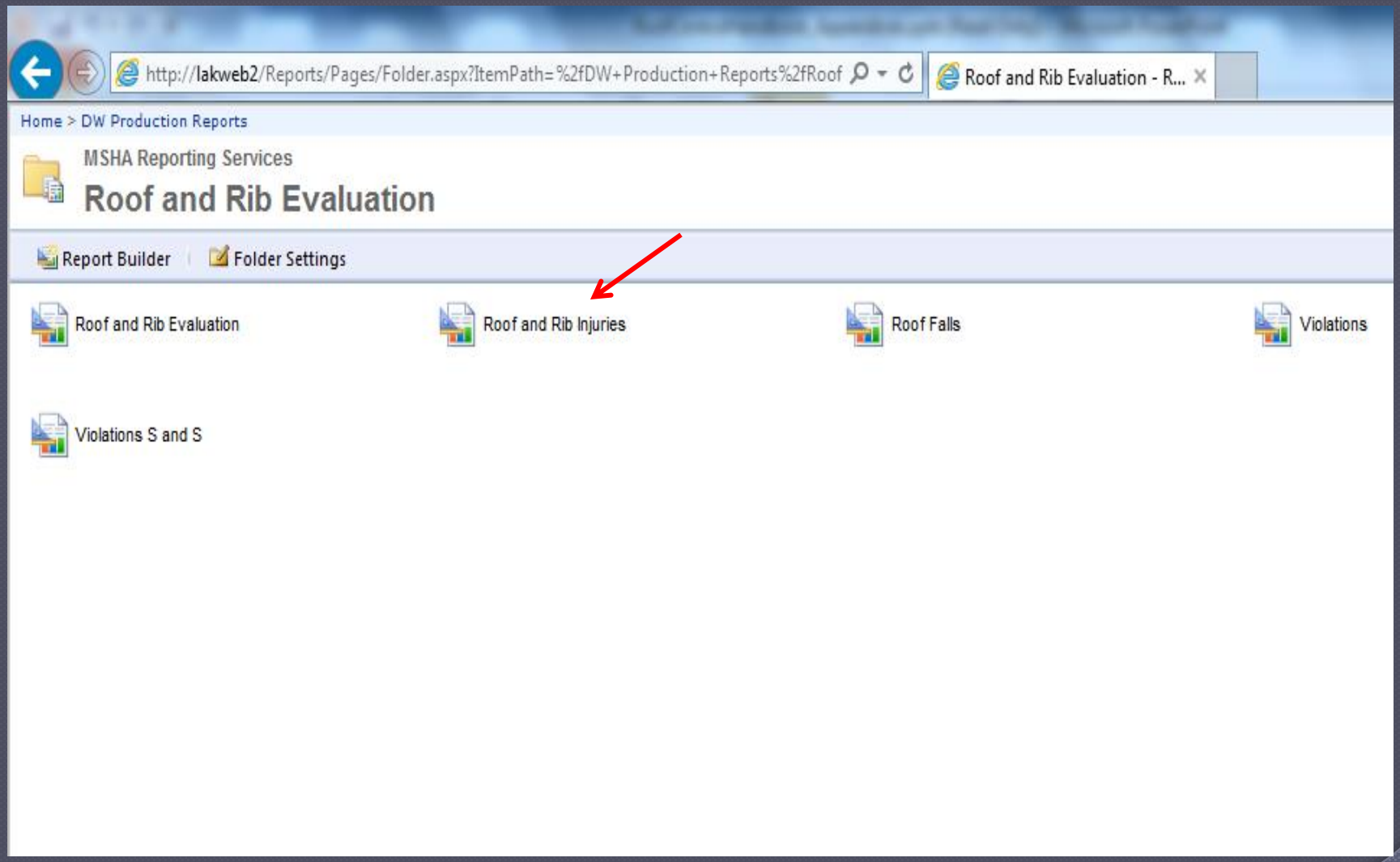
6 Months:	07/22/2013	to	01/21/2014
2 Years:	01/22/2012	to	01/21/2014
Last 2 Qtrs:	07/01/2013	to	12/31/2013
Last 4 Qtrs:	01/01/2013	to	12/31/2013

Historical Record: Report Manager Overview

The **injury rates** (number of roof fall injuries per 200,000 hours worked) are important because a large mine that has had several injuries may actually be safer than a smaller one with fewer injuries. The injury rate should be compared to the national and District rates.

It should be noted, however, that injury rates are less meaningful for small mines. For example, a small mine that experiences one injury in a decade will seem to have a very high rate in the year when the injury occurs, but it will have a zero rate during the other 9 years.

Historical Record: Roof and Rib Injuries



Historical Record: Roof and Rib Injuries

Roof Control Accident 2 Years History, 1/22/2012 to 1/21/2014

Mine Id: **1102632**

Operator: **Springfield Coal Company LLC**

Mine Name: **Crown III Mine**

Report Date

1/22/2014

Degree 03, DAYS AWAY FROM WORK ONLY

Doc Number: **220130450021**

Accident Date: **2/8/2013**

Classification: **07 - FALL OF ROOF OR BACK**

Type: **STRUCK BY FALLING OBJECT**

Inj Source: **CAVING ROCK,COAL,ORE,WSTE**

Location: **FACE**

Days Restrict:

Days Lost: **7**

Ret to Work: **2/18/2013**

WHILE ATTEMPTING TO BOLT #4 ENTRY A BROW BROKE LOOSE STRIKING EE ON THE HEAD AND NECK.

Historical Record: Roof and Rib Injuries

- The **severity** of these injuries, including the body part injured and number of days lost. This information is normally available in the narrative for the accident.
- The **location in the mine and worker activity.** The goal is to determine whether the injury occurred primarily in the face area or outby, and whether a particular activity (such as roof bolting) is likely to cause injury.

Historical Record: Roof and Rib Injuries

When the accident and injury experience at the mine indicates that the plan is inadequate, MSHA's standard at 30 CFR 75.223 (a) requires that "[r]evisions of the roof control plan shall be proposed by the operator."

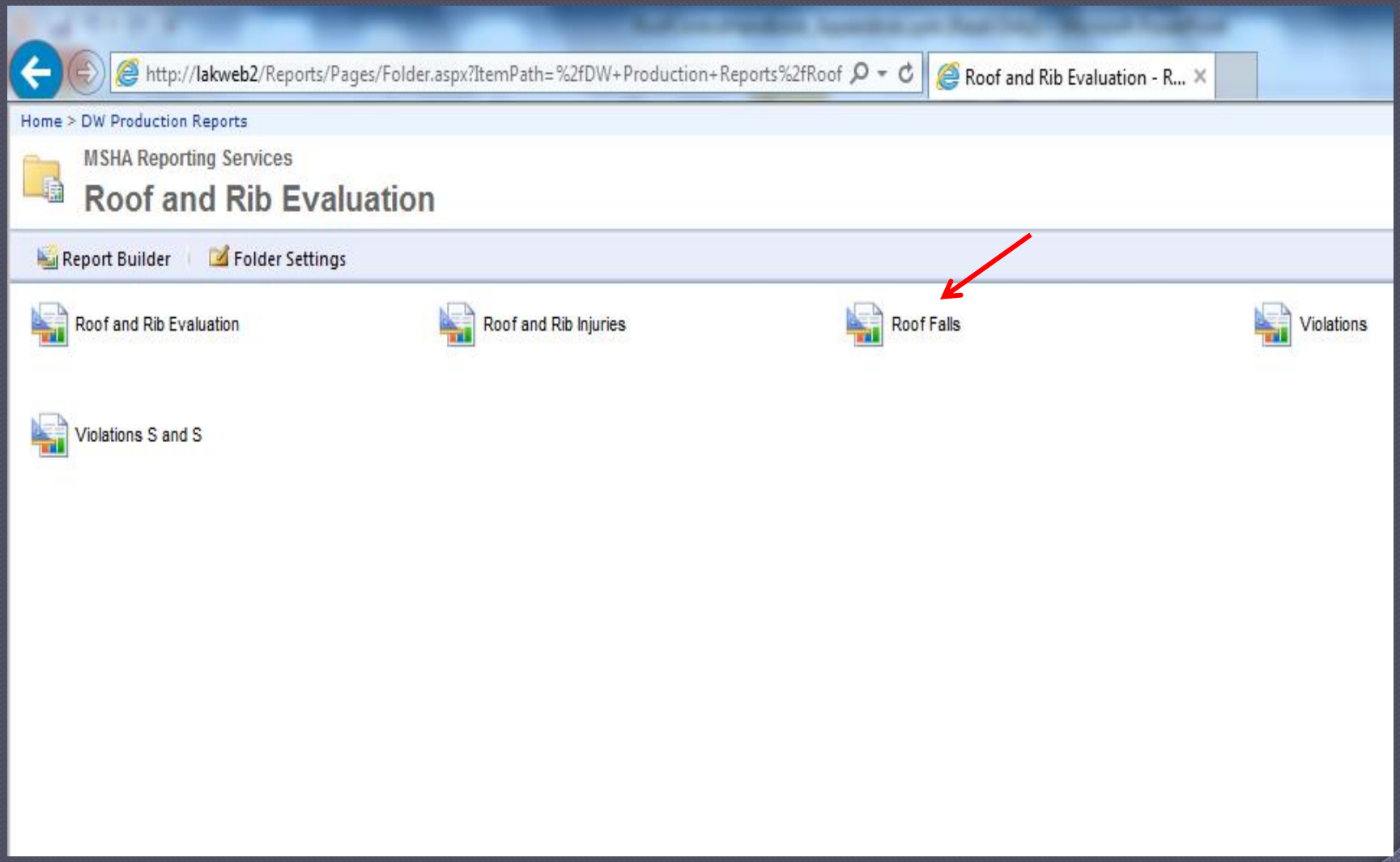
Historical Record: Roof Injuries

Research has shown that the vast majority of roof fall injuries are caused by pieces of rock that fall out from between the bolts. Improved skin control can be provided by roof support devices such as headers, mats, and pizza pans can help, as can various protective devices that can be fitted to the roof bolting machine. By far, the most effective skin control technique is to install screen wire mesh when the roof is first bolted.

Historical Record: Rib Injuries

The greatest rib fall risk usually occurs at mines with greater mining heights operating under deeper cover. Rib bolting on cycle is by far the most effective rib control technique. Inside-control, walk-through, roof bolters are also highly desirable.

Historical Record: Non-Injury Roof Falls



Historical Record: Non-Injury Roof Falls

Roof Control Accident 2 Years History, 1/22/2012 to 1/21/2014

Mine Id: **1102632**

Operator: **Springfield Coal Company LLC**

Mine Name: **Crown III Mine**

Report Date

1/22/2014

Degree 00, ACCIDENT ONLY

Doc Number: **220120370099**

Accident Date: **2/3/2012**

Classification: **07 - FALL OF ROOF OR BACK**

Type: **ACC TYPE, WITHOUT INJURIES**

Inj Source: **NO VALUE FOUND**

Location: **OTHER**

Days Restrict:

Days Lost:

Ret to Work:

A ROOF FALL WAS FOUND IN THE MAIN WEST ENTRIES BETWEEN # 5 AND # 6 Entries. A K order was issued and a plan was agreed upon to start renovating the fall area.

Historical Record: Non-Injury Roof Falls

A wide variety of strategies are available for reducing the risk of roof falls, including:

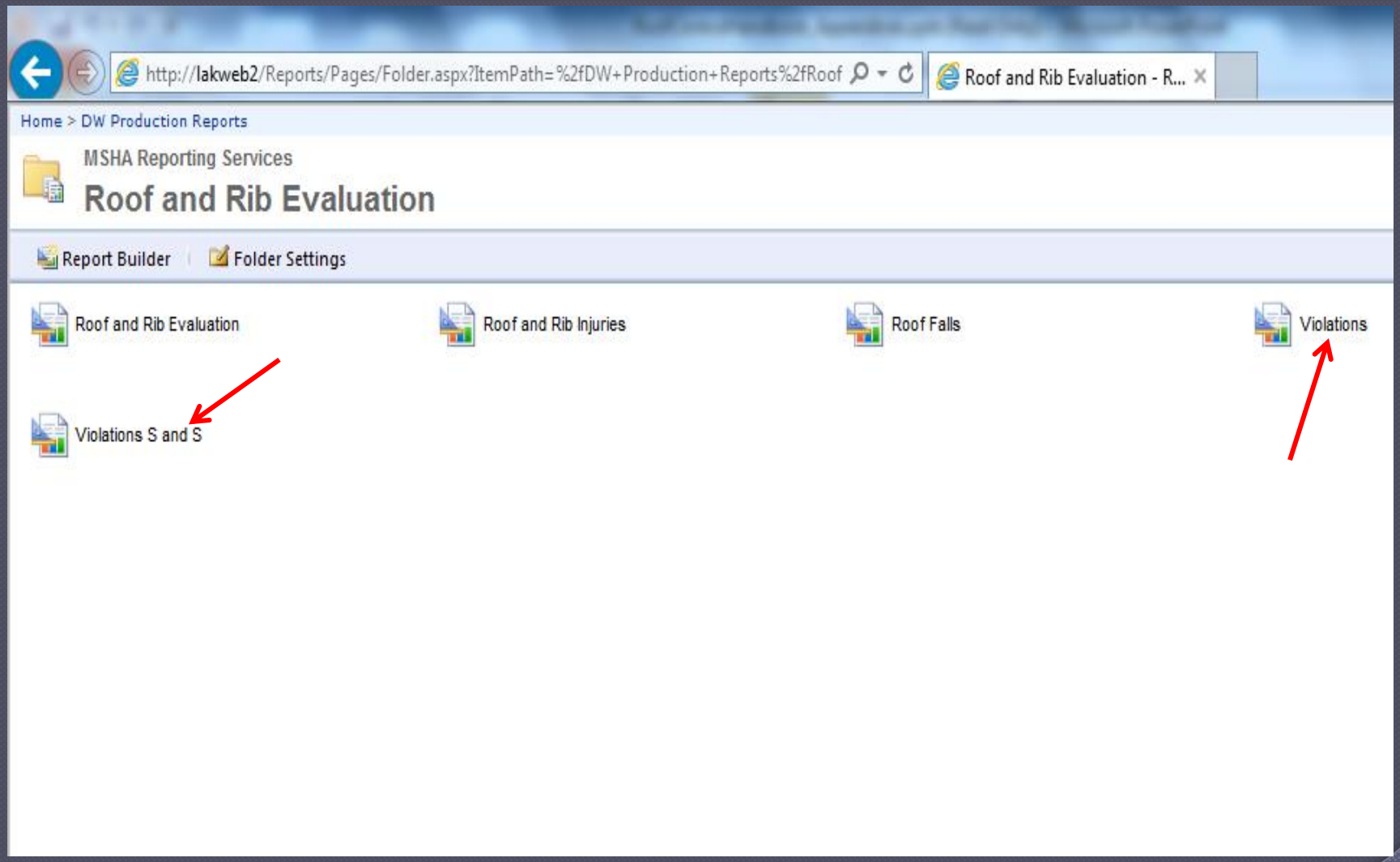
- Longer, stronger, and/or more closely spaced primary supports.
- Increased use of supplemental supports (cable bolts, trusses, standing support).
- Narrowed entry widths and reduced intersection diagonals.

Historical Record: Non-Injury Roof Falls

Strategies for reducing of roof falls (con't):

- Shorter cut depths and reduced time that the roof remains unbolted.
- Mine layout changes, particularly entry or panel orientation.
- Focused support in areas where specific geologic factors are present.

Historical Record: Citations



Historical Record: Citations

Roof Control Accident 6 Months History, 7/22/2013 to 1/21/2014

Mine ID: **1102632** Operator: **Springfield Coal Company LLC**

Mine Name: **Crown III Mine**

Report Date

1/22/2014

Vio Number:	**8443794**	Likelihood:	**Reasonably**	Due Date:	**7/24/2013**
Issue Date:	**7/24/2013**	Inj/Illness:	**LostDays**	Term Date:	**7/24/2013**
30 CFR:	**75.220(a)(1)**	No Affected:	**1**	Status:	**Terminated**
Type Action:	**104(a)**	Negligence:	**ModNegligence**	Init Viol No.:	
C/O/S:	**Citation**	Enf Area:	**Safety**	Replcd by Order:	
S&S:	**Y**	Event No:	**4256868**	Contractor:	
		Activity Code:	**E01**	AR No:	**24944**

The company is not following its approved roof control plan on page 11 which states that when entry widths are over 2 feet too wide a standing support such as jacks, props, cribs, or crib alternatives will be installed. In unit #2 at cross-cut #22 between entries 2 and 3 the cross-cut is 21 feet to 20 feet 2 inches for 11 feet. The roof in this area is fractured and a hazard when wide widths are not supported. Standard 75.220(a)(1) was cited 23 times in two years at mine 1102632 (23 to the operator, 0 to a contractor).

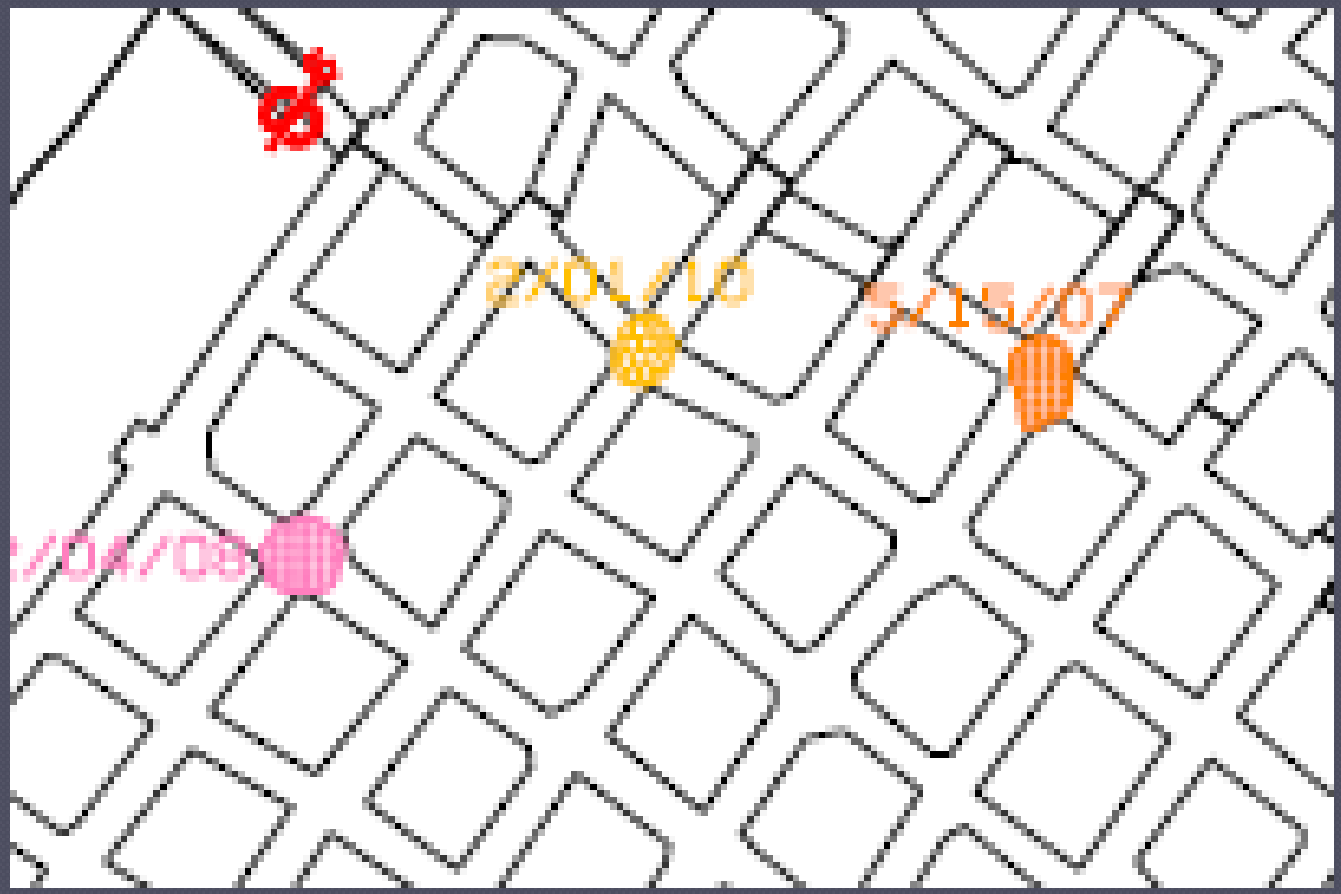
Historical Record: Citations

- The **number** of roof/rib control citations at the mine during at least the last six months.
- The **citation rate**—number of roof/rib control citations per 200,000 hours worked—for at least the last two quarters, compared to the district and national rates.
- The **standards** most often cited
- The **issues** most often involved in the citations—roof, ribs, support, equipment, etc.

Historical Record: Previous Review Forms

Past Roof Control Inspection and Plan Review Forms (MSHA Form 2000-204): Particularly close attention should be paid to whether concerns raised in past reviews continue to be adequately addressed. For example, if past reviews identified rib conditions as a concern and the mine's recent history indicates a high rate of rib fall injuries or citations, then changes might be needed to protect the miners from rib hazards.

Historical Record: Roof Fall Map



Historical Record: Roof Fall Map

The history of unplanned roof falls as plotted on the mine map assists mine operators and MSHA in evaluating the effectiveness of the roof control system and identification of hazardous trends, preferred orientations, or other common characteristics of the roof falls.

Under 30 CFR 75.223 (b), underground coal mine operators must plot on a mine map each unplanned roof fall and coal or rock burst that occurs in the “active workings.” (The term “active workings” is defined in 30 CFR 75.2 and discussed in PPL No. P12-V-3).

Historical Record: Roof Fall Map

However, the roof fall evaluation may be incomplete unless all known roof falls, both within and outside of “active workings,” are plotted on the mine map. Accurate plotting of all roof falls may also be highly valuable during a mine emergency, because rescuers need to be aware of blocked travelways.

The District Manager may require, under 30 CFR 75.222 (a), and based on the site-specific geologic conditions and accident experience at the mine, that all unplanned roof falls, whether they occur in active workings or not, be investigated and plotted on a mine map.

Roof Fall Accident Investigations

Roof Fall Accident Investigations

- Under 30 CFR50.11 (b), each operator of a mine shall investigate each accident at the mine, and develop a report of each investigation. MSHA may also conduct an investigation.
- An operator may not use Form 7000-1 or an investigation report conducted or prepared by MSHA.
- The operator shall submit a copy of any investigation report at MSHA's request.

Items to be included in a Roof Fall Investigation

30 CFR 50.11 (b) lists items that the operator's report shall include, such as:

(4) A description of the site;

(5) An explanation of the accident, including any explanation of the cause of any accident,

(7) A sketch, where pertinent, including dimensions depicting the occurrence; and

(8) A description of steps taken to prevent a similar occurrence in the future.

Items to Include:

- A ***sketch in plan view***, showing:
  - Approximate dimensions of the fall, including intersection diagonals if available, and
  - Widths of entries leading into the fall.

- A ***cross-section sketch***, showing the approximate shape and height of the fall.

Items to Include:

- ***Geologic information***, including:
  - Thickness and rock type of the roof beds involved,
  - Noticeable geologic structures such as clay veins, slips, or drag folds
  - Approximate rate of groundwater inflow, if present.

This information may be shown on the sketches.

Items to Include:

The ***roof support*** installed, including:

- Type, pattern, diameter, and length of the primary roof bolts,
- Type, pattern, and other characteristics of any supplemental support, and
- Timing of the installation of any supplemental support.

Items to Include:

The ***sequence of events*** leading to the fall, if known, and the general condition of the area. Answers to the following should be provided:

- Were the roof bolts or standing supports taking weight?
- Was the roof sagging?
- Had tension fractures appeared?
- Were roof cutters, rib spall, or floor heave noted?
- Was water present, and when was it first noticed?
- Did anyone witness the failure?
- What was the duration of failure?

Items to include

Other critical information, including:

- When the area was developed,
- Orientations of the headings and the roof fall,
- Any workings above or below,
- Depth of cover, and
- Local topographic features such as stream valleys.

(The information listed above should be available from the mine map(s).)

Roof Fall Investigation Form

Roof Fall Investigation Data Form

Date of Fall: _____ Fall Location: _____ Date of Investigation: _____

Cross Section of Roof Fall. Show approximate shape and height of the

Plan View of Roof Fall. Show approximate dimensions of the fall, including intersection

Roof Fall Investigation Form

Other geologic factors: _____

_____

Primary roof support: _____

_____

Supplemental support: _____

_____

Groundwater inflow? _____

Depth of cover: _____ Multiple seam? _____

Sequence of events leading to the fall, general condition of the area, and other comments: _____

_____

_____

Steps to prevent re-occurrence: _____

_____

Investigation conducted by:

_____

Geotechnical Assessments Prior To Retreat Mining

Geotechnical Assessments Prior To Retreat Mining

- Retreat mining (longwall or pillar recovery) increases the stress and deformation near the retreated areas.
- Instability and roof falls can result.
- Weak roof that is most likely to be affected.
- A geotechnical assessment identifies at-risk areas so that precautions can be taken.

Geotechnical Assessments: Past Retreat Mining Experience

Review past experience, including roof falls, coal and rock bursts, rib falls, and floor heave.

Use available surface borehole logs to identify roof rock geology and the presence of sandstone channels, rider seams, transition zones, and other features.

Use mine maps to identify areas of deeper cover, stream valley influence, and potential multiple seam interactions.

Geotechnical Assessments: Underground Mapping

Mapping should not try to record every feature that is observed, but rather should focus on those features that are most significant to roof control at the mine.

- ***Geologic features*** that could create roof instability during retreat mining, such as major joints or slips, faults, drag folds, etc.
- ***Current ground conditions*** including the presence of sagging roof, open fractures, cutters, excessive rib slough, groundwater inflows, and floor heave.

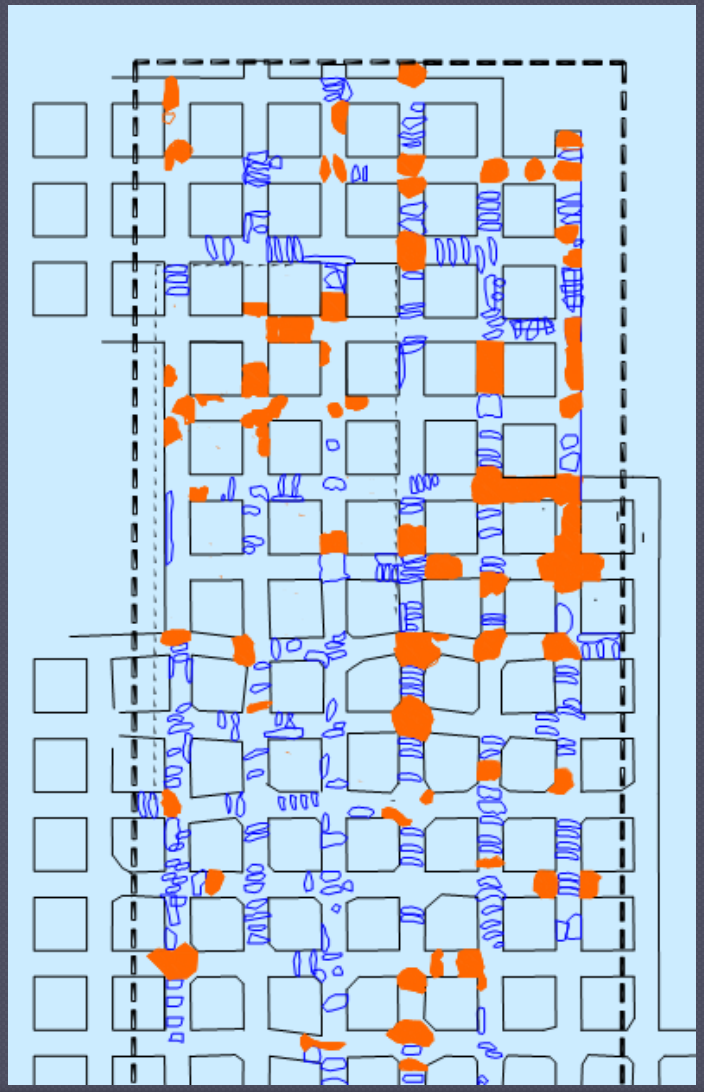
Geotechnical Assessments: Underground Mapping

- ***Roof support installed*** and any evidence of unusual weight on the supports.
- ***Unusual mining dimensions*** such as wide intersection diagonals and locations where the height may exceed the reach of the Mobile Roof Supports.

Geotechnical Assessments: Test Holes

Test holes should also be checked using a scratch tool (such as a tape measure) or borescope to locate major cracks and features such as rider seams. It is a good practice to log and record the crack data, so that any new cracks can be identified when the holes are monitored during retreat mining.

Geotechnical Assessments: Hazard Map



The hazard map integrates the significant information obtained from the core logs, mine maps, and underground mapping. It should be presented in a format that is most useful to the miners that will be using it.

Geotechnical Assessments: Hazard Map

The hazard map should also clearly define the actions to be taken prior to or during retreat mining, such as:

- Monitor more closely,
- Install extra support, or
- Do not mine—skip pillars or portions of pillars

Questions?

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