UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DISTRICT C

FINAL REPORT OF MAJOR ROOF-FALL DISASTER

LUNDALE MINE
AMHERST COAL COMPANY
LUNDALE, LOGAN COUNTY, WEST VIRGINIA

February 12, 1958

By

James T. Whalen
Federal Coal-Mine Inspector

and

William M. Cordray
Federal Coal-Mine Inspector (Roof Control)

Originating Office - Bureau of Mines
Mount Hope, West Virginia
W. R. Park, District Supervisor
Health and Safety District C

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INTRODUCTION

A roof fall occurred at 6:25 p.m., Wednesday, February 12, 1958, in the Lundale mine of the Amherst Coal Company, Lundale, Logan County, West Virginia. Seven men were caught by the falling material; 5 were killed instantly and an additional man was injured so seriously that he died about 54 hours later in a hospital at Man, West Virginia. The seventh man was caught and covered completely, but he was not injured seriously and crawled from under the fallen rock without assistance. Five other employees in the section were not injured by the roof fall. Work of recovering the injured man and the 5 bodies was directed by company officials and inspectors of the West Virginia Department of Mines and the United States Bureau of Mines and was completed at 3:05 a.m., February 13.

The names of the victims, their ages, marital status, occupations, and the number of their dependents are listed in Appendix A of this report.

The extensive fall of roof in an old haulage entry in No. 17 road section occurred with almost no warning; the area was being reactivated to provide a shuttle-car roadway to three new working places.

GENERAL INFORMATION

The Lundale mine is at Lundale, Logan County, West Virginia, and about 10 miles northeast of Man, West Virginia, and it is served by the Chesapeake and Ohio Railway Company. The names and addresses of the operating officials are:

H. E. Jones, Sr.	President	Charleston, West Virginia
H. E. Jones, Jr.	Executive Vice President	Charleston, West Virginia
George Jones	Vice President-Maintenance	Charleston, West Virginia
W. G. Beddow	Production Manager, Logan County Division	Slagle, West Virginia
Alfred Newland	Division Service Superintendent	Lundale, West Virginia
H. T. Brewster	Division Superintendent	Lundale, West Virginia
W. B. Hayes	Safety Director	Lundale, West Virginia
Cecil Edwards	Mine Foreman	Lundale, West Virginia
Paul Schwab	Engineer	Man, West Virginia

A total of 228 men was employed; 190 worked underground and 38 on the surface, 2 shifts a day, 4 days a week, and produced an average of 3,000 tons of coal daily. Production for the year of 1957 was 712,637 tons of coal. The last Federal inspection of this mine prior to the disaster was completed February 7, 1958. Access into the mine was by several drifts into the Cedar Grove coal bed, which averaged 66 inches in thickness in the areas being mined.

Localized dispositional changes in the immediate roof were encountered in parts of the mine. In some areas of the mine, the roof immediately overlying the coal bed was comprised of light gray unconsolidated shale of varying degrees in hardness; it ranged from 2 to 12 inches in thickness and was occasionally interspersed with 2- to 3-inch streaks of coal. Such roof was overlain with 30 feet plus of firm consolidated dark gray shale. In areas of light cover (outcrop, creeks, ravines, etc.), the roof immediately overlying the coal bed consisted of firm consolidated shale of varying degrees in hardness and contained slips. The main roof consisted of shale and sandstone beddings. The immediate roof in the area involved consisted of firm consolidated shale ranging from 25 to 35 feet in thickness.

The logs of 2 boreholes, 1,015 and 2,840 feet from the roof fall, are shown in Appendix E. It will be noted that a stratum of firm shale 25 to 35 feet 10 inches in thickness was immediately above the coal bed.

The floor underlying the coal bed consists of fire clay ranging from 1 to 1-1/2 feet in thickness that yields (heaves) easily, as indicated by the fact that all the floor material in No. 17 road section had heaved near the pillar areas.

The mine records show that previous to this occurrence, the last employee fatally injured by a fall of roof in this mine was on October 16, 1951.

MINING METHODS, CONDITIONS, AND EQUIPMENT

Mining Methods: The mine was developed by a room-and-pillar method. Main and cross entries were driven in sets of 6, 18 to 20 feet in width; however, because of sloughing of coal from the ribs, entry widths averaged 22 feet. Rooms were driven 24 feet in width. Entries were on 60-foot centers, and crosscuts were turned at 80-foot intervals. Pillars were extracted by the pocket method.

Systematic methods of roof support for development work were in effect, and copies of the timbering rules and roof-bolting plans were posted in the mine offices. Verbal roof-support plans for pillar work and the reactivating of abandoned areas were in effect, but these plans were not being followed in the No. 17 road section where the accident occurred.

The conventional timbering plan required that 2 rows of permanent posts or crossbars be set on 4-foot centers lengthwise to within 12 feet of the working faces. The timbering plan required further that 2 safety posts be set between permanent timbers and the face. Required safety posts were not set in 8 of the active working places when these places were examined during the investigation.

Roof bolts had been or were being installed in the 4 sections being operated at the time of this disaster. The roof-bolting plans for rooms and entries required that wooden crossbars 2 by 8 inches by 16 feet be bolted to the roof with 2 or 4 expansion-type roof bolts, 5/8 inch in diameter and 30 to 60 inches in length. The crossbars were to be installed on 4-foot centers to within 48 inches of the uncut faces. In track entries, line posts were not used, legs were not installed under crossbars, and roof support consisted of crossbars held in place with 4 bolts. In non-track entries where bolts were used, posts were required to be set under the ends of the bolted crossbars and these posts were to be kept within 12 feet of the faces as the coal was being removed. Additional posts were to be set under the ends of the crossbars as the faces were advanced. Roof bolts and their installation were in accordance with the recommendations made by a roof-control representative during the investigation; however, several of the provisions of the bolting plan were not complied with, as many crosscuts not used for haulage or the moving of supplies were not timbered, rooms were driven from 20 to 24 feet in width, and entries and crosscuts were 20 to 22 feet in width, instead of 18 feet. Breaker posts were set in the pillar sections; however, in No. 17 road section, where the disaster occurred, posts had not been set from the fall area inby toward the pillared area. Coal was bottom cut in solid and pillar work, and the cuts averaged about 8 feet in depth. The cuts were made with rubber-tired mining machines. Rubber-tire mounted roof-bolting machines, mobile loaders, and shuttle cars were used in the 4 operating sections.

During development of No. 17 road section, roof in Nos. 14 and 17 roads (track entries) was supported with roof bolts only; 4 bolts were installed through crossbars. Roof bolts were not used in the other entries in the section, and a row of line timbers was installed on each side of the entry to support the roof in Nos. 13, 15, 16, and 18 roads. These roof-support procedures were adequate during development, but immediately prior to the roof fall on February 12, practically every line timber inby the transfer point in No. 17 road section had rotted or been broken by heaving floor material or coal falling from the ribs. Some of these timbers were being replaced along the new shuttle-car roadway on the day of the roof fall (see Appendix D).

During the investigation, representatives of the company, West Virginia Department of Mines, and the Bureau of Mines checked roof-bolting and timbering plans for the mine. Systematic roof-support plans were made for pillar areas, and all roof-bolting permits were revised. Because of this disaster, all revised bolting plans required the use of conventional timbers for supplemental support, and safety precautions were included in the permits to cover pillaring and reactivating abandoned areas. All parties agreed to the provisions of the revised bolting plans, and these plans were put into effect during the investigation.

STORY OF ROOF FALL AND RECOVERY OPERATIONS

Activities of Bureau of Mines Personnel: The Logan office of the Bureau of Mines was notified of the occurrence about 7:15 p.m., February 12, 1958, by a telephone message from an official of the company. Federal Coal-Mine Inspectors J. T. Whalen and P. T. Akers proceeded to the mine immediately and arrived at the main openings about 8:30 p.m. After conferring with mine officials, Whalen notified the Mount Hope office of the Bureau of Mines of available details regarding the roof fall. Then, a group of representatives of the West Virginia Department of Mines and Bureau of Mines, company officials, and members of the mine safety committee entered the mine about 9:15 p.m., and arrived in the affected area about 9:30 p.m. Federal Inspectors T. W. Gay and R. G. Calvert arrived at the mine about 10:30 p.m., to assist with the recovery work.

James Westfield, assistant director, W. R. Park, district supervisor, and W. M. Cordray and A. J. Fumich, Federal inspectors, arrived at the mine about 9:30 a.m., February 13, and, after conferring with State and company officials, entered the mine and assisted with the investigation. Westfield, Park, Whalen, and Cordray assisted with the official hearing to determine the cause of the roof fall.

Mining Conditions Prior to the Roof Fall: Six parallel entries, designated from left to right as Nos. 13, 14, 15, 16, 17, and 18 roads,

were advanced on 60-foot centers for a distance of 1,500 feet inby the junction of Nos. 17 and 35 roads. Development mining of coal in the area involved in the roof-fall accident (No. 17 road section) was completed in October 1956. Retreat mining was started immediately thereafter and completed to within 900 feet of the junction, as shown in Appendix B. Butt entries in sets of 6 were turned left off No. 13 road and driven a distance of about 1,100 feet. Rooms were turned right and left off these butt entries and the pillars recovered outby to the mouth of No. 13 road in No. 17 road section (see Appendix B). During the mining of the inby chain pillars in No. 17 road section, 8 blocks of coal were left unmined about 300 feet inby the roof-fall area because of the excessive thickness of the impurities (middle rock) in the coal.

A barrier pillar, 400 feet in length and 200 feet in width between road No. 18 and the mined-out No. 41 section, was being recovered in conjunction with the chain pillars in No. 17 road section. The barrier pillar was being mined by driving rooms in sets of 3 and then recovering the pillars. The extent of the mined-out area adjacent to the barrier pillar is shown in Appendix B. The roof-fall area in No. 17 road section was developed about 17 months prior to the accident.

Evidence of Activities and Story of the Roof Fall: At the beginning of the first shift (7:15 a.m., to 3:15 p.m.), February 12, the day of the accident, work was started to clean and retimber a shuttle-car roadway from the transfer point on No. 14 road to No. 18 road. This roadway was being prepared to open 3 rooms (Nos. 9, 10, and 11) into the barrier pillar adjacent to No. 18 road. While part of the crew cleaned the loose coal from the roadway, material that had sloughed from the ribs during the time the area was idle, other crew members throughout the shift timbered roof inby the transfer point; 18 bolts were also installed on No. 18 road at the entrance to No. 11 room. During the shift, the foreman and crew members observed and examined the roof inby the transfer point and in the general area where the roof fall occurred later. Hazardous roof was not detected, although thin layers of loose roof were observed; this loose material was taken down. Employees and the section foreman testified during the investigation that audible noise of roof "working" was about normal and as expected in pillar areas; these men also testified that no unusual evidence of "weight" was observed on timbers or ribs anywhere in the area. About 250 tons of coal that had sloughed from the ribs were removed from the new roadway during the shift. The extent of the cleaning and timbering along the new roadway is shown in Appendix D.

The second shift entered the mine February 12 about 3:15 p.m. The crew of 12 men, including the foreman, arrived in No. 17 road section about 3:45 p.m. Three crew members with a loading machine began working in pillar blocks on No. 78-A road off No. 13 road. The rest of the crew

continued the cleaning and timbering along the new roadway to open the 3 rooms in the barrier pillar. The crew cleaning the roadway was instructed by the section foreman to continue cleaning No. 17 roadway and to clean the ribs so that the entry could be retimbered. The loading-machine operator, Estes Wood, tested the roof along the proposed roadway and found it solid except for a break in the roof near the left rib of the 45-degree crosscut left off No. 17 road. Coal was loaded from the floor from rib to rib along No. 17 road (entry) and in the 45-degree crosscut; several shuttle cars of coal, broken posts, and brattice material were loaded from this crosscut. Loading was then directed toward and into the open crosscut right between Nos. 17 and 18 roads and directly opposite No. 9 room in the barrier pillar (see Appendix D). When the new roadway had been advanced a short distance into the right crosscut, the conveyor chain on the loading machine broke into 2 pieces. The loading machine was then trammed from the crosscut to No. 17 road so as to provide sufficient maneuvering room to repair the conveyor chain.

While the new roadway was being cleaned and timbered, Nos. 9, 10, and 11 rooms off No. 18 road and into the barrier pillar were cut, drilled, and blasted. The cutting-machine crew joined the loading crew in the crosscut right off No. 17 road, and the shot firer helped with the timbering. The shuttle car hauling from the loading machine with the broken conveyor chain was used to procure a supply of conveyor flights for the broken chain. The conveyor chain was strung out on the floor in front of the loader in No. 17 road when the shuttle car returned with the flights. In traveling a short distance outby the loader, the shuttle car developed brake trouble. The shuttle-car operator needed assistance to repair the car brakes, and he requested such help from the shot firer; this left 7 men repairing the conveyor chain of the loader. While working on the shuttle-car brakes, the car operator and shot firer heard a "ripping" noise in the roof inby and immediately thereafter an extensive fall of roof occurred.

Immediately after hearing the "ripping" noise, the shot firer ran outby and the car operator, who was working at the inby end of the shuttle car, traveled to the controls and began moving the car outby; however, the inby end of the car was caught by the falling roof material. The shuttle-car operator and the shot firer were outby the falling roof material, but the seven men working inby the shuttle car on the conveyor chain were covered by the roof fall. The loading-machine operator was not injured severely and he was able to crawl from under the fallen roof without assistance. The shot firer and shuttle-car operator were able to hear at least one man under the fallen rock call for help. Examination of the fall area indicated the other five men under the fallen roof were dead.

The roof material fell from rib to rib and extended lengthwise for 87 feet in No. 17 road; it ranged from 12 to 60 inches in thickness and extended into the right crosscut off No. 17 road about 24 feet. The fallen material broke over the loading machine and into several pieces on the outby end.

Roof in No. 17 road, a track entry, was supported during development with roof bolts installed on 4-foot centers. The roof-bolting plan for track entries stipulated that 5/8-inch-diameter bolts of high carbon steel and at least 36 inches in length be used with wooden crossbars, 2 by 8 inches by 16 feet in length. Other provisions of the roof-support plan required that entries be driven at maximum widths of 18 feet and crosscuts not used for haulage be supported with timbers. Examination of No. 17 road in the fall area and outby the roof fall during the investigation showed that 36-inch length roof bolts had been installed through wooden crossbars on the recommended 4-foot centers lengthwise and crosswise. However, timbers had not been set in unused crosscuts as required by the roof-support plan and the entry averaged 25 feet in width in the roof-fall area; coal sloughing from the ribs contributed materially to the excessive width of the entries. Apparently, the corners of the 45-degree crosscut adjacent to No. 17 road had been loaded during the cleaning operations, as the entrance to this crosscut was 44-1/2 feet in width. The 45-degree crosscut was about 26 feet wide midway between Nos. 16 and 17 roads. Employees testified during the investigation that timbers had been set at the corner and along the left rib of the right crosscut off No. 17 road prior to the roof fall; however, the number of timbers set at these locations could not be determined because of the fallen roof. Timbers had not been set in the fall area of No. 17 road during the cleaning of the entry (see Appendix D).

Recovery Operations: Recovery operations were started immediately after the local mine officials were notified of the roof fall. Equipment, including 7 hydraulic jacks, cribbing material, and timbers were rushed to the scene. Work was started immediately to raise the fallen rock on the outby and right side of No. 17 road, as the rock was thinner at this location and appeared to be the location from which the 1 man alive should be rescued. It was necessary to remove the bodies of 2 of the victims located near the edge of the rock before attempting to release the live man, Glenn Burchett. Cribs were erected under the rock and blocking (crossbars and timbers) was advanced as the rock was raised so that every precaution could be taken to prevent the massive rock from shifting or breaking. The bodies of the first 2 victims were removed from under the fallen rock at 10:15 p.m., and 11:25 p.m., respectively. Burchett was rescued alive and conscious at 11:45 p.m., February 12. He died in a local hospital on February 15, 1958, 54 hours later. After Burchett was released and removed from under the rock, work was begun on the left side of the entry to recover the remaining 3 bodies from under the rock. The

body of the last victim was recovered about 2:35 a.m., February 13, 1958. Dr. Thomas P. Long, company physician, was present underground during the recovery operations, and he gave medical assistance to Burchett, the injured man, before Burchett was taken to the surface. The rescue workers and the bodies of the 5 victims arrived on the surface at 3:05 a.m., February 13, 1958.

INVESTIGATION OF CAUSE OF ROOF FALL

Investigation Committee: The underground investigation of the disaster was conducted on February 13 and 17-20, 1958. Members of the official investigation committee were:

West Virginia Department of Mines

Crawford L. Wilson	Chief
L. M. Morris	Assistant Chief
Pat Heatherman	Inspector-at-Large
J. A. Philpott	Inspector-at-Large
Earl Rutherford	District Inspector
J. A. Tawney	District Inspector

Amherst Coal Company

H. E. Jones, Sr.	President
H. E. Jones, Jr.	Executive Vice President
George Jones	Vice President-Maintenance
W. G. Beddow	Production Manager
Alfred Newland	Division Service Superintendent
H. T. Brewster	Division Superintendent
W. B. Hayes	Safety Director
Cecil Edwards	General Mine Foreman
Paul Schwab	Engineer

United Mine Workers of America

Charles Ferguson	Safety Director
R. R. Humphries	Secretary-Treasurer, District 17
Jerry Stidham	Field Representative, District 17
Arbie Dillon	Chairman, Mine Safety Committee
Tony Protuck	Member, Mine Safety Committee
Calvin Tomblin	Member, Mine Safety Committee

United States Bureau of Mines

James Westfield	Assistant Director--Health and Safety
W. R. Park	District Supervisor
J. T. Whalen	Federal Coal-Mine Inspector
W. M. Cordray	Federal Coal-Mine Inspector

Crawford L. Wilson, chief of the West Virginia Department of Mines, conducted an official inquiry and investigation of the disaster by interrogating a number of officials and employees of the company in the mine offices at Lundale, West Virginia, February 14, 1958. The purpose of the inquiry was to hear and record all testimony relevant to conditions and practices in the mine prior to and on February 12, and to determine therefrom, if possible, the cause of the disaster. Some of the information thus obtained is included in this report. Representatives of the operating company, United Mine Workers of America, West Virginia Department of Mines, and Bureau of Mines questioned the officials and employees during the inquiry. The following men represented the several organizations during the inquiry:

West Virginia Department of Mines

Crawford L. Wilson	Chief
L. M. Morris	Assistant Chief

Amherst Coal Company

H. E. Jones, Jr.	Executive Vice President

United Mine Workers of America

Charles Ferguson	Safety Director

United States Bureau of Mines

W. R. Park	District Supervisor

Mining Methods and Practices as Factors in the Roof Fall: The logs of 2 boreholes, 1,015 and 2,840 feet from the area where the roof fall occurred, indicate that the coal bed is immediately overlain with firm consolidated shale ranging from 25 to 35 feet in thickness. Visual observations of accessible caved areas (pillared) near the roof fall indicated that the structure of the shale roof was homogeneous. Shale of this type splits with a foliation so perfect that it yields slabs having a plane surface almost as smooth as the cleavage planes of minerals.

The No. 17 road section, consisting of 6 entries turned on 60-foot centers, had been developed, and the remaining blocks of coal were being extracted at the time of this roof fall. The No. 77-A road section consisted of butt entries, turned left off No. 17 road section. These butt entries had been developed and pillared to No. 13 road of No. 17 road section. The investigation revealed that in preparing to extract the coal in the 200- by 400-foot barrier pillar adjacent to and right

of No. 18 road, it was necessary to clean up and retimber the inby entries of No. 17 road section (see Appendixes B and D). Heaved floor material had broken most of the timbers in the area, and considerable coal had sloughed from the ribs in all entries throughout the area. Roof movement and "weight" in the area that caused the rib sloughing and heaved floor material were due to the proximity of the (pillared) areas where 8 blocks of coal, 300 feet inby the roof fall, had been left unmined. The cleaning and retimbering of a roadway from the transfer point on road No. 14 to the crosscut between Nos. 17 and 18 roads and opposite No. 9 room resulted in widening the entries to approximately 25 feet; a 15-foot-wide roadway was to be provided and timbers were set on 4-foot centers lengthwise along the new roadway. Timbers had not been set along the entire length of the roadway prior to the accident, and line timbers set before and after the disaster are shown in Appendix D. Although No. 17 road averaged 25 feet in width after it was cleaned, line timbers or other roof supports were not provided along the new roadway to compensate for the additional width of the entry. In addition, the corners and inby side of the coal pillars for the 45-degree crosscut between Nos. 16 and 17 roads had been removed during the cleaning operations; this widened the crosscut at No. 17 road to 44-1/2 feet and additional timbers or other roof supports were not provided in the crosscut. The cleaning operations in the crosscut right between Nos. 17 and 18 roads increased the width of the crosscut considerably. Employees stated that some timbers were set in this area, but evidence of such timbering was not readily apparent after the roof fall. The coal that had sloughed from the right rib of No. 18 roadway from No. 11 room inby for a distance of 62 feet was loaded, thereby widening No. 18 road. Timbers were not set in the widened No. 18 road, although an old break in the roof was present in No. 18 road beginning midway between Nos. 9 and 10 rooms and extending inby and diagonally over the coal pillar left of the crosscut where the loading machine was last operated. Eighteen bolts were installed on the day of the accident on No. 18 road at the entrance to No. 11 room.

The rock that fell intact measured 87 feet in length, averaged 25 feet in width, and varied from 60 inches in thickness at the inby end to 12 inches at the outby end of the fall (see Appendix C).

Summary of Evidence: Conditions observed in the mine during recovery operations and the investigation following the disaster, together with information available from previous Federal coal-mine inspection reports and that obtained from company officials and workmen, provided evidence as to the cause of the roof-fall disaster. The evidence from which the conclusions of the Federal investigators are drawn is summarized as follows:

1. In general, the immediate roof in No. 17 road section consisted of firm, strong shale; however, an old break in the roof was present

in No. 18 road beginning midway between Nos. 9 and 10 rooms and extending inby and diagonally over the coal pillar left of the crosscut where the loading machine was last operated.

2. During development of No. 17 road section, roof in Nos. 14 and 17 roads (track entries) was supported with roof bolts. Roof bolts were not used in the other entries in this section, and a row of line timbers installed on each side of the entry was used to support the roof in Nos. 13, 15, 16, and 18 roads.

3. Adequate roof support was provided in No. 17 road section during development, and there was no evidence of roof falls or roof failures in the unpillared areas prior to this disaster.

4. Roof bolts installed along Nos. 14 and 17 roads during development were in accordance with the roof-bolting permit, except that cribs or timbers were not provided in unused crosscuts.

5. Practically every line timber inby the transfer point in No. 17 road section had rotted or been broken by heaving floor material or coal falling from the ribs prior to this disaster.

6. Written roof-support plans for pillar work and the reactivating of idled areas were not provided.

7. Considerable coal sloughed from the ribs during development of No. 17 road section, and greater amounts of coal sloughed from the ribs in the pillar areas and in the areas adjacent to pillared areas.

8. Roof movement and "weight" in the area that caused the rib sloughing and heaved floor material were due to the proximity of the (pillared) areas where 8 blocks of coal, 300 feet inby the roof fall, had been left unmined.

9. In preparing a new shuttle-car roadway from the transfer point in No. 17 road section to the rooms in the adjacent barrier pillar, the entry floor from rib to rib was cleaned of loose coal, heaved bottom, debris, and old timbers; this clean-up operation increased the average width of the entries to 25 feet.

10. The new roadway was in proximity to pillared areas and had increased the width of the entries considerably, and roof supports were to be the same as had been used during the development of the section. A row of line timbers was to be installed 4 feet apart lengthwise on each side of the roadway.

11. The new line timbers along the new roadway were not continuous in the unbolted areas, and line posts were not installed in bolted areas prior to the roof-fall disaster.

12. The repairing of the broken conveyor chain of the loading machine was responsible for seven employees congregating near the loading machine when the roof fall occurred.

13. The extensive collapse of the roof material occurred almost immediately after the audible warning of roof "ripping" was heard, and apparently none of the seven men covered by the falling rock had sufficient warning to escape.

14. There was no evidence to indicate that the roof fall occurred because of roof-bolt failures; the greater part of the fallen material separated and failed 1 to 2 feet above the bolt anchorage.

Cause of the Roof Fall: The Federal investigators are of the opinion that this disaster was caused by a combination of conditions as follows:

1. Widening of the entries in providing a new roadway removed natural roof support (coal ribs) in the area of the roof fall.

2. Artificial roof support in the form of timber or other material was not provided to compensate for the removal of natural roof support.

3. Reliance of officials and employees on roof bolts for adequate roof support in an entry in proximity to pillar areas.

4. Failure to replace rotted and broken timbers and provide adequate roof support in an idled area that was being reactivated.

5. Failure of officials and employees to observe evidence of roof failure and provide adequate roof support in the right crosscut and inby, adjacent to the pillar area.

6. The breaking of the conveyor chain of the loader which was responsible for the seven men congregating to help repair the conveyor chain.

RECOMMENDATIONS

The following recommendations are submitted in the belief that, if followed, the number and severity of roof falls at this and other mines may be minimized or eliminated entirely:

1. Systematic methods of roof support for pillar work should be adopted and complied with by all officials and employees.

2. Planned, systematic procedures should be provided for the reactivating of idled or abandoned areas, and such procedures should be followed by all officials and employees.

3. When idled or abandoned areas in proximity of pillared workings are being reactivated, such areas should be examined carefully and roof supports in addition to original supports and replacement of original supports should be provided.

4. In providing new roadways and otherwise reactivating idle or abandoned areas, every precaution should be taken to prevent widening entries or crosscuts by removing natural roof support (coal ribs).

5. Roof support in roadways and other areas adjacent to pillar workings should not be solely dependent on roof bolts. Line timbers should be installed in conjunction with the roof bolts in such areas.

6. All provisions of the roof-bolting plan in effect at the mine should be complied with, including recommendations covering entry widths and the use of timbers or cribs in crosscuts not used for haulage or storage of materials.

7. Sketches and copies of company's timbering and roof-bolting plans for pillar work should be posted conspicuously at strategic locations, along with presently posted plans for development work.

8. Work, other than to make the place safe, should not be performed in any underground area until the roof is supported adequately.

9. Complete extraction should be striven for in pillar areas, and pillar blocks and/or pillar remnants that tend to retard caving should not be left in the goaf.

10. The number of men permitted to congregate in a working place should be held to a minimum, and employees who are not needed for work or repairs in the area should not gather or be permitted therein.

ACKNOWLEDGMENT

The cooperation of the representatives of the West Virginia Department of Mines, company officials and employees, and members of the United Mine Workers of America during this investigation is gratefully acknowledged.

Respectfully submitted,

/s/ James T. Whalen

James T. Whalen
Federal Coal-Mine Inspector

/s/ William M. Cordray

William M. Cordray
Federal Coal-Mine Inspector (Roof Control)

Approved by:

/s/ W. R. Park

W. R. Park
District Supervisor

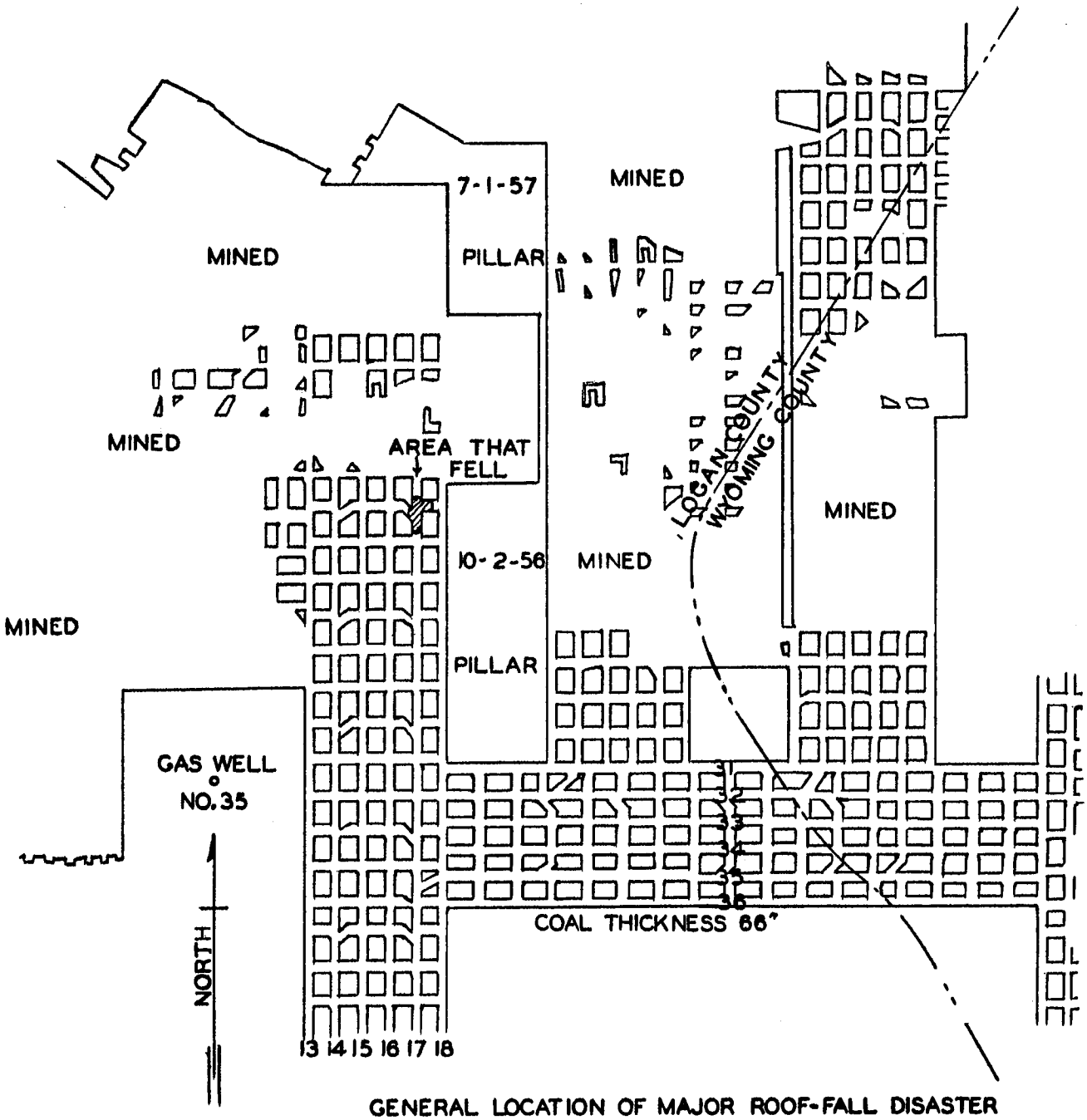
APPENDIX A

VICTIMS OF ROOF FALL, LUNDALE MINE

AMHERST COAL COMPANY

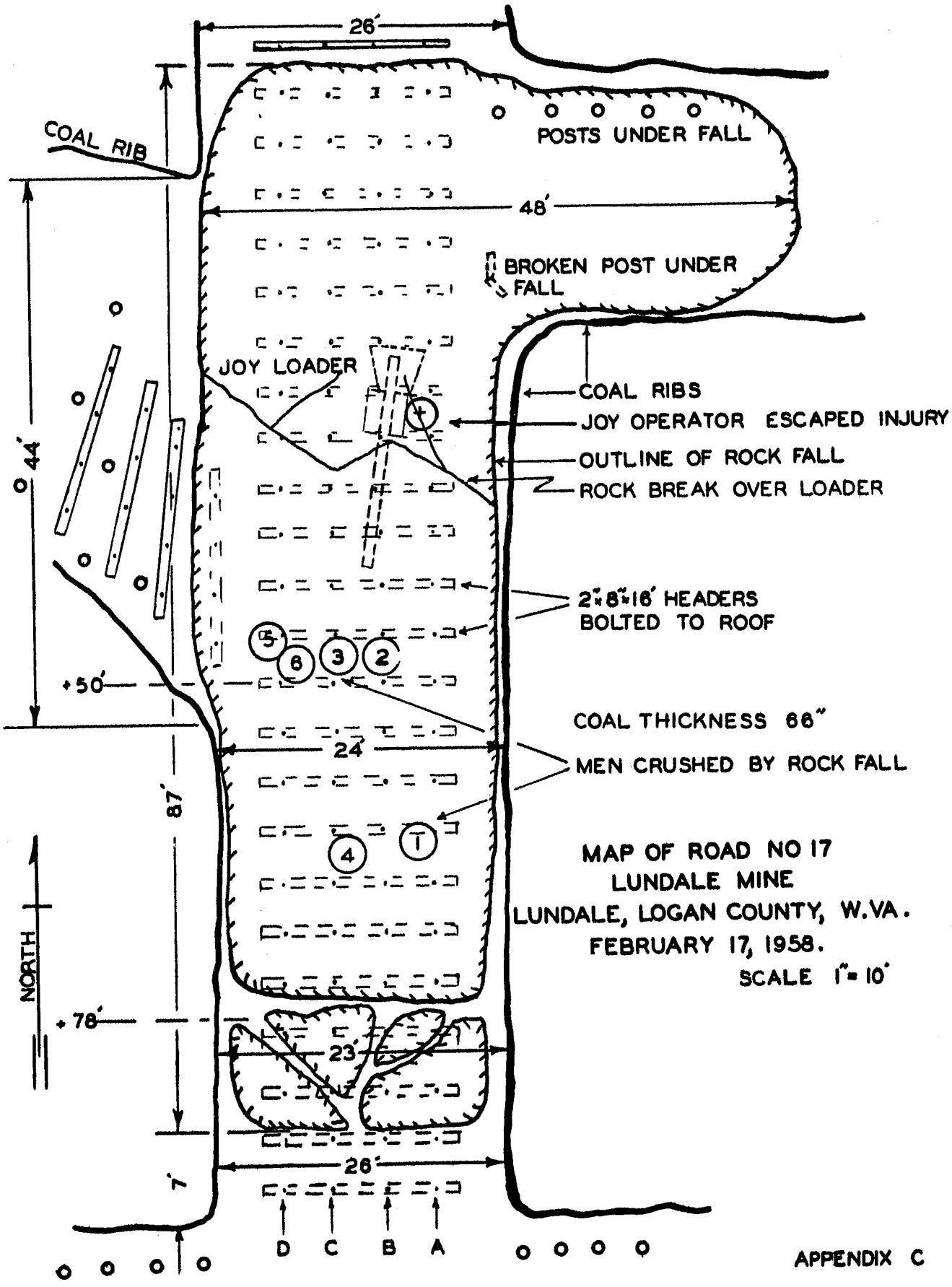
February 12, 1958

Name	Age	Occupation	Marital Status	Number of Dependents
A. J. Pennington	41	Foreman	Married	6
James E. Rogers	23	Roof Bolter	Married	3
William Collins	41	Machineman	Married	10
Elmer Lee Broady	44	Machineman	Married	4
Earl Johnson	44	Roof Bolter	Married	2
Glenn Burchett	42	Driller	Married	5

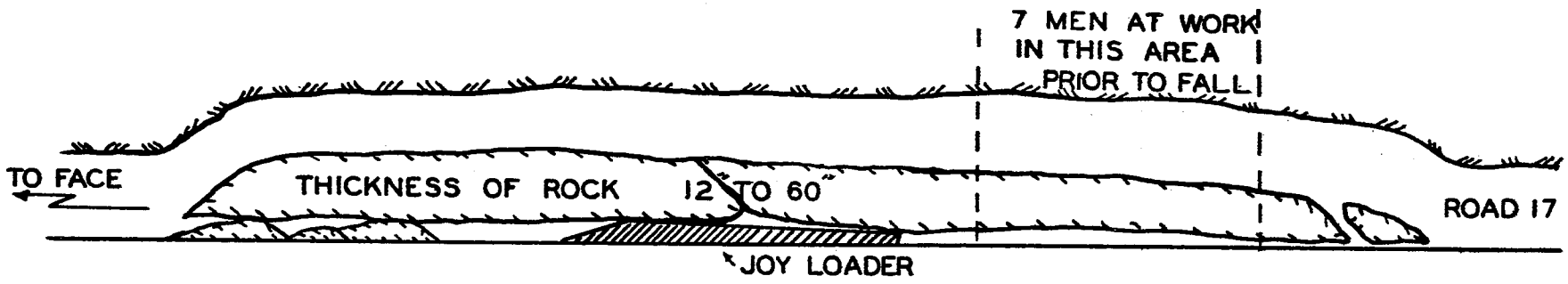


GENERAL LOCATION OF MAJOR ROOF-FALL DISASTER
LUNDALE MINE, AMHERST COAL COMPANY,
LUNDALE, LOGAN COUNTY, WEST VIRGINIA. FEBRUARY 12,1958.

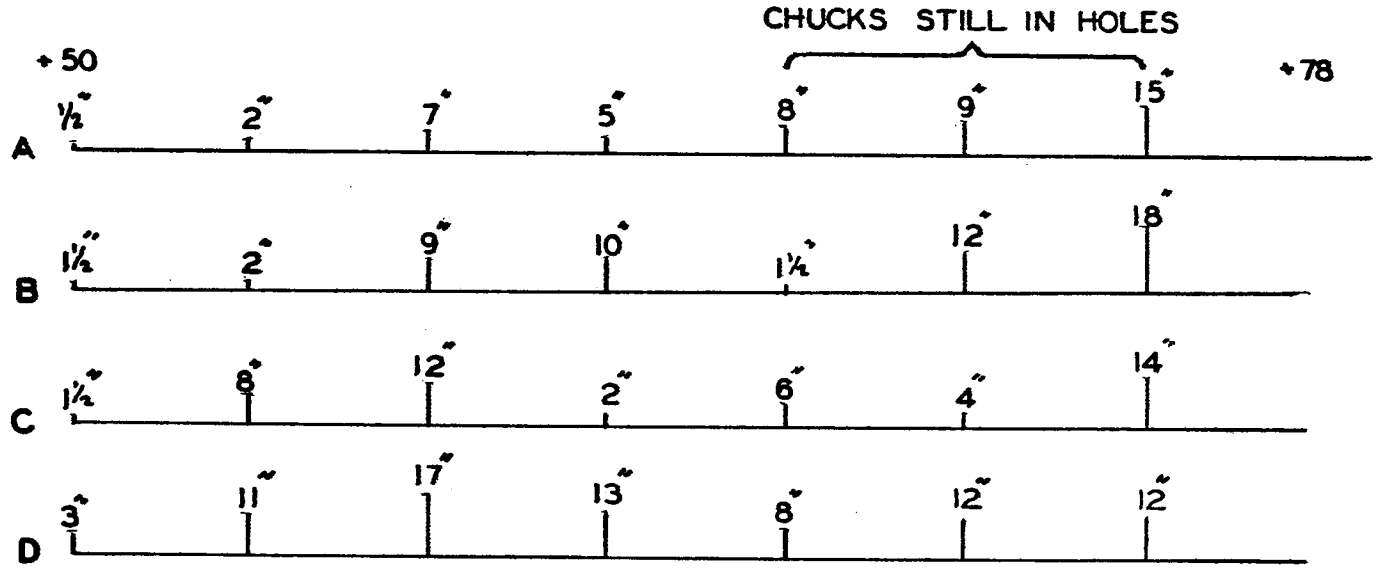
0 100 300 600
SCALE, FEET


26'
COAL RIB
POSTS UNDER FALL
48'
BROKEN POST UNDER FALL
JOY LOADER
COAL RIBS
JOY OPERATOR ESCAPED INJURY
OUTLINE OF ROCK FALL
ROCK BREAK OVER LOADER
44'
2"x8"x16' HEADERS BOLTED TO ROOF
5
6
3
2
+50'
COAL THICKNESS 66"
24'
MEN CRUSHED BY ROCK FALL
87'
4
1
MAP OF ROAD NO 17
LUNDALE MINE
LUNDALE, LOGAN COUNTY, W.VA.
FEBRUARY 17, 1958.
SCALE 1"= 10'
NORTH
+78'
23'
7'
26'
D
C
B
A

APPENDIX C



SIDE VIEW OF FALL LOOKING TOWARD ROCK FALL FROM SLANT
SCALE 1" = 10'



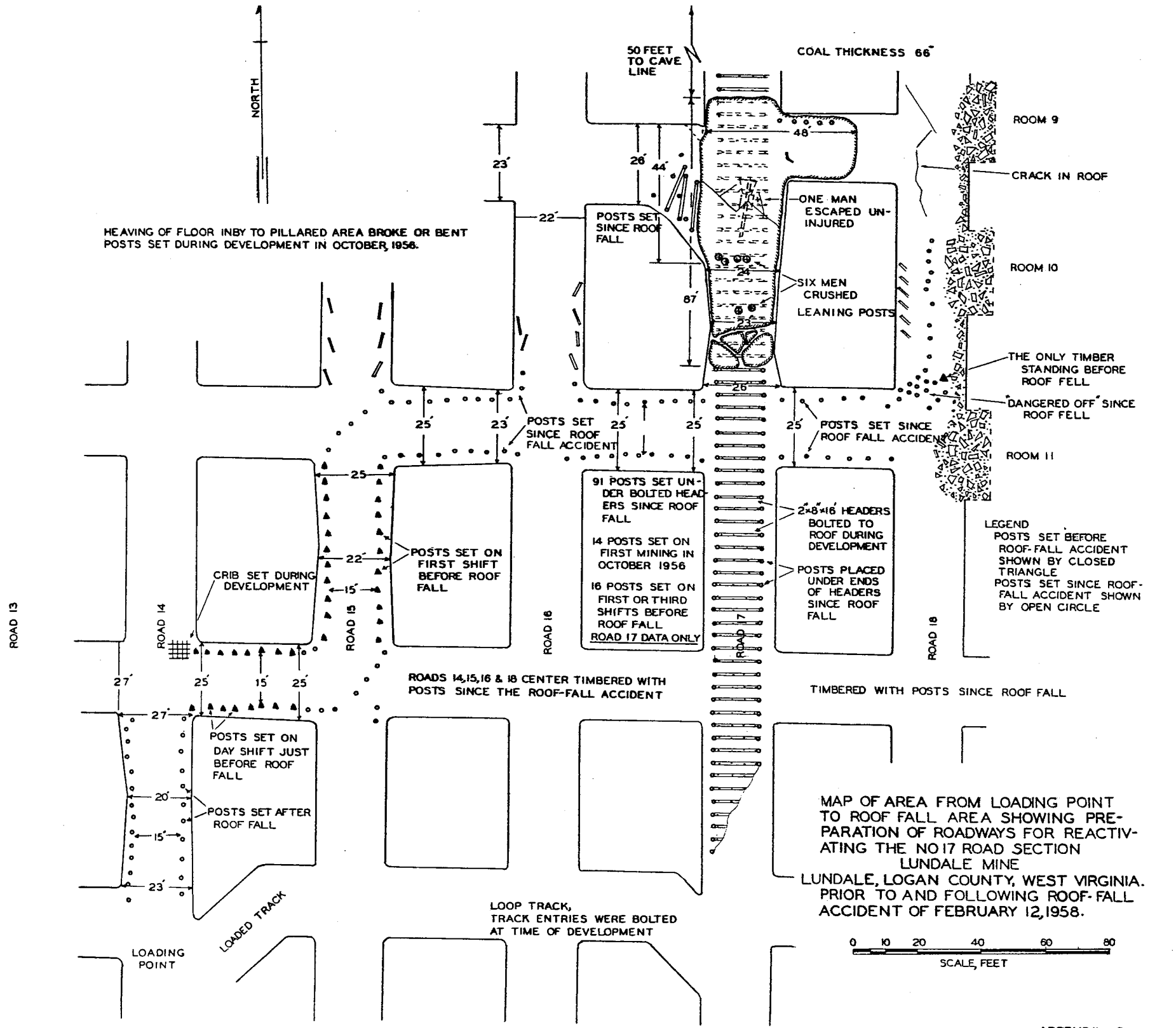
SIDE VIEW LOOKING OUT SHOWING DEPTH
OF BOLT HOLES LEFT IN ROOF AFTER FALL
SCALE ¼" = 1'-0"

APPENDIX C-1

APPENDIX E

BOREHOLE DATA

	55-12-A			55-13-A	
	Surface	41.3	41.3	Surface	6.6	6.6
	Sandstone	89.7	130.10	Sandstone	63.2	69.8
	Shale	11.4	142.2	Shale	29.6	99.2
	Sandstone	35.2	177.4	Coal	.3	99.5
	Coal	.4	177.8	Slate	1.6	100.11
	Shale	3.9	181.5	Sandstone	93.9	194.8
	Coal	1.10	183.3	Shale	25.4	220.0
	Fire Clay	1.4	184.7	Sandstone	25.9	245.9
	S. Shale	6.2	190.9	Shale	3.8	249.5
	Sandstone	88.5	279.2	Coal	2.1	251.6
	Coal	1.1	280.3	Fire Clay	1.1	252.7
	Shale	4.10	285.1	Shale	8.5	261.0
	Coal	1.1	286.2	Sandstone	87.7	348.7
	Fire Clay	1.5	287.7	Coal	1.10	350.5
	Shale	15.3	302.10	Shale	3.1	353.6
	Sandstone	62.4	365.2	Sandstone	43.5	396.11
	Shale	48.0	413.2	S. Shale	39.3	436.2
	Coal	.10	414.0	Shale	42.1	478.3
	Fire Clay	1.3	415.3	Coal	.6	478.9
	Shale	9.2	424.5	Shale	9.8	488.5
	Coal	1.2	425.7	Coal	1.1	489.6
	Shale	1.1	426.8	Fire Clay	.9	490.3
	Coal	.5	427.1	Shale	3.6	493.9
	Shale	5.8	432.9	Coal	.5	494.2
	Coal	1.8	434.5	S. Shale	10.8	504.10
	Fire Clay	.6	434.11	Coal	1.11	506.9
	S. Shale	6.4	441.3	Fire Clay	1.2	507.11
	Shale	36.2	477.5	Sandstone	37.4	545.4
	Coal	2.1	479.6	Shale	3.4	548.8
	Fire Clay	1.0	480.6	Coal	2.4	551.0
	Shale	7.3	487.9	Fire Clay	1.8	552.8
	Shale	25.9	513.6	Shale	35.10	588.6
Coal Bed	Coal	1.8	515.2	Coal Bed	Coal	1.3	589.9
	Slate	.4-1/2	515.6-1/2		Slate	.3	590.0
	Coal	.9-1/2	516.4		Coal	.10	590.10
	Slate	.9	517.1		Slate	.2-1/2	591.00-1/2
	Coal	2.5	519.6		Coal	2.3-1/2	593.4
	Fire Clay	1.6	521.0		Fire Clay	1.2	594.6


NORTH
50 FEET TO CAVE LINE
COAL THICKNESS 66"
ROOM 9
CRACK IN ROOF
ROOM 10
ROOM 11
HEAVING OF FLOOR INBY TO PILLARED AREA BROKE OR BENT POSTS SET DURING DEVELOPMENT IN OCTOBER, 1956.
POSTS SET SINCE ROOF FALL
ONE MAN ESCAPED UN-INJURED
SIX MEN CRUSHED
LEANING POSTS
THE ONLY TIMBER STANDING BEFORE ROOF FELL
DANGERED OFF SINCE ROOF FELL
POSTS SET SINCE ROOF FALL ACCIDENT
91 POSTS SET UNDER BOLTED HEADERS SINCE ROOF FALL
14 POSTS SET ON FIRST MINING IN OCTOBER 1956
16 POSTS SET ON FIRST OR THIRD SHIFTS BEFORE ROOF FALL
ROAD 17 DATA ONLY
2×8×16 HEADERS BOLTED TO ROOF DURING DEVELOPMENT
POSTS PLACED UNDER ENDS OF HEADERS SINCE ROOF FALL
LEGEND
POSTS SET BEFORE ROOF-FALL ACCIDENT SHOWN BY CLOSED TRIANGLE
POSTS SET SINCE ROOF-FALL ACCIDENT SHOWN BY OPEN CIRCLE
CRIB SET DURING DEVELOPMENT
POSTS SET ON FIRST SHIFT BEFORE ROOF FALL
ROAD 13
ROAD 14
ROAD 15
ROAD 16
ROAD 17
ROAD 18
ROADS 14,15,16 & 18 CENTER TIMBERED WITH POSTS SINCE THE ROOF-FALL ACCIDENT
TIMBERED WITH POSTS SINCE ROOF FALL
POSTS SET ON DAY SHIFT JUST BEFORE ROOF FALL
POSTS SET AFTER ROOF FALL
LOADED TRACK
LOADING POINT
LOOP TRACK, TRACK ENTRIES WERE BOLTED AT TIME OF DEVELOPMENT
MAP OF AREA FROM LOADING POINT TO ROOF FALL AREA SHOWING PREPARATION OF ROADWAYS FOR REACTIVATING THE NO 17 ROAD SECTION LUNDALE MINE LUNDALE, LOGAN COUNTY, WEST VIRGINIA. PRIOR TO AND FOLLOWING ROOF-FALL ACCIDENT OF FEBRUARY 12, 1958.
0 10 20 40 60 80
SCALE, FEET

APPENDIX D