



Kentucky
Department for Surface Mining
Reclamation and Enforcement

Reclamation Advisory Memorandum

From: Dave Rosenbaum, Commissioner

Date: August 17, 1992

Subject: Subsidence Control

RAM # 107

For quite some time the Department has been working with industry representatives to review various methodologies for designing subsidence control plans adequate to meet the requirements of 405 KAR 8:040 Section 26. Much of the work has centered around the amount of protection that must be afforded to structures which may exist within or adjacent to the proposed permit area.

The purpose of this memorandum is to announce that the Department has reviewed the published research by authors Z. T. Bieniawski and Charles T. Holland/Frank L. Gaddy. The pillar design formulas outlined in this research will be accepted as adequate measures to reduce the likelihood of subsidence in accordance with 405 KAR 8:040 Section 26(1)(b)2. The authors acknowledge that the formulas should be modified by an appropriate factor of safety. Recognizing the wide variety of structures which must be considered in designing a subsidence control plan, the Department has classified structures into four (4) categories and established minimum pillar design safety factors for each based upon the published research. These categories are:

CATEGORY 1

- (a) water and sewer lines four (4) inches in diameter or less;
- (b) exposed oil and gas collector pipelines less than six (6) inches in diameter; and
- (c) electric lines and telephone lines to single family dwellings, livestock buildings, or other domestic structures.

CATEGORY 2

- (a) public roads not identified in Category 3;
- (b) single poles for electric transmission or telephone lines;
- (c) buried oil and gas collector pipelines less than six (6) inches in diameter; and
- (d) mobile homes.

CATEGORY 3

- (a) oil and gas non-collector pipelines less than six (6) inches in diameter;
- (b) oil pipelines six (6) inches in diameter or greater;
- (c) water lines greater than four (4) inches in diameter;
- (d) impoundments having a storage volume twenty (20) acre feet or more not identified in Category 4;
- (e) reservoirs serving as public water supplies;
- (f) aquifers serving as public water supplies;
- (g) multi-leg structures for electric transmission lines or telecommunications;
- (h) perennial streams;
- (i) dwellings that are occupied or reasonably subject to habitation;
- (j) state and federal roads; and
- (k) commercial/industrial buildings.

CATEGORY 4

- (a) hospitals, schools, churches, and publicly owned buildings;
- (b) gas pipelines six (6) inches in diameter or greater;
- (c) dams classified as Class B or Class C impoundments; and
- (d) state and federal highway bridges.

Occasional double-poles or braced poles in an otherwise single-pole electric line or telephone line, used at points where the line abruptly changes direction or elevation, will not be considered multi-leg structures under Category 3.

For this purpose, a stream whose drainage area is less than 200 acres will not be considered perennial unless site-specific information indicates that the stream meets the 405 KAR 8:001 definition of "perennial stream" (flows continuously during all of the calendar year as a result of ground water discharge or surface runoff).

Structures and renewable resource lands not listed in the above categories will be classified by the Department on a case-by-case basis as necessary.

For structures in each of the above categories a subsidence protection zone must be established. The protection zone must encompass an area fifteen (15) feet offset on each side of the structure at the surface and downward fifteen (15) degrees (from vertical) to the coal seam to be mined.

If the surface slope at the structure exceeds five (5) percent, the protection zone on the downhill side must be increased by a distance equal to the depth to the coal seam times the surface slope, in percent.

The above protection zone design criteria are described in the SME Mining Engineering Handbook (p. 13-6).

Pillar design for subsidence control in the protection zone will be considered adequate when the minimum safety factors presented below are used.

MINIMUM PILLAR DESIGN SAFETY FACTORS

| <u>METHOD</u> | <u>CATEGORY 1</u> | <u>CATEGORY 2</u> | <u>CATEGORY 3</u> | <u>CATEGORY 4</u> |
|----------------|-------------------|-------------------|-------------------|-------------------|
| Holland-Gaddy | Narrative | 1.8 | 2.0 | 2.5 |
| Bieniawski-PSU | Narrative | 1.5 | 1.75 | 2.3 |

The narrative for Category 1 must describe how the proposed mining plan will not cause material damage or diminution of value or foreseeable use of the structure.

In using the formulas and safety factors outlined above, applicants must take into account all recommendations in the author's research which may include minimum pillar sizes. The compressive strength value of the coal used in the formulas must be obtained from representative samples at sufficient areal and vertical locations to furnish adequate geologic information as required by 405 KAR 8:040 Section 13. The sampling procedures for determining compressive strength outlined in the SME Mining Engineering Handbook (pp. 13-103) are recommended.

The Department will continue to accept the 50% recovery method outlined in the SME Mining Engineering Handbook (pp. 13-6 - 13-8) and will consider other methods case-by-case if the applicant provides copies of the original research papers and can demonstrate the method is applicable.

Regardless of the method used to design subsidence control plans an applicant must ensure that all other applicable requirements of 405 KAR 8:040 Section 26 are met.

It is anticipated that the acceptance of the above described methods should allow applicants more flexibility in designing adequate subsidence control plans while at the same time maximizing resource recovery.