Project 0-311, Evaluation of Fast-Setting Repair Materials for Concrete Pavements and Bridges [Presentation Slides]

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"Evaluation of Fast-Setting Repair Materials for Concrete Pavements and Bridges"

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Report Date: December 1982

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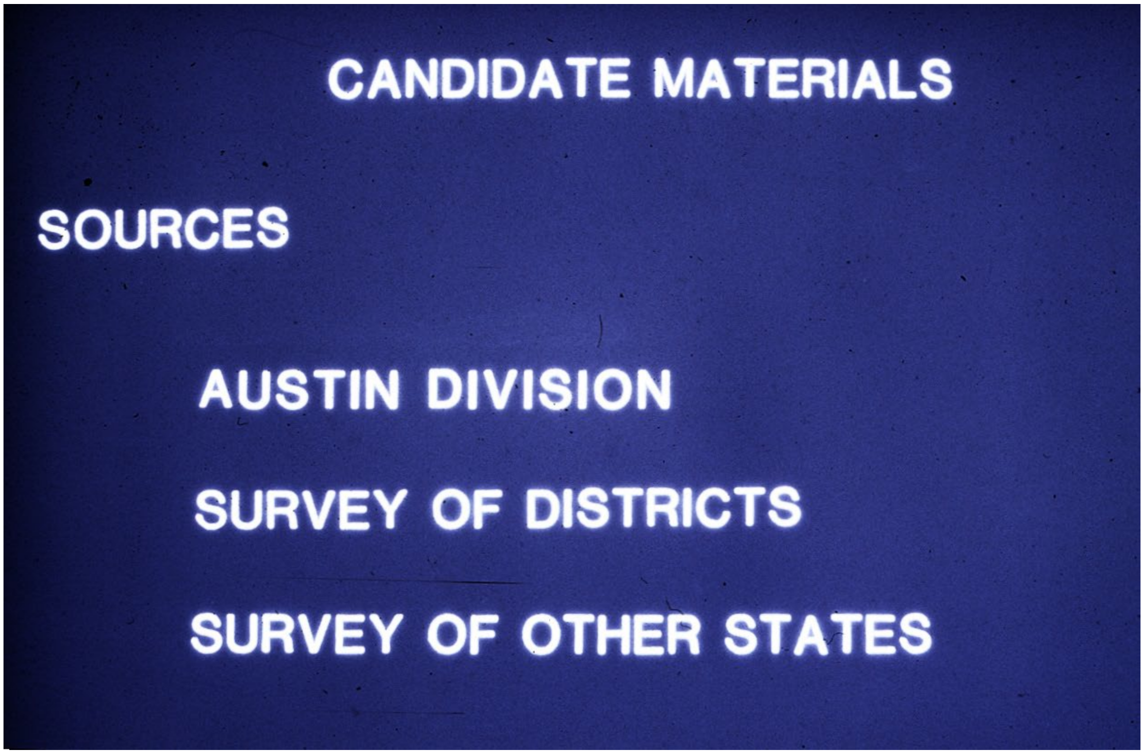

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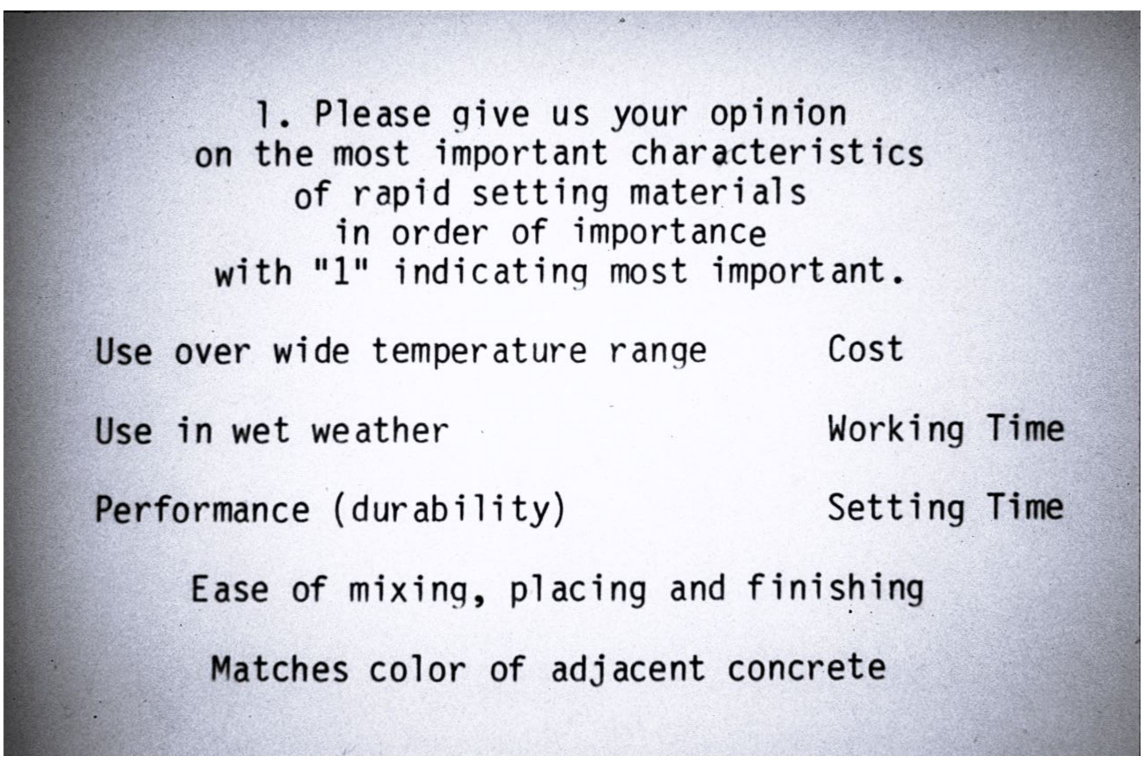

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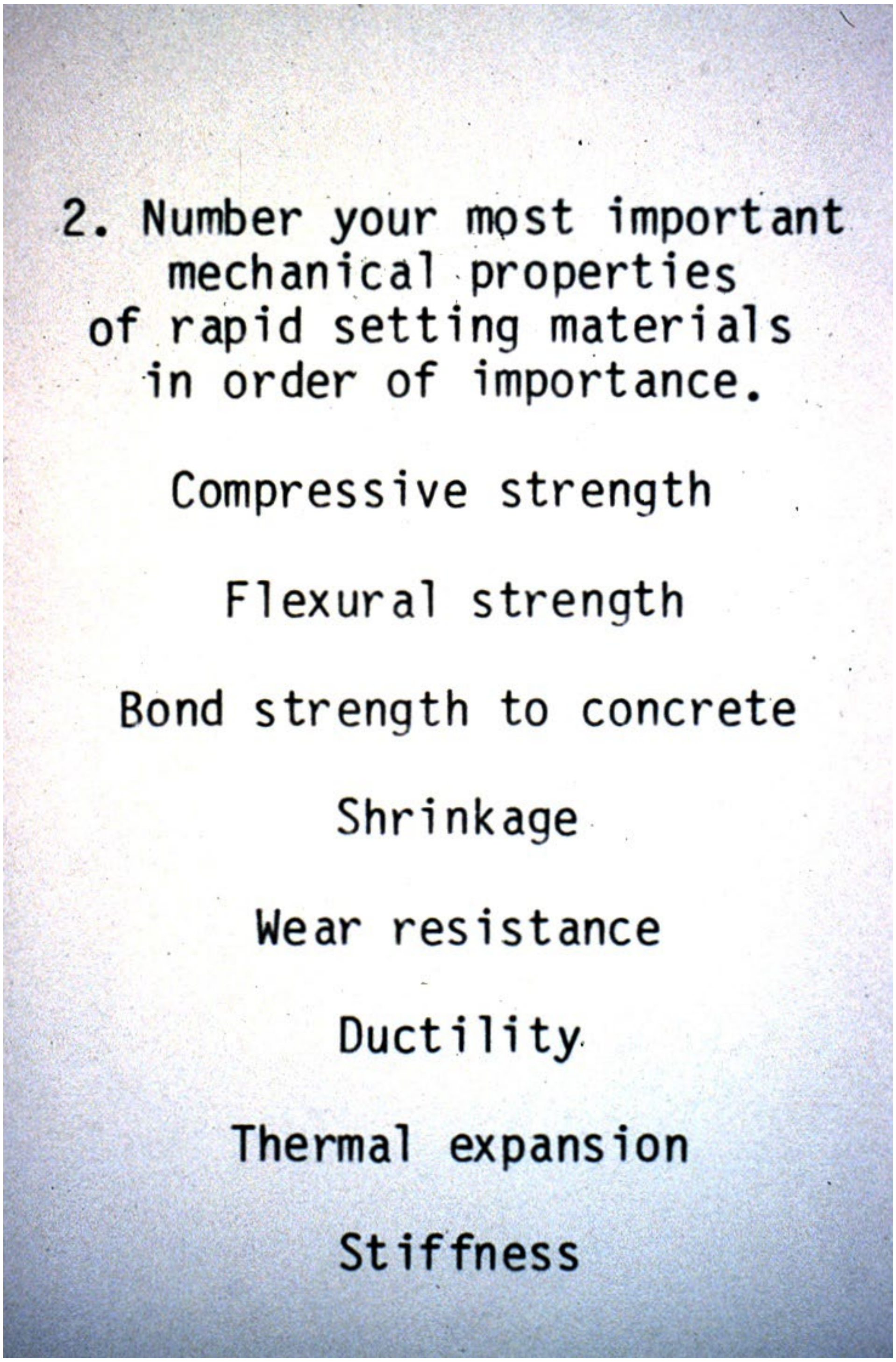

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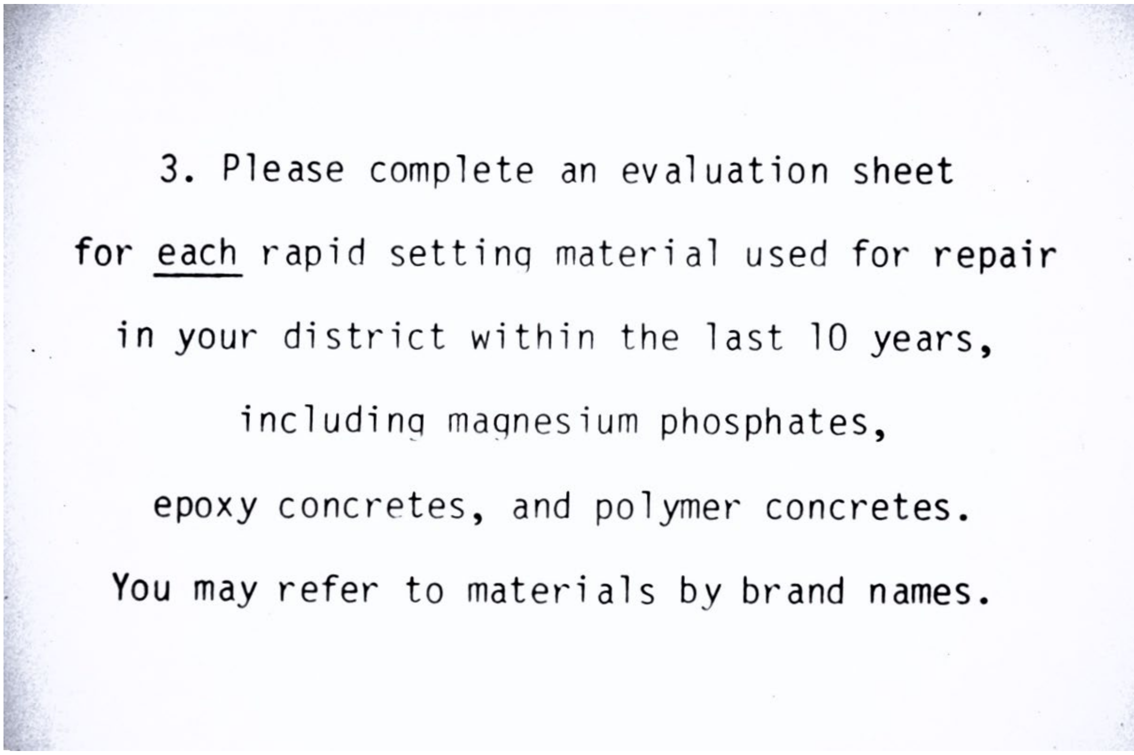

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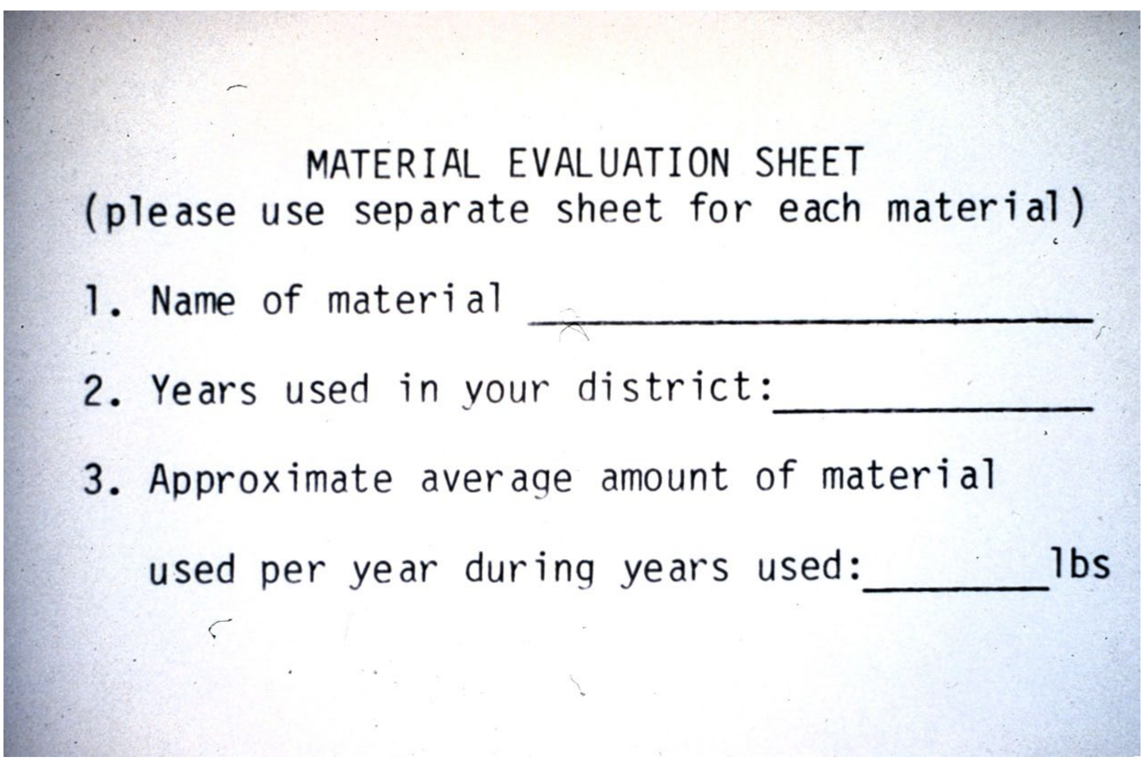

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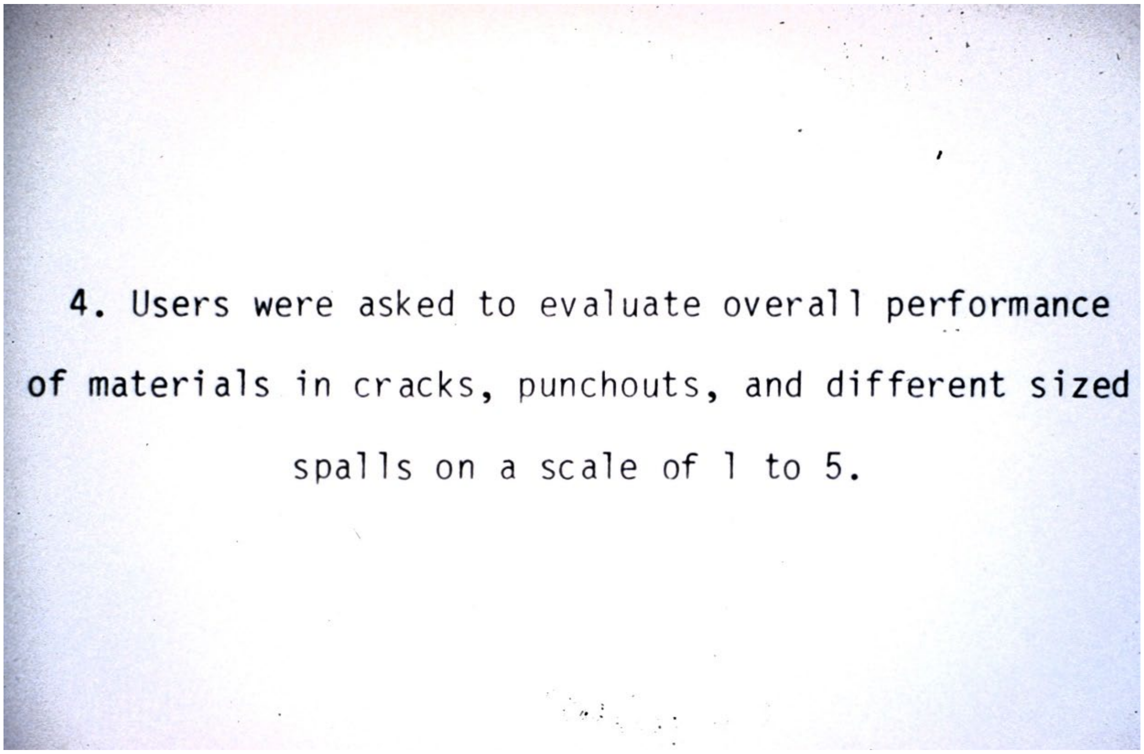

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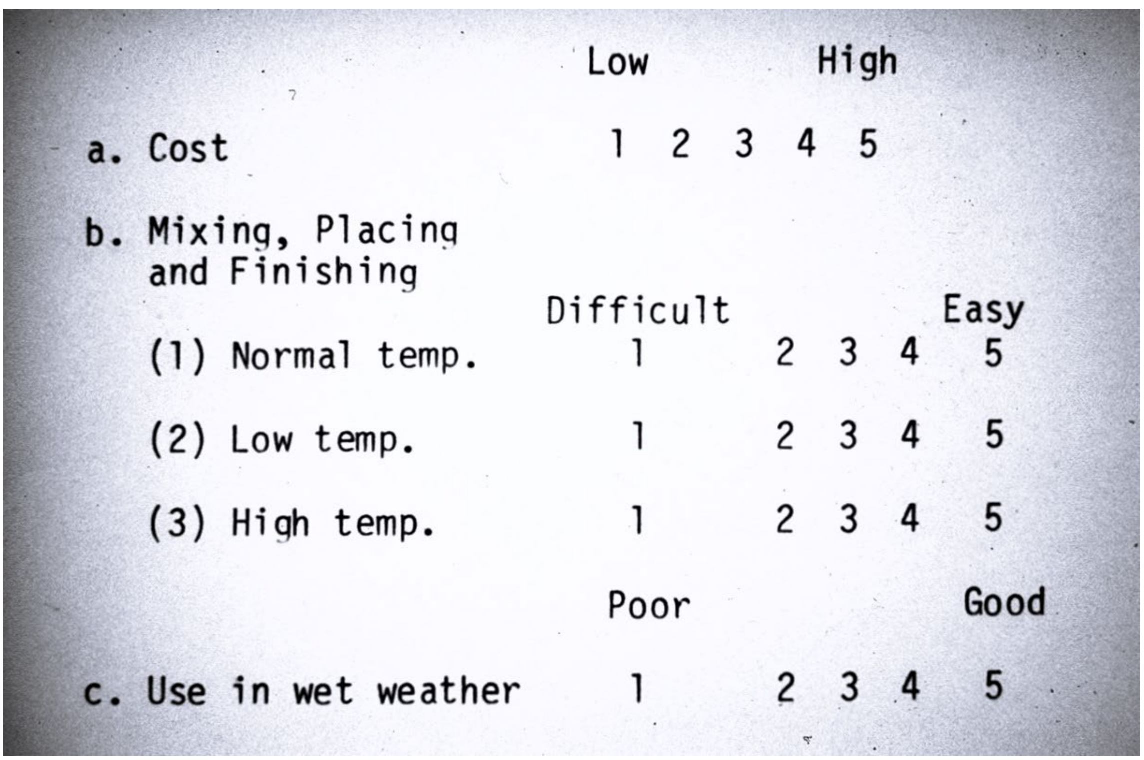

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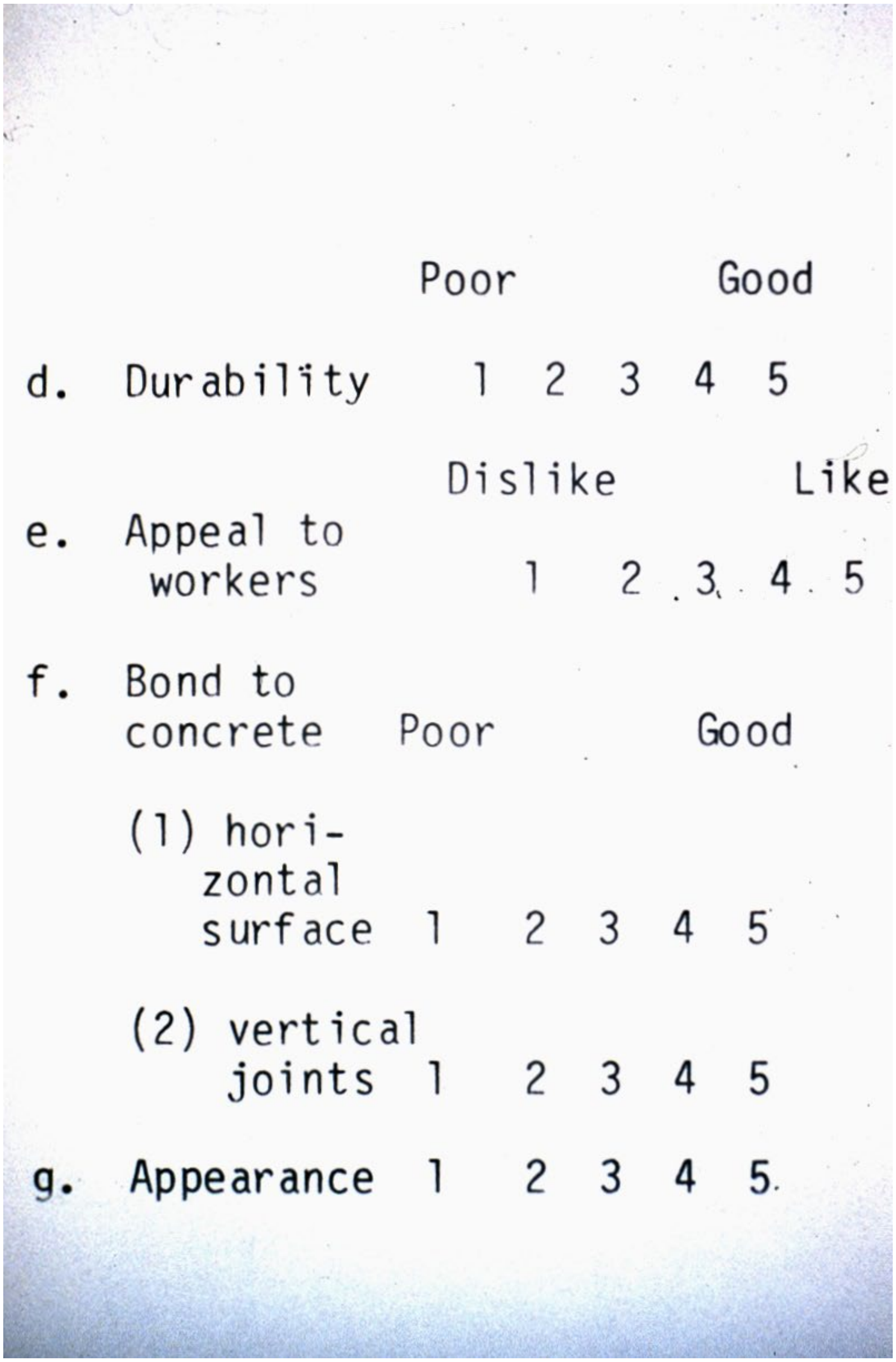

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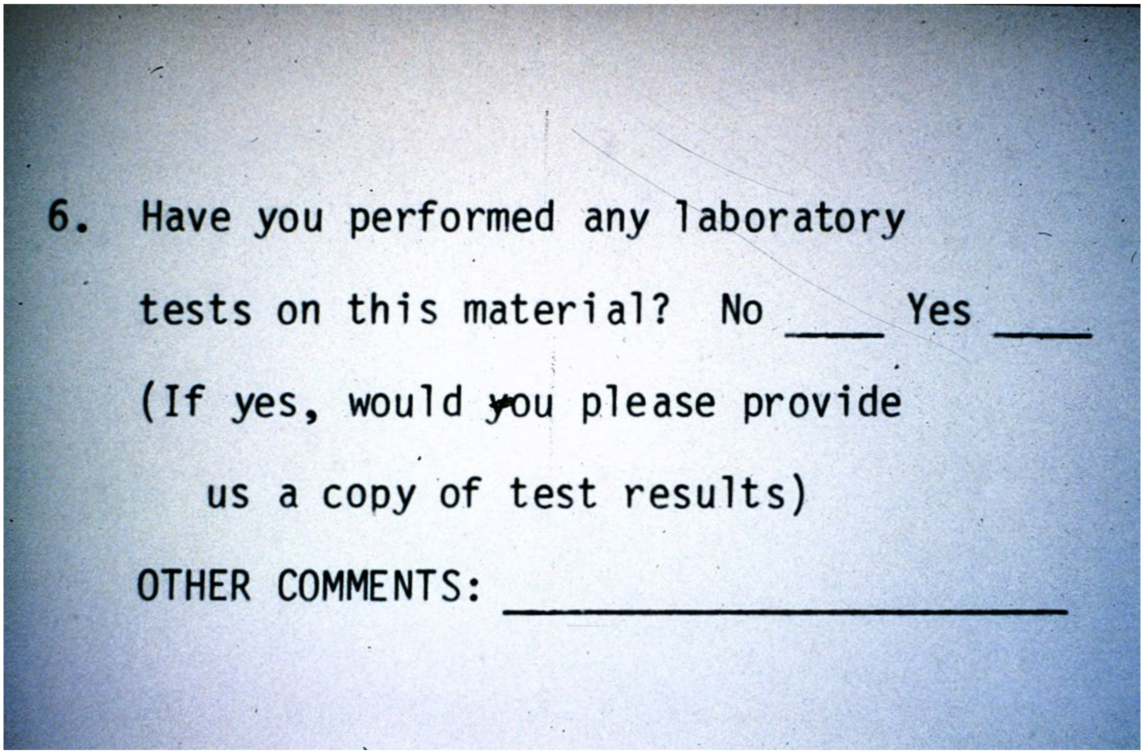

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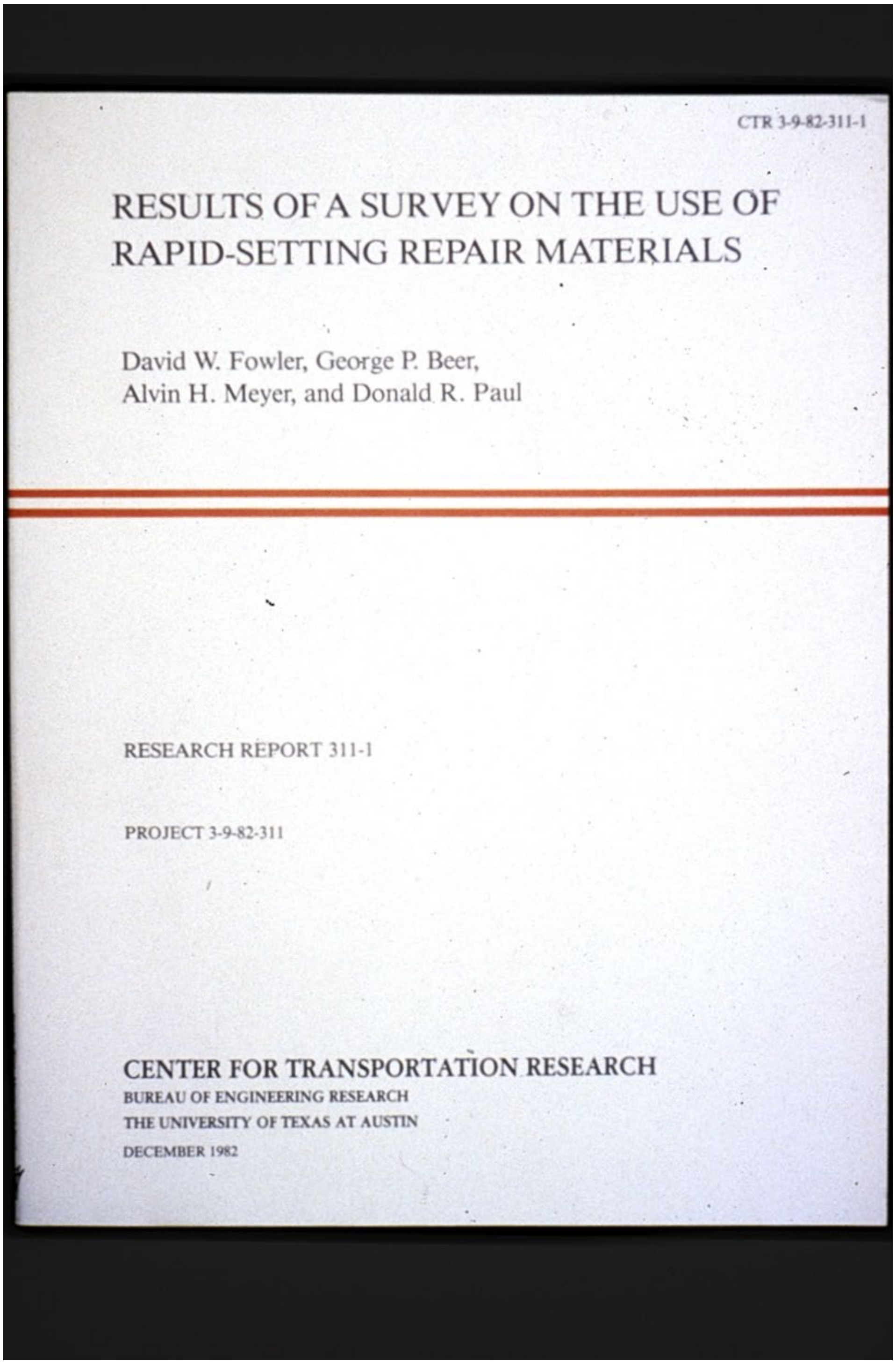

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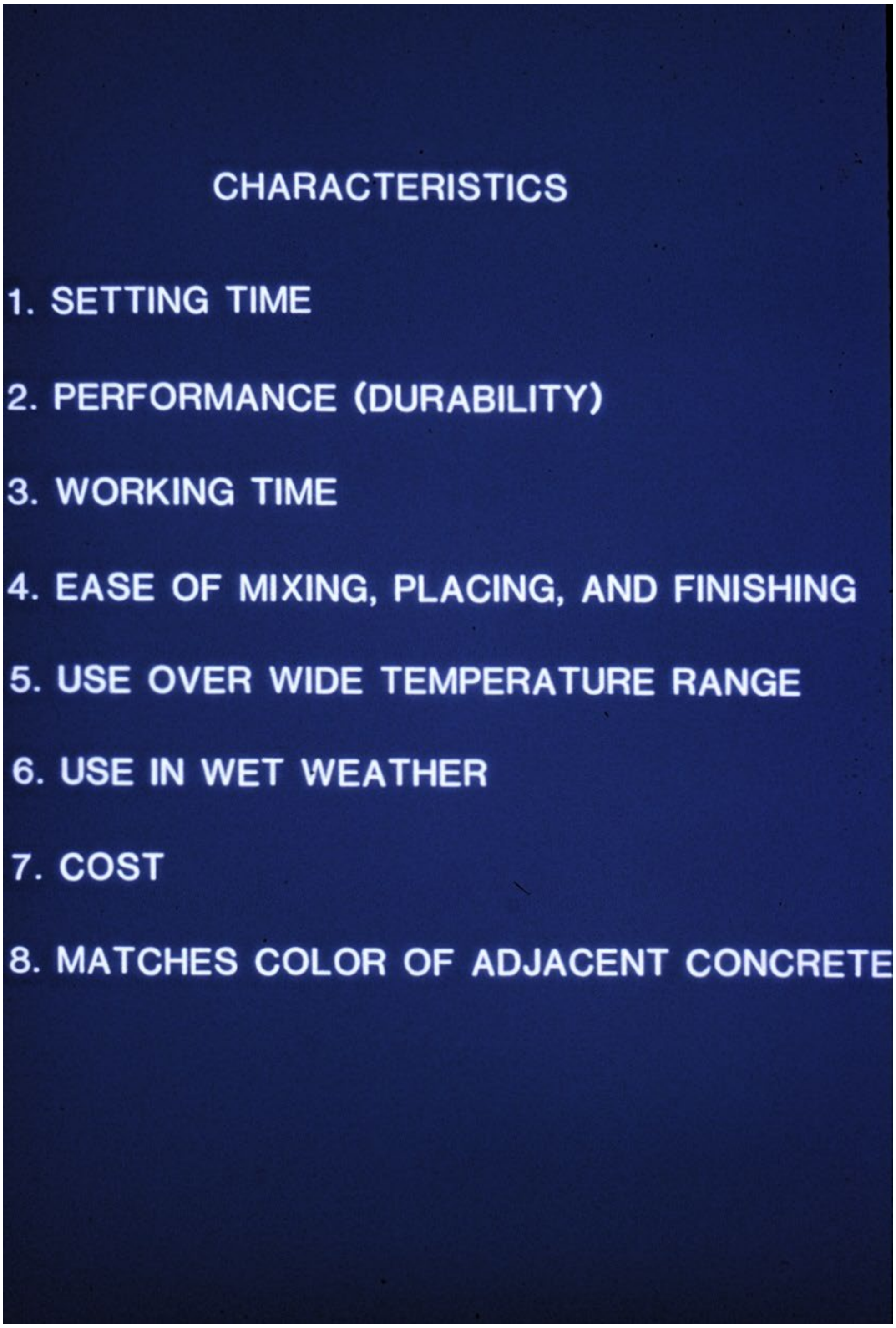

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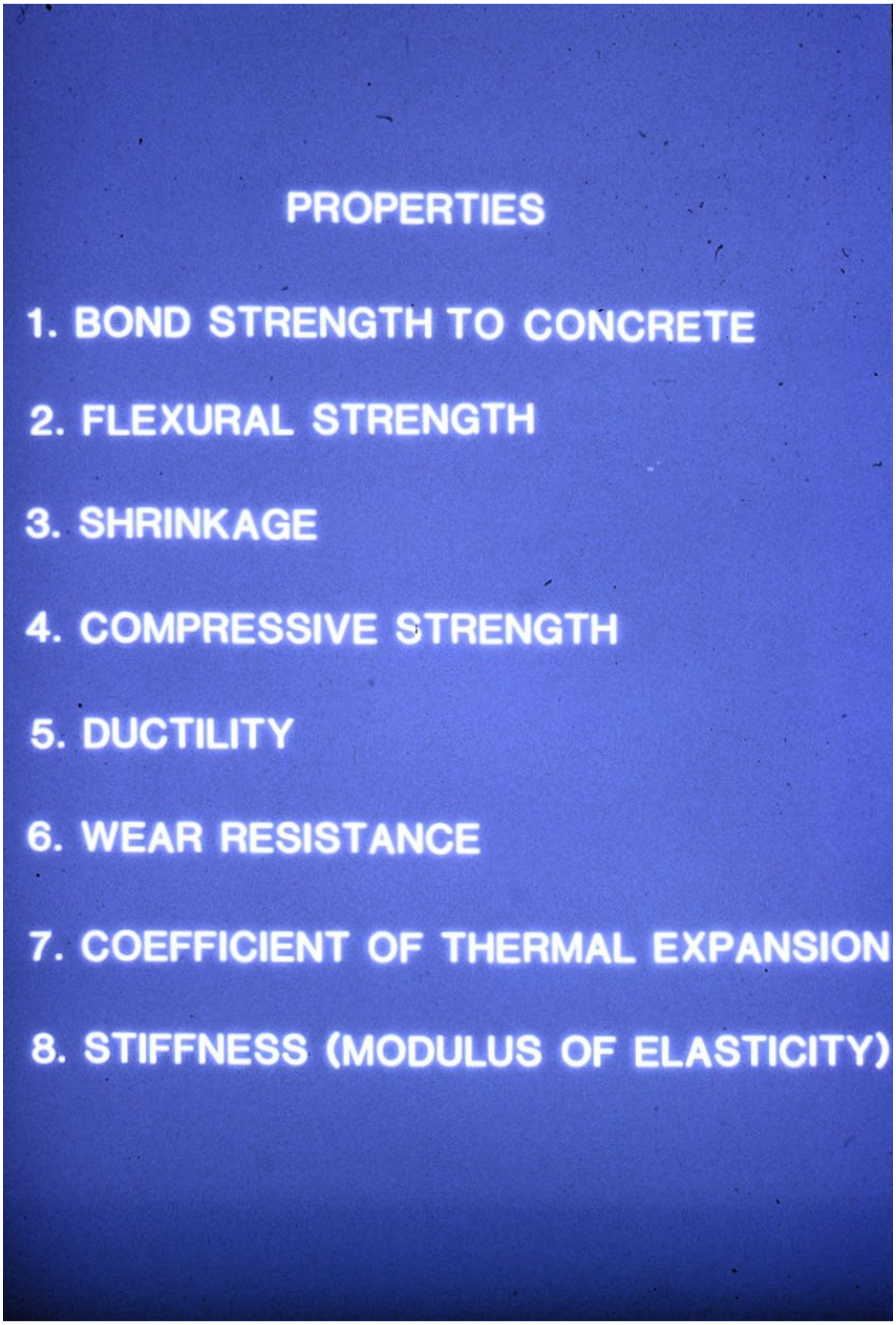

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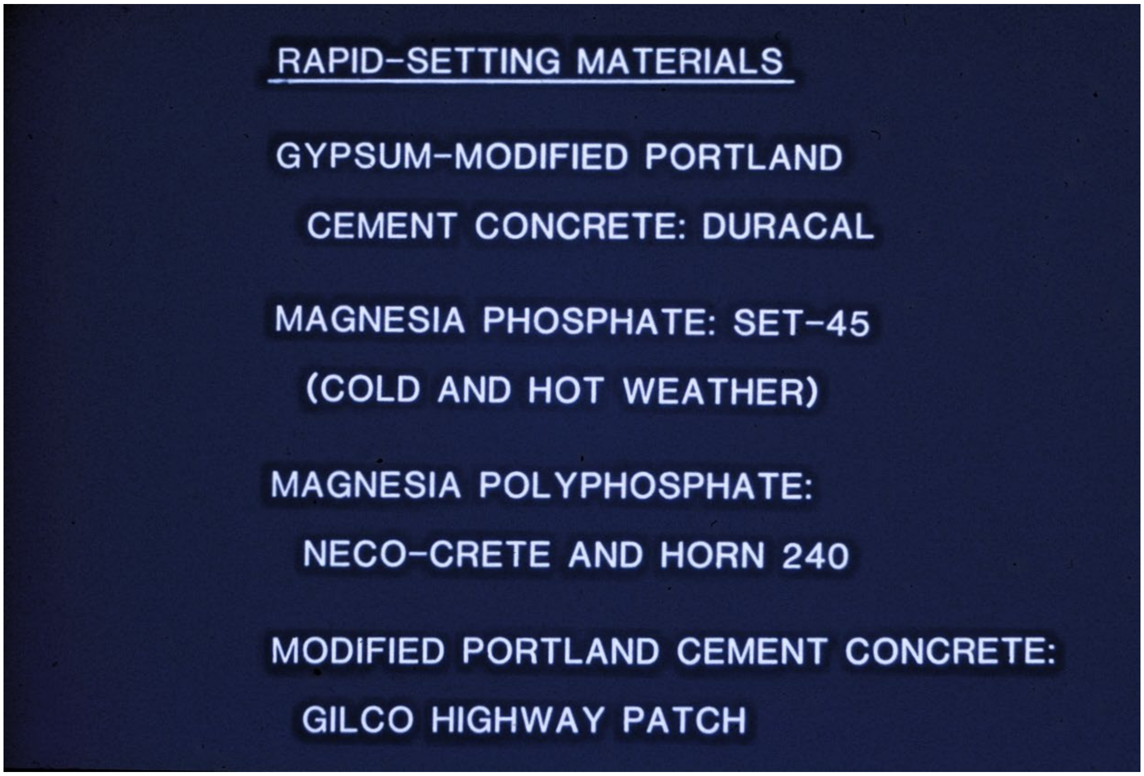

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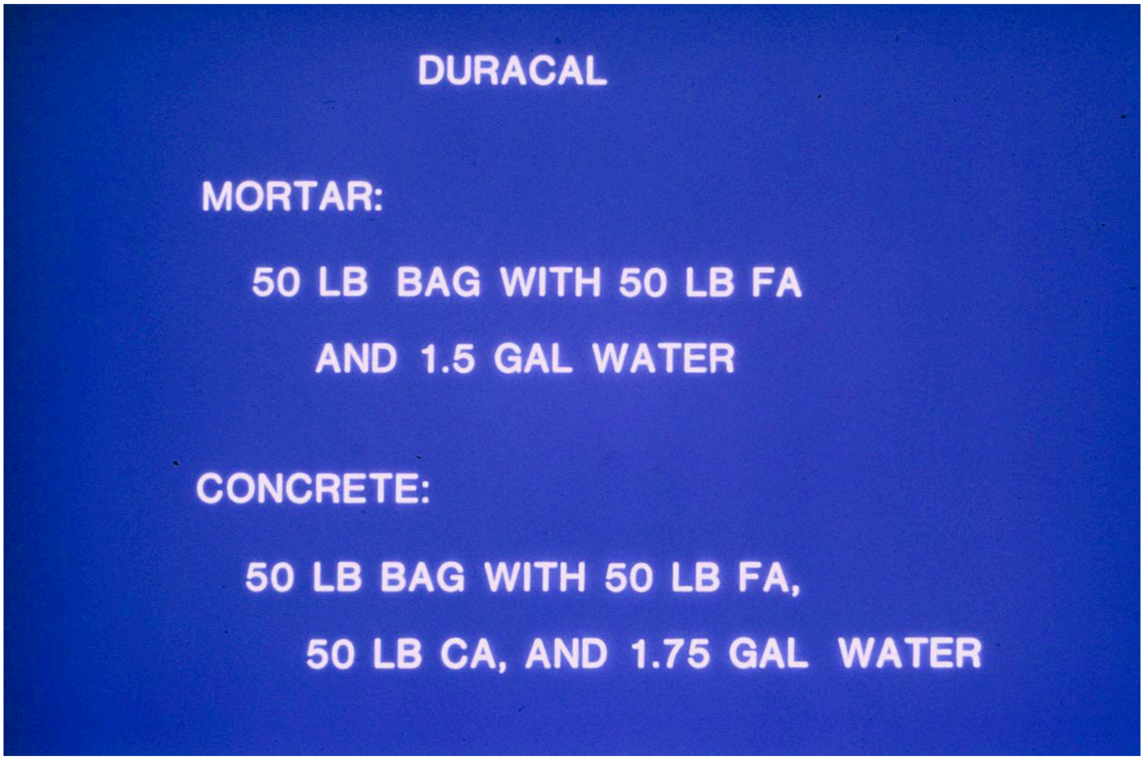

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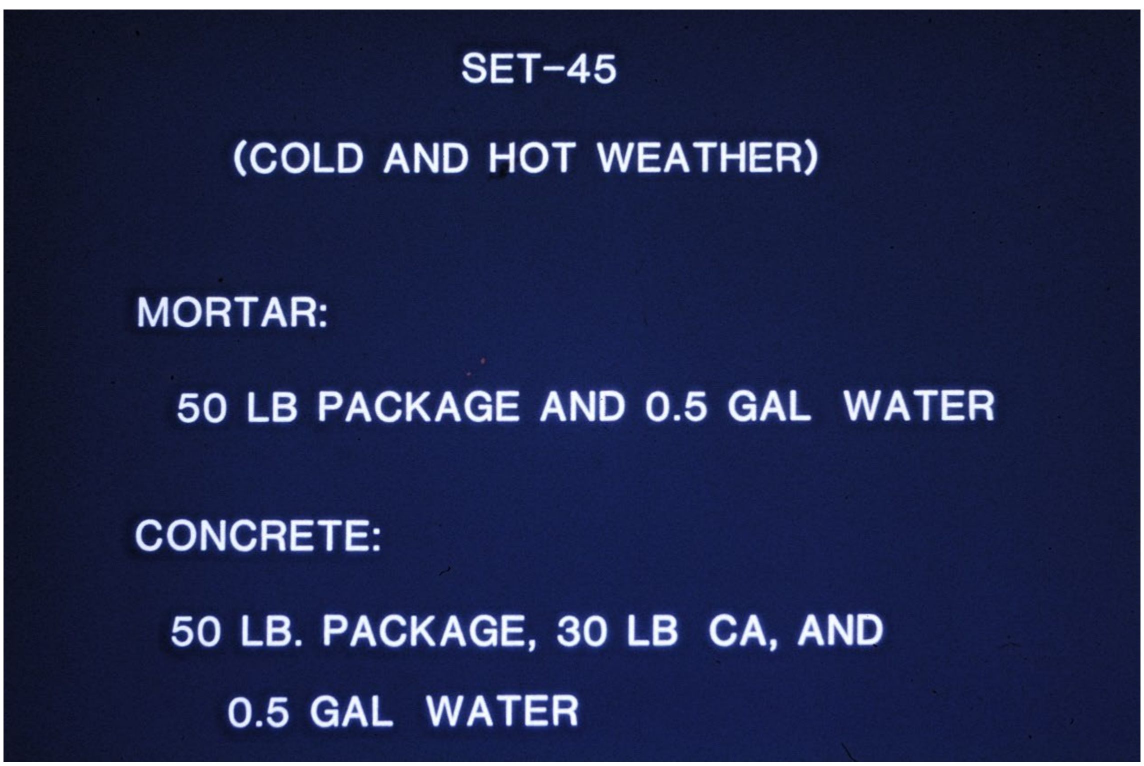

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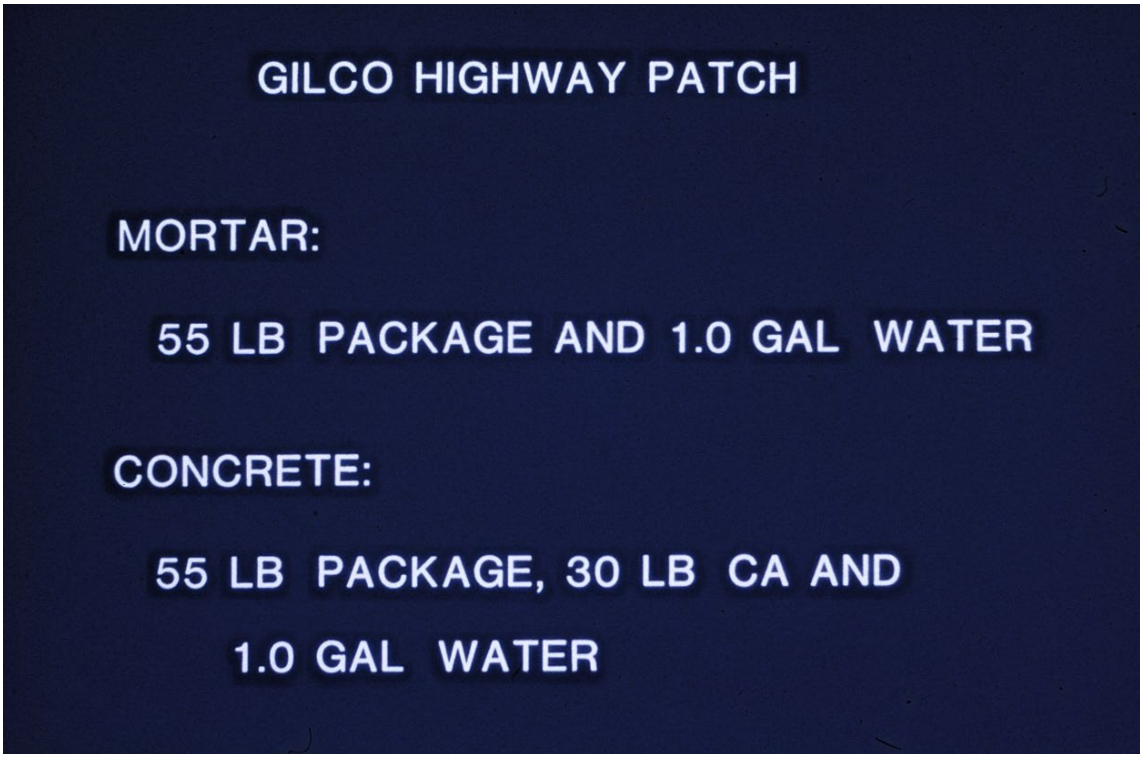

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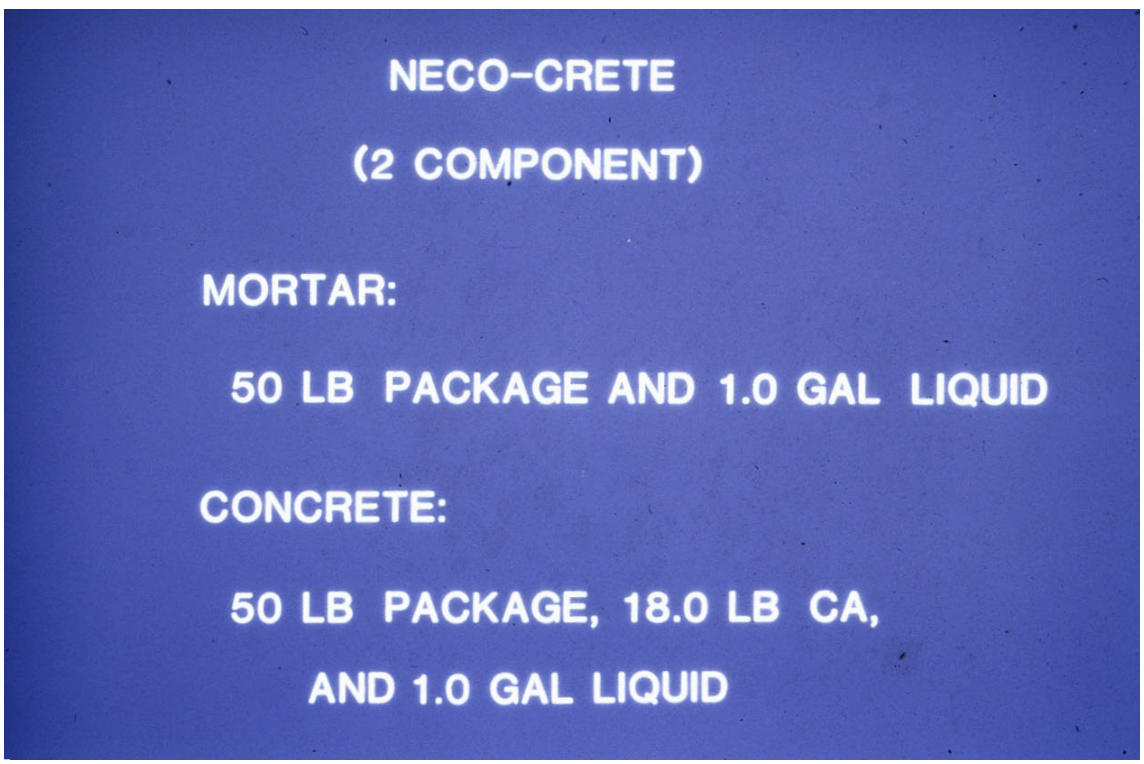

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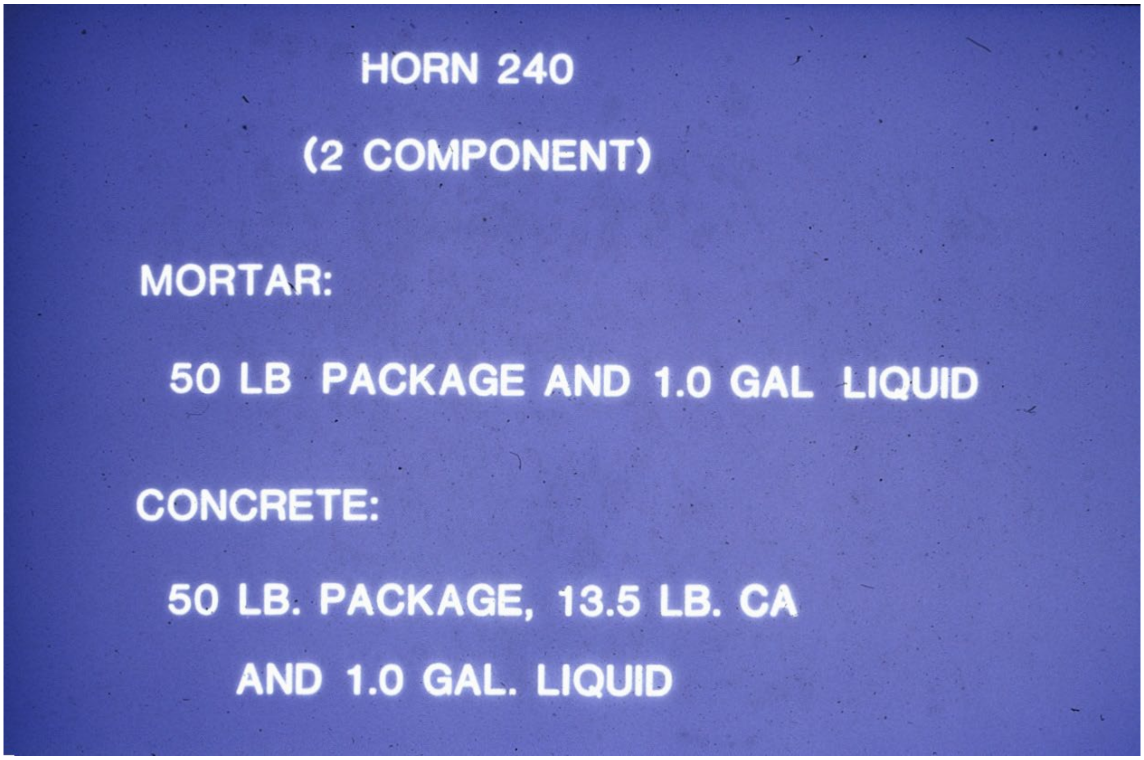

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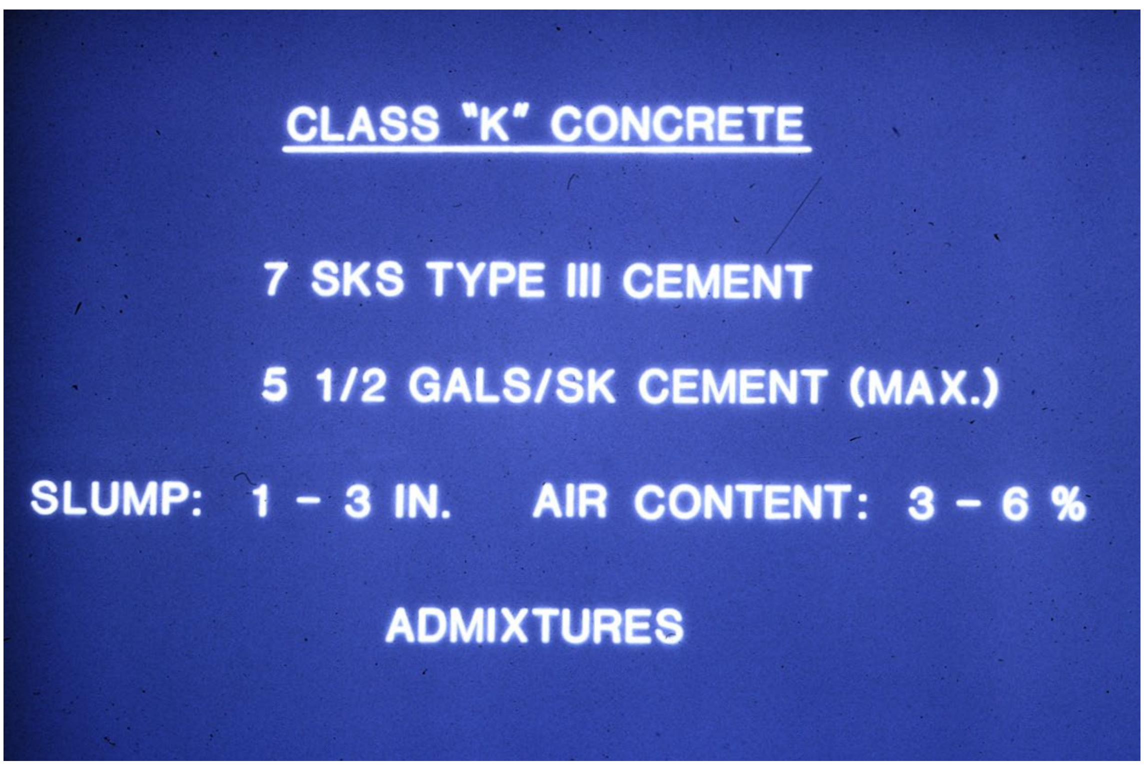

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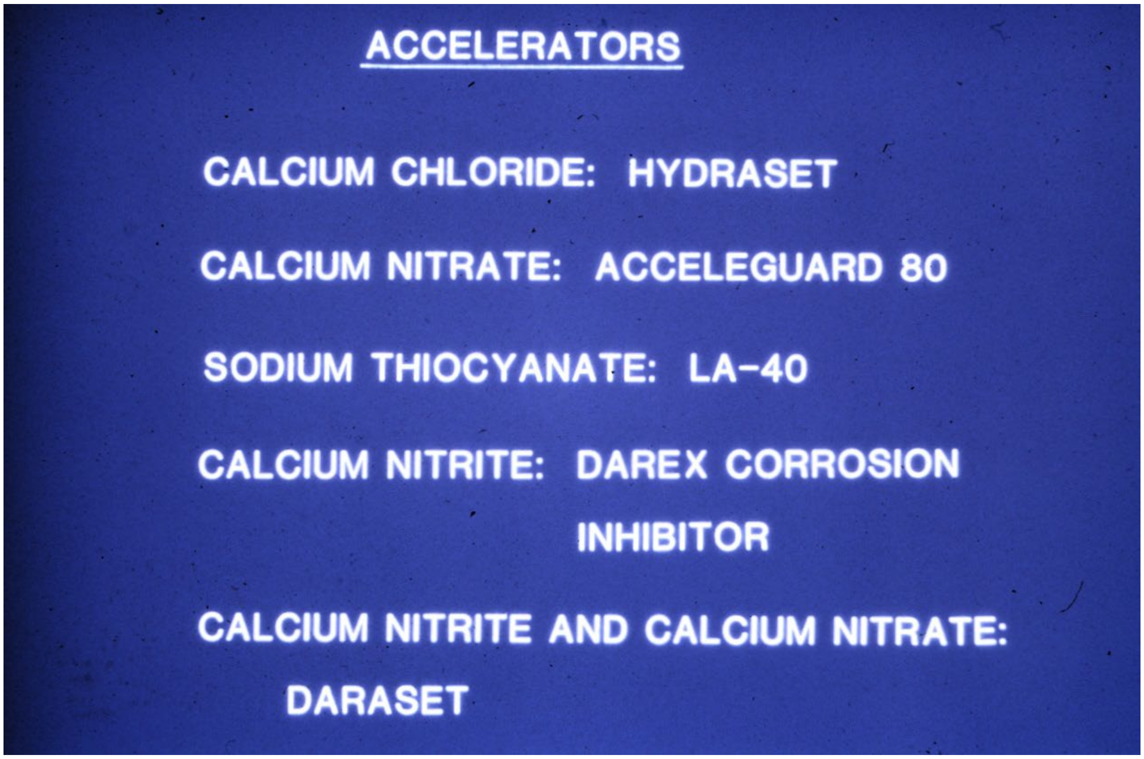

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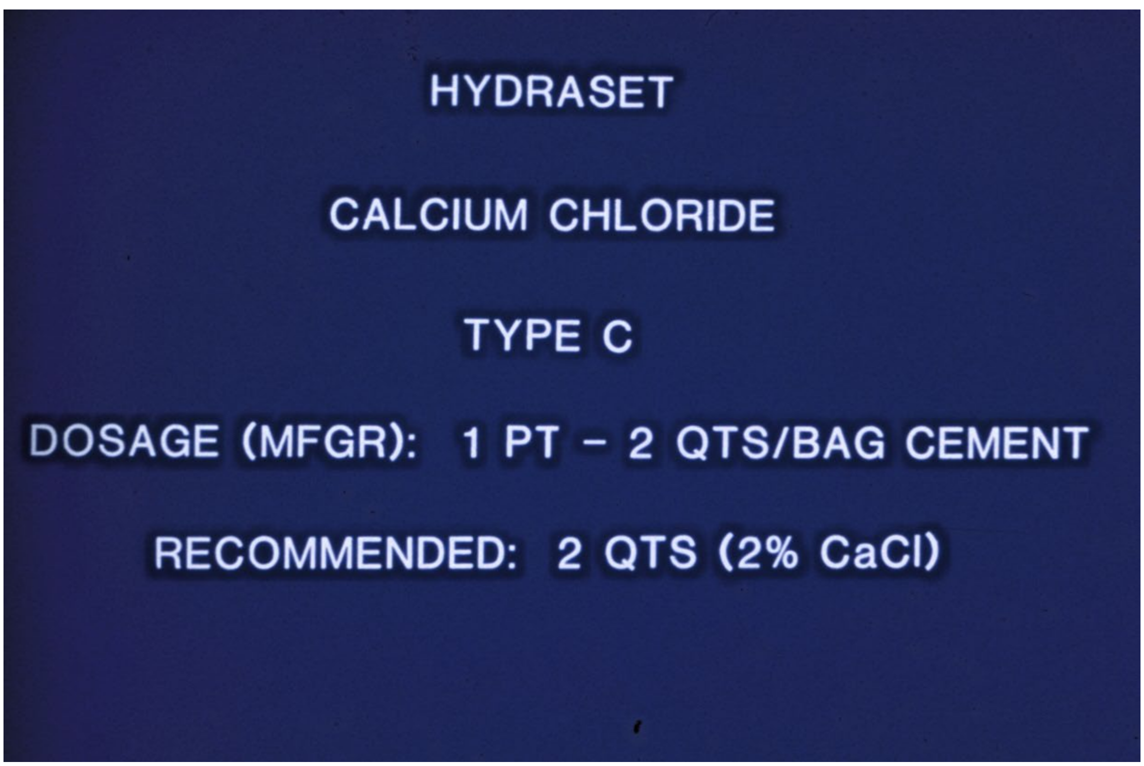

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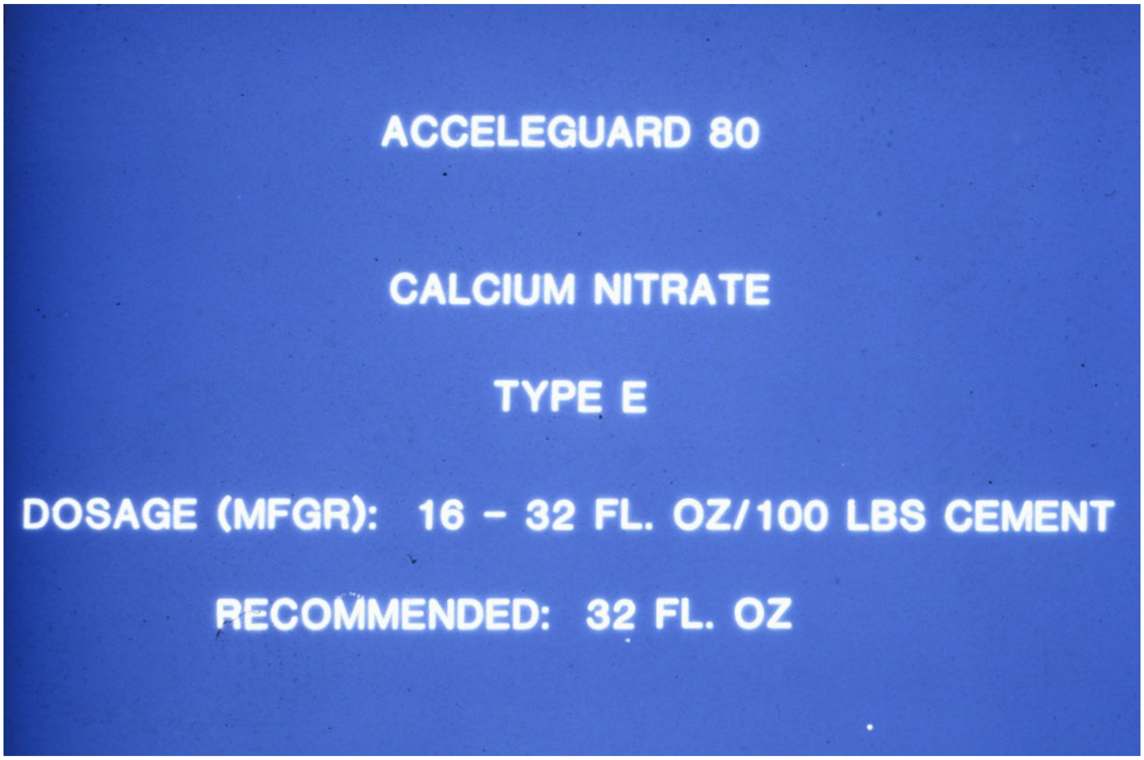

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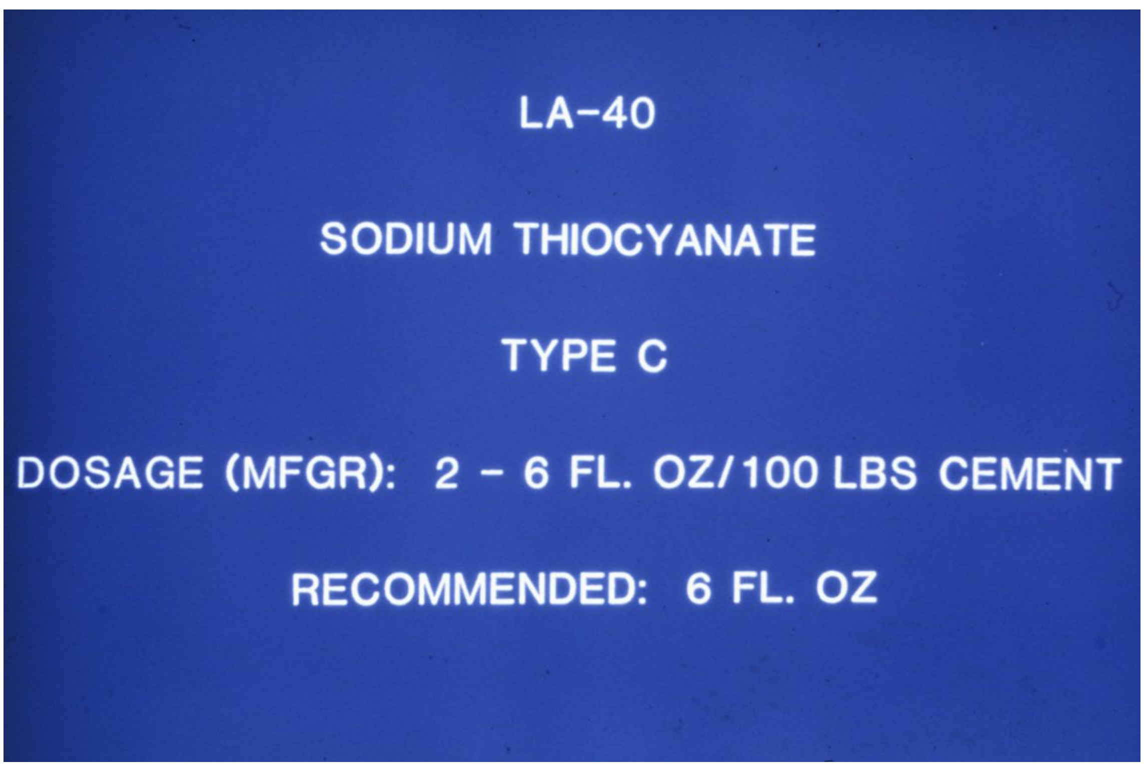

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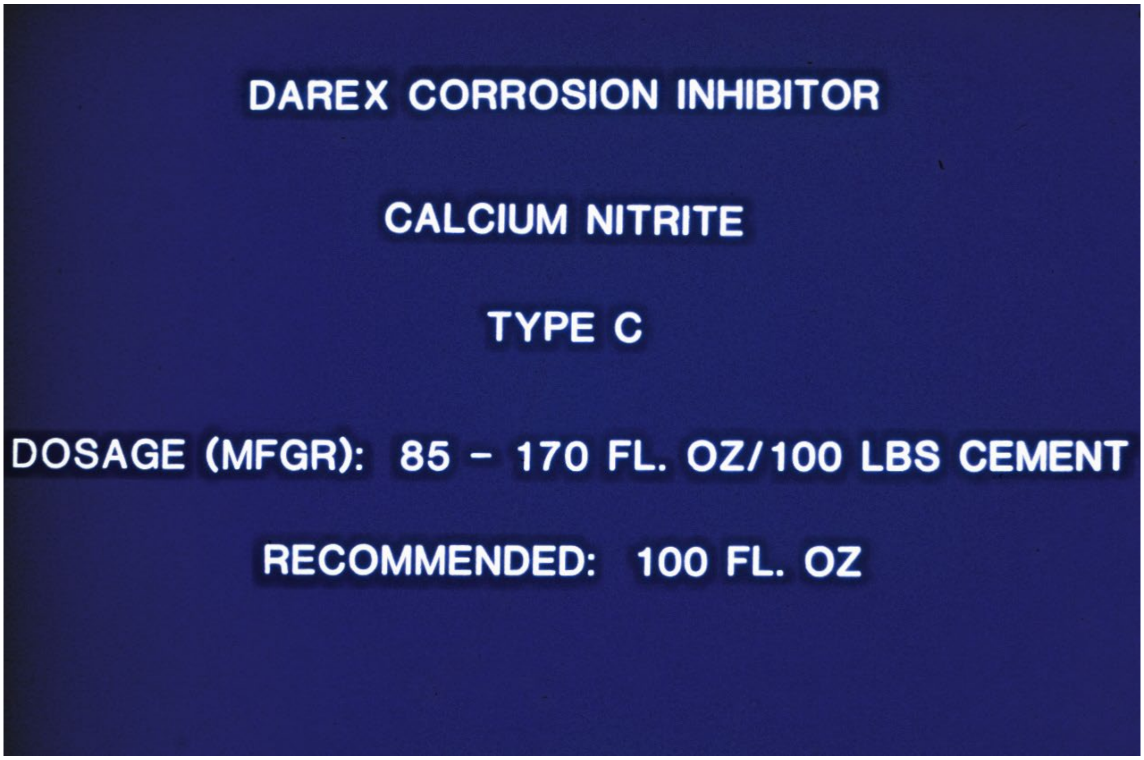

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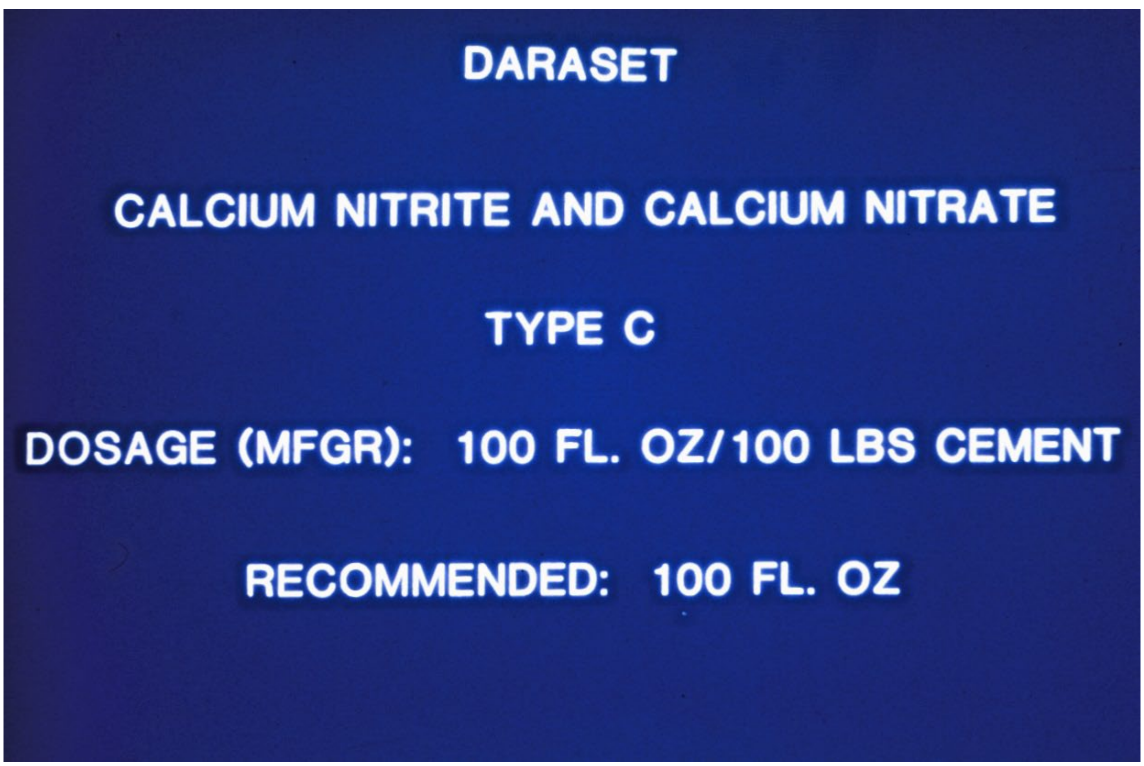

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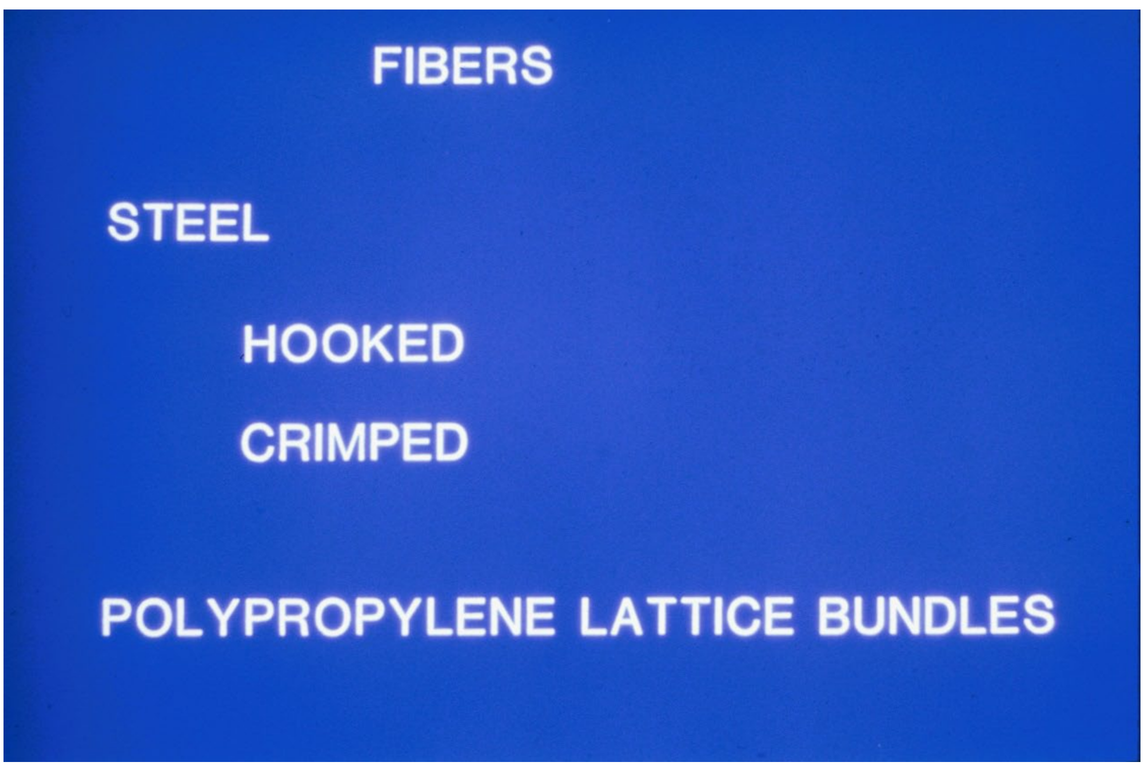

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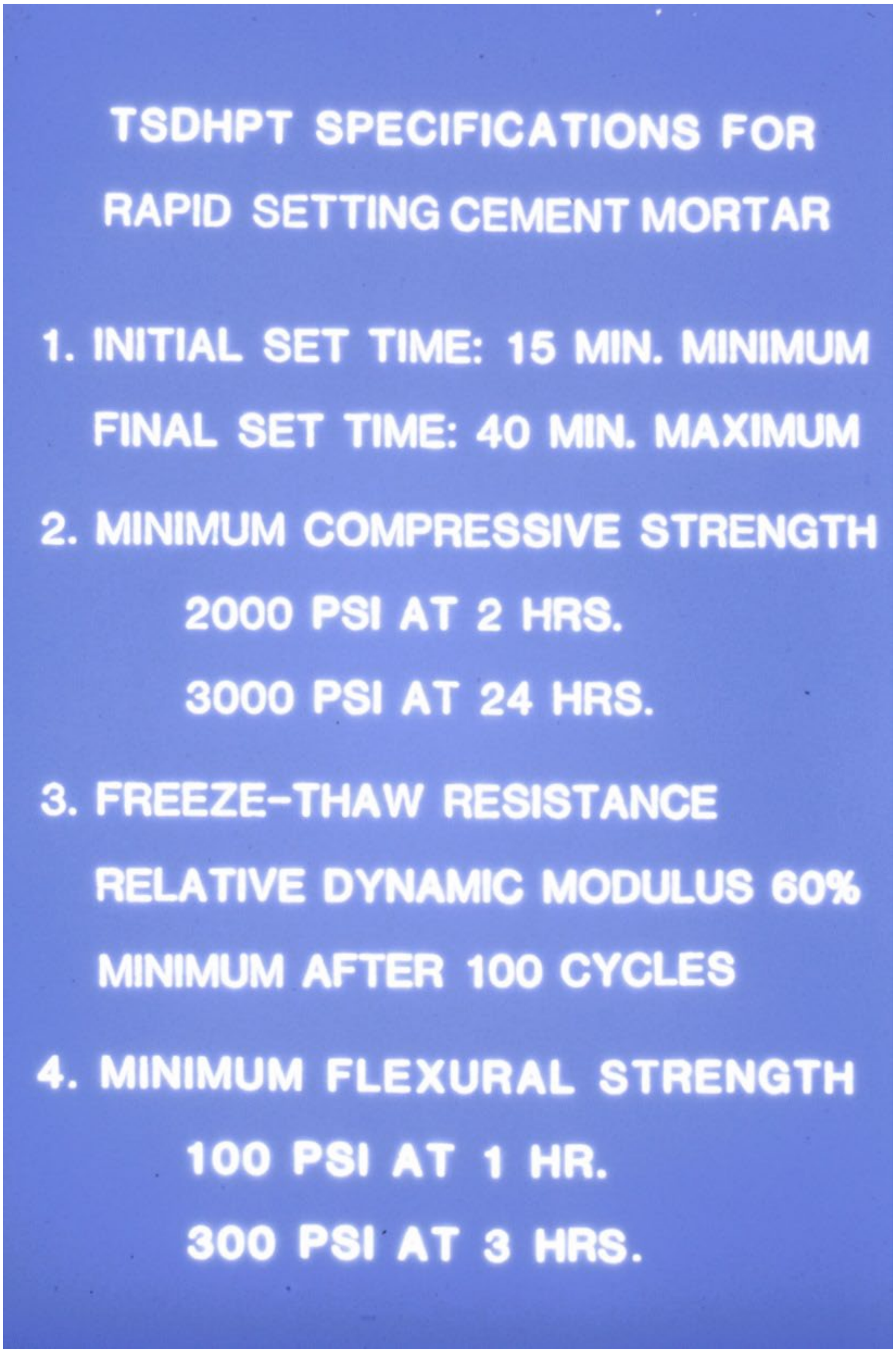

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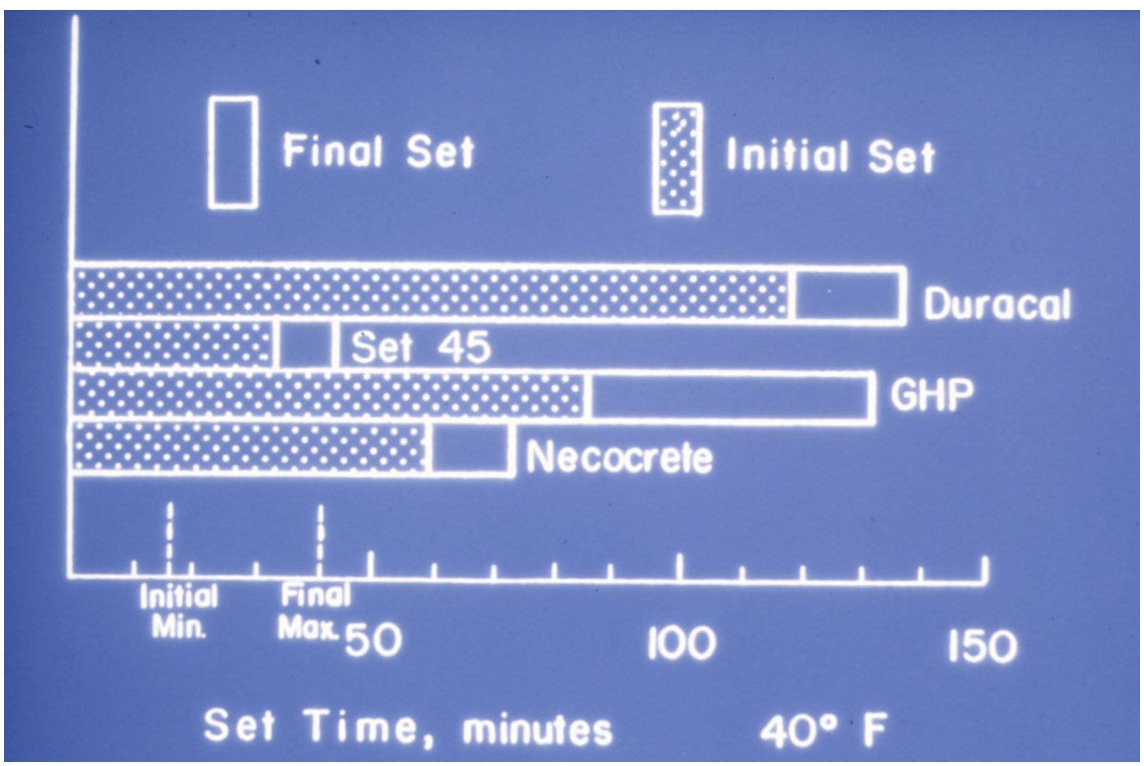

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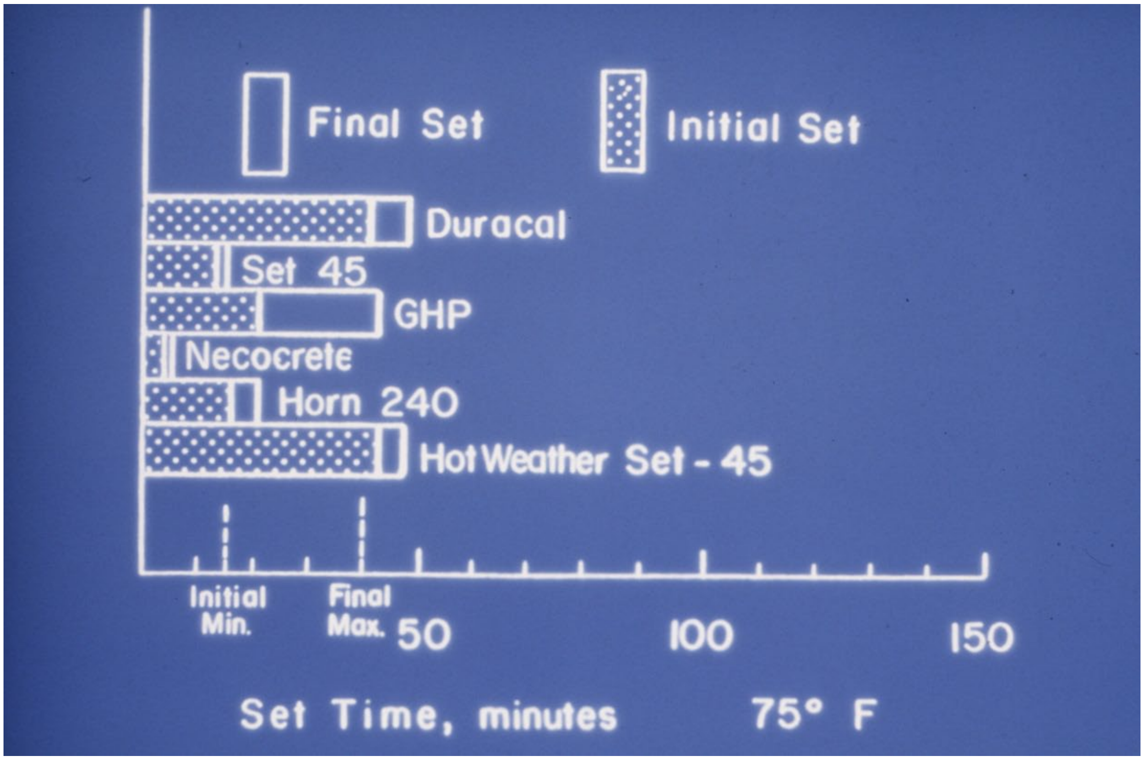

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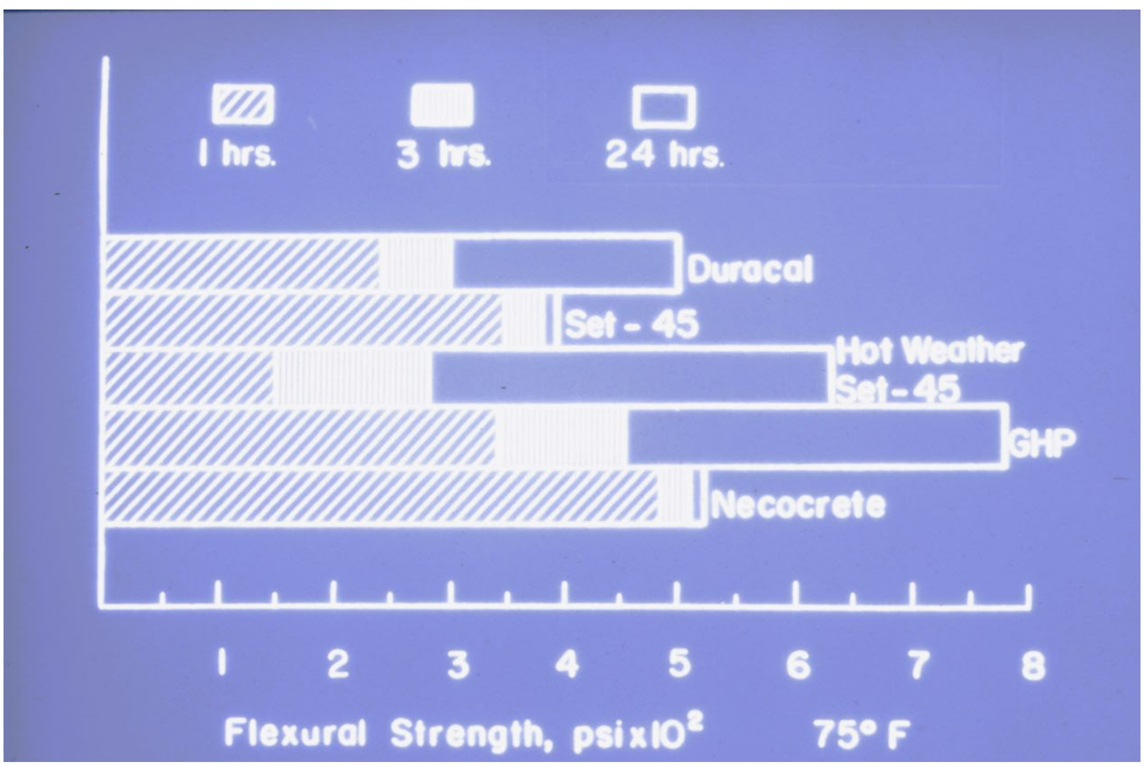

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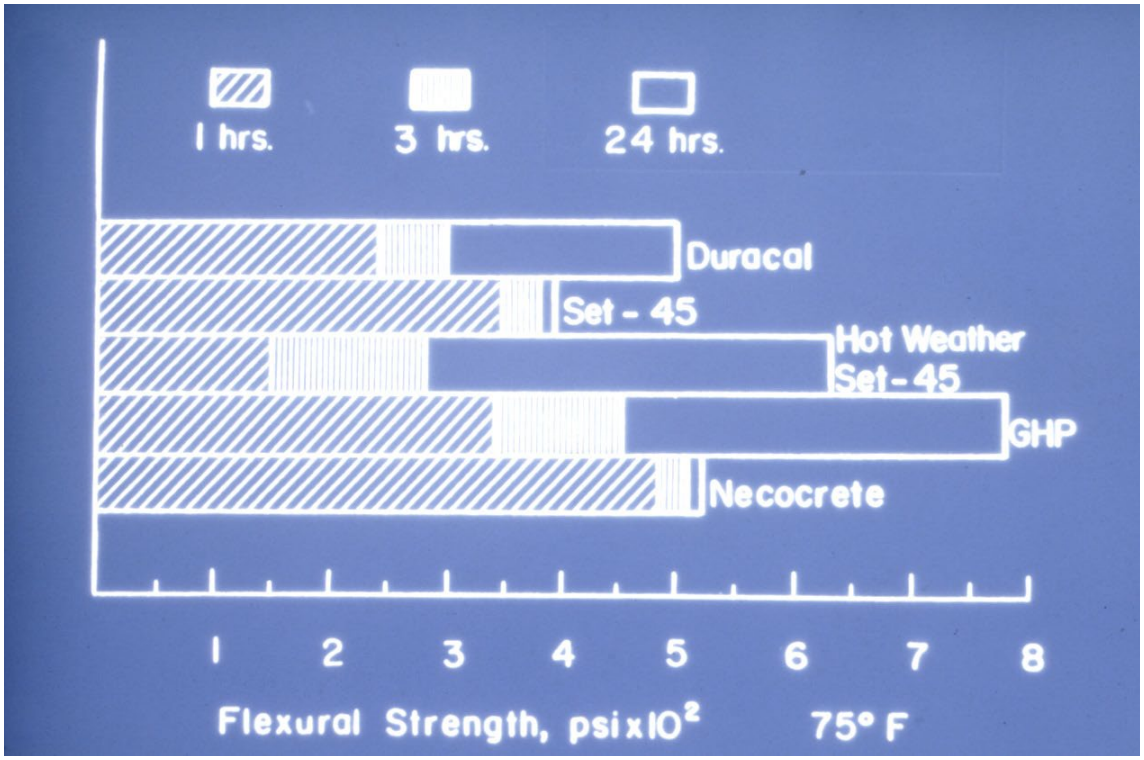

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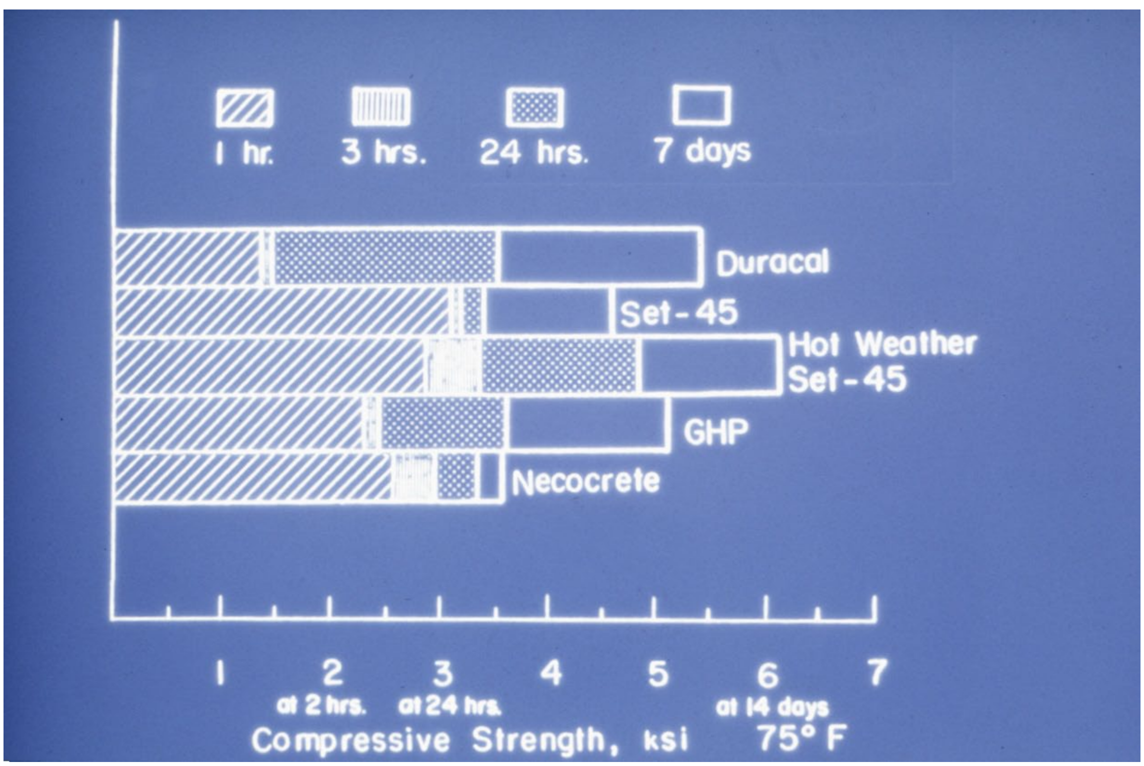

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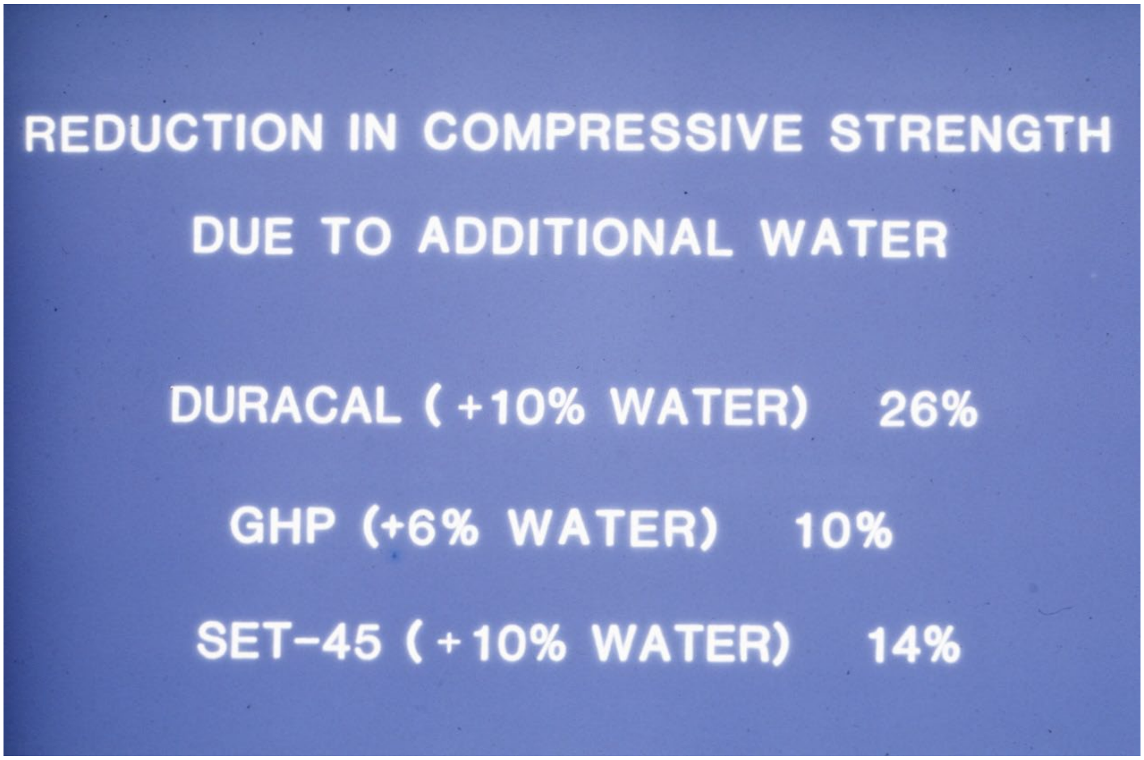

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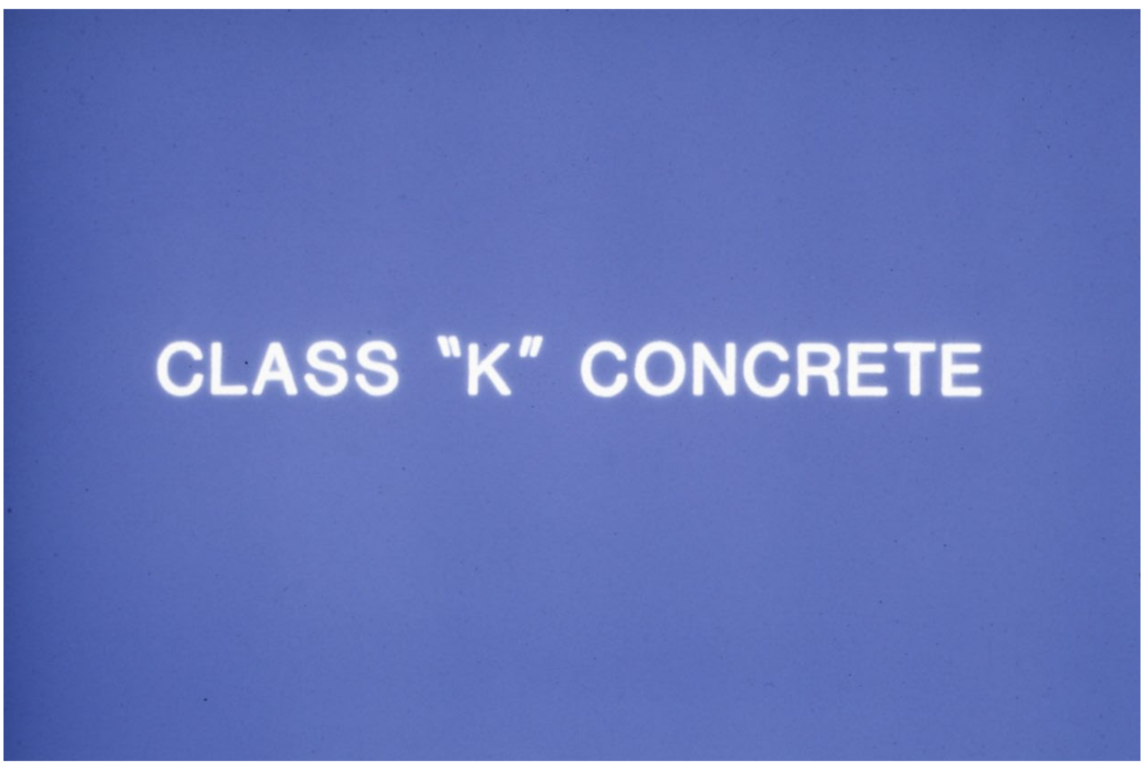

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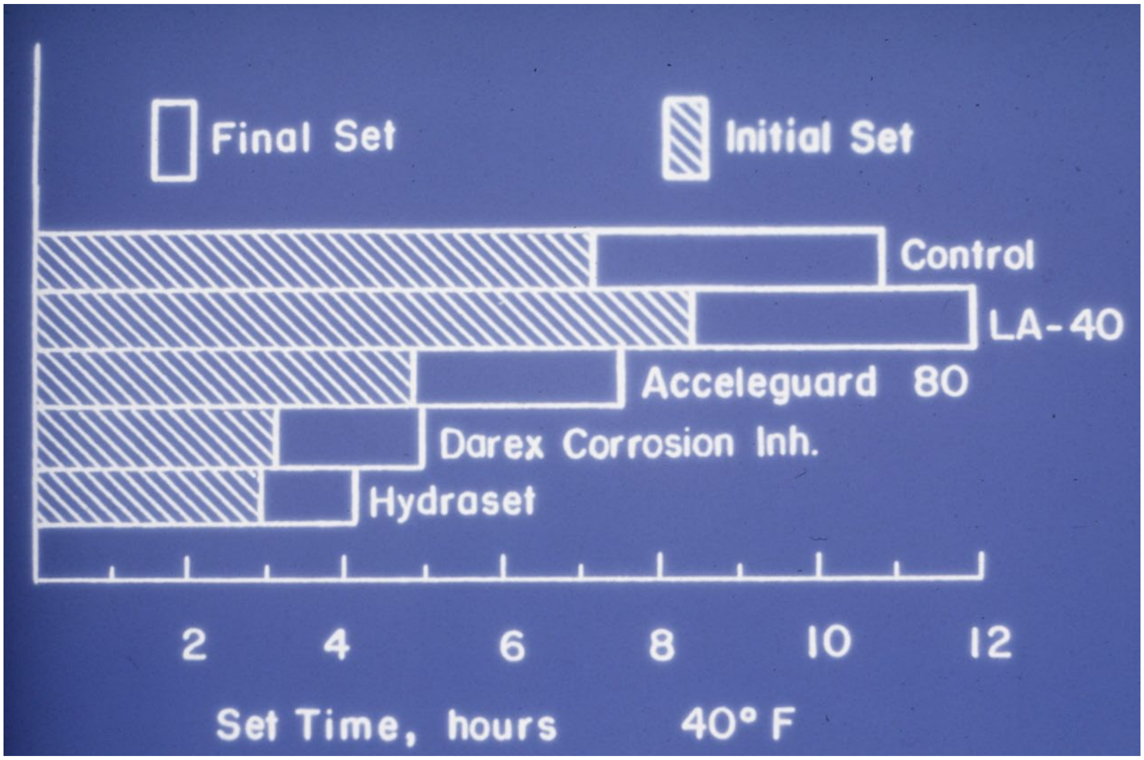

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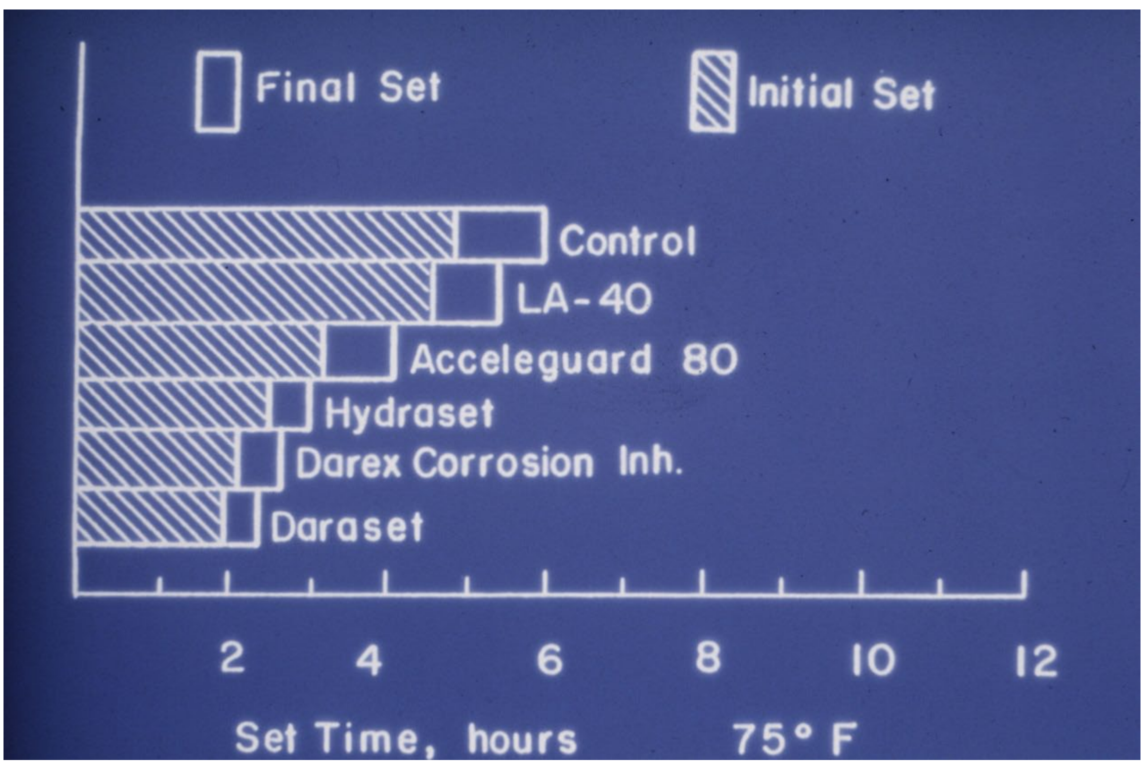

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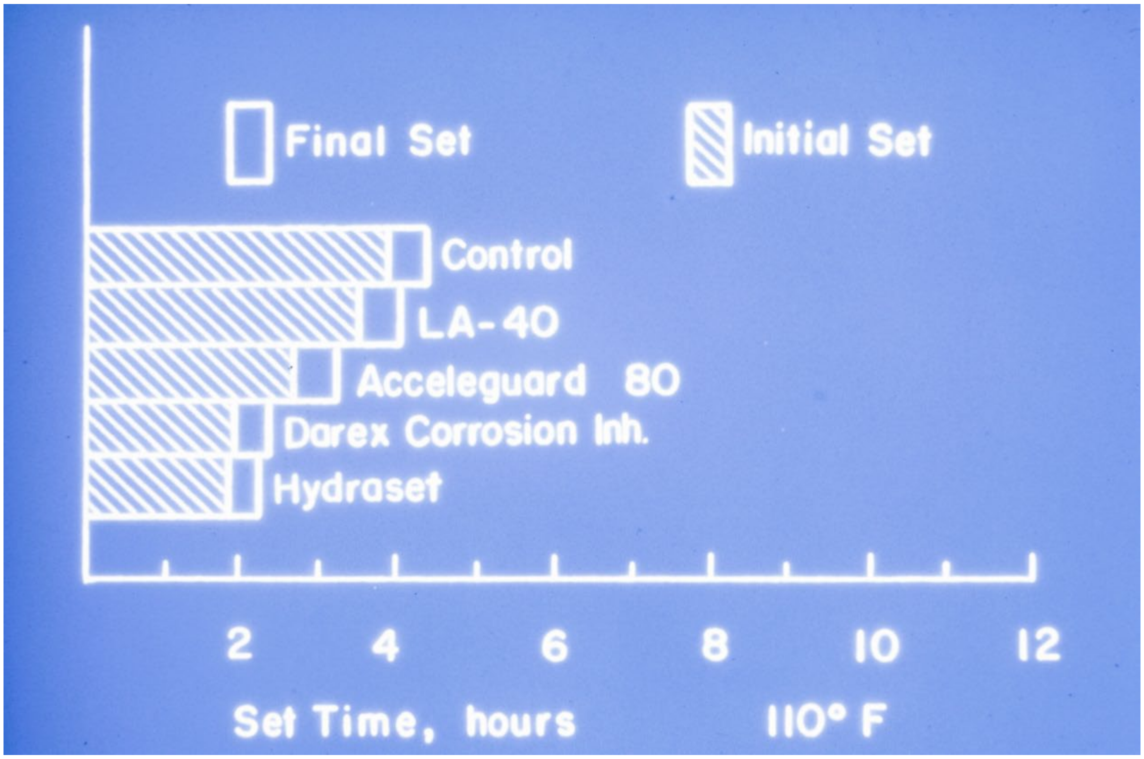

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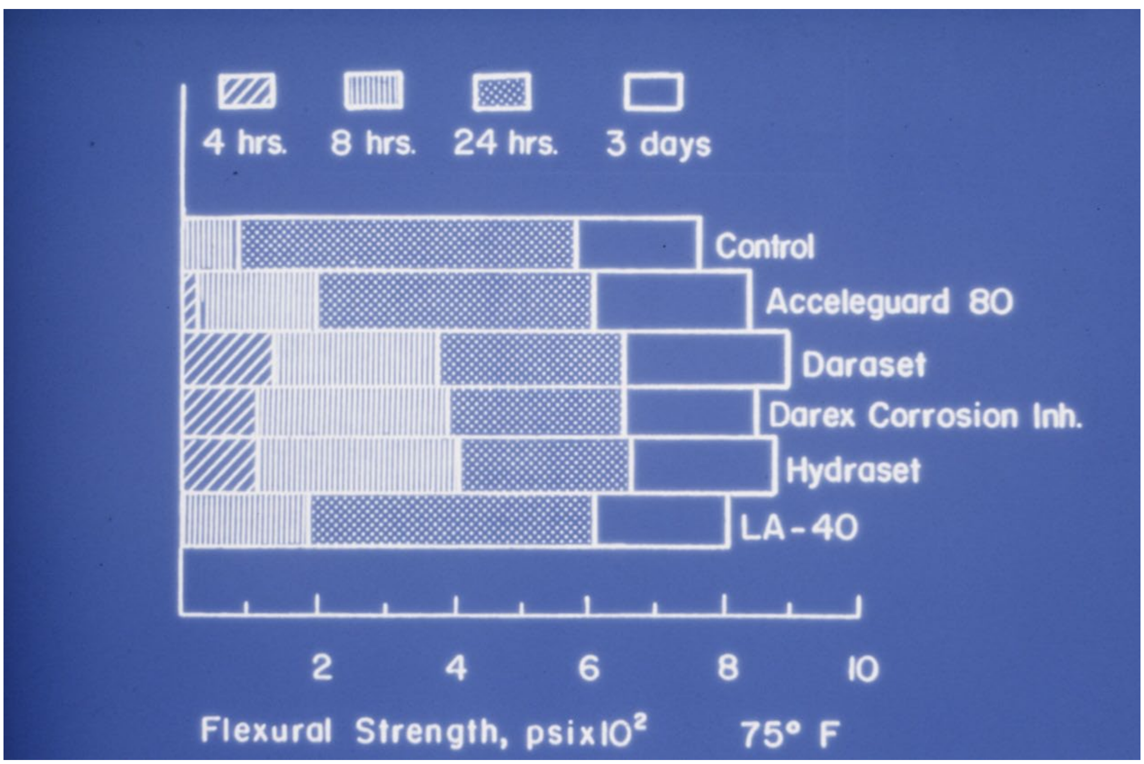

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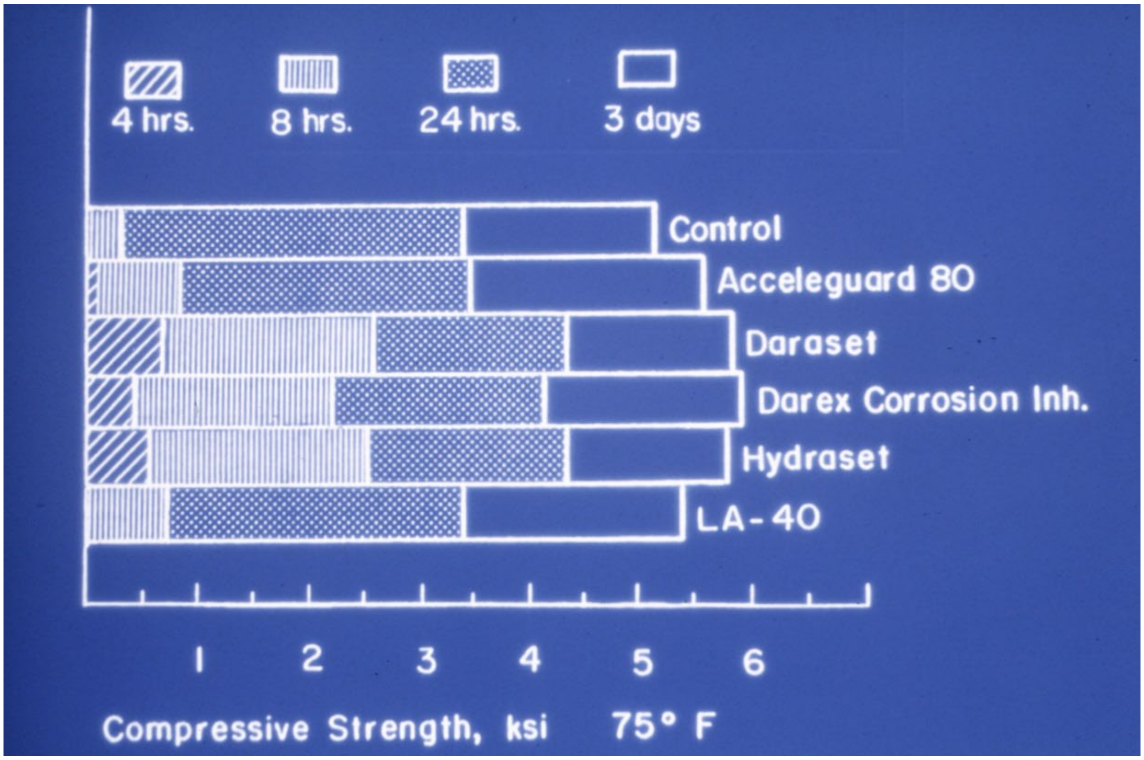

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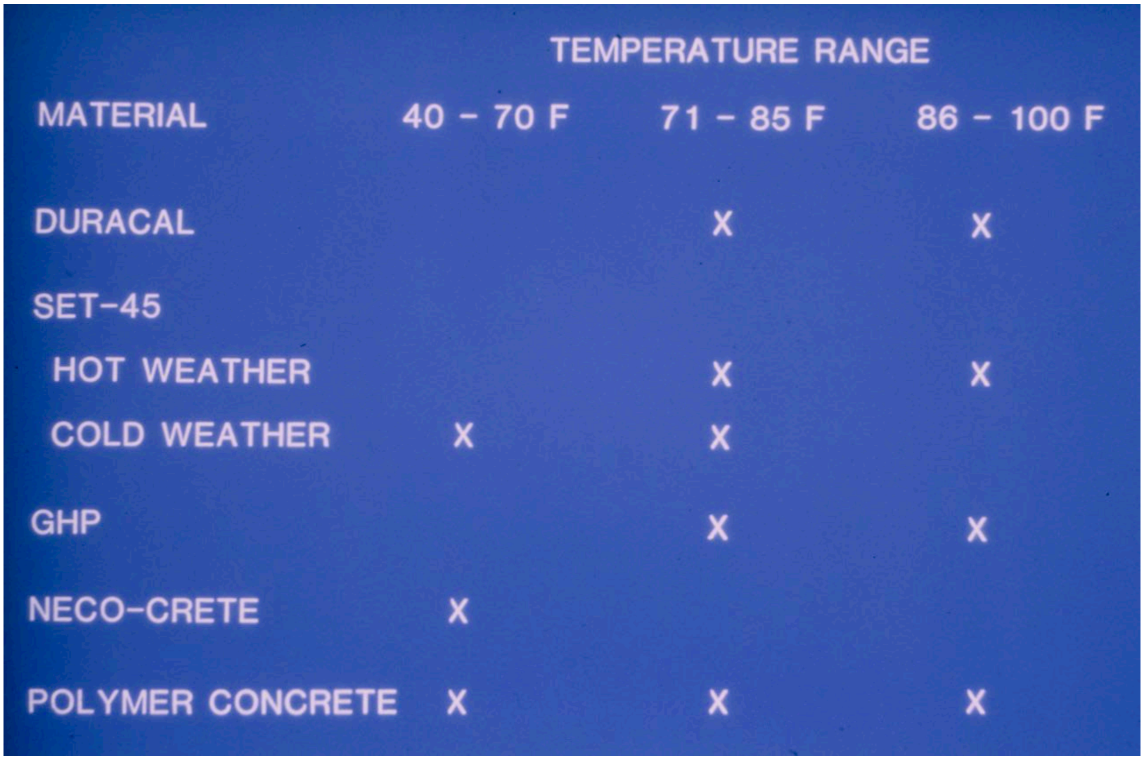

	TEMPERATURE RANGE		
MATERIAL	40 – 70 F	71 – 85 F	86 – 100 F
DURACAL		X	X
SET-45			
HOT WEATHER		X	X
COLD WEATHER	X	X	
GHP		X	X
NECO-CRETE	X		
POLYMER CONCRETE	X	X	X

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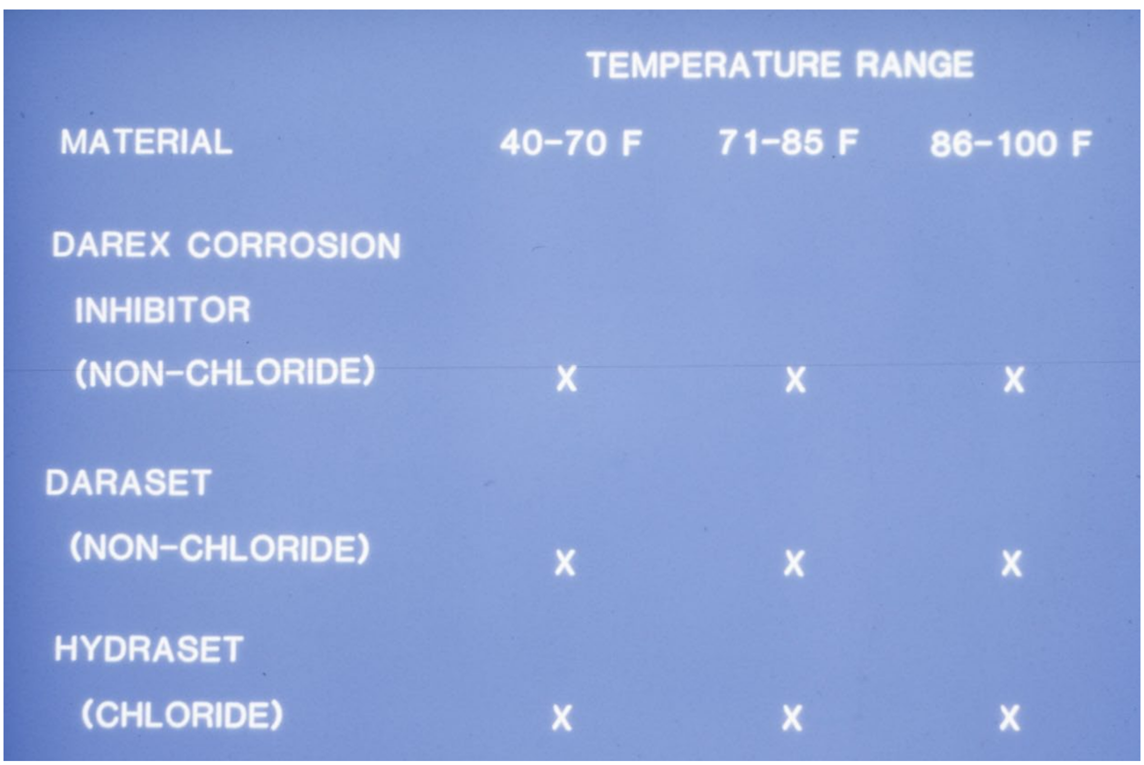

	TEMPERATURE RANGE		
MATERIAL	40-70 F	71-85 F	86-100 F
DAREX CORROSION INHIBITOR (NON-CHLORIDE)	X	X	X
DARASET (NON-CHLORIDE)	X	X	X
HYDRASET (CHLORIDE)	X	X	X

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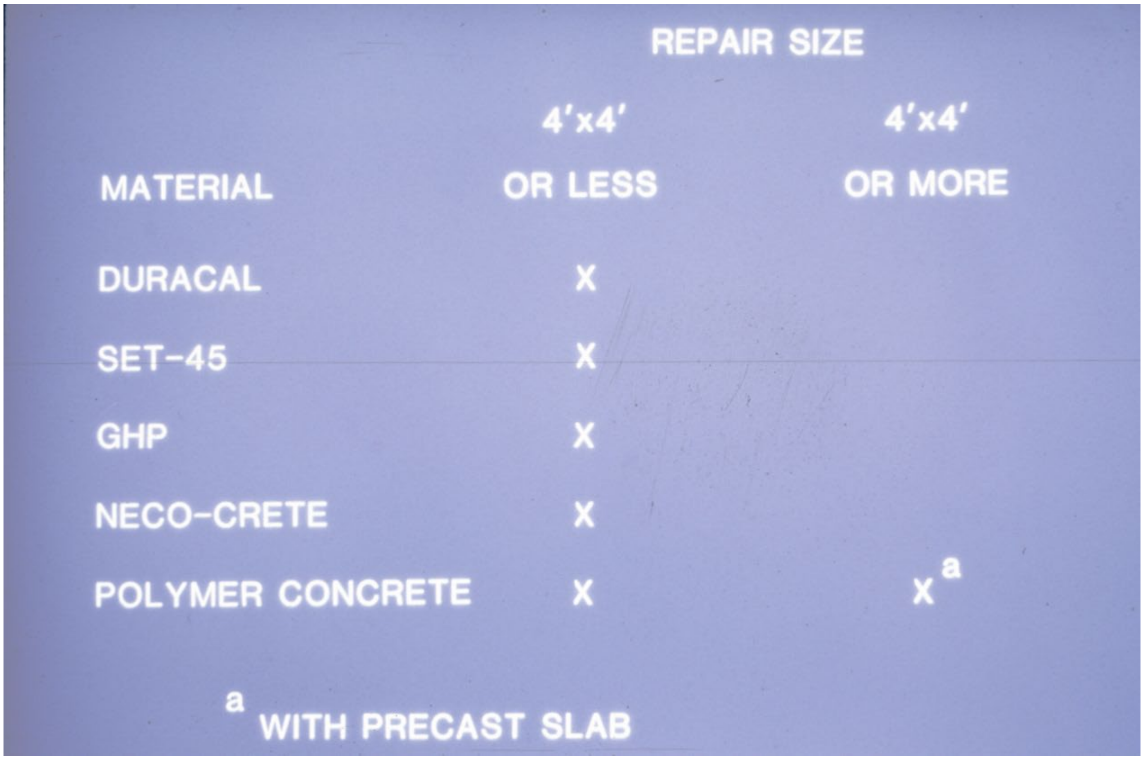

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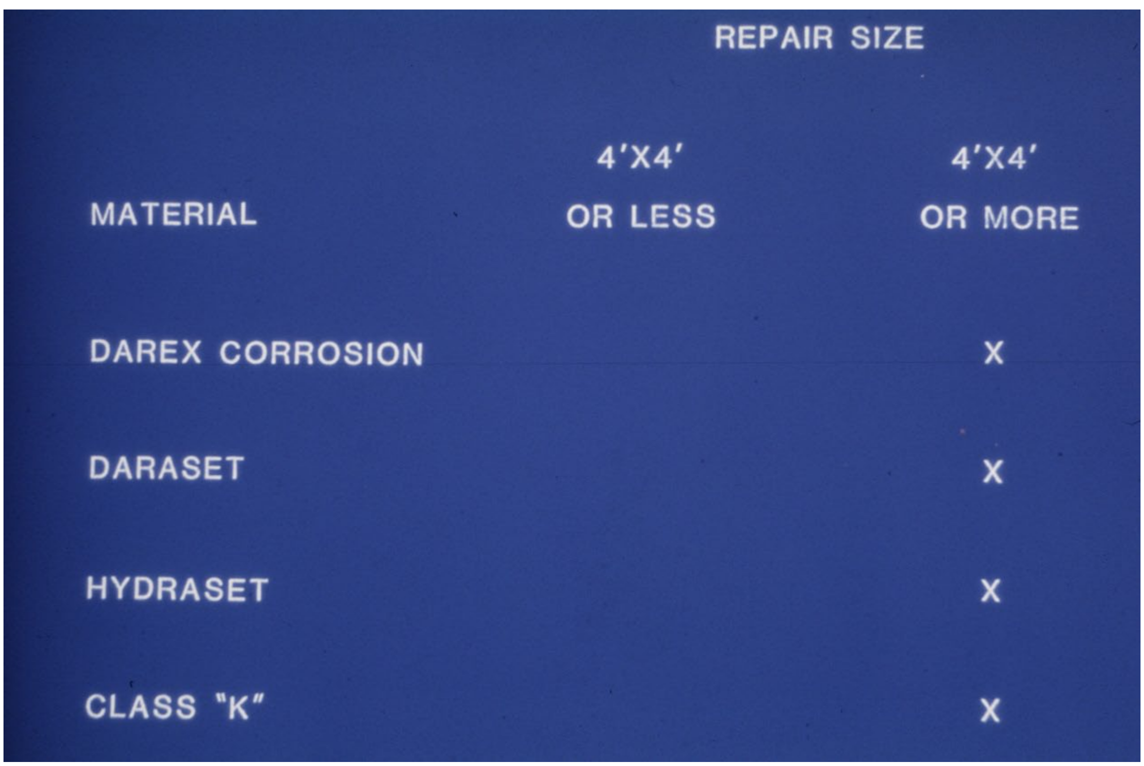

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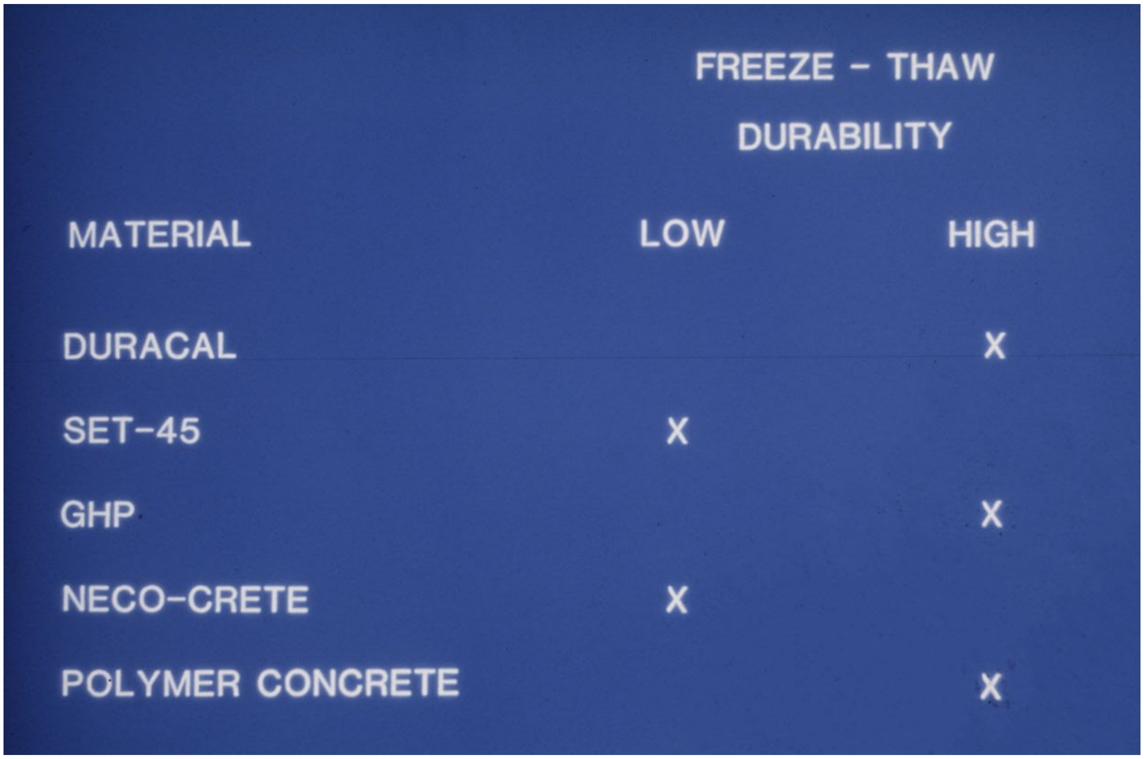

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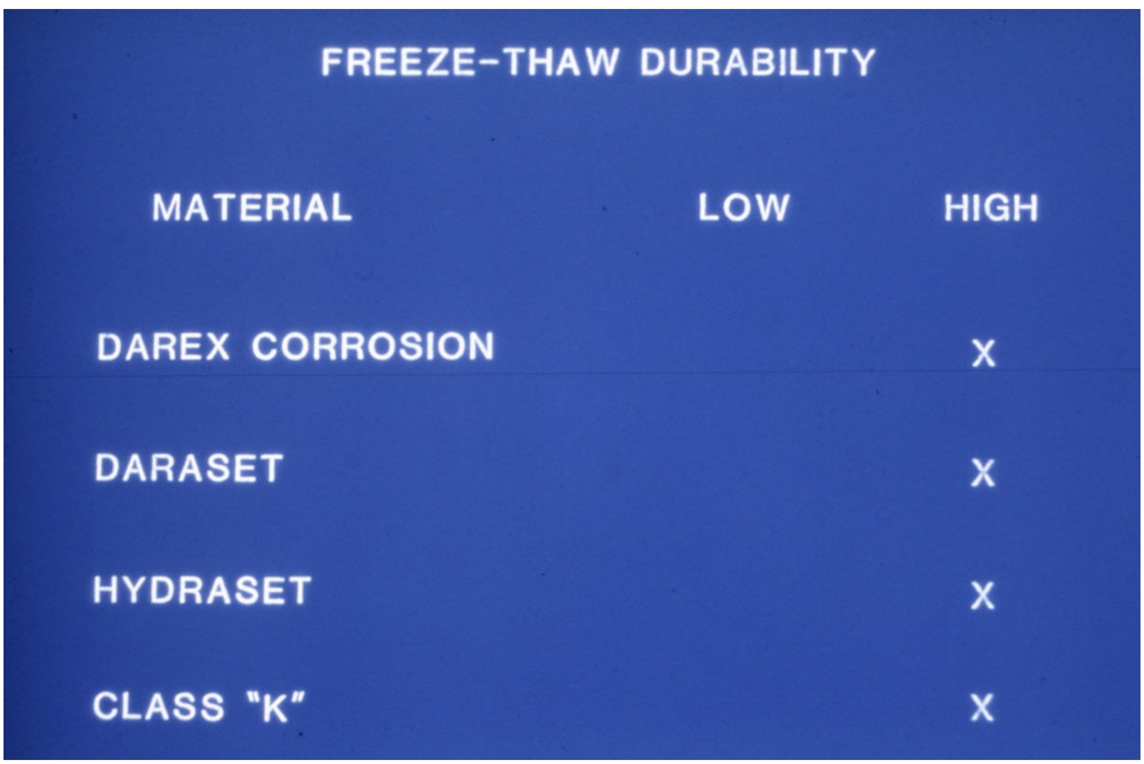

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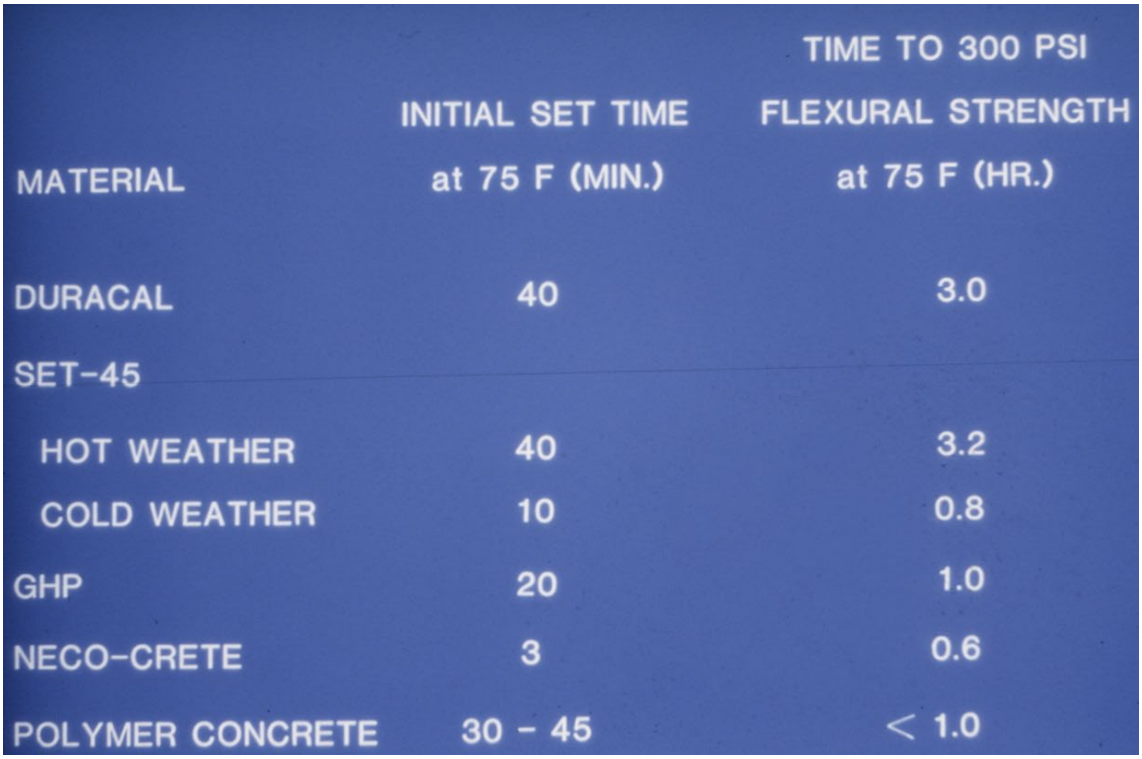
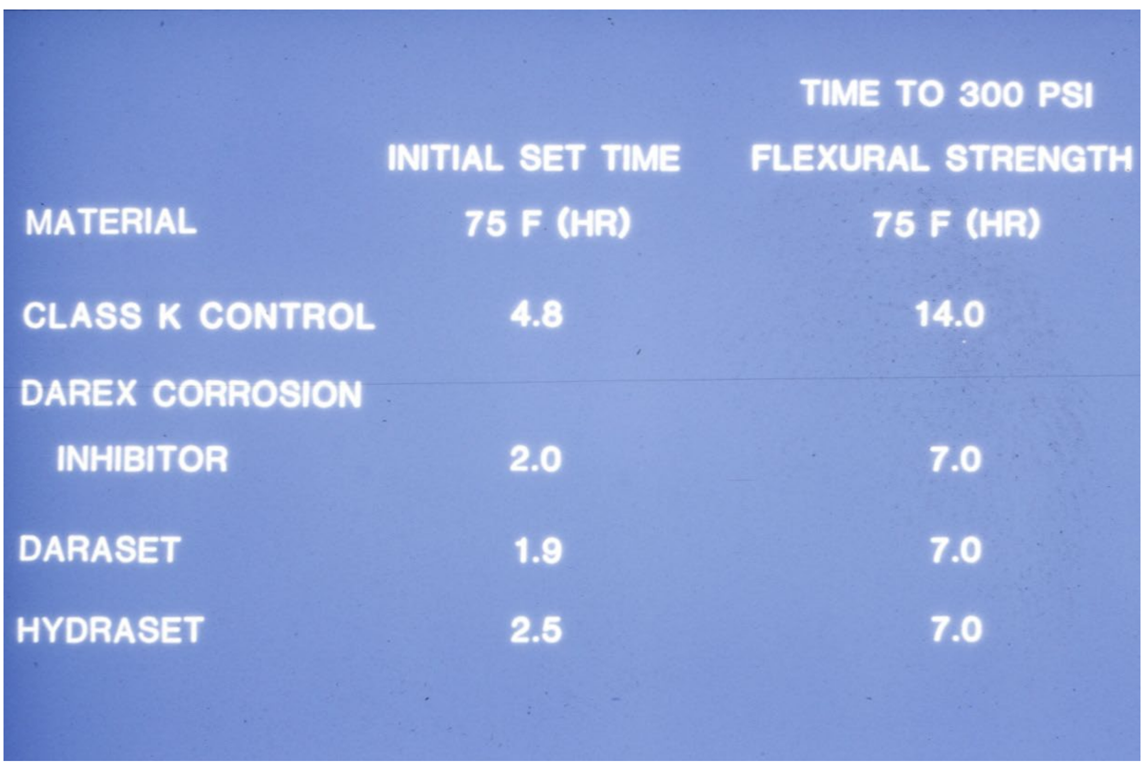


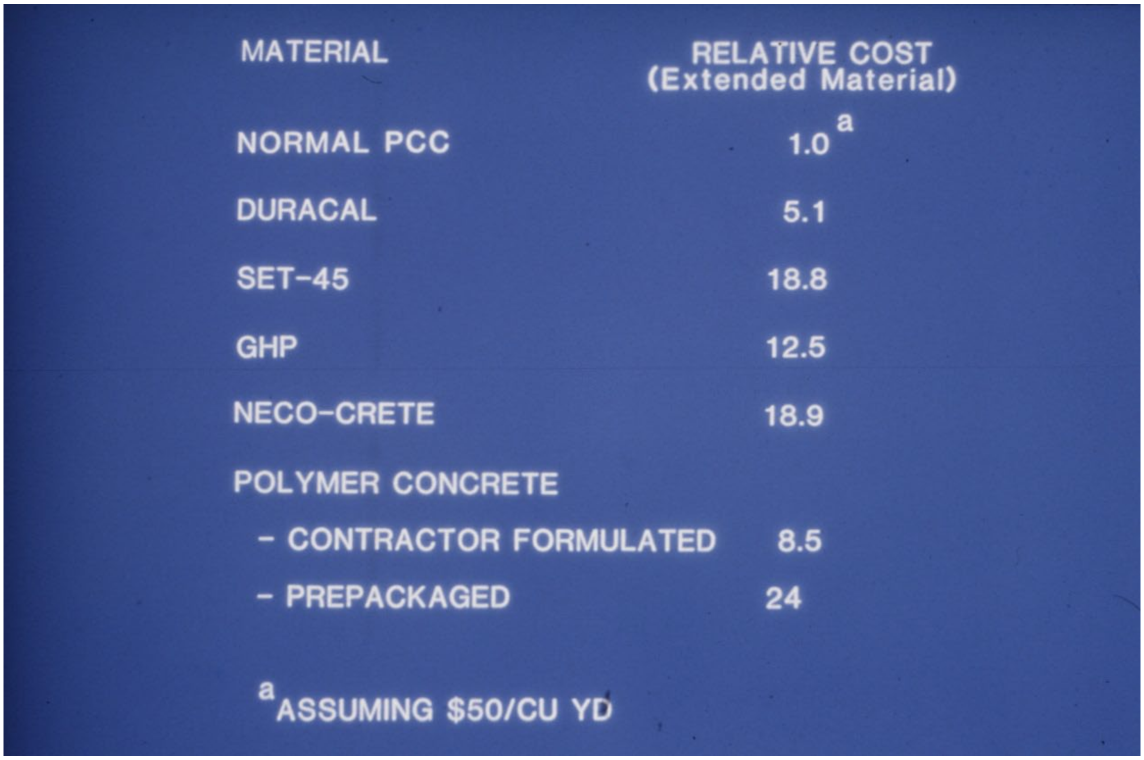
MATERIAL	INITIAL SET TIME at 75 F (MIN.)	TIME TO 300 PSI FLEXURAL STRENGTH at 75 F (HR.)
DURACAL	40	3.0
SET-45		
HOT WEATHER	40	3.2
COLD WEATHER	10	0.8
GHP	20	1.0
NECO-CRETE	3	0.6
POLYMER CONCRETE	30 - 45	< 1.0

Slide 55. Initial set time and time to achieve 300 psi flexural strength. Alt text: [Table 16]



MATERIAL	INITIAL SET TIME 75 F (HR)	TIME TO 300 PSI FLEXURAL STRENGTH 75 F (HR)
CLASS K CONTROL	4.8	14.0
DAREX CORROSION INHIBITOR	2.0	7.0
DARASET	1.9	7.0
HYDRASET	2.5	7.0

Slide 56. Initial set time and time to achieve 300 psi flexural strength [Class "K" concretes]. Alt text: [Table 17]



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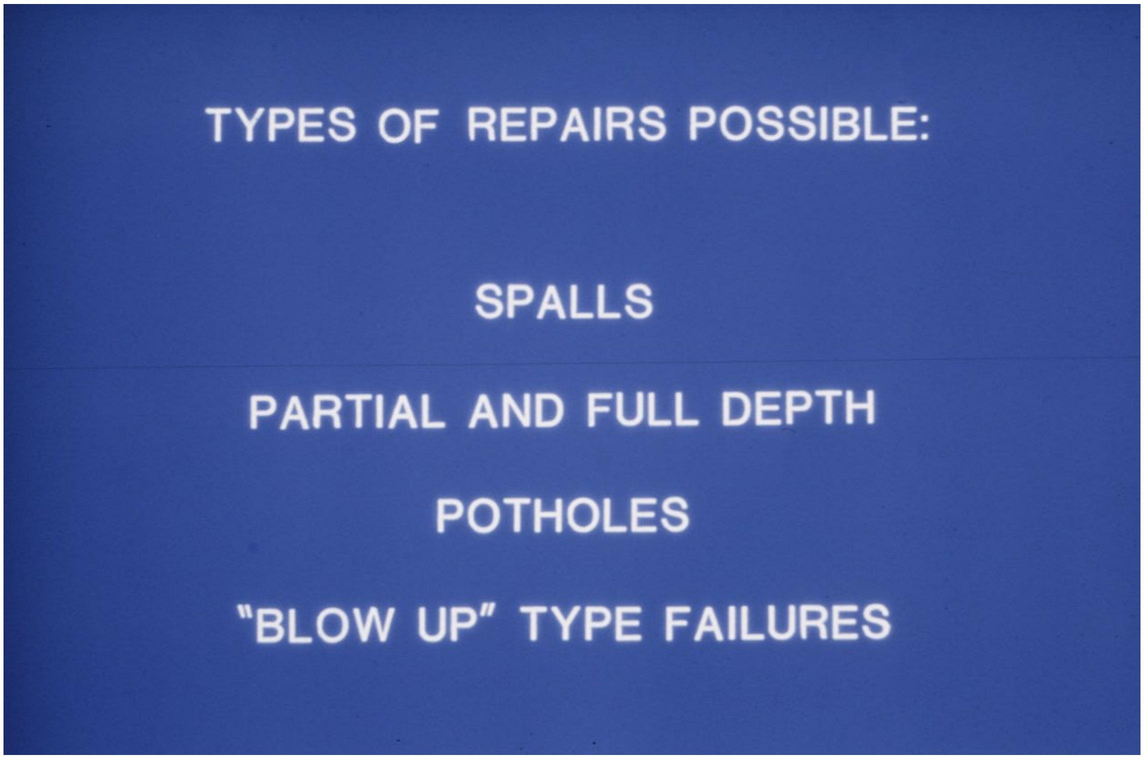

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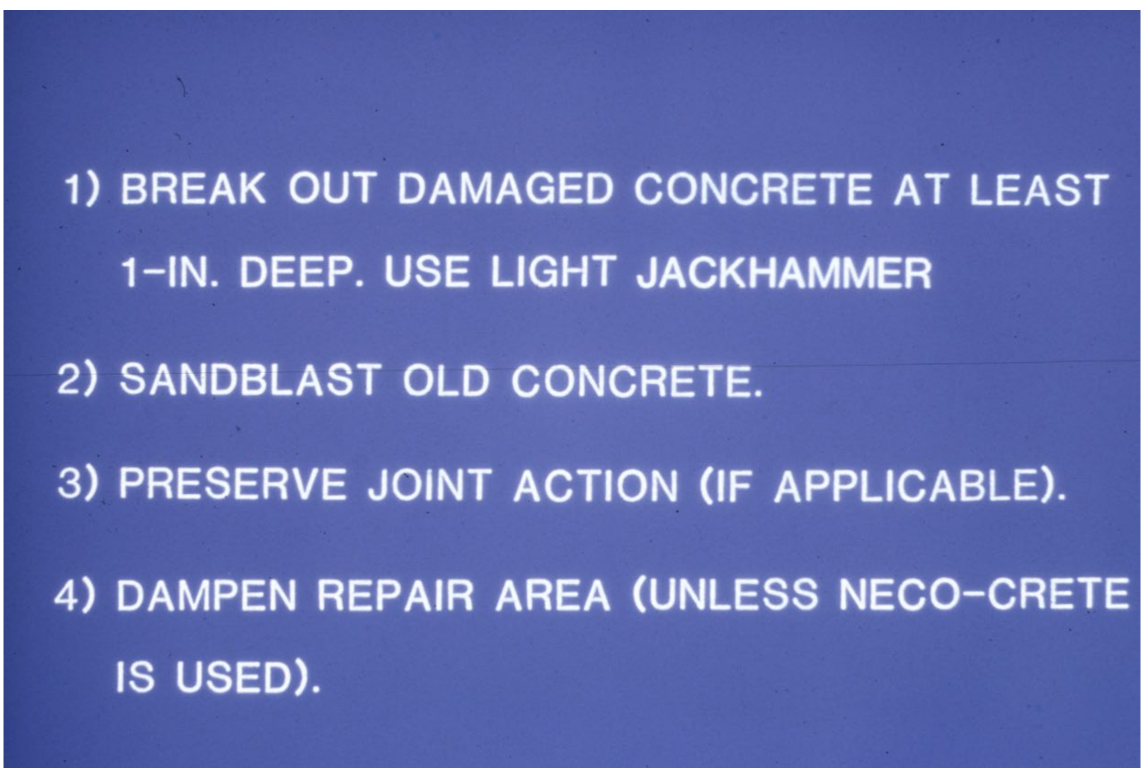

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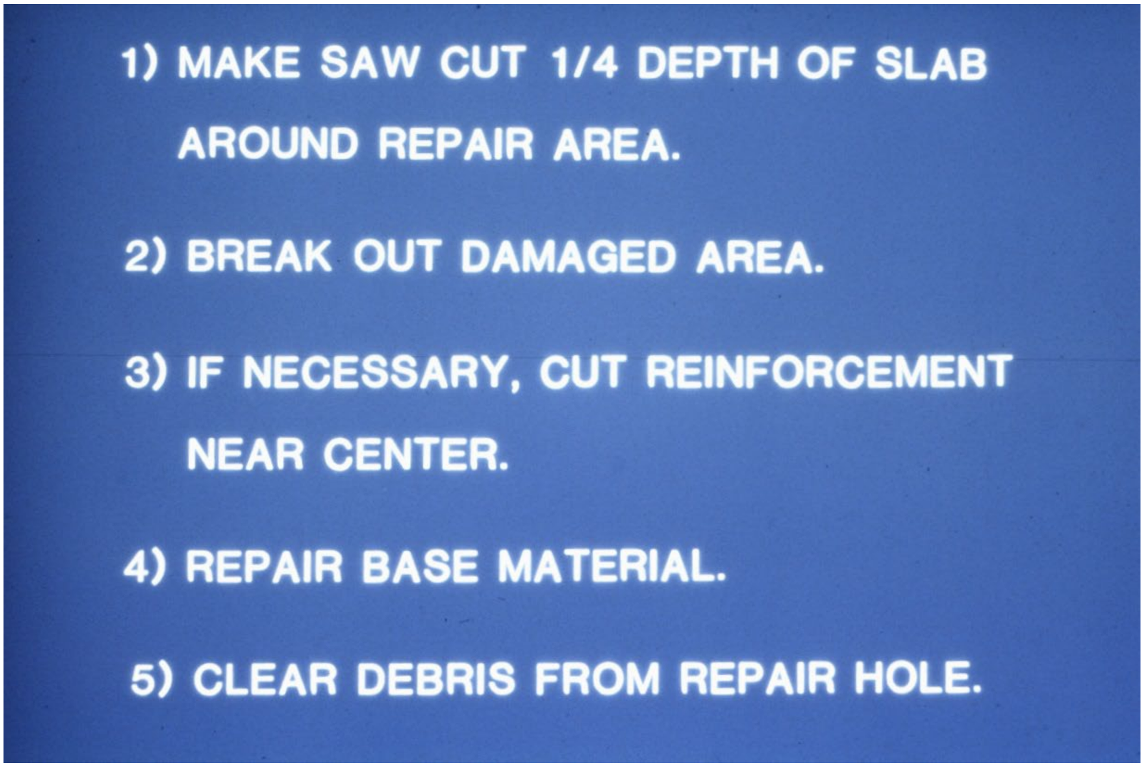

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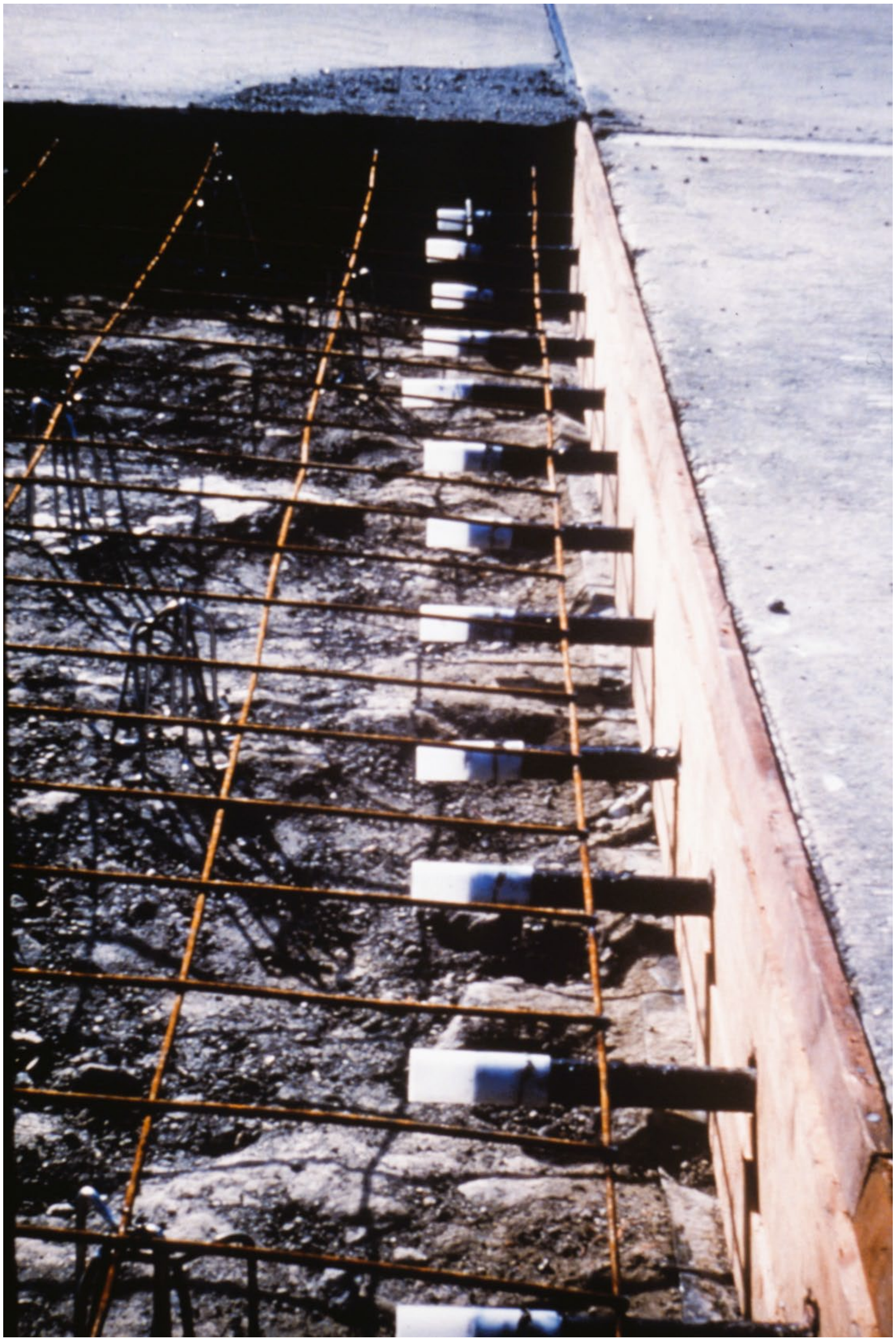

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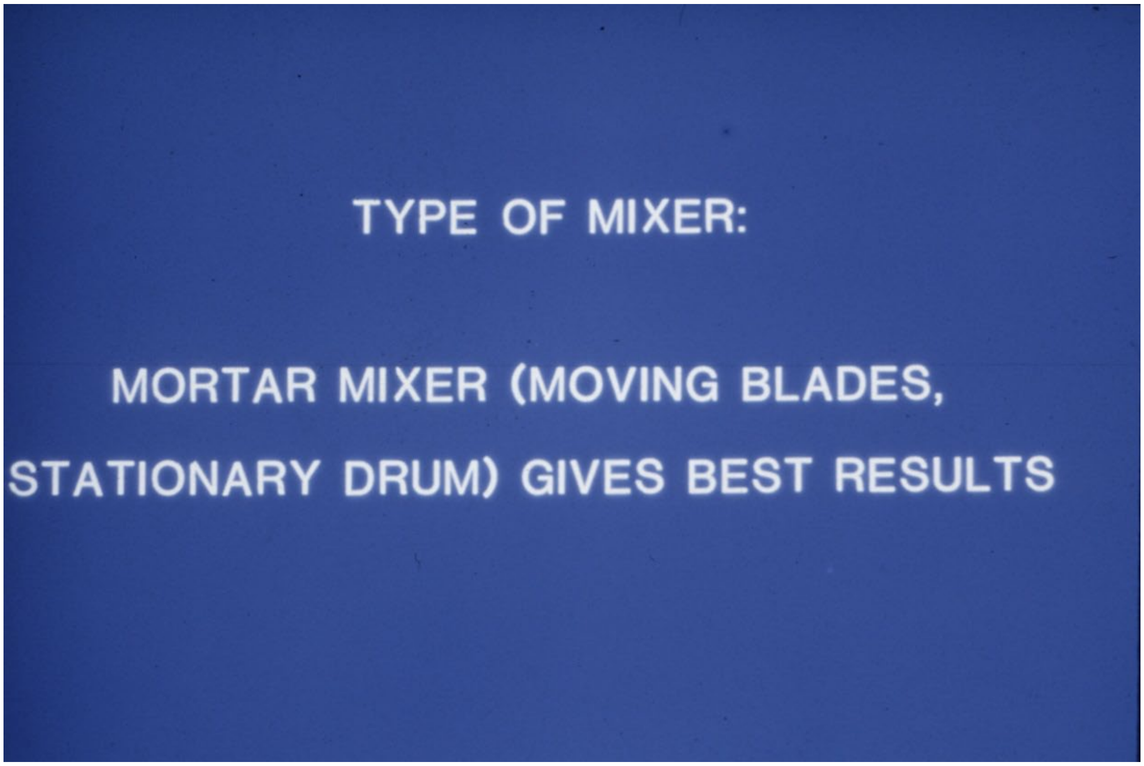

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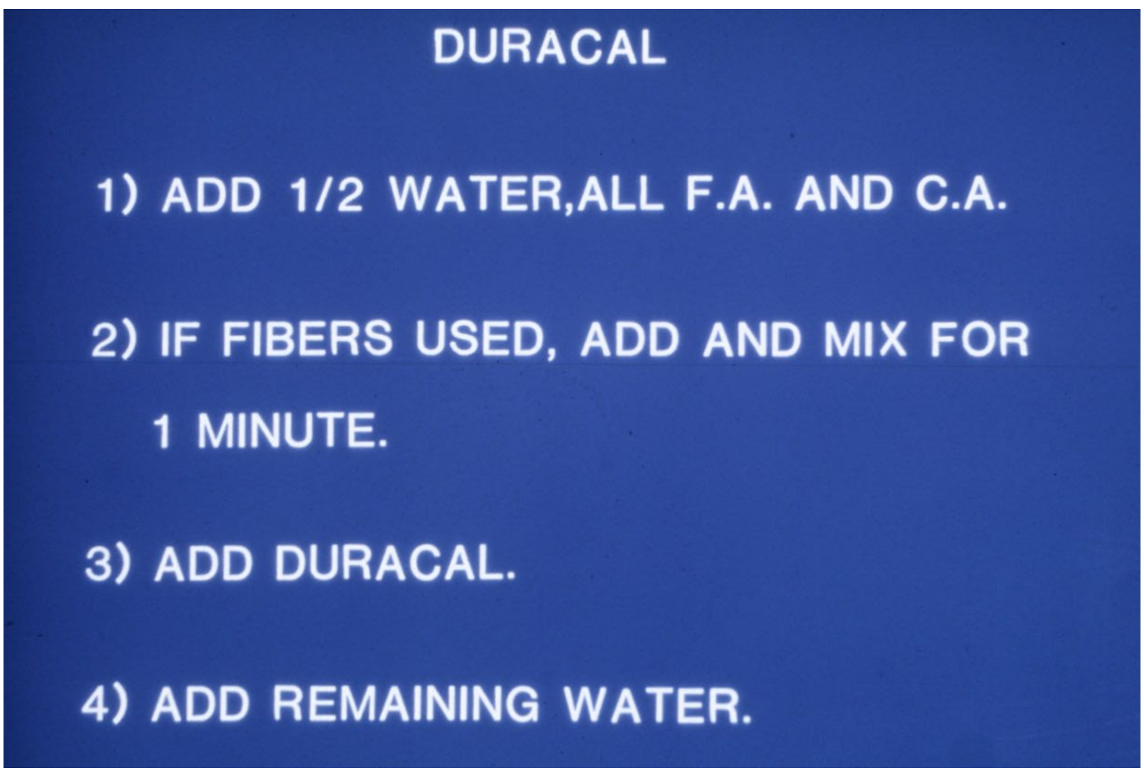

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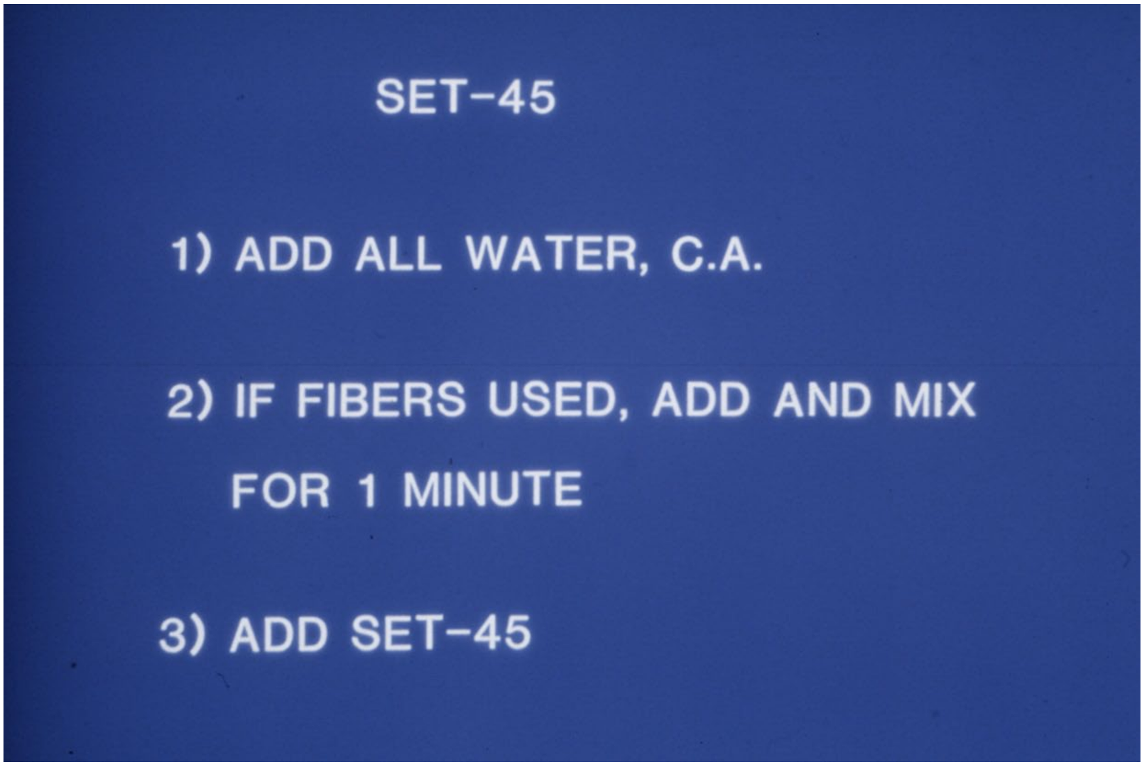

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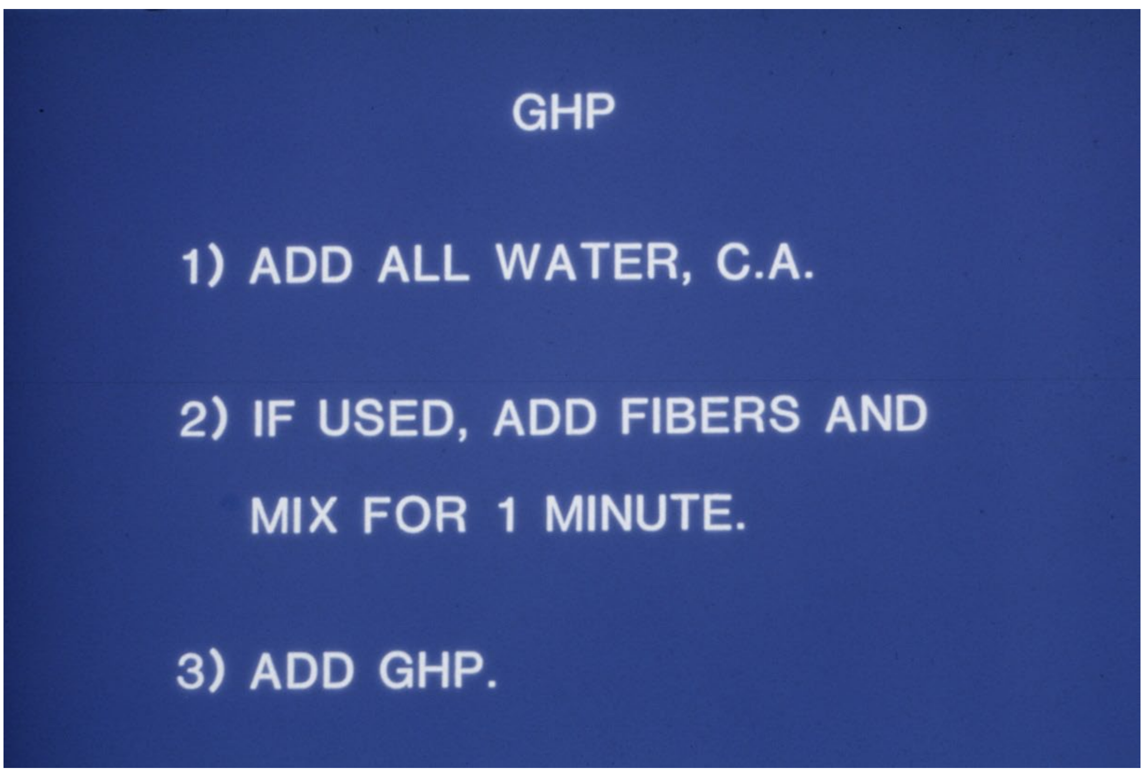

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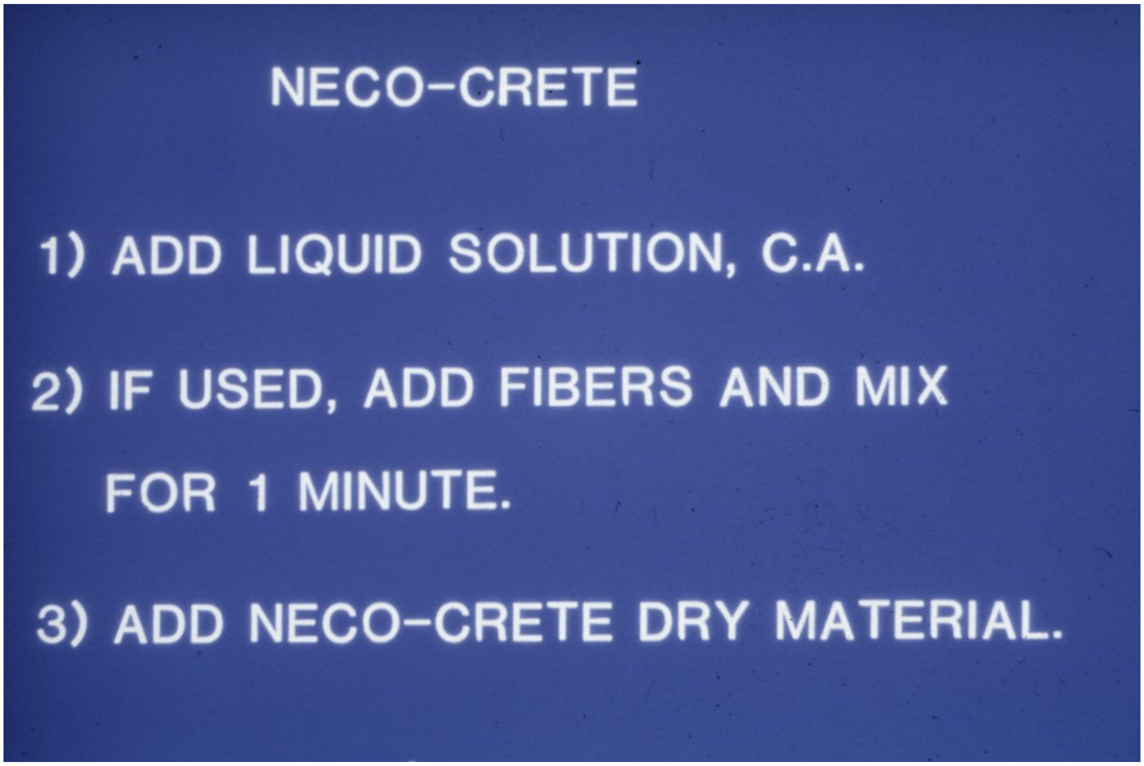

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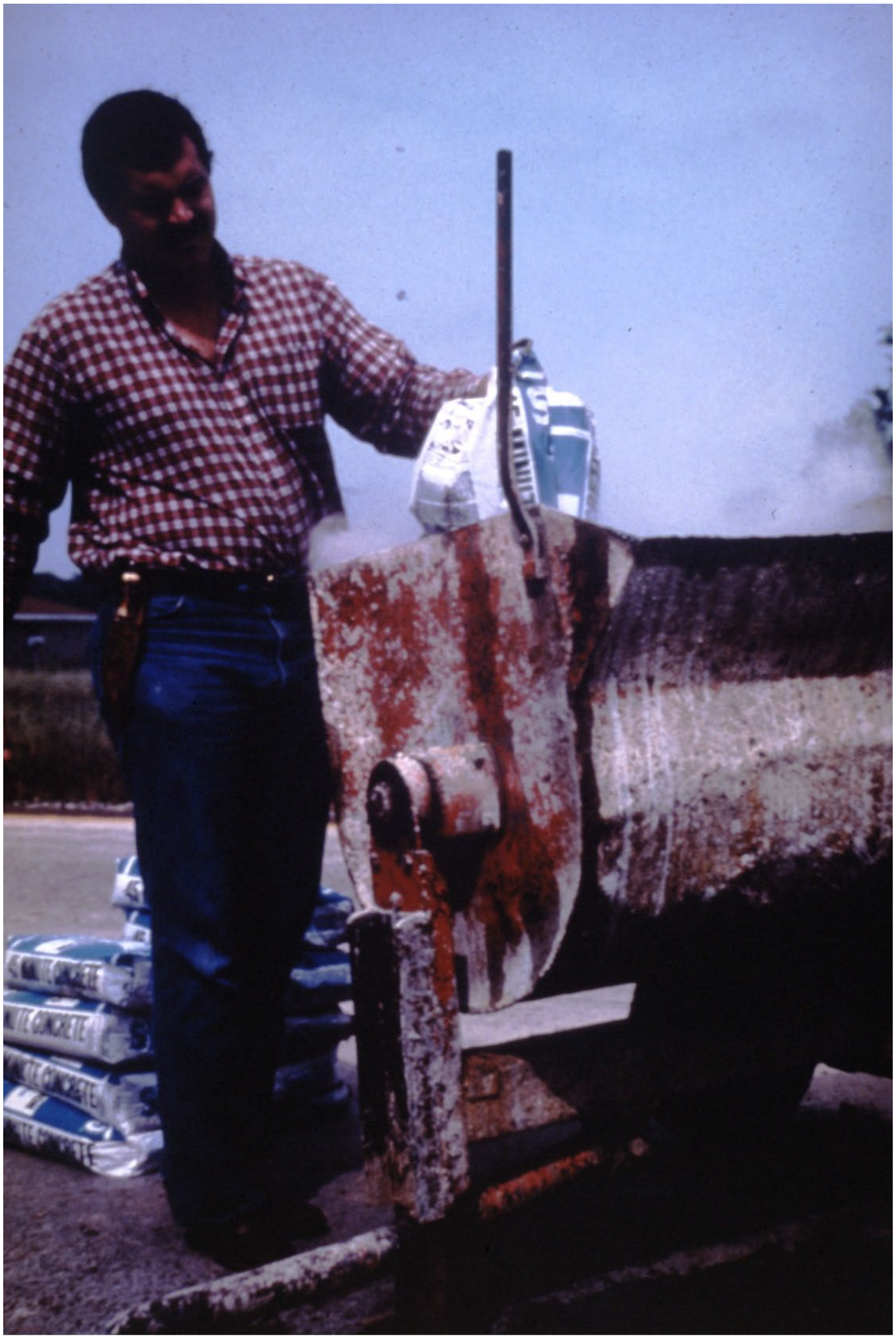

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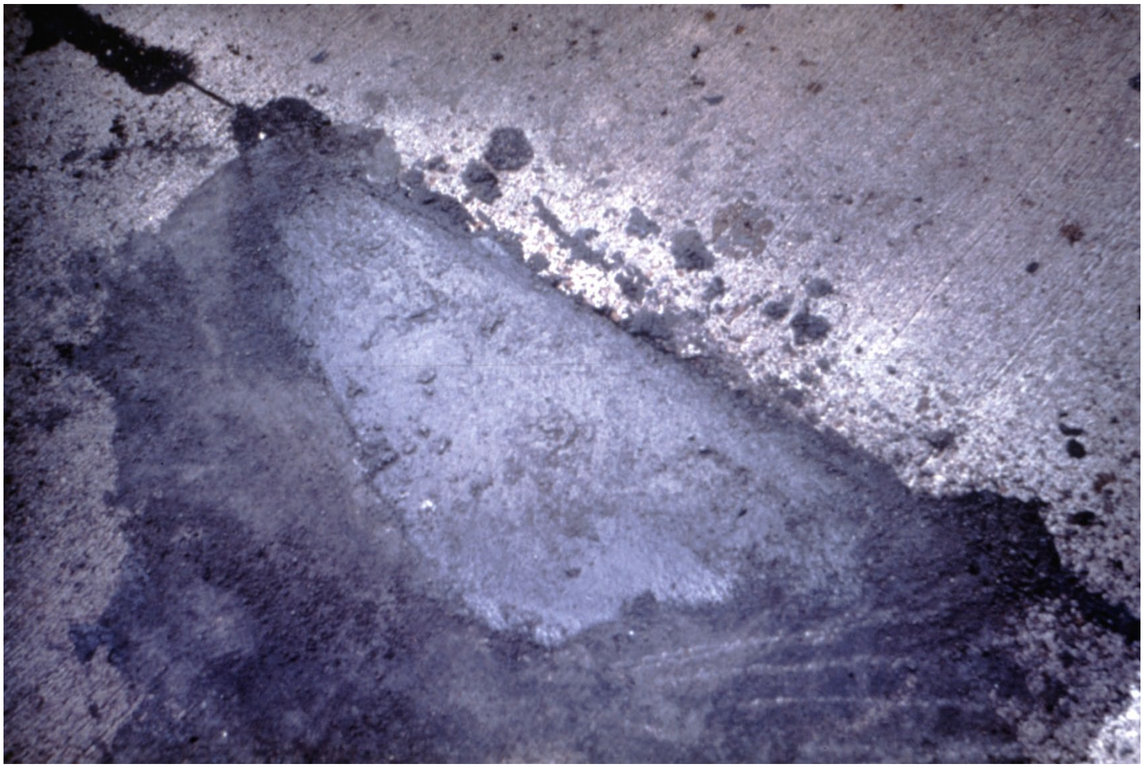

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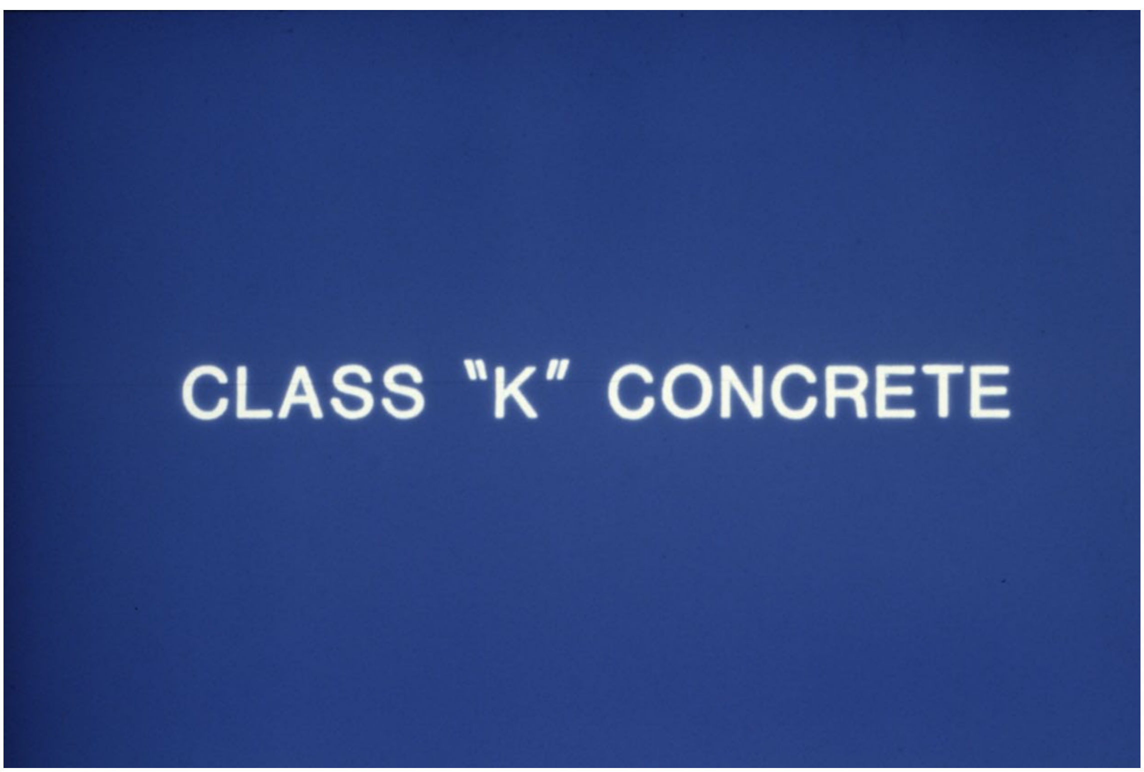
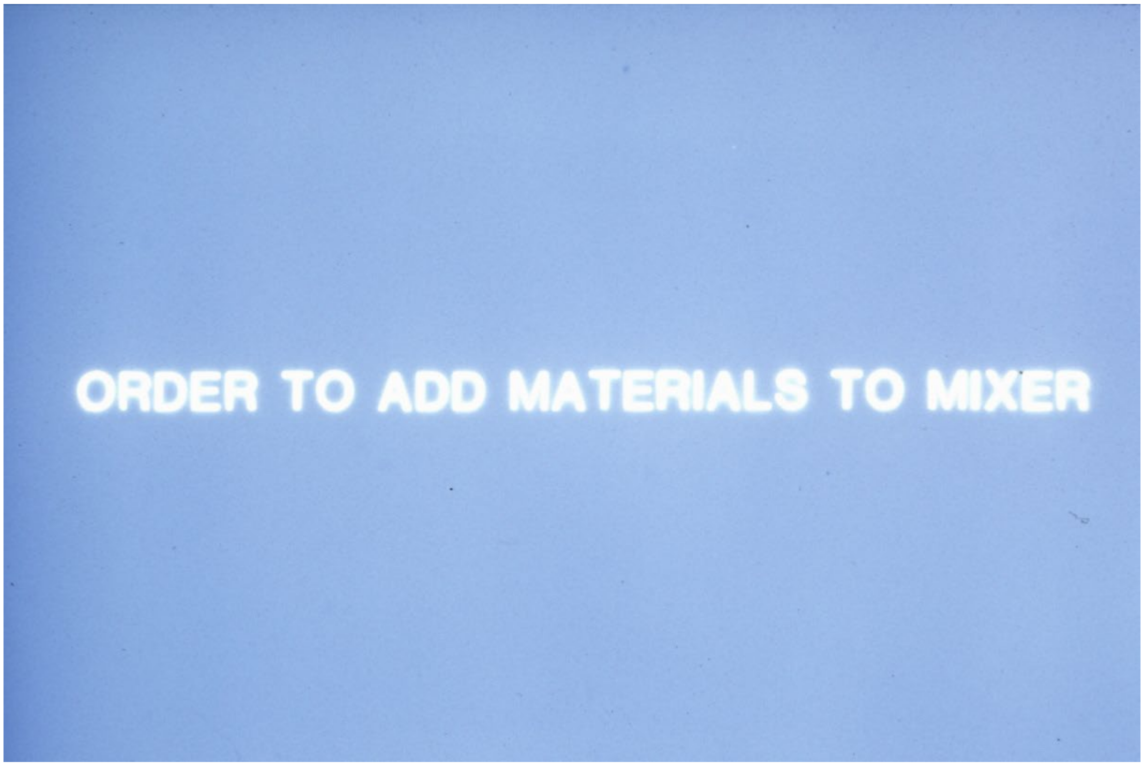
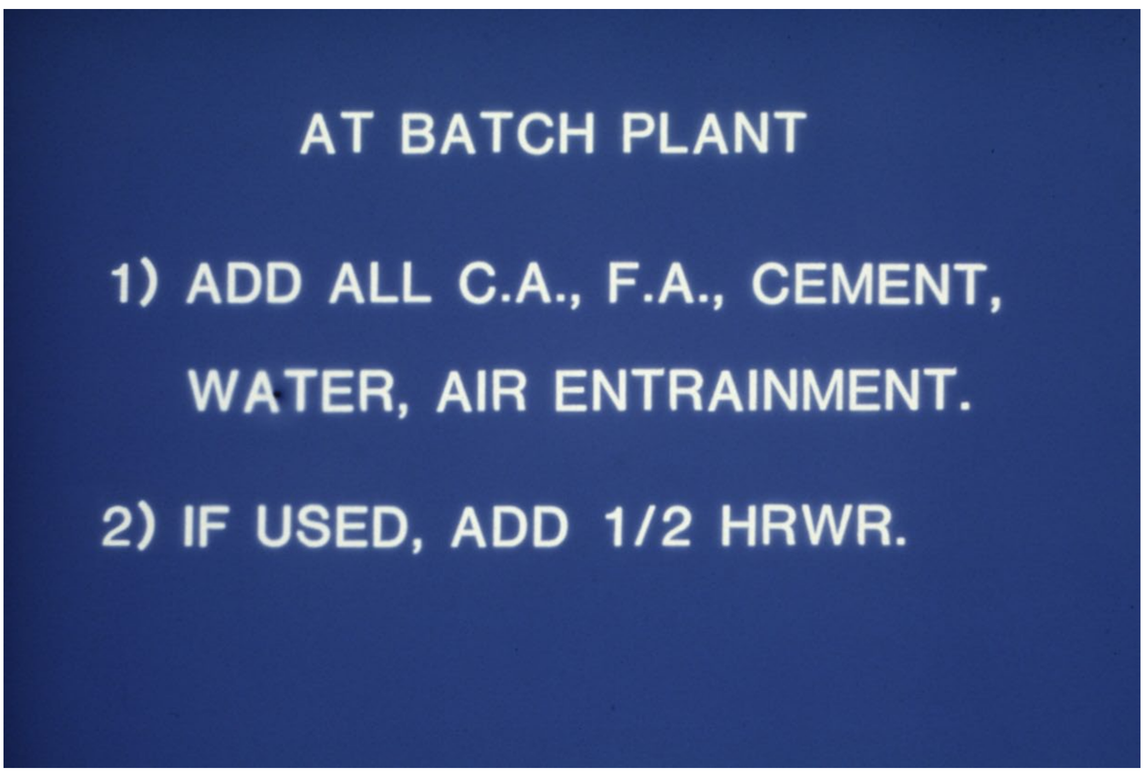


Slide 95. Class "K" Concrete



Slide 96. Order to Add Materials to Mixer

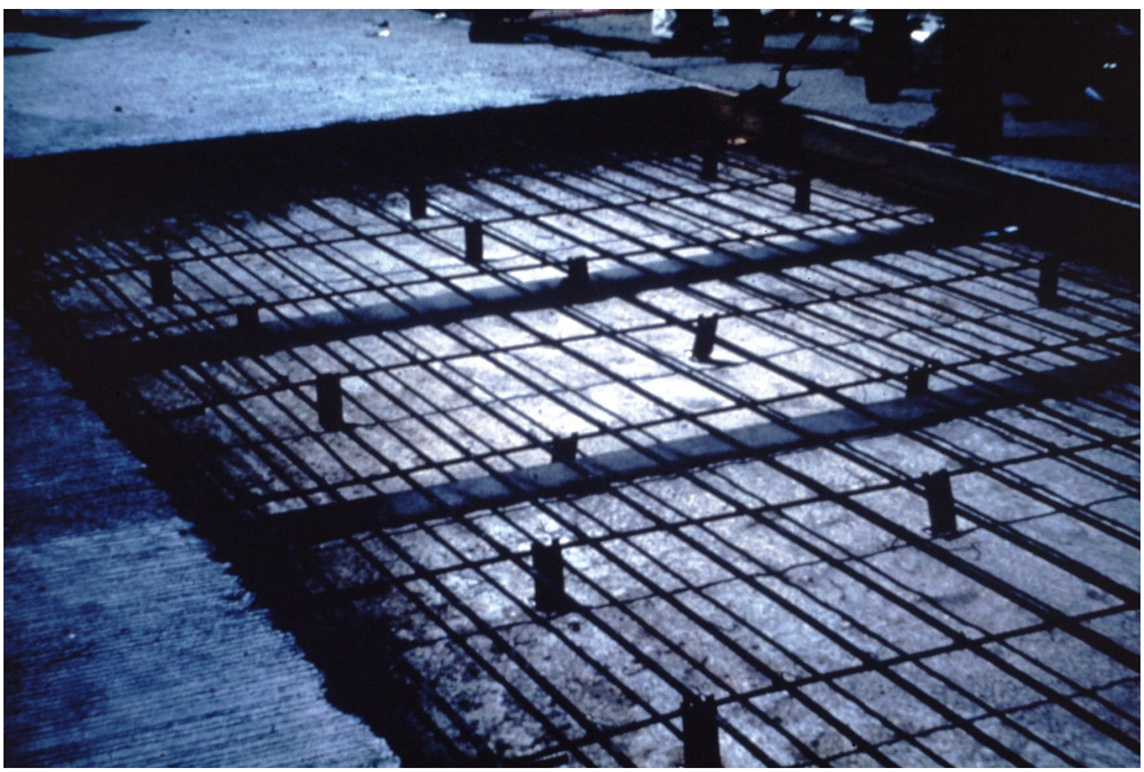


Slide 97. At Batch Plant

Slide 98. At Repair Site

Slide 99. Adding admixtures

Slide 100. Placing and Finishing



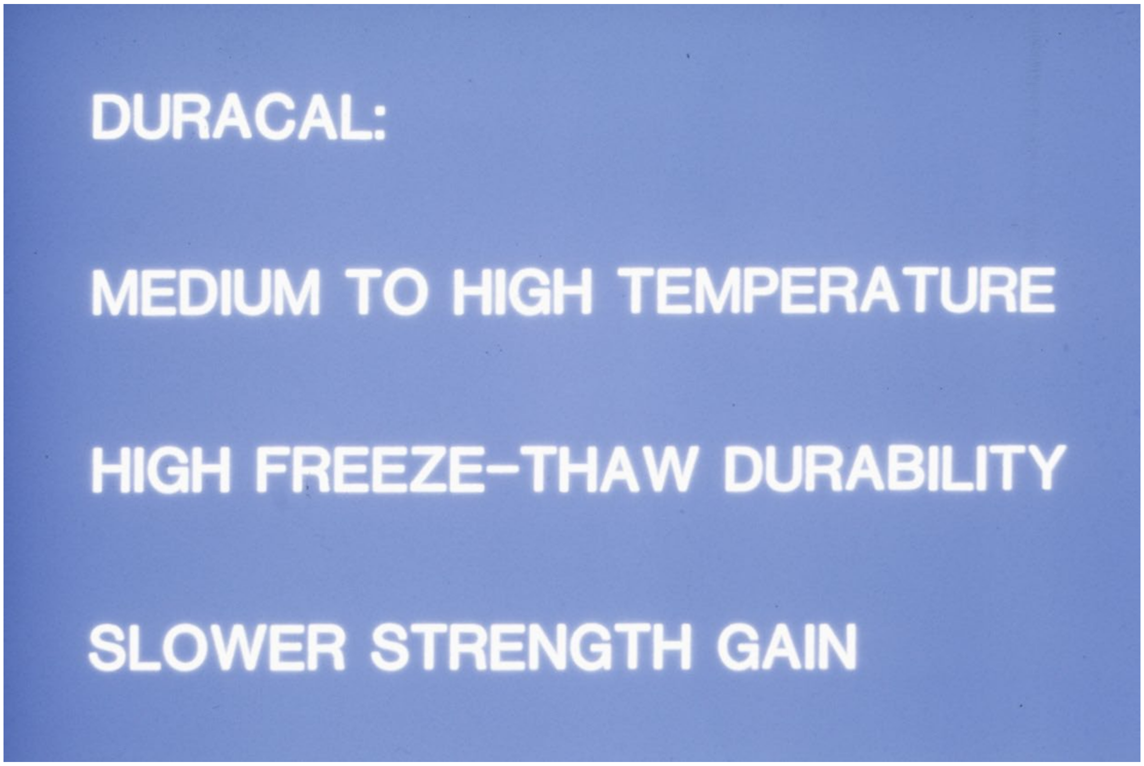
Slide 101. Preparing repair area for concrete

Slide 102. Placing Class "K" concrete

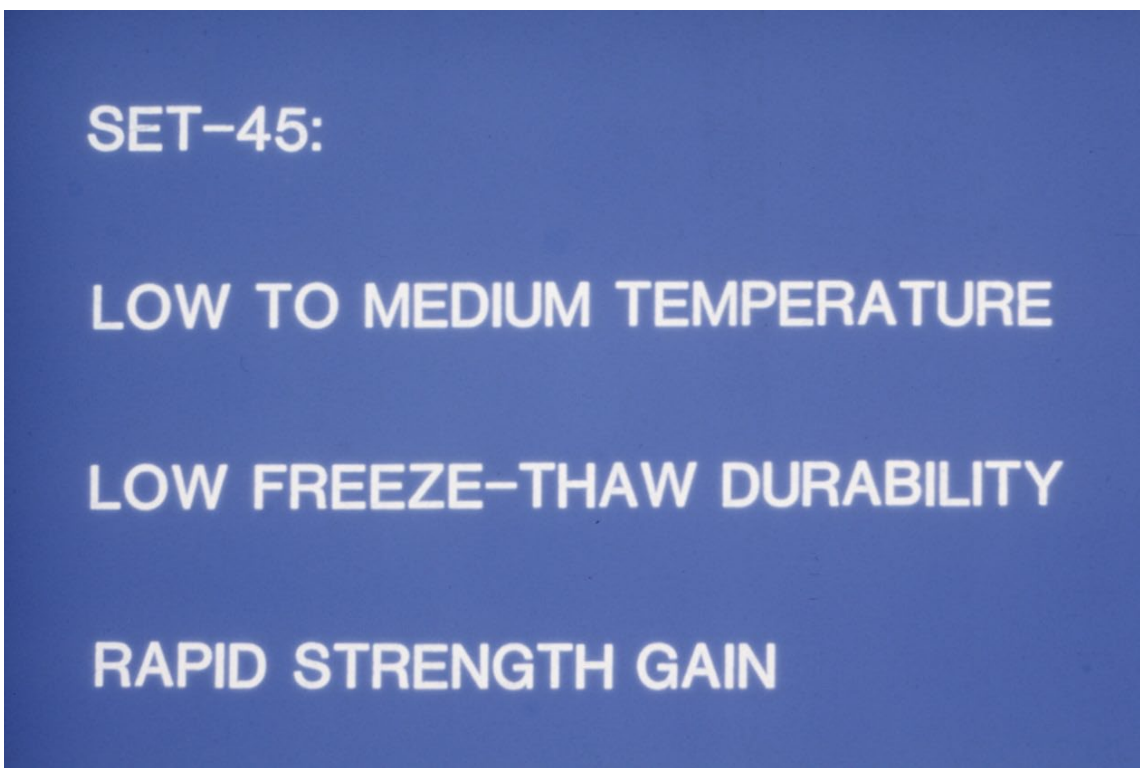
Slide 103. Spreading and consolidating

Slide 104. Screeding and finishing

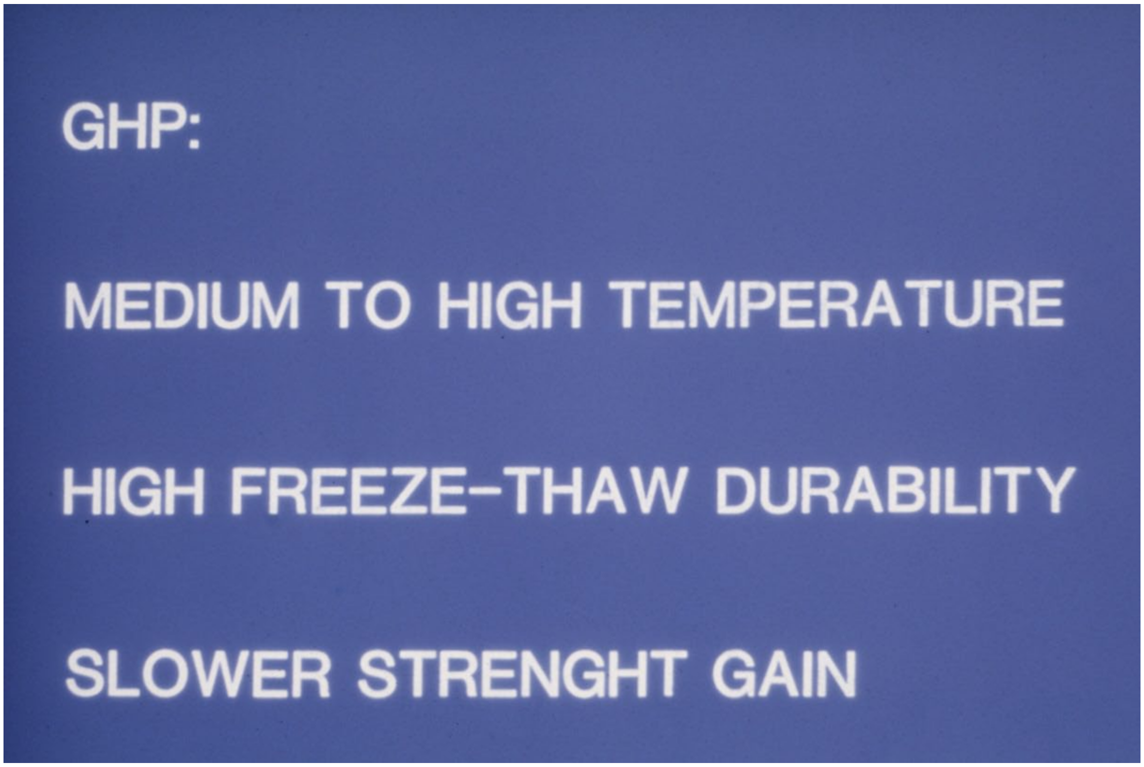
Slide 105. Summary



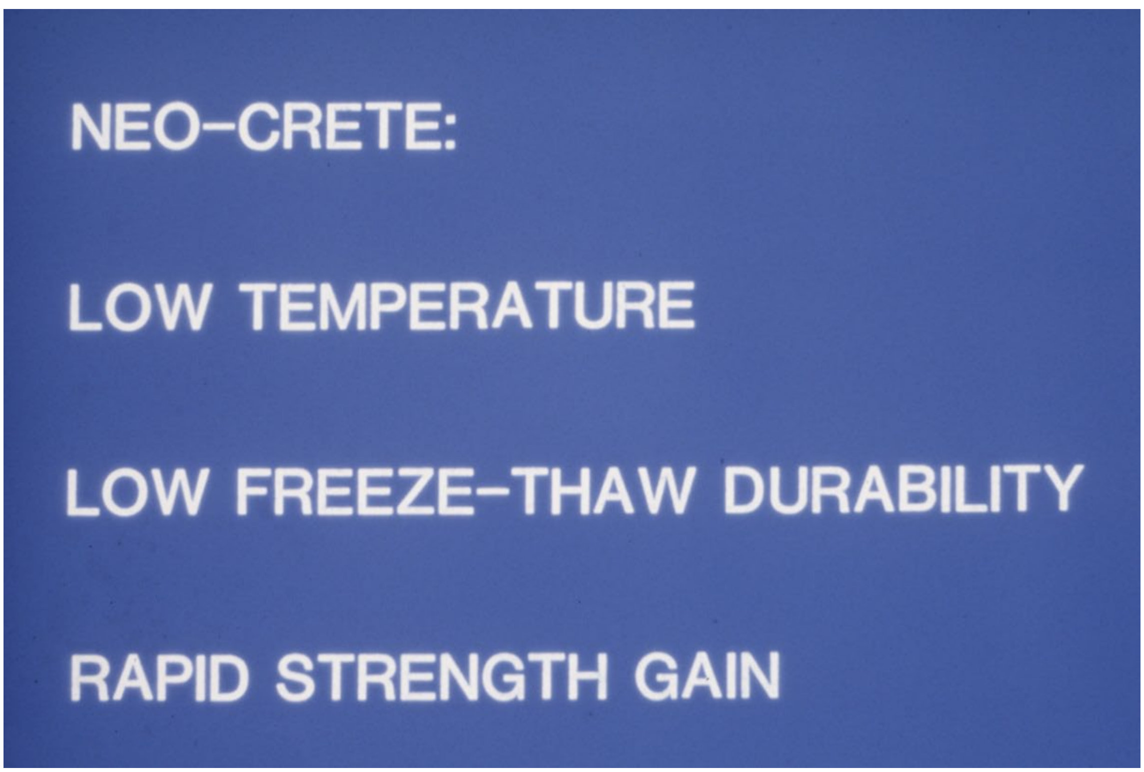
Slide 106. Duracal



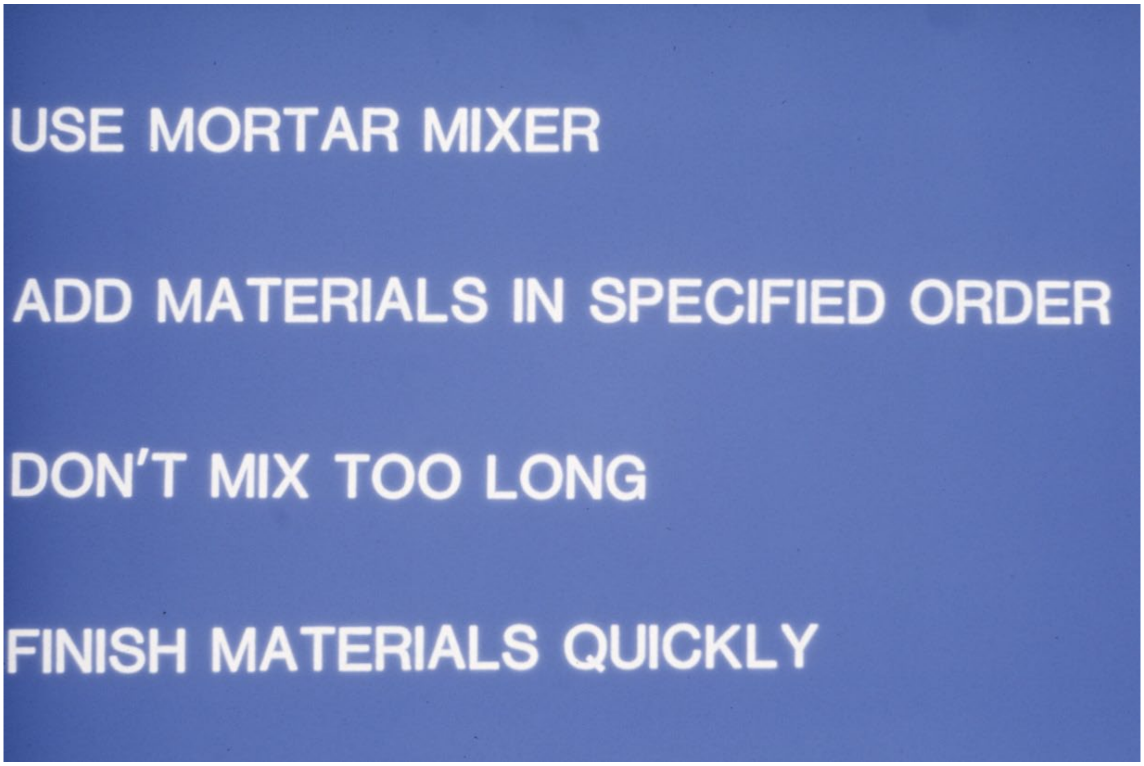
Slide 107. Set-45



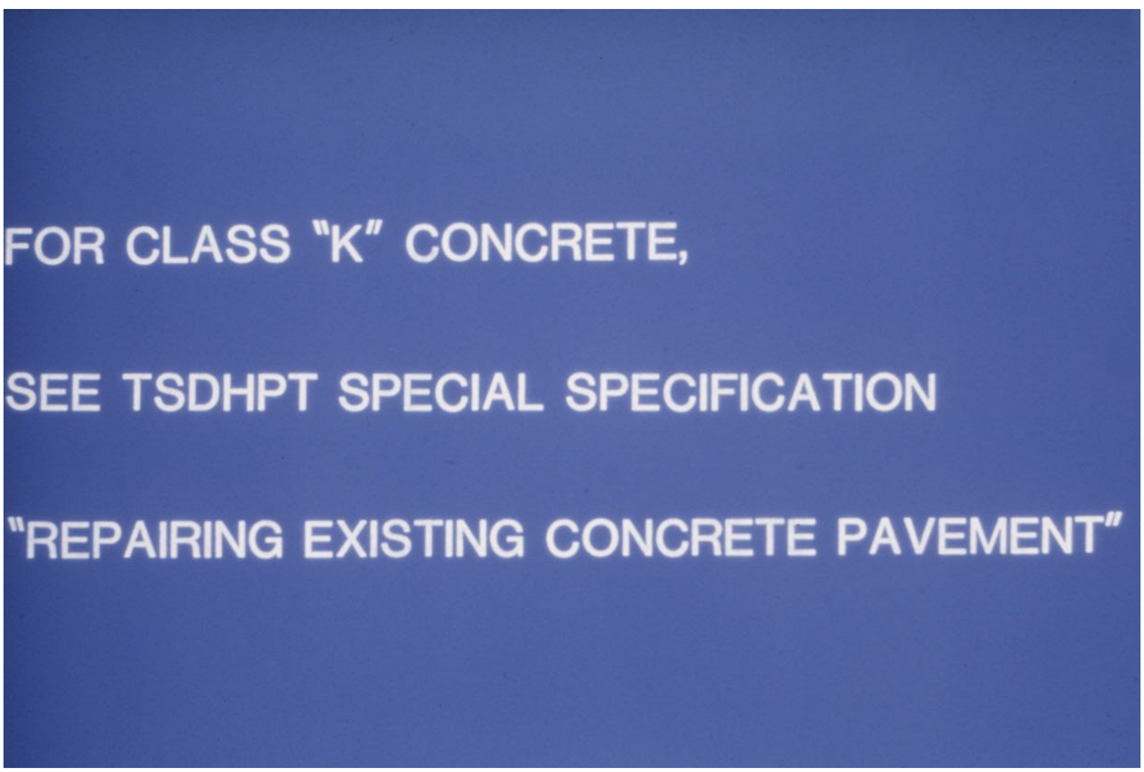
Slide 108. GHP



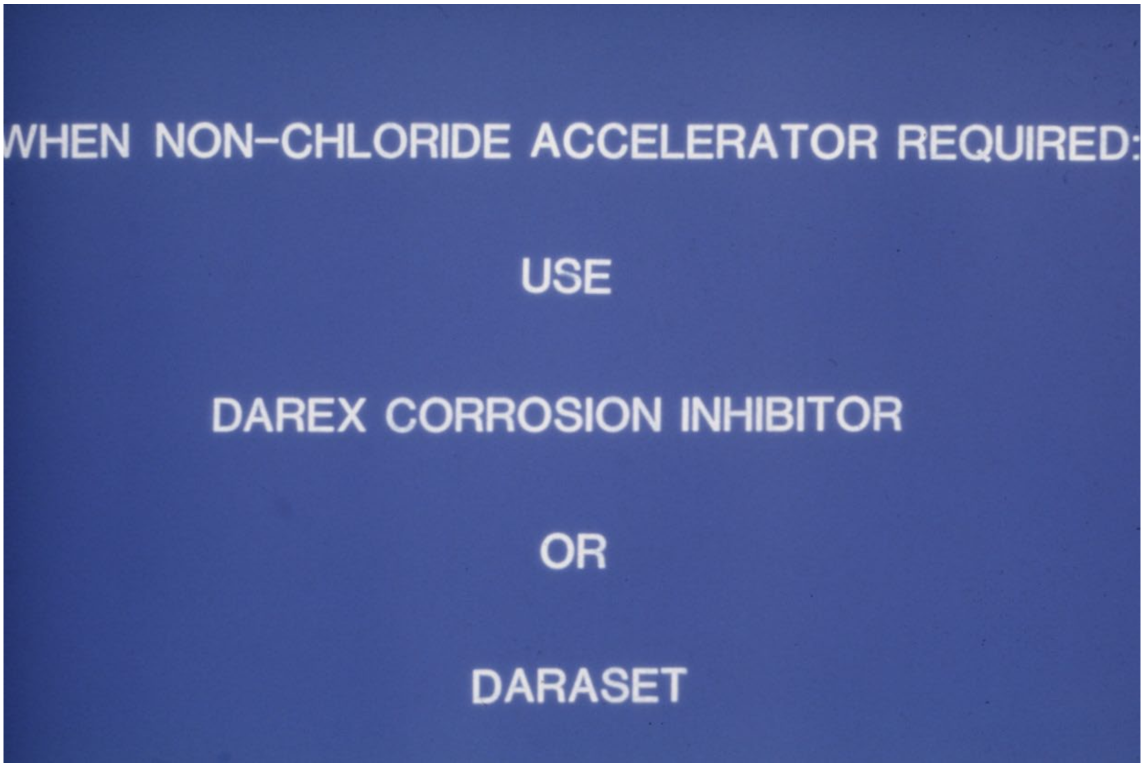
Slide 109. Neo-Crete



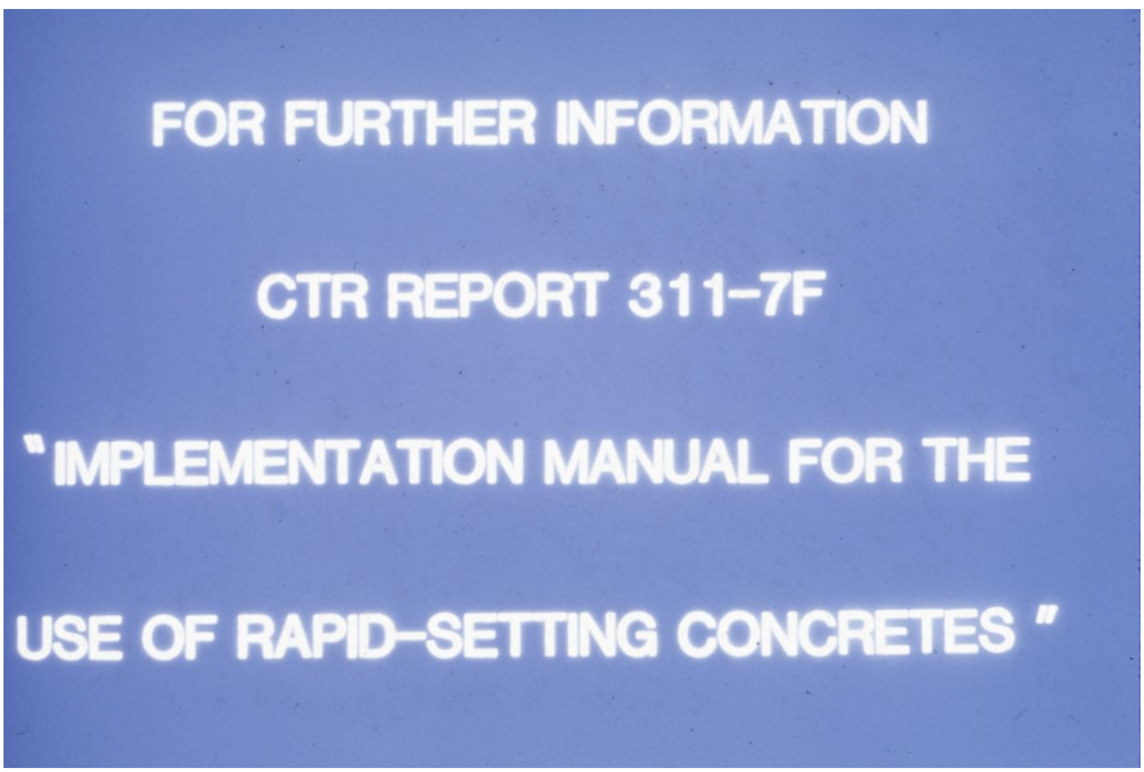
Slide 110. Prepackaged materials instructions



Slide 111. Class "K" Concrete



Slide 112. When Non-chloride Accelerator Required



Slide 113. For Further Information

Appendix A. Slides Script

The following script was prepared by the original authors to accompany the 35mm presentation slides.

PROJECT 311

"Evaluation of Fast-Setting Repair Materials for Concrete Pavements and Bridges" (Implementation)

Slides Script

1. Title

2. Materials included in the study were rapid-setting materials and accelerated portland cement concrete.

3. Candidate materials were selected on the basis of a survey of Austin Division and districts within the state and materials engineers in other state highway departments selected.

4. A questionnaire was developed to obtain the experience of the respondents as to the ideal characteristics and properties of rapid repair materials and on their experiences with available materials for highway repairs.

5-12. The next eight slides summarize the questions on the survey form.

13. The results of the survey were summarized in Research Report 311-1.

14. Based on the survey of Texas districts, the desired characteristics are shown in the order of preference. It is interesting to note that costs was no. 7 on the list of eight characteristics.

15. The properties based on the survey of Texas districts are shown in this slide also in order of preference. The survey of other states gave results very similar to the properties shown in this slide.

16. Based on discussions with highway department personnel, four generic types of rapid-setting materials were selected for laboratory and field study: gypsum-modified portland cement concrete: the brand chosen was Duracal; magnesia phosphate: Set-45, both cold and hot weather formulations were used; magnesia polyphosphate: Neco-Crete and Horn 240 were the brands selected; modified portland cement concrete: Gilco Highway Patch was selected.

17. The following slides indicate the manufacturers' recommendations for mix proportions.

18. Duracal, which is a gypsum-modified portland cement concrete, may be produced as a mortar or a concrete. For mortar, 50 lb of fine aggregate and 1.5 gal water must be added to the 50 lb bag. For concrete, 50 lb of fine aggregate, 50 lb of coarse aggregate, and 1.75 gal of water must be added.

19. With Set-45, a magnesia phosphate, in order to produce a mortar, .5 gal of water should be added to the package. For concrete, 30 lb of coarse aggregate, and .5 gal of water are recommended by the manufacturer. However, as will be described later, tests show that 25 lbs of coarse aggregate gave better results.

20. For Gilco Highway Patch, which is a modified portland cement concrete, 1 gal of water is required to produce mortar. To produce concrete, 30 lb of coarse aggregate and 1 gal of water are recommended by the manufacturer. Test results indicated that 15 to 20 percent more water is required to produce the desired workability.

21. Neco-Crete, which is a magnesia polyphosphate, is a two-component system which utilizes 1 gal of liquid with a 50 lb package. To produce concrete, 18 lb of coarse aggregate are recommended to be added to the mortar mix.

22. Horn 240, which is also a magnesia polyphosphate, is very similar to Neco-Crete. The manufacturer recommends, however, that 13.5 lb of coarse aggregate, instead of 18 lb, should be added to the mortar mix to produce concrete.

23. Class "K" Concrete is a special type of rapid-setting portland cement concrete used by the State Department of Highways and Public Transportation. It uses 7 sacks of Type III cement, a maximum of 5-1/2 gal per sack of cement, 3 to 6 percent air content, and various admixtures including accelerators. The slump is in the range of 1 to 3 inches.

24. Based on discussions with highway department personnel, five generic types of accelerators were selected for study. The types and brand names are shown in the slide.

25. Hydraset is a calcium chloride-based Type C accelerator. Based on laboratory tests, it was found that the maximum dosage recommended by the manufacturer, 2 qt per bag of cément, gave the best results.

26. Acceleguard 80 is a calcium nitrate Type E accelerator and tests indicate that 32 fl oz per 100 lb of cement is the desirable dosage.

27. LA-40 is a sodium thiocyanate Type C accelerator. The recommended dosage was found to be 6 fl oz per 100 lb of cement.

28. Darex Corrosion Inhibitor is a calcium nitrite Type C accelerator. Tests indicate that 100 fl oz per 100 lb of cement is the optimum dosage.

29. Daraset is a Type C accelerator containing calcium nitrite and calcium nitrate and 100 fl oz per 100 lb of cement is the rcommended dosage.

30. Other admixtures used in the study included air entrainment and high range water reducer (HRWR). The HRWR water reducer permits the use of a lower water-cement ratio but at the same time provides adequate workability.

31. Several types of fibers were used. Two types of steel fibers, hooked and crimped, were investigated. Polypropylene lattice bundles were also used in the study.

32. The three different types of fibers are shown in this slide. The hooked and crimped steel fibers provide better bond to the concrete than straight, smooth fibers. The steel fibers provide considerable toughness to the concrete; that is, after the initial crack, considerable more deflection can be achieved in a concrete slab or beam before failure occurs. Generally, steel fibers are added to the concrete in the range of 60 - 85 lb per cu yd.. The hooked fibers should be used in a loose uncollated form for best results. The polypropylene fibers serve to prevent segregation of concrete during placement and to provide some control of shrinkage cracking. The manufacturer recommends the use of 1.6 lb per cu yd. As the polypropylene bundle is dispersed through the concrete, a netlike structure is formed.

33. The results of the test program for determining materials properties will be discussed.

34. The current Texas specification for rapid-setting mortar requires a 15 min. minimum initial set time and 40 min. maximum final set time. The minimum compressive strength is 2000 psi at 2 hr., 3000 psi at 24 hr.. For freeze-thaw resistance, the relative dynamic modulus must be 60 percent minimum after 100 cycles. The minimum flexural strength is 100 psi at 1 hr., 300 psi at 3 hr..

35. Prepackaged materials

36. The next three slides indicate the initial and final set at three different temperatures: 40°, 75°, and 110°F. It can be observed that at a temperature of 40°, only the Set-45 meets the initial set time; none of the materials met the final set time. Duracal and Gilco Highway Patch required nearly 2-1/2 hr. to reach final set. Set-45 exceeded the 40 min. maximum final set time by only a few minutes. All three slides show the initial and final set times required by the Texas specification for rapid-setting mortar as reference points (see slide #34).

37. At 75°F, Neco-Crete set much more rapidly than all the other materials and failed to meet the minimum initial set time. Set-45 and Horn 240 met the set time criteria; Duracal and Hot Weather Set-45 exceeded the maximum set time requirements.

38. For 110°F, Neco-Crete, Gilco Highway Patch, and Cold and Hot Weather Set-45, failed to meet the minimum initial set time. Duracal was the only material which met the initial and final set time requirements.

39. The flexural strength of the materials at 75°F indicate that Neco-Crete gave the highest strength at 1 hr., nearly 500 psi. At 24 hr., Gilco Highway Patch gave the highest strength, almost 800 psi.

40. For compressive strength at 75°F, the Cold Weather Set-45 developed the highest compressive strength, at 1 hr. in excess of 3000 psi. At 24 hr. and 7 days, Hot Weather Set-45 gave the highest strengths. The minimum compressive strengths required by the Texas specifications for rapid-setting mortar at various times are shown as reference points

(see slide #34).

41. Laboratory tests were performed to determine the effect of adding additional water on the compressive strength of some of the materials. It was found that adding 10 percent more water than recommended resulted in a 26 percent decrease in strength of Duracal. Six percent additional water resulted in a 10 percent decrease in strength for GHP. Ten percent additional water in Set-45 resulted in a 14 percent decrease in strength.

42. The properties of Class "K" concrete will be given for the different accelerators at 40°, 75°, and 110°F.

43. The Darex Corrosion Inhibitor and Hydraset both resulted in initial set times of about 3 hr. The LA-40 proved to provide no advantages in either initial or final set time. Daraset was not included in these tests.

44. At 75°F, the Hydraset, Darex Corrosion Inhibitor, and Daraset all resulted in initial set times of between 2 and 2-1/2 hr. It should be noted that Daraset is a more economical form of Darex Corrosion Inhibitor. Again, LA-40 proved to have very little effect on the set times.

45. At 110°F, the Darex Corrosion Inhibitor and Hydraset again gave the lowest initial set times of about 2 hr. and final set times of less than 2-1/2 hr. Daraset was not included in these tests.

46. Flexural strength at 75°F showed little variation at 24 hr. and 3 days. However, Daraset, Darex Corrosion Inhibitor and Hydraset all resulted in the highest strengths at 4 and 8 hr.

47. Similar results were obtained for compressive strength at 75°F.

48. Recommendations for use

49. This table summarizes the recommended temperature ranges for the rapid-setting materials including polymer concrete. Duracal, Hot Weather Set-45, and Gilco Highway Patch are suitable at the range of 71-100°F. Cold Weather Set-45 is recommended in the range of 40-85°F. Neco-Crete should be used only at the lower temperature range of 40-70°F. Polymer concrete can be used at all temperature ranges by varying the amounts of promoter and initiator. Research Report 246-4F should be consulted for specific recommendations on the use of polymer concrete.

50. Of the six accelerators testd, only three are recommended for use in Class "K" concrete. Darex Corrosion Inhibitor and Daraset, both non-chloride accelerators, and Hydraset, a chloride accelerator, can be used at all temperature ranges. The Daraset would generally be the preferred non-chloride accelerator because of its lower cost.

51. The next two slides give the recommended repair sizes for the different materials. Because of the rapid-setting characteristics, Duracal, Set-45, Gilco Highway Patch and Neco-Crete should be used in repair sizes 4'x4' or less. Polymer concrete should generally be limited to 4'x4' repair sizes except that it has been found to be quite feasible for large repairs in which precast slabs are bonded to the surrounding concrete with polymer concrete. Research Report 246-1 should be consulted for precast slab repairs.

52. Class "K" concrete using accelerators should generally be used for larger size repairs.

53. The freeze-thaw durability has been found to be high for Duracal, GHP, and polymer concrete, but low for Set-45 and Neco-Crete.

54. The Class "K" accelerated concretes were all found to have good freeze-thaw durability.

55. This table summarizes the initial set time and the time to achieve to 300 psi flexural strength.

56. The same information is shown for Class "K" concretes with and without accelerators. It can be seen that the accelerators reduce the initial set time by a factor of 2; the time required to achieve 300 psi flexural strength is also reduced by a factor of 2.

57. Based on a cost of $50/cu yd for normal portland cement concrete, the relative costs of the rapid-setting materials are shown. The costs are based on the use of coarse aggregate to extend the prepackaged materials. The costs range from about $250/cu yd for Duracal to about $1200/cu yd for prepackaged polymer concrete.

58. Highway repair procedures

59. It is possible to use these repair materials on four types of repairs.

60. This slide shows a spall which has been filled with asphalt.

61. A full-depth repair is shown in this slide.

62. The preparation of the repair area is quite important. The procedures will be described for several types of repairs.

63. Spalls

64. These are the procedures recommended for repairing spalls.

65. This slide shows a spall ready for placement of repair materials.

66. Full-depth repairs

67. The next two slides summarize the recommended procedures for preparing for full-depth repairs.

68. This is a continuation of the repair procedure.

69. Sawing around the repair area is shown in this slide. The saw cut should generally be about one-quarter of the depth of the slab. Care should be taken to avoid cutting the reinforcing steel.

70. Jack hammers ar shown being used to break out the concrete inside the sawn area. Light jack hammers are preferred to prevent cracking of the concrete outside the saw cut.

71. This slide shows a full-depth repair ready to receive the repair materials. Any broken or badly corroded steel should be replaced.

72. Where the repair area abuts an expansion/contraction joint, care should be taken to maintain the working joint. Dowels should be coated or covered to prevent bonding of the concrete to the dowels.

73. Prepackaged materials

74. The mixing procedures will be discussed for each of the rapid-setting materials.

75. It has been found that a mortar mixer which utilizes moving blades and a stationary drum gives the best results for rapid-setting concrets. Mortar mixers are not suitable for aggregates greater than 1/2" in size.

76. The mixing times for the materials are as follows: 3-4 minutes for Duracal and Gilco Highway Patch and 2 minutes or less for Set-45 and Neco-Crete because of their more rapid setting. However, air temperature should be taken into consideration in determining the precise mixing time. In hotter weather, these recommended mixing times may have to be reduced.

77. The order in which the materials are added in the mixer is important. The following slides describe the recommended order for each material.

78. For Duracal, one-half the water and all the fine and coarse aggregates should be added initially. Fibers, if used, should be added and mixed for one minute. The Duracal is added, followed by the remaining water.

79. For Set-45, all the water and coarse aggregates are first placed in the mixer. Fibers should then be added and mixed for one minute, followed by the addition of all the Set-45.

80. For GHP, the same procedure is used as for Set-45.

81. For Neco-Crete, the same procedure as used for Set-45 and GHP are followed.

82. The coarse aggregate is shown as being added to the mortar mixer.

83. Steel fibers are next added to the mix.

84. The prepackaged rapid-setting material is added.

85. Placing and finishing

86. These are the procedures recommended for placing and finishing the repair material.

87. The material is shown being placed into the repair area.

88. The concrete is being vibrated.

89. Here, a shovel is being used to consolidate the material.

90. A 2x4 is used to screed the surface.

91. Completion of screeding the surface.

92. A broom can be used to texture the surface (Duracal or GHP only).

93. For small spalls, a can or bucket can be used to place the materials.

94. The completed spall repair.

95. Repair procedures for Class "K" concrete.

96. The order in which the materials are added to the mixer will be described.

97. At the batch plant, all the coarse aggregate, fine aggregate, cement and water and air entrainment are added. One-half of the high range water reducer, if used, should be added.

98. At the site, the accelerator and remaining high range water reducer, if used, are added. The material should be mixed at high speed for two minutes.

99. Admixtures are being added at the site.

100. Placing and finishing.

101. Repair area prepared for concrete.

102. Placing Class "K" concrete.

103. Spreading and consolidating.

104. Screeding and finishing.

105. Summary.

106. Duracal is appropriate for use in medium to high temperatures, areas subjected to freeze-thaw, and where lower strength gain can be tolerated.

107. Set-45 is appropriate for low to medium temperature ranges, in areas where freeze-thaw durability is not important, and where rapid strength gains are desired.

108. GHP should be used in medium to high temperatures, in areas where good freeze-thaw durability is required, and where slower strength gains can be tolerated.

109. Neco-Crete should be used at lower temperatures where low freeze-thaw durability is required and rapid strength gain is needed.

110. In using prepackaged materials, use a mortar mixer, add materials in a specified order, avoid overmixing, and place and finish materials quickly.

111. For Class "K" concrete, the specification is spelled out in a special publication, "Repairing Existing Concrete Pavement."

112. The recommended non-chloride accelerators are Darex Corrosion Inhibitor and Daraset.

113. For further information on the use of rapid-setting concretes and accelerated concretes, the Center for Transportation Research Report 311-7F summarizes their use. For additional information on polymer concrete, consult Research Report 246-4F.

*

Appendix B. Accessible Tables

These tables provide accessible versions of data from a selection of previous slides, where scanned images of tables were converted to machine readable tables. The table values listed are the best estimates of library staff and may differ slightly from the values intended to be represented by the original authors.

Material	Initial Set Time (minutes)	Final Set Time (minutes)
Duracal	120	135
Set-45	30	40
GHP	85	130
Neco-Crete	60	70

Table 1. Data from [Slide 36](). Initial and final set time (minutes) at 40°F.

Material	Initial Set Time (minutes)	Final Set Time (minutes)
Duracal	40	50
Set-45	10	11
GHP	20	40
Neco-Crete	5	6
Horn 240	15	20
Hot Weather Set-45	40	45

Table 2. Data from [Slide 37](). Initial and final set time (minutes) at 75°F.

Material	1 hour	3 hours	24 hours
Duracal	2.5	3.0	5.0
Set-45	3.5	3.8	4.0
Hot Weather Set-45	1.5	2.8	6.3
GHP	3.5	4.5	7.8
Neco-Crete	4.8	5.1	5.3

Table 3. Data from [Slide 39](). Flexural strength (psi x 10^2) of materials at 75°F.

Material	1 hour	3 hours	24 hours	7 days
Duracal	1.4	1.5	3.5	5.5
Set-45	3.0	3.1	3.4	4.5
Hot Weather Set-45	2.9	3.4	4.9	6.0
GHP	2.4	2.5	3.5	5.0
Neco-Crete	2.5	3.0	3.4	3.5

Table 4. Data from Slide 40. Compressive strength (ksi) of materials at 75°F.

Material	Initial Set Time (hours)	Final Set Time (hours)
Control	7.0	10.9
LA-40	8.2	12.0
Acceleguard 80	5.0	7.5
Darex Corrosion Inhibitor	3.1	5.0
Hydraset	3.0	4.1

Table 5. Data from Slide 43. Initial and final set time (hours) at 40°F.

Material	Initial Set Time (hours)	Final Set Time (hours)
Control	5.0	6.0
LA-40	4.5	5.5
Acceleguard 80	3.0	4.0
Hydraset	2.5	3.0
Darex Corrosion Inhibitor	2.1	2.6
Daraset	2.0	2.4

Table 6. Data from Slide 44. Initial and final set time (hours) at 75°F.

Material	Initial Set Time (hours)	Final Set Time (hours)
Control	4.0	4.4
LA-40	3.5	4.0
Acceleguard 80	2.6	3.2
Darex Corrosion Inhibitor	2.0	2.3
Hydraset	2.0	2.2

Table 7. Data from Slide 45. Initial and final set time (hours) at 110°F.

Material	4 hours	8 hours	24 hours	3 days
Control	0.0	1.0	5.9	7.6
Acceleguard 80	0.3	2.0	6.0	8.4
Daraset	1.5	3.8	6.5	9.0
Darex Corrosion Inhibitor	1.2	3.9	6.5	8.5
Hydraset	1.2	4.0	6.6	8.7
LA-40	0.0	1.9	6.0	8.0

Table 8. Data from Slide 46. Flexural strength (psi x 10^2) of materials at 75°F.

Material	4 hours	8 hours	24 hours	3 days
Control	0.0	0.3	3.4	5.3
Acceleguard 80	0.2	0.8	3.5	5.6
Daraset	0.7	2.6	4.3	5.8
Darex Corrosion Inhibitor	0.5	2.3	4.2	5.9
Hydraset	0.6	2.5	4.3	5.8
LA-40	0.0	0.8	3.4	5.4

Table 9. Data from Slide 47. Compressive strength (ksi) of materials at 75°F.

Material	TR: 40–70°F	TR: 71–85°F	TR: 86–100°F
Duracal	No	Yes	Yes
Set-45 (Hot weather)	No	Yes	Yes
Set-45 (Cold weather)	Yes	Yes	No
GHP	No	Yes	Yes
Neco-Crete	Yes	No	No
Polymer Concrete	Yes	Yes	Yes

Table 10. Data from Slide 49. Recommended temperature ranges (TR) for rapid-setting materials.

Material	TR: 40–70°F	TR: 71–85°F	TR: 86–100°F
Darex Corrosion Inhibitor (Non-chloride)	Yes	Yes	Yes
Daraset (Non-chloride)	Yes	Yes	Yes
Hydraset (Chloride)	Yes	Yes	Yes

Table 11. Data from Slide 50. Accelerators recommended for use in Class "K" concrete.

Material	4'x4' or less	4'x4' or more
Duracal	Yes	No
Set-45	Yes	No
GHP	Yes	No
Neco-Crete	Yes	No
Polymer Concrete	Yes	Yes, with precast slab

Table 12. Data from Slide 51. Recommended repair sizes for rapid-setting materials.

Material	4'x4' or less	4'x4' or more
Darex Corrosion Inhibitor	No	Yes
Daraset	No	Yes
Hydraset	No	Yes
Class "K"	No	Yes

Table 13. Data from Slide 52. Recommended repair sizes for Class "K" accelerated concretes.

Material	Low	High
Duracal	No	Yes
Set-45	Yes	No
GHP	No	Yes
Neco-Crete	Yes	No
Polymer Concrete	No	Yes

Table 14. Data from Slide 53. Freeze-thaw durability of rapid-setting materials.

Material	Low	High
Darex Corrosion Inhibitor	No	Yes
Daraset	No	Yes
Hydraset	No	Yes
Class "K"	No	Yes

Table 15. Data from Slide 54. Freeze-thaw durability of Class "K" accelerated concretes.

Material	Initial Set Time (minutes)	Time to 300 psi FS (hours)
Duracal	40	3.0
Set-45 (Hot weather)	40	3.2
Set-45 (Cold weather)	10	0.8
GHP	20	1.0
Neco-Crete	3	0.6
Polymer Concrete	30–45	<1.0

Table 16. Data from Slide 55. Initial set time (minutes) and time to achieve 300 psi flexural strength (FS) at 75°F.

Material	Initial Set Time (hours)	Time to 300 psi FS (hours)
Class "K" Control	4.8	14.0
Darex Corrosion Inhibitor	2.0	7.0
Daraset	1.9	7.0
Hydraset	2.5	7.0

Table 17. Data from Slide 56. Initial set time (hours) and time to achieve 300 psi FS at 75°F.

Material	Relative Cost (Extended material)
Normal PCC	1.0
Duracal	5.1
Set-45	18.8
GHP	12.5
Neco-Crete	18.9
Polymer Concrete (Contractor formulated)	8.5
Polymer Concrete (Prepackaged)	24

Table 18. Data from Slide 57. Relative costs of rapid-setting materials, based on a cost of $50/cu yd for normal portland cement concrete (PCC).