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GEORGIA DEPARTMENT OF TRANSPORTATION

CONTRACT RESEARCH

GDOT RESEARCH PROJECT NO. 8703

FINAL REPORT

INVESTIGATION OF RUTTING AND SEGREGATION OF ASPHALT MIXTURES IN THE STATE OF GEORGIA

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JULY 1988

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Georgia Department of Transportation

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-GA-88-8703		

4. Title and Subtitle	5. Report Date
Investigation of Rutting & Segregation of Asphalt Mixtures in State	July, 1988
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
E. R. Brown J. R. Brownfield	RP 8703

9. Performing Organization Name and Address	10. Work Unit No.
Highway Research Center Auburn University 238 Harbert Engineering Center Auburn University, AL 36849	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Office of Materials and Research Georgia Department of Transportation 15 Kennedy Drive Forest Park, GA 30050	Final
	14. Sponsoring Agency Code

15. Supplementary Notes

In cooperation with the Federal Highway Administration

16. Abstract The objective of this project was to review existing GDOT specifications, mix design and construction procedures for asphalt concrete and to make recommendations for improvement where appropriate. The two primary areas of concern were aggregate segregation and rutting of asphalt pavements.

Laboratory tests to study segregation showed that the loss of desirable mixture properties is significant when the gradation of the mixture is approximately 10% coarser than the job mix formula on the No. 8 sieve. Quality control is very important in reducing segregation. There is no correlation between the variabiliity of plant sample gradations and the amount of segregation.

The study of rutted pavements found that where in-place voids after traffic was low (1.5 to 3 percent) there were problems with rutting. Several rutted pavement projects had deviations in plant produced material of 2 to 5 percent on the No. 200 sieve.

17. Key Words	18. Distribution Statement
Asphalt mixtures, segregation, rutting	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	132	

Form DOT F 1700.7 (8-69)

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I. INTRODUCTION

The Georgia Department of Transportation (GDOT) has taken steps to improve the overall performance of asphalt concrete pavements. Some problem areas have been identified by GDOT for investigation to provide suggested changes to specification or construction procedures that will result in overall better performance. Two problems that have been identified as important to GDOT are aggregate segregation and rutting of asphalt concrete.

GDOT typically uses relatively large maximum size aggregate for their base and binder course mixtures to insure that a mixture is produced that is resistant to rutting. The use of mixtures having large maximum size aggregate does minimize rutting however these mixtures tend to segregate during the production, hauling, and/or laydown operation. GDOT has previously funded projects to look at procedures to minimize aggregate segregation and from this has developed a number of specific steps to minimize segregation. These steps have been placed in the form of a checklist to be used by the inspector and contractor to help insure that construction projects do not experience segregation problems. These steps have helped to reduce the amount of segregation but they have not solved the problem.

Within the next few years rutting has the potential to become the most severe asphalt pavement problem in the State of Georgia. Because of this potential problem GDOT has taken a number of steps to minimize pavement rutting. One step that GDOT has taken involved adding a requirement to the specifications that disallows the use of natural sand and uncrushed gravels in the upper asphalt concrete surface. It is known

that the use of crushed aggregate will result in an asphalt mixture that is more resistant to permanent deformation than mixtures using uncrushed aggregate and thus these steps should improve the resistance to rutting.

The objectives of this project were to review existing GDOT specifications and mix design and construction procedures for asphalt concrete and to make recommendations for improvement where appropriate. The two primary areas of concern were aggregate segregation and rutting of asphalt pavements.

Several steps were taken to accomplish the proposed work. First of all a review of literature relating to segregation and rutting was made. A number of on-going construction projects were observed to identify any aggregate segregation problems and to evaluate existing construction procedures in the State of Georgia. A sampling and testing plan was developed to evaluate pavements having segregation problems and to compare these segregated mixtures with random mixtures that appeared to conform to the specifications. The GDOT Materials Laboratory and various Division Laboratories performed tests on these samples to determine gradation, asphalt content, and voids in total mix. The data was analyzed to compare segregated areas to material from other areas. Existing data on a number of pavements that had experienced rutting was analyzed to identify possible causes of the rutting. A series of laboratory tests was conducted at Auburn University to measure properties of asphalt mixture representing segregated and non-segregated areas.

II. PREVIOUS RESEARCH

Aggregate segregation in asphalt pavements occurs when coarse aggregate congregates at one spot in the pavement. The coarse spots have open textures and low densities which often result in areas of high permeability that are susceptible to ravelling, cracking and moisture damage (6). To review previous research this paper has been divided into 3 parts: Sources of segregation, diagnosis of segregation, and prevention of segregation.

Sources of Segregation

The National Asphalt Paving Association (NAPA), in 1987 (1,4), suggested stockpiles containing "single-sized" aggregate would minimize segregation in the stockpiles. Stockpiling in horizontal layers reduces segregation in stockpiles by not allowing the truckload of aggregate to roll down long slopes. NAPA also recommended improved cold bin openings that allow unrestricted flow. The conventional bin opening may partially plug due to bridging aggregate. A trapezoidal bin opening, with the calibration belt flowing away from the wider end of the opening, gives more uniform flow out of the bin.

In a paper from Kennedy, McGennis and Holmgreen (6), they state that a segregated stockpile creates special problems in a drum mix plant because there is no internal gradation check. They suggest that a minimum of three stockpiles should be used, more than three if there is a large variation in aggregate size, and five or six stockpiles if segregation is to be minimized. They state that loaders should not "scoop" from the side of a stockpile, but instead should ram the side of the stockpile and rotate the bucket after coming to a stop. The material should be dumped directly into

the center of the cold bins, and if aggregate intermingling occurs between cold bins, bulk heads should be used (6).

Conveyor belts and drums

The gradation of the aggregate will usually not be altered on the conveyor belt that leads from the cold feeds to the drum; the aggregate blend that is delivered to the drum has the same gradation as it did when it was delivered to the belt. Segregation may occur in the drum mixer. NAPA (4) states that good asphalt coating of large particles will reduce this segregation. They recommend that the mixing dwell time be increased or the asphalt cement (AC) be introduced earlier in the drum. To achieve increased dwell time, they suggest that donuts be welded to the inside of the drum or the slope of the drum be decreased, both of which allow a longer time period for the aggregate to be coated with asphalt. They also state that a mix can become segregated when it is deposited on the belt from some drums that allow fines to fall on one side of the belt and coarse particles on the other.

Kennedy et al. (6) consider conveyor speed as a possible reason for segregation; if the belt is run too fast it will throw large particles to the far side of the silo, which will eventually result in a coarse strip on one side of the mat.

Batchers, rotating chutes, and silos

Middleton, Goodknight and Eaton, in their 1967 study on the effects that hot storage has on an asphalt concrete mix, concluded that storage silos had little to no effect on the aggregate gradation (8). Their study was conducted on asphalt concrete mixtures with fine aggregate gradations (1/2 inch maximum size) which are not very susceptible to segregation.

In 1970, Foster (3), using a gradation with a maximum size of 1 1/2 inches, noted that there could be considerable segregation in the silo. He showed the segregation pattern to be large aggregates around the edge of the silo and finer aggregates in the center. He also showed how the gradation of unloaded material differed from the gradation of the material that was being loaded into the silo. He suggests that keeping the material one silo diameter above the top of the cone will force the material to recombine as it is loaded into the trucks. He mentions the use of gob hoppers (batchers) at the top of the silo but has no data to show how much they will reduce segregation.

Dan Houston (5), in the same year, reported that certain bin geometry combinations yielded less segregation. The combination that had the least segregation was a circular silo with a 1x4 opening at the bottom of the silo and a rotating spout at the top of the silo. The second least segregated mix was from a circular bin with a 1x4 opening at the bottom of the silo and a batcher at the top of the silo.

In 1974, Zdeb and Brown (10) reported gradation variability to increase with storage, as indicated by a more than 2-fold increase in standard deviation of percent passing most sieves.

In 1987, NAPA (4) considered storage silos the most sensitive place for segregation to occur. They stated that batchers and rotating chutes are effective only as long as they are operated properly. Rotating chutes must rotate, and batchers should be filled sufficiently before dumping and should never be emptied except at the end of daily operation. NAPA says that emptying the silo below the cone, or operating the silo at maximum capacity, will result in segregation. They suggest that trucks be loaded

in three separate drops instead of one large one. The first drop should be just behind the cab, the second should be just in front of the tailgate and the third should be in between the first two.

Kennedy et al., of the University of Texas in Austin (6), also consider improper use of storage silos as the most important cause of segregation. In agreement with NAPA, they suggest that operating a silo between 25 and 75% capacity will result in the best mix.

Pavers

Pavers have not been seriously considered as possible areas of segregation until recently. NAPA recognizes the fact that poor paver operation can cause segregation (4). Their recommendations for paver operators are as follows:

1) Do not empty hopper.
2) Do not dump wings unless absolutely necessary.
3) Flood the hopper.
4) Adjust gates so that augers run continually.
5) Adjust paver speed to match the rate of production of the HMA plant.

In addition to the things mentioned about paver operations by NAPA, Kennedy et al. (6) suggest modifications to the paver. They say that welding a bevelled bottom on the wings will promote a more continuous flow of HMA from the wings to the drag slats. Also, fillets placed in the corners of the wings will hinder the collection of coarse material on the outside of the wings.

Diagnosis of Segregation

Nady, in a paper published in 1984 (4), reports a case study in which eight cores within a twenty-foot section of roadway could not be removed intact due to a lack of fines in the mixture. He noted that there was no visible segregation in this area.

Two years later, Mike Lackey, in a study directed toward segregation in Kansas, stated that a big problem with segregation is that it is often unnoticeable when the pavement is placed, but after a year of traffic, segregated spots appear; "You can't cure them if you can't see them" (7).

Lackey's concern about non-visibility was shared by Kennedy, McGennis, and Holmgreen (6) who suggested that wet pavements and a low angle of sunlight would make segregation more visible. Lackey approached the problem by measuring density profiles with nuclear density meters. As stated earlier, segregated areas of pavements have open textures and low densities, hence low density spots on profiles may often be the result of segregation. These profiles provided a way of indicating segregated spots shortly after the pavement was placed.

When segregation is visible behind the paver, there is information available that will assist in diagnosing its cause. NAPA printed a paper on hot mix construction (1) in which field and laboratory experience are translated into a format that can readily assist field diagnosis of mat deficiencies, one of which is segregation. Their table suggests possible causes of segregation and what can appear to be segregation without being detrimental to the performance of the HMA pavement. In another paper (4) NAPA presents much of the same data in a flow chart form that can assist in

locating causes of segregation. Kennedy et al. also present a checklist in their paper (6) that can be used to locate the source of a segregation problem.

Prevention of Segregation

In his 1984 paper, Nady (9) mentions a case study of some paving jobs where everything was held constant except for the AC content (i.e. aggregate blend, asphalt course, HMA facility, paver crew, etc.). From this study, he concluded that by increasing the AC content, segregation could be reduced.

Kennedy, McGennis and Holmgreen (6) report that often a 0.2 percent increase in AC content will eliminate segregation problems. They state that a mix with an AC content significantly less than the one that produces the minimum voids in mineral aggregate (VMA) tends to have more segregation problems than the mix that has an AC content near the one that produces the minimum VMA. They also recognize that mixes with large aggregate or that are coarse-graded are more prone to segregate than fine-graded mixes, and well-graded mixes have less tendency to segregate than do gap-graded mixes.

NAPA (4) says that proper mix design can eliminate segregation without changing the AC content. They caution, however, that in order to produce a mix near the design gradation, there must not be segregation in the stockpiles.

III. TEST PLAN

A test plan was developed to insure the collection of all data that would be useful in completing this project. The first step involved inspection of on-going projects to identify particular problems that need to be studied. Inspections were also made on completed pavements to evaluate the overall extent of segregation and other problems facing the GDOT.

After observation of a number of projects and several discussions with GDOT personnel a test plan was developed to measure the extent of segregation and to evaluate data on asphalt concrete mixtures that had experienced rutting. Most of the rutted pavements were constructed 7-10 years prior to conducting this study. The analysis of these pavements involved reviewing the existing data on file at GDOT to identify possible causes of rutting.

A list of information needed for the rutting study was prepared and the files were searched to locate as much of this information as possible. The information identified, as needed, included mix design, date constructed, quality control data, and results of tests conducted on pavement after rutting was observed. Specific asphalt mix information searched for included voids total mix (VTM) for mix design, VTM for plant samples, VTM for initial construction, and VTM after traffic. A comparison of the VTM for mix design and the VTM after traffic was used to establish the acceptability of the mix design density. The mix design VTM should be approximately equal to the VTM after traffic. If there is a significant difference between the VTM in mix design and after traffic this would be due to changes in the mix after mix design or insufficient compactive effort during mix design.

A detailed test plan was established to evaluate the causes of segregation on a number of projects. Three types of mixes which were evaluated were "B", Base, and "E" mixtures. These are the most widely used mixes by GDOT. The base mix tends to segregate more than the other mixes since it is coarser. These mixes were evaluated when produced with various types of plant and equipment as shown in Table 1. There has been much concern about drum-mix vs. batch plants, the use of storage silos, the use of coaters on drum mix plants and the stockpiling operation. This plan of study was designed to develop data to help answer some of these questions.

All of the blocks in Table 1 were not filled due to the lack of projects being constructed with all combinations shown. Care was taken to insure that as many as possible of those blocks of most interest were evaluated.

A sampling plan and series of tests were specified for each block evaluated. The sampling plan is shown in Figure 1. This random sampling plan was followed at each location. Additional samples were taken within each test area at observed segregated areas. Data was also obtained from the crushing operation and from quality control tests during construction. By using this approach the aggregate gradation and variability can be followed from start to finish. Tests conducted on the samples obtained from each location included gradation, asphalt content, density, and theoretical maximum density.

After data from the sampled pavements was obtained and analyzed a test plan was developed to look at mixtures in the laboratory that were representative of those materials observed in the field. One aggregate type was selected and mixes were prepared using a gradation slightly finer

Table 1. Types of Mixes and Equipment Evaluated for Segregation.

	Batch Plant				Drum Mix Plant			
	Silo Used		Silo Not Used		Coater		No Coater	
	Separate ** Stockpiles	Combined *** Stockpiles	Separate Stockpiles	Combined Stockpiles	Separate Stockpiles	Combined Stockpiles	Separate Stockpiles	Combined Stockpile
B MIX	-	-	-	4*	-	1	-	3
BASE MIX	1	1	-	-	-	2	1	2
E MIX	-	-	-	-	-	-	1	2

* Number of projects evaluated
** Coarse aggregate stockpiles separated into individual sizes
*** Coarse aggregate stockpiles contain combined stockpiles

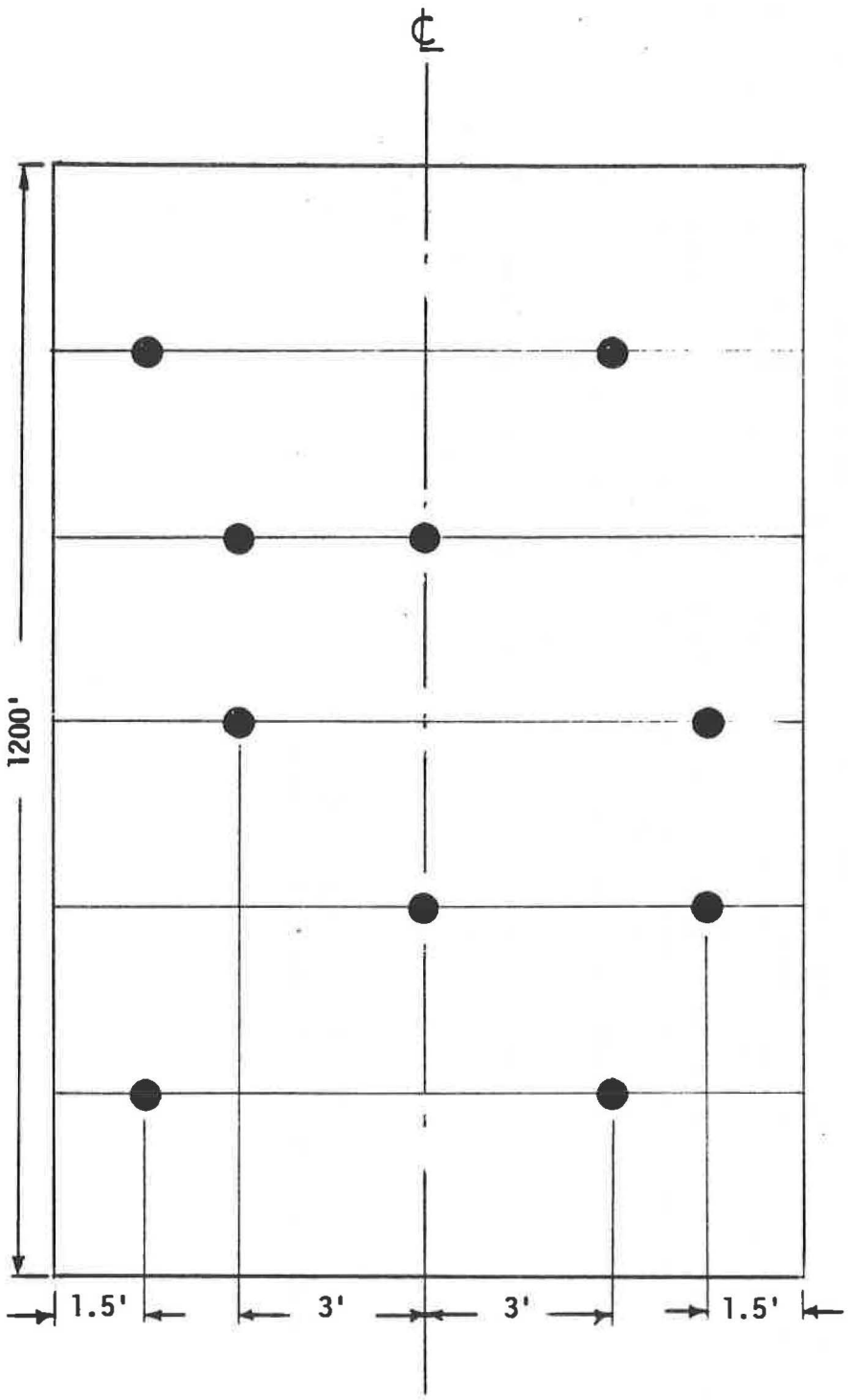

Figure 1. Layout of Random Sampling Plan.

than the job mix formula for a particular project to a gradation representative of a badly segregated mix. When a mixture segregates, the asphalt content is normally higher for the finer material and normally lower for the coarser material. The mixes were prepared in a Gyratory Testing Machine (GTM) using 120 psi pressure, 30 revolutions, and 1 degree angle. After being compacted these samples were tested to determine density, voids in total mix, stability, flow, indirect tensile strength and permeability.

IV. ANALYSIS OF MIXTURES OBTAINED FROM RUTTED PAVEMENTS

Data from a number of rutted pavements was analyzed to determine possible causes of rutting. Most of these projects were constructed between 1977 and 1980 and many of these pavements had been overlayed or removed and replaced prior to this study. All analyses were made based on existing data. Obviously some data that would have been helpful in the analysis was not available, however, the data on hand was used to the fullest extent possible to identify the causes of rutting. The data generally included mix design data, quality control test results, and results of failure investigations.

Summaries of the data obtained from the rutted pavements are shown in Tables 2 through 12. Much of the data is incomplete; however, all data available that was possibly related to rutting is provided in the tables.

In evaluating the data a number of items were studied to determine possible problem areas. A list of the items evaluated include:

1) Variability of aggregate gradation, asphalt content, and in-place voids during production of asphalt mixtures.
2) Significant difference in aggregate gradation during construction and that measured in mix design.
3) Low in-place voids during construction.
4) Lower voids in-place than shown in mix design.
5) Higher asphalt content during construction than mix design.
6) Low in-place voids after traffic.

A list of the data, which may help explain the rutting problems, is provided in Table 13.

Table 2. Properties of Rutted Pavements (I-75 Houston & Peach, 1981)

Test Type	Mix Type	Percent Passing 1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Tensile Strength	Asphalt Content
Mix Design	F	-	-	100	94	63	46	16	6	2090	10	4.7	-	6.0
Plant Production														
Average	F	-	-	100	-	65	50	20	5.5	-	-	5.9	-	5.9
Std. Dev.	F	-	-	0	-	1.8	2.8	1.4	0.6	-	-	1.16	-	0.30
In-Place (Final)														
Average	F	-	-	-	-	-	-	-	-	-	-	-	60.1	-
Std. Dev.	F	-	-	-	-	-	-	-	-	-	-	-	23.1	-
Mix Design	B	100	100	-	80	-	43	18	8	2050	10	5.0	-	5.1
Plant Production														
Average	B	100	-	-	80	-	46	17	5.4	-	-	4.9	-	5.1
Std. Dev.	B	0	-	-	2.6	-	2.0	1.5	0.9	-	-	0.8	-	0.14
In-Place (Final)														
Average	B	-	-	-	-	-	-	-	-	-	-	-	64.4	-
Std. Dev.	B	-	-	-	-	-	-	-	-	-	-	-	23.9	-

Table 3. Properties of Rutted Pavements (I-20 Newton, 1985)

Test Type	Mix Type	Percent Passing 1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	B	100	96	-	63	52	38	-	5	3800	10	3.6	5.0
Plant Production													
Average	B	100	98	-	70	-	39	-	5.1	-	-	5.3	4.4
Std. Dev.	B	0	0.7	-	2.1	-	1.4	-	0.2	-	-	0.50	0.15
Mix Design	F	-	-	-	100	66	45	17	6	3170	9	4.0	5.5
Plant Production													
Average	F	-	-	100	98	65	45	18	5.7	-	-	7.4	5.6
Std. Dev.	F	-	-	0	2.0	2.4	2.2	1.3	0.6	-	-	1.6	0.16

Table 4. Properties of Rutted Pavement (IR-75 Crisp, 1985)

Test Type	Mix Type	Percent Passing 1	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	B	100	81	63	42	33	15	5	3680	10	4.5	4.5
Plant Production												
Average	B	100	-	62	-	34	-	5.1	-	-	5.1	4.4
Std. Dev.	B	0	-	3.8	-	2.2	-	0.5	-	-	0.8	0.18
Mix Design	F	-	100	98	62	44	19	6	2670	10	4.5	6.0
Plant Production												
Average	F	-	100	-	62	43	17	5.8	-	-	6.6	5.6
Std. Dev.	F	-	0	-	3.6	2.3	1.3	0.8	-	-	1.0	0.3

Table 5. Properties of Rutted Pavement (I-75 Monroe, 1980)

Test Type	Mix Type	Percent Passing 1 1/2	1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	B	-	100	98	-	68	-	43	21	8	2200	9	4.3	5.1
Plant Production Average	B	-	100	-	-	68	-	46	22	3.3	-	-	5.9	6.0
Std. Dev.	B	-	0	-	-	2.5	-	1.8	1.8	0.6	-	-	1.2	0.14
Mix Design	Base	100	99	-	61	-	-	36	17	7	2050	10	4.5	4.6
Plant Production Average	Base	100	100	-	62	-	-	35	-	2.4	-	-	6.4	4.6
Std. Dev.	Base	-	-	-	-	-	-	-	-	-	-	-	-	-
Mix Design	H	-	-	-	100	99	68	53	25	7	1867	9	4.3	5.9
Plant Production Average	H	-	-	-	100	-	70	52	25	4.2	-	-	7.4	6.7
Std. Dev.	H	-	-	-	0	-	1.6	1.5	2.1	0.7	-	-	1.2	0.18

Table 6. Properties of Rutted Pavement (I-75 Crisp 1979)

Test Type	Mix Type	Percent Passing 1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	B	100	99	78	66	53	43	20	7	1800	12	4.5	5.4
Plant Production													
Average	B	100	-	-	78	-	45	19	7.7	-	-	5.7	5.2
Std. Dev.	B	0	-	-	4.4	-	2.8	0.9	1.0	-	-	0.9	0.20
Mix Design	H	-	-	100	99	73	53	23	8	-	-	-	6.6
Plant Production													
Average	H	-	-	100	-	74	55	23	9.4	-	-	6.5	6.5
Std. Dev.	H	-	-	0	-	3.4	4.4	2.4	1.8	-	-	1.6	0.24

Table 7. Properties fo Rutted Pavement (I-85 Harris-Troup Counties, 1979)

Test Type	Mix Type	Percent Passing 1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	B	100	98	-	80	-	45	17	7	2350	13	5.0	5.4
Plant Production													
Average	B	100	-	-	77	-	45	18	4.8	-	-	5.0	5.5
Std. Dev.	B	0	-	-	2.2	-	1.5	1.3	1.0	-	-	1.01	0.14
Mix Design	H	-	-	100	98	70	55	20	8	2470	12	4.6	6.5
Plant Production													
Average	H	-	-	100	-	78	56	19	4.9	-	-	6.0	6.9
Std. Dev.	H	-	-	0	-	2.1	1.8	1.6	1.8	-	-	0.99	0.26

Table 8. Properties of Rutted Pavement (I-75 Cobb-Cherokee Counties, 1986)

Test Type	Type	1 1/2	1	3/4	1/2	3/8	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	Base	100	99	-	74	-	36	-	5	2550	11	5.6	4.5
Plant Production	Base												
Average		100	97.1	-	76.8	-	37.1	-	6.8	-	-	-	4.5
Std. Dev.		0	2.1	-	4.0	-	3.0	-	1.0	-	-	-	0.11
In-Place (Final)	Base												
Average													
Std. Dev.													
Mix Design	B	-	100	99	-	65	33	-	5	3230	13	4.4	4.5
Plant Production	B												
Average		-	100	-	-	67	34	-	5.9	-	-	5.9	4.5
Std. Dev.		-	0	-	-	1.9	1.4	-	0.4	-	-	0.6	0.11
In-Place (Final)	B												
Average		-	100	-	-	68	35	-	6.0	-	-	-	-
Std. Dev.													
Mix Design	E	-	-	100	99	83	45	17	6	2960	11	5.0	5.3
Plant Production	E												
Average		-	-	100	-	82	45	21	6.6	-	-	5.8	5.4
Std. Dev.		-	-	0	-	2.3	1.0	1.1	0.4	-	-	0.6	0.18
In-Place (Final)	E												
Average		-	-	100	-	82	44	20	6.9	-	-	-	-
Std. Dev.													

Table 9. Properties of Rutted Pavement (I-75 Crisp-Turner County, 1980)

Test Type	Mix Type	Percent Passing 1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Tensile Strength	Asphalt Content
Mix Design	H			100	99	68	54	24	6	2080	9	4.6	-	6.0
Plant Production	H													
Average				100	-	72	54	24	6.6	-	-	5.0*	-	6.0
Std. Dev.				0	-	2.1	1.8	1.2	1.1	-	-	0.56	-	0.20
In-Place (Final)	H													
Average				-	-	-	-	-	-	-	-	2.9	62.2	-
Std. Dev.				-	-	-	-	-	-	-	-	1.5	18.0	-
Mix Design	B		100	-	80	-	48	22	7	2070	9	4.4	-	5.3
Plant Production	B													
Average		100	-	-	77	-	49	22	7.5	-	-	4.8	-	5.2
Std. Dev.										-	-	0.61	-	0.24
In-Place (Final)	B													
Average			-	-	-	-	-	-	-	-	-	3.0	89.0	-
Std. Dev.			-	-	-	-	-	-	-	-	-	1.2	23.2	-

* In-Place Voids

Table 10. Properties of Rutted Pavement (I-75 Lowndes, 1980)

Test Type	Mix Type	Percent Passing 1	3/4	1/2	3/8	4	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	B												
Average	B	100	97	-	65	-	46	18	4.0	2100	10	4.5	5.3
Plant Production	B									-	-		
Average	B	100	-	-	69	-	48	20	5.4	-	-	5.3	4.8
Std. Dev.	B	0			2.2		1.6	1.0	0.6			0.93	0.18
Mix Design	H			100	98	74	52	21	7	2610	12	4.4	5.9
Average	H												
Plant Production	H												
Average	H			100	-	72	53	22	7.5	-	-	7.1	5.9
Std. Dev.	H			0	-	2.1	2.5	1.6	1.5	-	-	1.44	0.17

Table 11. Properties of Rutted Pavement (I-20 West Asphalt Concrete "A")

Test Type	Stability	Flow	Voids Total Mix	Tensile Strength	Asphalt Content
In-Place (After Traffic)					
Average	1948	15.7	1.3	69.7	-
Std. Dev.	480	0.9	0.4	9.0	-
Recompacted					
Average	3119	15.8	1.5	-	5.5
Std. Dev.	162	1.7	0.3	-	0.36

Table 12. Properties of Rutted Pavement (I-85 Banks & Franklin, 1986)

Type Test	Mix Type	Percent Passing 1 1/2	1	3/4	1/2	3/8	8	50	200	Stability	Flow	Voids Total Mix	Asphalt Content
Mix Design	E	-	-	100	97	82	45	19	6	-	-		
Plant Production													
Average	E	-	-	100	96	82	45	18	5.8	-	-	5.8	5.4
Std. Dev.	E	-	-	0	1.7	2.2	2.0	0.9	0.5	-	-	1.1	0.2
Mix Design	Base	100	97	-	73	-	33	-	5.0	-	-	-	-
Plant Production													
Average	Base	100	98	-	78	-	36	-	5.4	-	-	6.4	4.3
Std. Dev.	Base	0	1.8	-	2.7	-	1.7	-	0.5	-	-	0.9	0.1
Mix Design	B	-	100	98	-	60	33	-	5	-	-	-	-
Plant Production													
Average	B	-	100	-	66	-	35	-	53	-	-	5.9	4.5
Std. Dev.	B		0	-	2.7	-	1.9	-	0.4	-	-	1.0	0.19

Table 13. Properties of Mixtures Experiencing Rutting

Project Location	Mix Type	Variability During Plant Production: Asphalt Content	Gradation: Max Variability	Gradation: -200	In-Place Voids	Average In-Place Voids	Initial Voids In-Place Minus Mix Design Voids	Asphalt Content During Constr. Minus Mix Design	Diff Between Production Grad. And Mix Design: Max	Diff Between Production Grad. And Mix Design: -200	In-Place Voids After Traffic
1. I-75 Houston	F	0.30	2.8	0.6	1.2	5.9	1.2	-0.1	4	0.5	-
& Peach, 1981	B	0.14	2.6	0.9	0.8	4.9	-0.1	0	3	2.6	-
2. I-20 Newton	B	0.15	2.1	0.2	0.5	5.3	1.7	-0.6	7	0.1	-
1985	F	0.16	2.4	0.6	1.6	7.4	3.4	0.1	2	0.3	
3. IR-75 Crisp	B	0.18	3.8	0.5	0.8	5.1	0.6	-0.1	1	0.1	-
1985	F	0.30	3.6	0.8	1.0	6.6	2.1	-0.4	2	0.2	-
4. I-75 Monroe	B	0.14	2.5	0.6	1.2	5.9	1.6	0.9	5	4.7	-
1980	Base	-	-	-	-	6.4	1.9	0	5	4.6	-
	H	0.18	2.1	0.7	1.2	7.4	3.1	0.8	3	2.8	-
5. I-75 Crisp	B	0.20	4.4	1.0	0.9	5.7	1.2	-0.2	8	0.7	-
1979	H	0.24	4.4	1.8	1.6	6.5	-	-0.1	2	1.4	-
6. I-85 Harris	B	0.14	2.2	1.0	1.0	5.0	0	0.1	3	2.2	-
Troup, 1979	H	0.26	2.1	1.8	1.0	6.0	1.4	0.4	8	3.1	-
7. I-75 Cobb	Base	0.11	4.0	1.0	-	-	-	-	3	1.8	-
Cherokee,	B	0.11	1.9	0.4	0.6	5.9	1.5	0	2	0.9	-
1986	E	0.18	2.3	0.4	0.6	5.8	0.8	0.1	4	0.6	-
8. I-75 Crisp	H	0.20	2.1	1.1	0.6	5.0	0.4	0	4	0.4	2.9
Turner, 1980	B	0.24	-	-	0.6	4.8	0.4	-0.1	3	0.5	3.0
9. I-75 Lowndes	B	0.18	2.2	0.6	0.9	5.3	0.8	-0.5	4	1.4	-
1980	H	0.17	2.5	1.5	1.4	7.1	2.7	0	2	0.5	-

Table 13 (continued)

Project Location	Mix Type	Variability During Plant Production: Asphalt Content	Gradation: Max Variability	Gradation: -200	In-Place Voids	Average In-Place Voids	Initial Voids In-Place Minus Mix Design Voids	Asphalt Content During Constr. Minus Mix Design	Diff Between Production Grad. And Mix Design: Max	Diff Between Production Grad. And Mix Design: -200	In-Place Voids After Traffic
10. I-20 West Asphalt Concrete A	-	0.36	-	-	-	-	-	-	-	-	1.5
11. I-85 Banks Franklin, 1986	E	0.20	2.2	0.5	1.1	5.8	-	-	1	0.2	-
	Base	0.10	2.7	0.5	0.9	6.5	-	-	5	0.4	-
	B	0.19	2.7	0.4	1.0	5.9	-	-	2	0.3	-

The variability of aggregate gradation is shown for the sieve size having the most variability and for the #200 sieve since these are the two most critical sieves. Generally, for good control, the standard deviation for the sieves having the most variability will range from 3.0 to 4.0. The standard deviation for the amount passing the No. 200 sieve should not greatly exceed 1.0. Project No. 5 in Table 13 has the highest overall variability of aggregate gradation. Since laboratory samples were not compacted during construction it is not clear what effect this high variability had on mixture properties but it was likely significant. Mix H on project 6 also had high variability on the amount of material passing the No. 200 sieve.

The variability of asphalt content is controlled to a large extent by the inherent variability in the test method itself. Normally the standard deviation of the asphalt content should not exceed 0.2 to 0.3. Project No. 10 is the only project to exceed this value.

The standard deviation of the in-place voids should not greatly exceed 1.0. Project 2-Mix F, project 5-Mix H, and project 9-Mix H do greatly exceed 1.0.

The average aggregate gradation during construction should not deviate from that selected in the mix design by more than 4 to 5 percent. If it does then a new mix design is needed. Project 5-Mix B, project 2-Mix B, and project 6-Mix H exceed the recommended values. Also projects 4 and 6 show significant differences between the percent passing No. 200 sieve during mix design and percent passing No. 200 sieve during plant production.

There is no doubt that low voids in the asphalt mixture leads to rutting under traffic. Most studies have shown that generally plastic flow occurs when the voids in the total mixture are reduced below 2-3 percent. The mixture design procedure has been selected to compact asphalt concrete in the laboratory to a density approximately equal to the density that will be obtained under traffic. The mix is typically designed to have 3-5 percent air voids. When a mix is designed to have 4 percent voids, certainly it should not end up having less than 3-4 percent voids after traffic. If the voids in the field are significantly lower than the mix design voids that indicates either a lack of control of materials or insufficient laboratory density. There is no doubt that the in-place air voids will be reduced to some extent after traffic. More than likely the additional compaction under traffic will reduce the voids by at least 1 percent and in most cases more than 1 percent. Six of the eleven projects evaluated had field voids in at least one of the layers within one percent of the mix design voids. Project number 1 had voids in-place slightly less than the mix design voids. Project No. 8 showed the in-place voids after traffic to be approximately 3 percent. Project 10 showed the in-place air voids after traffic to be 1.5 percent. Both of these projects had voids after traffic lower than the mix design voids.

The data for projects 4 and 6 showed significantly higher asphalt contents during construction than that indicated during mix design. The data shows that both of these had significantly lower amounts of -200 material in the field than in the laboratory. This lower filler content would require a higher asphalt content.

The in-place air voids should be at least 5-6 percent after compaction to allow for additional compaction under traffic. Several of the projects have air voids at approximately 5.0 percent or lower which may be too low to support the imposed traffic without additional densification and plastic flow. Projects 1, 2, 3, 6, 8, and 9 have voids approximately 5 percent or lower.

After reviewing all the data it appears that the biggest problem with the projects that experienced rutting was the relatively low in-place voids after compaction. Five to six percent voids after compaction are probably reasonable if a substantial compaction effort was exerted onto the asphalt mixture during construction. However, if the 5-6 percent voids were relatively easy to obtain during construction, then substantial additional compaction will likely occur under traffic. It also appears that the laboratory compactive effort (75 blows on each side with automatic hammer) provides a density somewhat lower than desired as shown by the in-place density after traffic in projects 8 and 10. The voids after traffic for these projects are well below the four percent that is normally provided during mix design.

The compaction and testing of samples in the field laboratory during construction would help to evaluate the effect of aggregate and asphalt variability. Any necessary changes in the job mix formula could be made with confidence using the results of these laboratory compacted samples.

V. ANALYSIS OF TEST RESULTS TO EVALUATE AGGREGATE SEGREGATION

A test plan was developed to evaluate segregation of asphalt mixtures being produced and placed in the summer of 1987. The plan involved sampling a number of projects immediately after construction as shown in Figure 1. The samples were evaluted to determine bulk density, theoretical maximum density, gradation, asphalt content, and voids in total mixture. Cores were also taken in noticeably segregated areas within the 1200 ft. test layout. The same tests were conducted on the segregated cores as on the random cores. Data on mix design and testing during plant production were also obtained for comparison with the in-place properties.

The test results for the 18 projects evaluated for the random samples, segregated samples, and plant samples are shown in Appendix A. This data was analyzed to evaluate the extent of segregation in these paving projects and to identify sources of segregation.

The data were analyzed to evaluate variation of plant samples and random field samples and to compare the segregated samples with the random field samples. A summary of this information is provided in Table 14. The results reported for plant mixes include the tests conducted during construction for the project being evaluated. In many cases the plant mix test results involve several days of operation which included material placed in the test area but was not limited to this material. This technique of evaluating plant tests was necessary in order to obtain sufficient plant samples for testing.

It should also be pointed out that the random samples taken in the field are truly random samples while the plant samples are not. The plant samples were taken from material sampled from the back of trucks. Truck

Table 14. Summary of Tests Results of Samples Taken at Plant, Random In-Place, and Segregated Areas.

Location	Mix* Type	Plant Mixes Gradation 1	3/4	1/2	8	200	AC	Random Samples Gradation 1	3/4	1/2	8	200	AC	Voids	Segregated Samples Gradation 1	3/4	1/2	8	200	AC	Voids
ACI-ID-85-1 (204)CT.5	1																				
Average		98	-	72	36	6.0	4.4	98	81	68	34	6.6	4.3	3.0	-	-	-	-	-	-	-
Standard Deviation		1.6	-	3.2	2.3	0.7	0.26	1.0	1.4	1.6	1.2	0.8	0.20	1.2	-	-	-	-	-	-	-
Number of Samples		12	-	12	12	12	12	10	10	10	10	10	10	10	-	-	-	-	-	-	-
MR4004(3)	2																				
Average		99	-	70	38	5.0	4.6	99	93	70	37	5.6	4.6	3.5	100	88	65	35	4.9	4.5	4.1
Standard Deviation		1.6	-	4.5	3.1	0.9	0.13	1.7	5.3	6.3	3.1	1.6	0.27	0.5	0.9	3.8	9.0	5.4	1.8	0.24	1.5
Number of Samples		11	-	11	11	11	11	10	10	10	10	10	10	10	4	4	4	4	4	4	4
GIP-TSAP-27(88)	10																				
Average		100	96	-	37	5.2	4.9	49	96	80	42	5.9	5.3	3.7	100	95	78	39	5.6	5.0	5.0
Standard Deviation		-	1.1	-	0.9	0.4	0.01	1.1	1.9	2.0	2.1	0.2	0.40	0.8	-	2.1	4.4	2.4	0.1	0.23	0.9
Number of Samples		2	2	-	2	2	2	10	10	10	10	10	10	10	4	4	4	4	4	4	4
MLP-RS-1057(9)	10																				
Average		99	-	67	36	4.1	4.9	97	90	78	34	5.4	4.8	6.3	-	-	-	-	-	-	-
Standard Deviation		1.4	-	2.2	1.2	1.1	0.09	2.3	4.8	5.2	1.9	0.6	0.25	3.6	-	-	-	-	-	-	-
Number of Samples		4	-	4	4	4	4	10	10	10	10	10	10	10	-	-	-	-	-	-	-

Table 14 (continued)

Project	Mix* Type	Plant Mixes Gradation 1	3/4	1/2	8	200	AC	Random Samples Gradation 1	3/4	1/2	8	200	AC	Voids	Segregated Samples Gradation 1	3/4	1/2	8	200	AC	Voids
EDS-TSAP-15(73)	10																				
Average		-	96	-	36	5.0	5.2	-	97	82	37	5.4	5.4	-	-	96	80	35	4.9	5.4	-
Standard Deviation		-	2.1	-	1.4	0.8	0.12	-	1.7	4.8	2.7	0.33	0.30	-	-	2.1	5.0	4.2	0.1	0.71	-
Number of Samples		-	11	-	11	11	11	-	10	10	10	10	10	-	-	2	2	2	2	2	-
EDS-TSAP-15(73)	10																				
Average		100	100	-	38	5.7	5.0	100	98	80	38	6.3	5.0	6.4	100	98	75	31	5.4	4.4	10.5
Standard Deviation		0	0.3	-	1.5	0.4	0.01	0	0.8	1.4	1.3	0.7	0.20	2.1	0	0.9	5.5	5.3	0.5	0.57	1.1
Number of Samples		5	5	-	5	5	5	10	10	10	10	10	10	10	4	4	4	4	4	4	4
FR-FRG-5-5(10)	14																				
Average		-	-	-	-	-	-	99	90	76	37	6.6	4.5	3.5	98	81	64	30	5.8	4.4	5.8
Standard Deviation		-	-	-	-	-	-	0.8	3.0	4.1	2.2	0.4	0.24	0.6	1.9	2.9	5.1	2.4	0.3	0.57	1.0
Number of Samples		-	-	-	-	-	-	10	10	10	10	10	10	10	4	4	4	4	4	4	4
APD-ACAPD-56-1 (7)CT5	14																				
Average		85	-	64	33	5.7	4.8	95	83	62	34	6.6	4.0	7.5	93	80	59	32	6.3	4.0	7.8
Standard Deviation		3.4	-	3.5	2.5	0.5	0.29	2.4	3.6	4.8	3.2	1.0	0.46	1.8	0.8	4.7	4.4	3.6	0.8	0.42	1.3
Number of Samples		10	-	10	10	10	10	10	10	10	10	10	10	10	4	4	4	4	4	4	4
APD-ACAPD-56-2(7)																					
Average	16	100	93	-	37	6.1	4.5	100	92	76	35	6.1	4.0	4.1	99	84	62	28	4.9	3.6	4.4
Standard Deviation		0.7	2.0	-	1.2	0.6	0.20	0.7	2.9	3.6	2.2	0.8	0.58	1.8	0.5	3.6	3.3	1.8	0.3	0.10	1.9
Number of Samples		9	9	-	9	9	9	10	10	10	10	10	10	10	4	4	4	4	4	4	4

Table 14 (continued)

Project	Mix* Type	Plant Mixes Gradation 1	3/4	1/2	8	200	AC	Random Samples Gradation 1	3/4	1/2	8	200	AC	Voids	Segregated Samples Gradation 1	3/4	1/2	8	200	AC	Voids
ZB-FR-26-2(49) CT.1	16																				
Average		100	99	-	37	5.6	4.5	100	99	83	39	5.3	4.6	6.1	100	99	81	36	5.3	4.5	7.2
Standard Deviation		0	1.0	0	2.7	0.6	0.22	0	0.8	3.5	1.5	0.4	0.14	0.9	0	0.5	3.1	1.3	0.3	0.30	0.3
Number of Samples		21	21	-	21	21	21	10	10	10	10	10	10	10	4	4	4	4	4	4	4
IR-ACIR-85-2 (103)CT6	19																				
Average		98	-	74	36	5.4	4.2	97	86	68	34	5.5	4.1	7.3	98	81	62	30	4.4	4.6	2.6
Standard Deviation		1.2	-	3.7	2.1	0.5	0.23	2.3	4.8	5.9	4.1	1.2	0.84	1.7	1.2	1.2	1.7	2.0	1.1	1.21	0
Number of Samples		32	-	32	32	32	32	10	10	10	10	10	10	2	3	3	3	3	3	3	1
TSAP-FR-104-1 (27)CT2	20																				
Average		99	-	72	36	5.8	4.4	96	84	71	38	6.5	4.4	7.1	94	75	54	26	5.0	3.2	9.6
Standard Deviation		1.2	-	3.2	2.5	0.4	0.21	1.8	5.1	5.1	3.4	0.5	0.57	1.8	5.4	5.6	6.0	3.3	0.6	0.42	2.5
Number of Samples		16	-	16	16	16	16	8	8	8	8	8	8	8	3	3	3	3	3	3	3
IR-ACIR-75-3 (158)CT3	20																				
Average		98	-	75	34	5.6	4.0	99	87	79	37	5.8	4.1	5.5	100	78	62	28	4.4	3.2	2.8
Standard Deviation		1.2	-	2.4	1.7	0.4	0.20	1.2	2.4	2.8	3.0	0.4	0.16	3.8	0.7	3.5	5.0	0.7	0.5	0.35	1.3
Number of Samples		36	-	36	36	36	36	10	10	10	10	10	10	10	2	2	2	2	2	2	2

Table 14 (continued)

Project	Mix* Type	Plant Mixes Gradation 1	3/4	1/2	8	200	AC	Random Samples Gradation 1	3/4	1/2	8	200	AC	Voids	Segregated Samples Gradation 1	3/4	1/2	8	200	AC	Voids
BRF-5-3(12)	22																				
Average		100	96	-	40	5.6	5.1	100	97	-	42	6.2	4.8	7.3	100	95	-	28	4.8	3.6	9.5
Standard Deviation		0	0.7	-	1.9	0.1	.09	0	2.2	-	4.8	0.5	0.37	1.5	0	3.0	-	71.3	0.7	0.63	1.1
Number of Samples		2	2	-	2	2	2	10	10	-	10	10	10	10	7	7	-	7	7	7	4
ZB-FR-2(51)CT.1	22																				
Average		100	98	-	39	5.0	5.0	100	98	81	40	5.3	5.0	4.4	100	96	70	30	4.4	4.3	6.4
Standard Deviation		0	0.8	-	2.0	0.3	0.16	0	1.0	2.4	2.0	0.3	0.19	1.2	0	1.6	2.4	1.1	0.1	0.23	1.9
Number of Samples		28	28	-	28	28	28	10	10	10	10	10	10	10	4	4	4	4	4	4	4
MLP-FR-7-1 (52)CT.1	22																				
Average		100	-	1.2	2.6	0.1	0.12	99	91	71	36	5.0	4.4	4.5	98	86	59	28	4.2	3.6	8.8
Standard Deviation		0.6	-	1.2	2.6	0.2	0.12	1.5	3.4	4.6	2.9	0.4	0.29	1.1	1.2	4.0	3.2	2.5	0.4	0.33	0.8
Number of Samples		6	-	6	6	6	6	10	10	10	10	10	10	10	4	4	4	4	4	4	4
ZB-FR-26-1 (53)CT.2	23																				
Average		100	100	99	48	6.7	5.5	100	100	98	48	7.3	5.6	5.5	-	-	-	-	-	-	-
Standard Deviation		0	0	0.5	2.0	0.8	0.22	0	0	0.7	0.8	0.1	0.2	0.7	-	-	-	-	-	-	-
Number of Samples		29	29	29	29	29	29	10	10	10	10	10	10	10	-	-	-	-	-	-	-

Tables 14 (continued)

Project	Mix* Type	Plant Mixes Gradation 1	3/4	1/2	8	200	AC	Random Samples Gradation 1	3/4	1/2	8	200	AC	Voids	Segregated Samples Gradation 1	3/4	1/2	8	200	AC	Voids
ZB-FR-26-2 (59)CT.4	24																				
Average		100	100	99	43	6.2	5.4	100	100	99	42	6.1	5.4	5.2	100	100	98	42	6.2	5.7	4.2
Standard Deviation		0	0	0.8	2.7	0.5	0.16	0	0	0.4	1.6	0.3	0.16	0.9	0	0	0.1	2.5	0.3	0.18	1.0
Number of Samples		35	35	35	35	35	35	10	10	10	10	10	10	10	4	4	4	4	4	4	4
ZB-FR-7-4 (37)CT.3	24																				
Average		100	100	99	47	7.1	5.3	100	100	98	50	6.9	5.8	8.6	100	100	98	48	6.5	5.9	8.6
Standard Deviations		0	0	0.7	4.7	0.5	0.10	0	0	0.7	3.3	0.4	0.51	1.2	0	0	0.8	5.6	0.8	0.52	0.7
Number of Samples		5	5	5	5	5	5	10	10	10	10	10	10	10	4	4	4	4	4	4	4

* Mix Type 1 - Batch Plant with Silo, Base mix, Single Size Coarse Aggregate
2 - Batch Plant with Silo, Base mix, Combined Size Coarse Aggregate
10 - Batch Plant without Silo, B Mix, Combined Size Coarse Aggregate
14 - Drum Mix with Coater, Base Mix, Combined Size Coarse Aggregate
16 - Drum Mix with Coater, B Mix, Combined Size Coarse Aggregate
19 - Drum Mix without Coater, Base Mix, Single Size Coarse Aggregate
20 - Drum Mix without Coater, Base Mix, Combined Size Coarse Aggregate
22 - Drum Mix without Coater, B Mix, Combined Size Coarse Aggregate
23 - Drum Mix without Coater, E Mix, Single Size Coarse Aggregate
24 - Drum Mix without Coater, E Mix, Combined Size Coarse Aggregate

samples are normally taken to be representative of the batch being sampled and thus these samples are generally an average of the batch. The sampling technique may partially explain why the variability of plant samples is almost always less than the variability of random in-place samples.

After the random samples were obtained the test area was inspected to locate any segregated areas. If there were segregated areas they were sampled and tested for comparison to the random samples. Three of the nineteen sections sampled did not appear to have segregated material. The test results were evaluated to better understand the difference between random and segregated samples. Table 15 shows that the difference between the segregated and random samples vary from zero percent difference in that passing the No. 8 sieve up to 14 percent. The No. 8 sieve is used since this sieve size is common to all projects. Those jobs with a small difference between segregated and random samples probably did not have significant segregation but may have only had differences in surface texture.

The difference in the percent passing the No. 8 sieve for the random and segregated samples is believed to be a measure of the degree of segregation. A plot of the standard deviation for plant samples versus this difference shows that there is no relation between the two properties (Fig. 2). A plot of the standard deviation for random samples versus this difference shows a general trend between the two values (Fig. 3). Thus it appears that the quality control gradation tests at the plant (as the samples are now obtained and tested) can not be used to predict segregation. Random samples taken in-place can be used to roughly predict segregation.

Table 15. Comparison of Gradation of Random and Segregated Samples.

Project	Mix Type	Average Percent Passing No. 8 Random Samples (A)	Average Percent Passing No. 8 Segregated Samples (B)	A-B	Standard Deviation of Random Samples (C)	Standard Deviation of Plant Samples	A-B/C
1. ACI-ID-I-85-1(204) CT.5	1	34	-	-	1.2	2.3	-
2. MR4004(3)	2	37	35	2	3.1	3.1	0.65
3. GIP-TSAP-27(88)	10	42	39	3	2.1	0.9	1.43
4. MLP-RS-1057(9)	10	34	-	-	1.9	1.2	-
5. EDS-TSAP-15(73)	10	37	35	2	2.7	1.4	0.74
6. EDS-TSAP-38(85) CT.1	10	38	31	7	1.3	1.5	5.38
7. FR-FRG-5-5(10)	14	37	30	7	2.2	-	3.18
8. APD-ACAPD-56-1(7) CT.5	14	34	32	2	3.2	2.5	0.62
9. APD-ACAPD-56-2(7)	16	35	28	7	2.2	1.2	3.18
10. ZB-FR-26-2(49) CT.1	16	39	36	3	1.5	2.7	2.00
11. IR-ACIR-85-2(103) CT.6	19	34	30	4	4.1	2.1	0.98
12. TSAP-FR-104-1(27) CT.2	20	38	26	12	3.4	2.5	3.53
13. IR-ACIR-75-3(158) CT.3	20	37	28	9	3.0	1.7	3.00
14. BRF-5-3(12)	22	42	28	14	4.8	1.9	2.92
15. ZB-FR-26-2(51) CT.1	22	40	30	10	2.0	2.0	5.00
16. MLP-FR-7-1(52) CT.1	22	36	28	8	2.9	2.6	2.76
17. ZB-FR-26-1(53) CT.2	23	48	-	-	0.8	2.0	-

Table 15 (continued)

Project	Mix Type	Average Percent Passing No. 8 Random Samples (A)	Average Percent Passing No. 8 Segregated Samples (B)	A-B	Standard Deviation of Random Samples (C)	Standard Deviation of Plant Samples	A-B/C
18. ZB-FR-26-2(59) CT.4	24	42	-	0	1.6	2.7	0
19. ZB-FR-7-4(37) CT.3	24	50	48	2	3.3	4.7	0.61

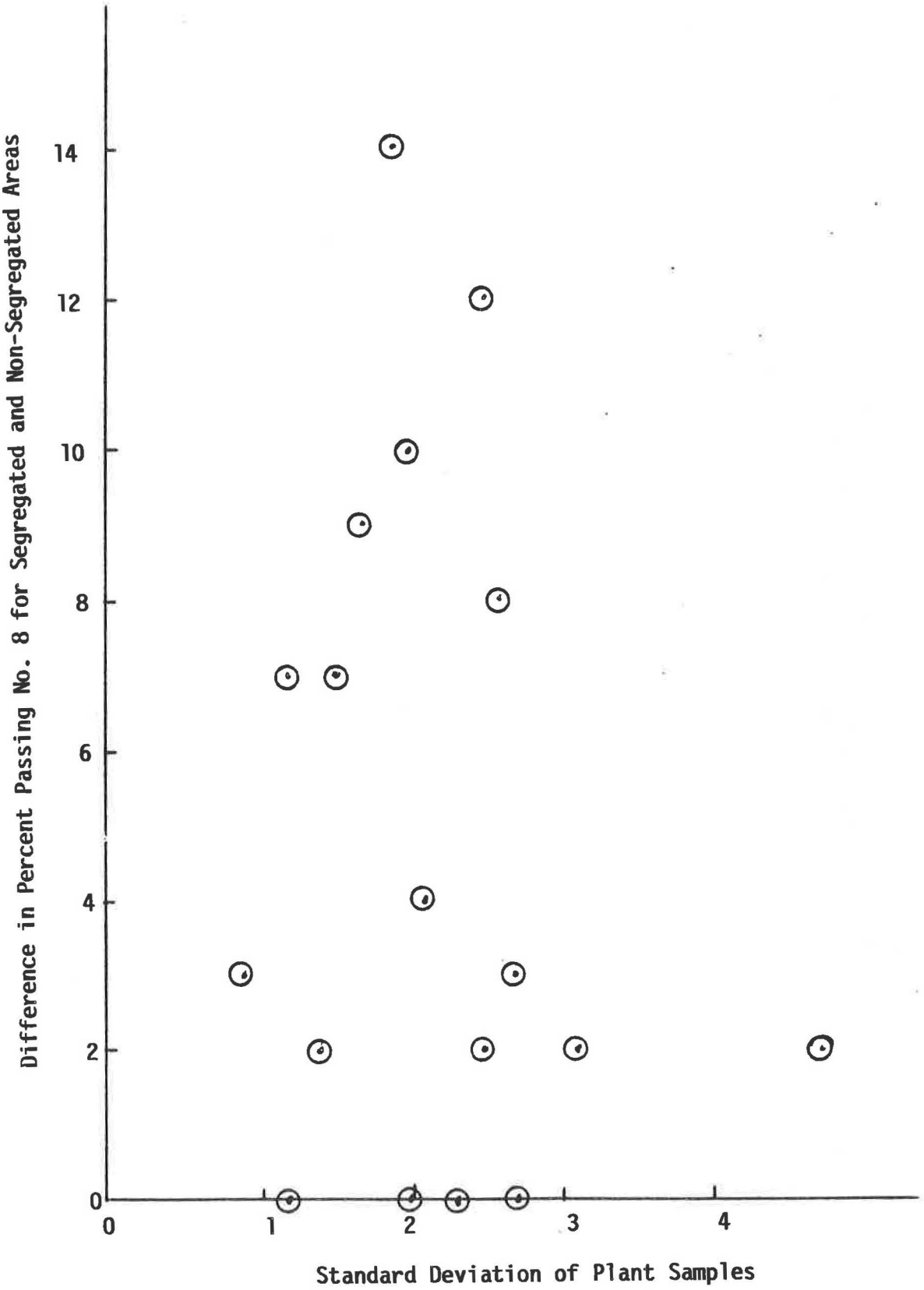

Figure 2. Relationship Between Variation of Plant Samples and Segregation.

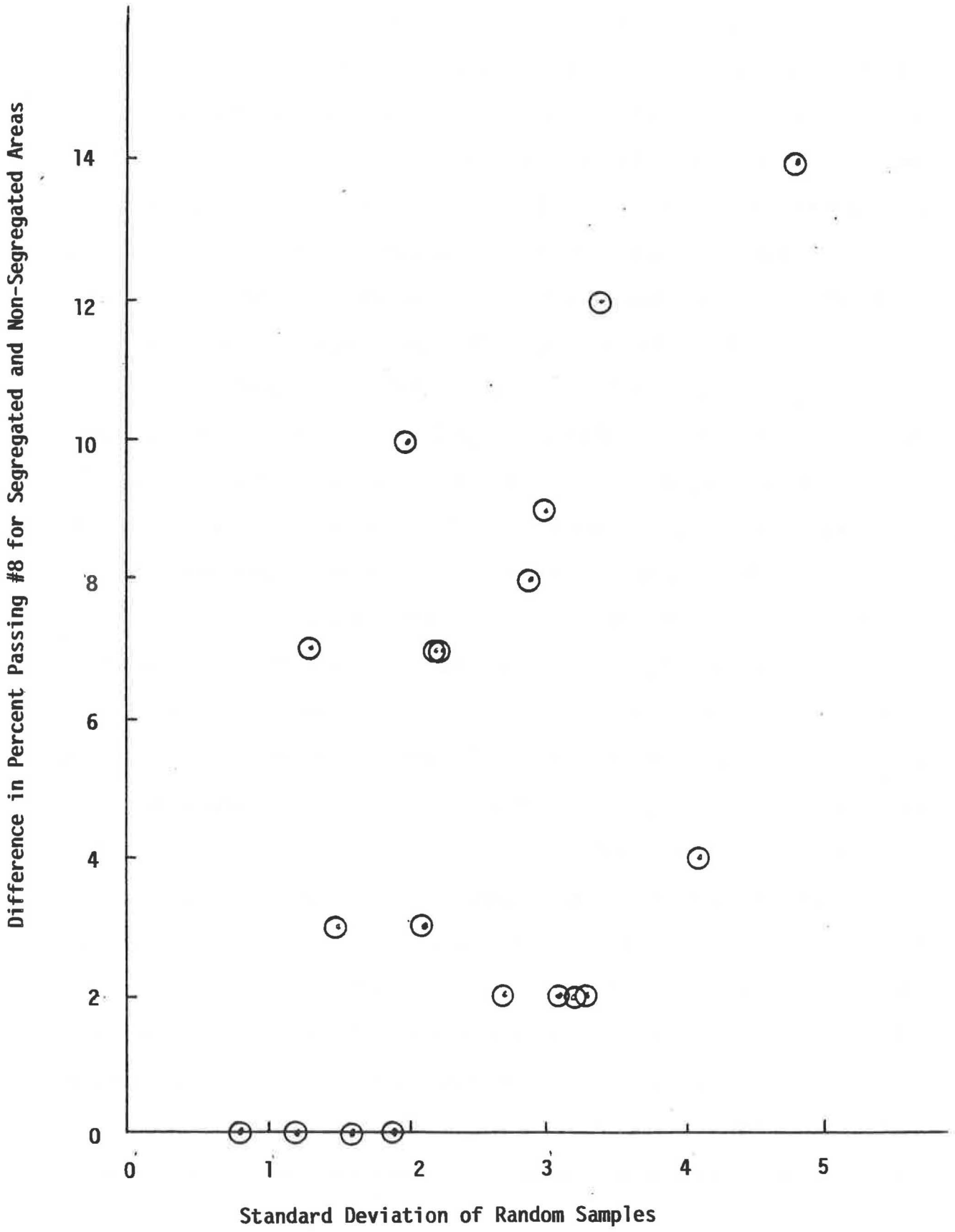

Figure 3. Relationship Between Variation of Random Samples and Segregation.

The term (A-B)/C shown in Table 15 is used to estimate the percent of the material in the test section having a gradation coarser than the segregated mix. When (A-B)/C is equal to 2 the amount of material coarser than the segregated material is 2.5 percent. When (A-B)/C is less than 2 it is assumed that "segregation" is simply a result of normal variability and not necessarily caused by some other problem such as observed at end of truck load. It is reasonable then to say that when (A-B)/C is greater than 2.0 segregation is likely caused by some major change in the process such as end of load or improper handling of material. After reviewing Table 15 then, it can be said that a difference of 7 or more between segregated and random samples is segregation while a difference less than 7 (in this case 4 or less) is the result of normal variation. Project numbers 6, 7, 9, 12, 13, 14, 15, 16 then represent projects with segregation while the other projects likely have some other surface defect other than segregation.

Because of the high variability between test results for the projects evaluated it is impossible to statistically compare the effects of plant type, silos, and mix types on the variability of test results. The results can be analyzed however to show trends. There are three independent measurements of gradation and asphalt content that can be used to compare the various projects. These measurements include random samples, plant samples, and difference between random samples and segregated samples. A comparison of the various projects is shown in Table 16. The projects were rated based on variability of the aggregate gradation. The projects having the higher variability were given the higher numerical rating. A rating of 2 indicates better control than a rating of 3. The overall rating was an average of the 3 individual ratings. This table clearly shows that the

Table 16. Numerical Comparison of Various Projects.

Project	Mix Type	Rating for Random Samples	Rating for Plant Samples	Rating for Random Minus Segregated Samples	Overall Score	Overall Rating
1. ACI-ID-I-85-1(204)CT.5	1	2	9	1	4	2
2. MR4004(3)	2	13	13	2	9.3	12
3. GIP-TSAP-27(88)	10	8	1	3	4	2
4. MLP-RS-1057(9)	10	6	2	1	3	1
5. EDS-TSAP-15(73)	10	10	3	2	5	3
6. EDS-TSAP-38(85)CT.1	10	3	4	5	4	2
7. FR-FRG-5-5(10)	14	9	-	5	7	7
8. APD-ACAPD-56-1(7)CT.5	14	14	10	2	8.7	11
9. APD-ACAPD-56-2(7)	16	9	2	5	5.3	4
10. ZB-FR-26-2(49)CT.1	16	4	12	3	6.3	6
11. IR-ACIR-85-2(103)CT.6	19	4	12	3	7.7	9
12. TSAP-FR-104-1(27)CT.2	20	16	10	9	11.7	15
13. IR-ACIR-75-3(158)CT.3	20	12	5	7	8	10
14. BRF-5-3(12)	22	18	6	10	11.3	14
15. ZB-FR-26-2(51)CT.1	22	7	7	8	7.3	8
16. MLP-FR-7-1(52)CT.1	22	11	11	6	9.3	12
17. ZB-FR-26-1(53)CT.2	23	1	7	1	3	1
18. ZB-FR-26-2(59)CT.4	24	5	12	1	6	5
19. ZB-FR-7-4(37)CT.3	24	15	14	2	10.3	13

overall rating of the batch plant exceeds that of the drum mix plant. A review of Table 16 shows that the overall best 5 projects from the standpoint of variability were constructed with batch plants (disregarding "E" mixes). The worse performing projects were those with mix type 20 and 22 which included drum mix plant without coater using combined size coarse aggregate.

VI. LABORATORY INVESTIGATION OF PROPERTIES OF SEGREGATED MIXES

Field Data

Shortly after placement of the binder layers of four different asphalt pavements in Georgia, ten six-inch cores were drilled according to the pattern shown in Figure 1. Cores were also drilled at any apparent segregated spots in the 1200 foot test section. Extraction tests were performed on all cores to reveal these aggregate gradations and AC contents. The results of these gradation tests were used to design a laboratory study to evaluate the effect of segregation on properties of asphalt mixtures.

Two things were recognized from the results of these tests. First, there was considerable variance in the severity of segregation from one project to another. One project deviated less than 10% from the mix design on the percent passing the 3/8" sieve, while other projects deviated much more than 15% from the specified percent passing. Secondly, for the mix investigated, it appears that gradation curves run approximately parallel for the random and segregated samples.

Six different gradations were used in the laboratory investigaiton. These gradations ranged from the fine side of the mix design (gradation #1) to the coarse side of mix design. The field data was also used in establishing AC contents for the laboratory prepared samples. The average asphalt content along with the average percent passing each sieve (for the random samples only) were used to determine the mix design film thickness. This film thickness was then used to back calculate an AC content for each aggregate gradation evaluated in the laboratory. These calculated AC contents were then compared with those resulting from the extractions. The

aggregate gradations and corresponding asphalt contents used in the laboratory study are shown in Table 17.

Two sets of laboratory samples were prepared. The first set contained Vulcan Materials Norcross granite and no lime; the second set contained Vulcan Materials Columbus granite and 1% lime. Each set included eight samples of each of the six gradations shown in Table 17.

Each sample was compacted with a Gyratory Testing Machine set at 30 revolutions, 120 psi, and 1 degree angle. After the sample was compacted, it was removed from the mold and allowed to cool for a minimum of two hours before handling.

The voids total mix information is presented in Figure 4. The total voids increase dramatically as the degree of segregation increases (samples get more coarse). Usually the voids in laboratory compacted samples should not exceed 5 percent. Using this parameter for acceptance criteria, even the smallest amount of segregation would be unacceptable.

The samples prepared without lime were separated into two groups, each group containing four samples of each of the six gradations. The eight samples of each gradation were separated to yield the same average specific gravity for both sets of four samples. Twelve of these samples disintegrated when they were vacuum saturated.

A falling head permeability test was set up to more directly approach the problem presented by high voids. Tests were performed only after 30 mm of water drained through the sample. If there was no noticeable drop (1 mm) in the water level in 5 minutes, the sample was considered impermeable.

The permeability data are plotted in Figure 5. Notice that the samples are impermeable for gradations #1, #2, and #3 and the permeability

Table 17. Range of Aggregate Gradation for Mixtures Evaluated in the Laboratory.

Sieve Size	Mix 1	Mix Design Mix 2	Mix 3	Mix 4	Mix 5	Mix 6
1"	100	100	100	100	100	100
3/4"	100	98.1	96.6	95.0	93.4	91.9
1/2"	88.2	80.6	73.6	66.7	59.8	52.8
3/8"	77.6	67.0	59.6	52.3	44.9	37.6
4	60.1	51.5	44.0	36.6	29.2	21.8
8	45.8	39.8	34.3	28.8	23.3	17.8
16	31.4	27.8	24.5	21.2	17.9	14.6
30	24.0	21.2	18.8	16.5	14.2	12.1
50	16.7	14.7	13.3	11.9	10.5	9.1
100	10.7	9.1	8.2	7.4	6.6	5.7
200	6.4	5.4	4.8	4.3	3.8	3.2
% AC	5.75	5.04	4.57	4.09	3.61	3.13

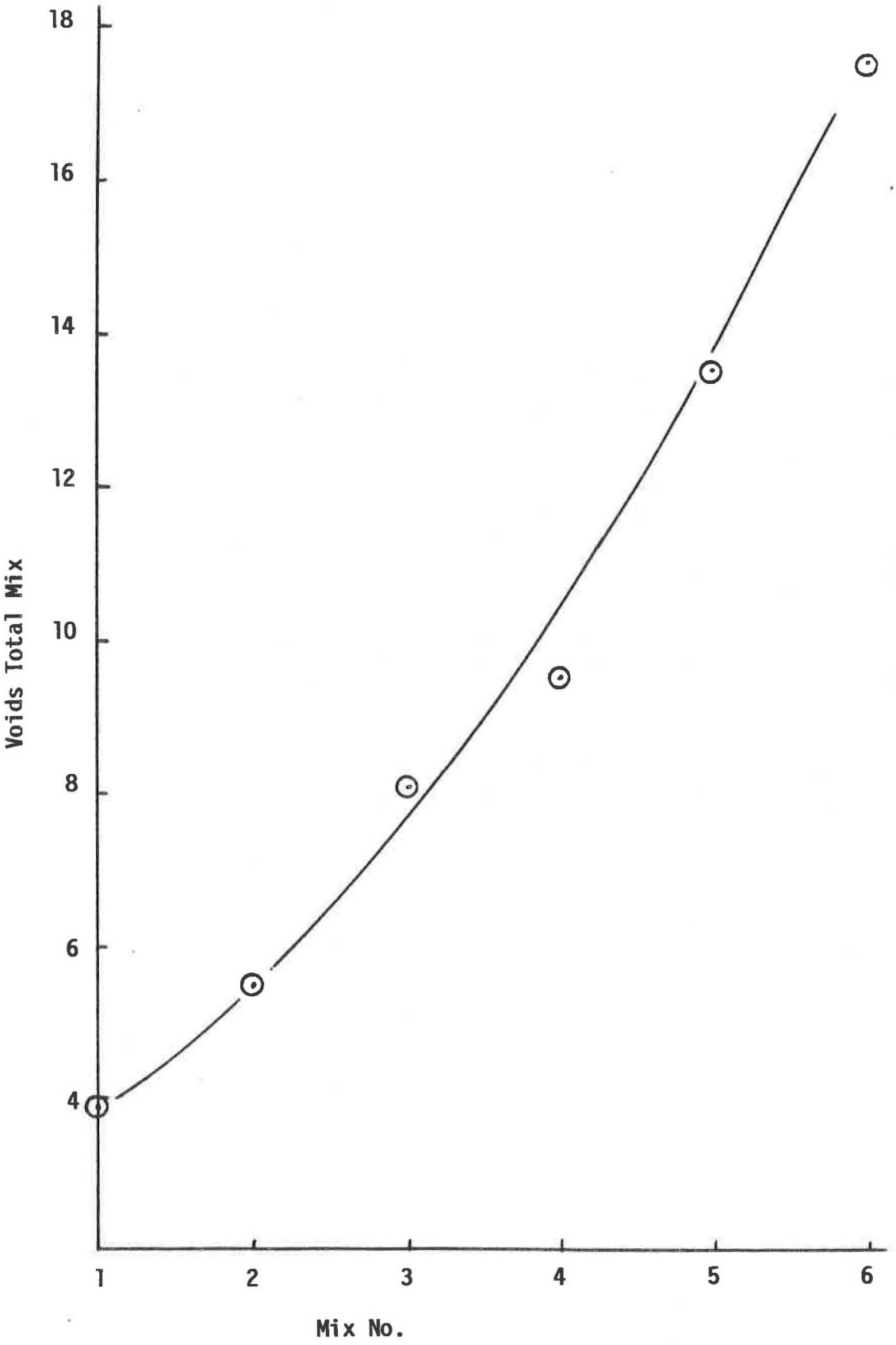

Figure 4. Voids Total Mix Versus Degree of Segregation.

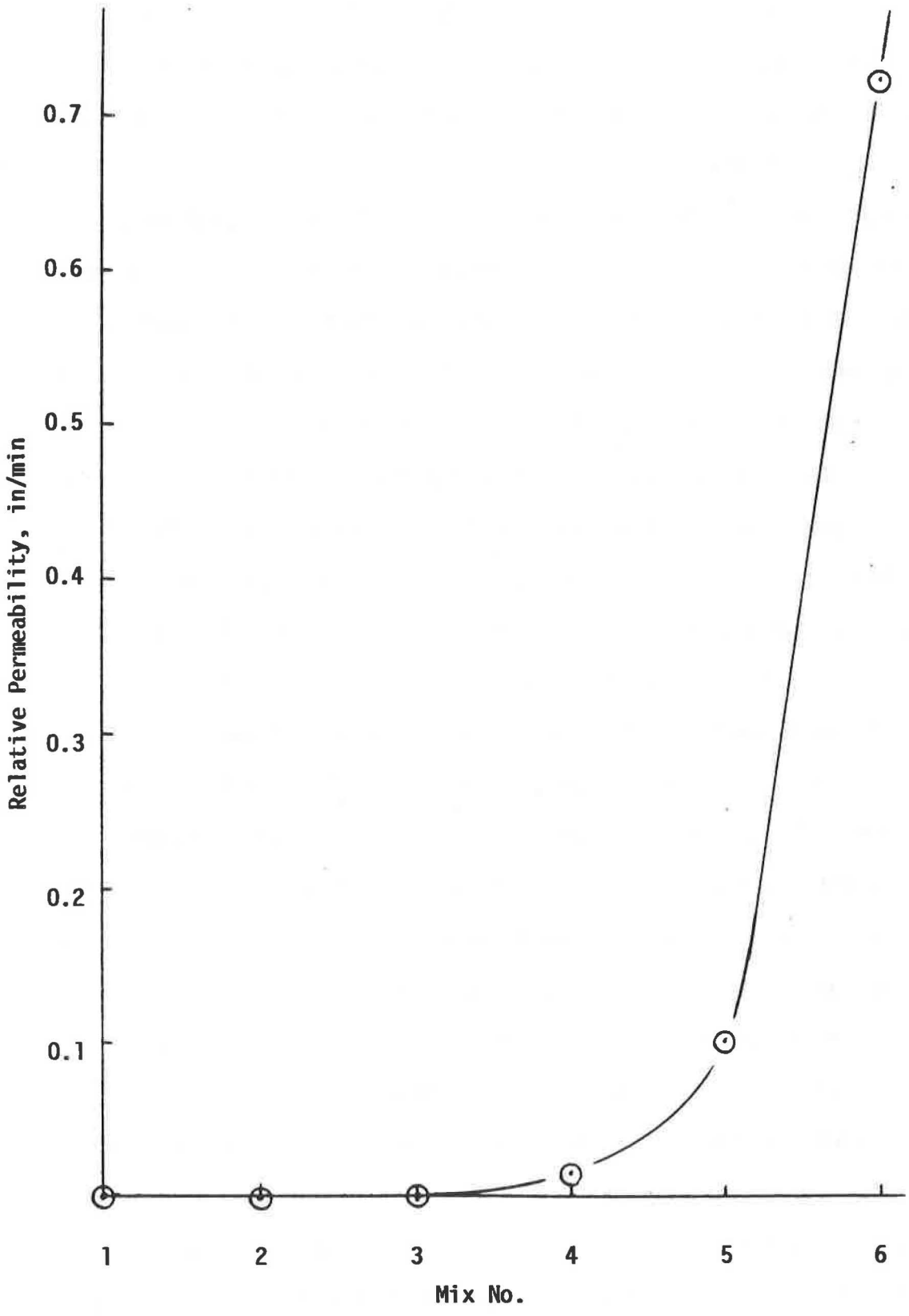

Figure 5. Permeability Versus Degree of Segregation.

increases dramatically from gradation #4 to gradation #6. Most AC pavement layers are designed and constructed to be impermeable. If segregation results in a permeable layer then the asphalt concrete will allow water to flow through which may cause weakening of the subgrade in some cases and stripping in other cases.

The remainder of the samples without lime (4 each of gradations #1 through #6) were used to determine how tensile strength changed with an increasing degree of segregation. The samples were tested in indirect tension using a constant deformation rate of 2 inches per minute. The data resulting from the indirect tensile test are shown in Figure 6. This graph indicates that tensile strength decreases rapidly with an increase in the degree of segregation. This decrease in tensile strength may result in more cracking in the pavement or it may result in ravelling of the mixture. Inspection of pavements that had segregation showed that ravelling was a problem when the segregated areas were not overlaid.

The Marshall Stability Test was conducted on all of the samples with lime. Each gradation group of eight samples was split into two groups of four samples with each group of four samples having the same average specific gravity as the other group. One group of four samples from each gradation was soaked for 24 hours in a water bath at 140^{0}F. Each of these samples was then tested in the Marshall apparatus, resulting in the Index of Retained Stability shown in Figure 7. The remaining samples were soaked for only 30 minutes in a 140^{0}F water bath before failing in the Marshall apparatus. These data appear as the non-conditioned stability values in Figure 8. The strength ratios all appear to be acceptable however this is not a very severe test. The data show that Marshall stabilities decrease as the degree of segregation increases.

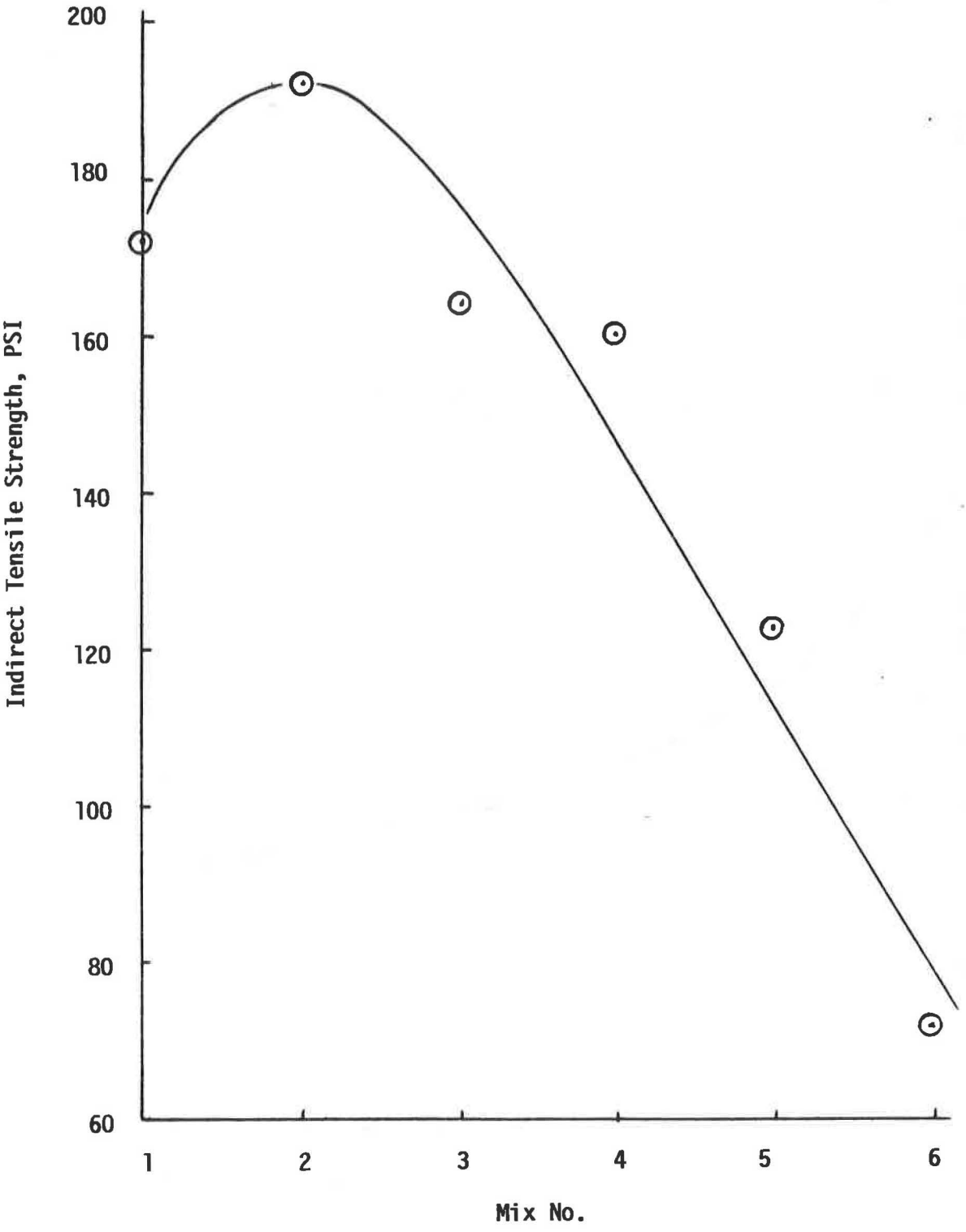

Figure 6. Indirect Tensile Strength Versus Degree of Segregation.

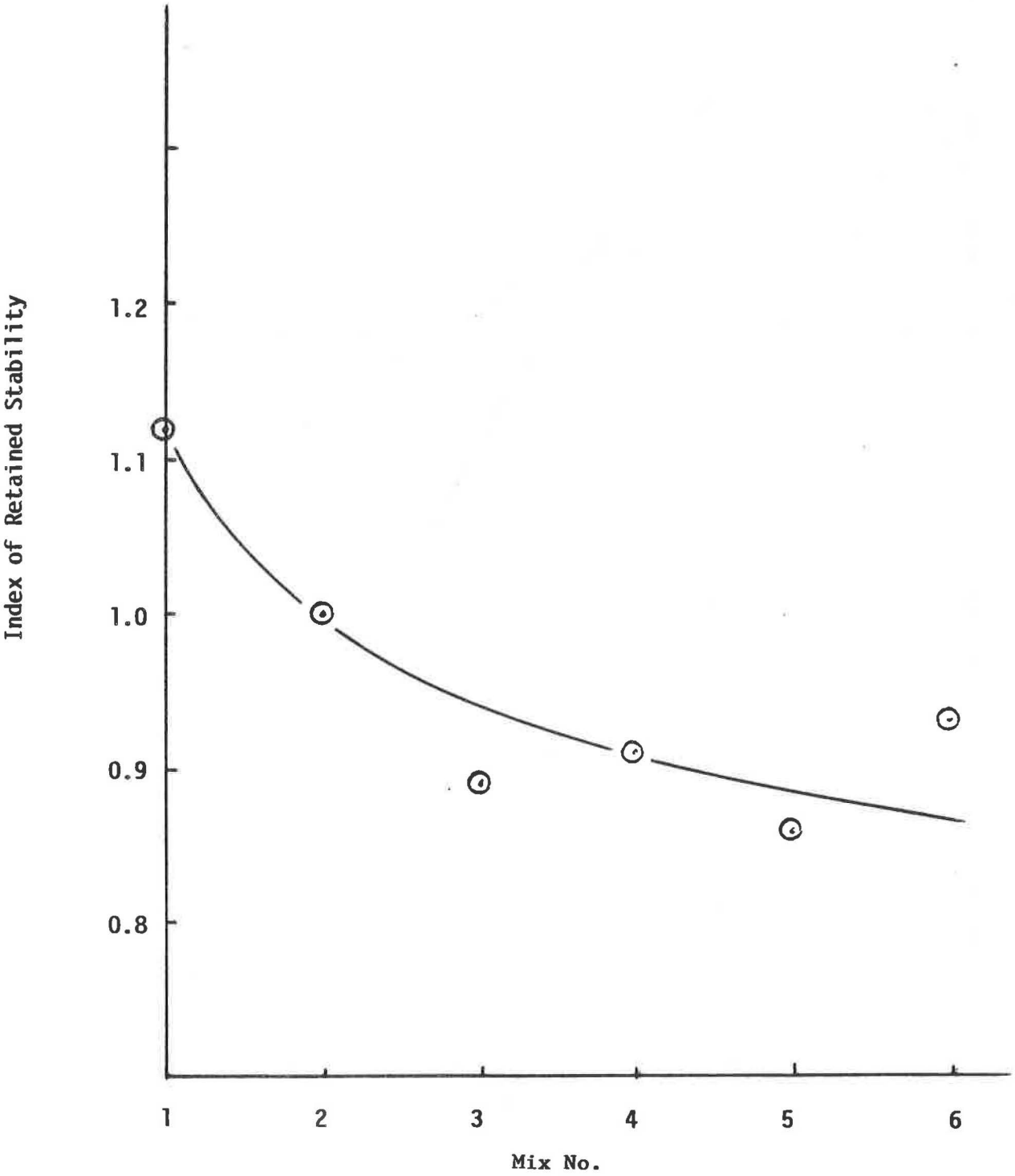

Figure 7. Index of Retained Stability Versus Degree of Segregation.

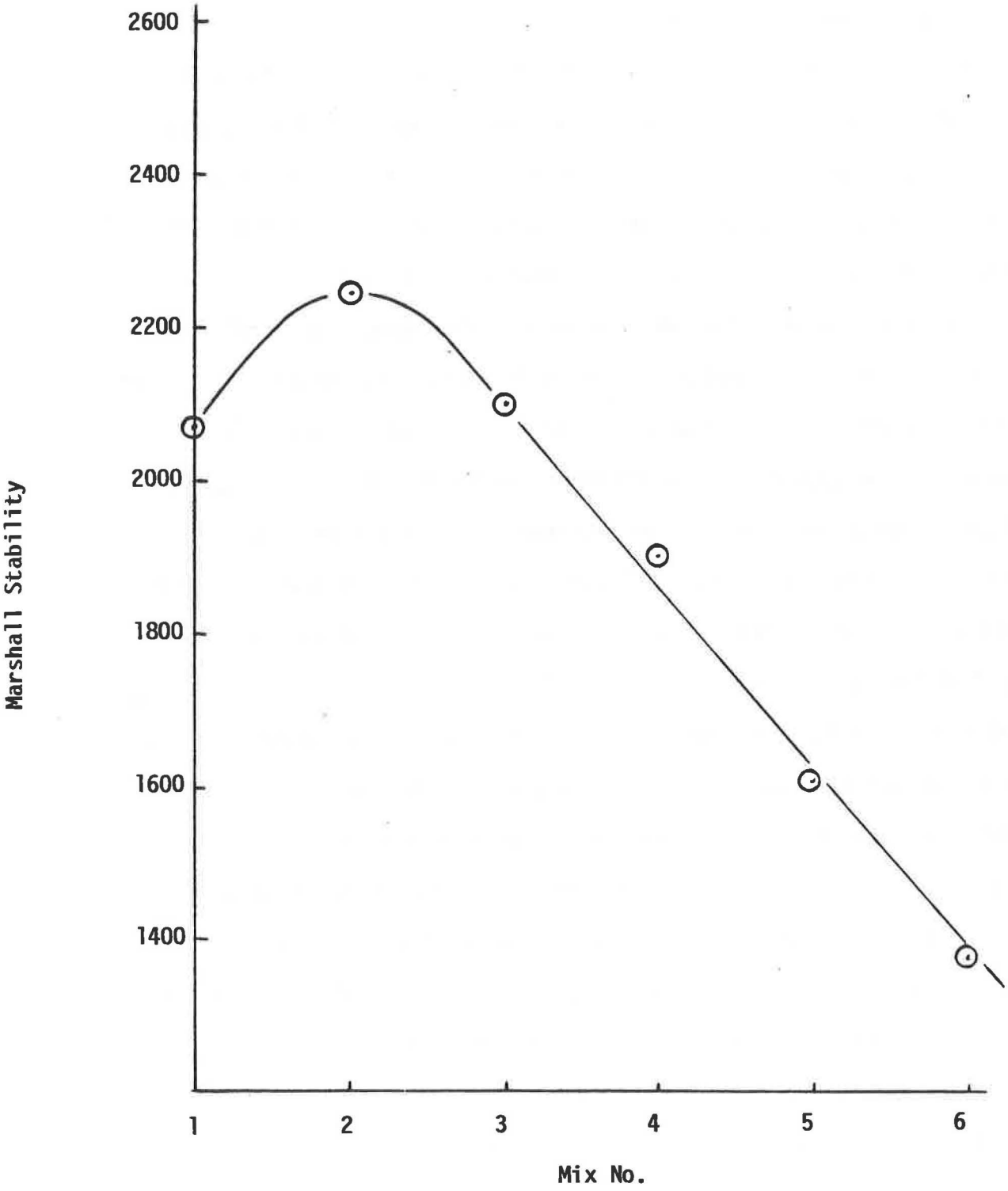

Figure 8. Marshall Stability Versus Degree of Segregation.

VII. REVIEW OF CONSTRUCTION PROCEDURES

Several site visits were made during construction of projects to observe construction procedures. The construction operations were observed at the asphalt plants and laydown sites.

Most of the asphalt plants visited were drum mix plants which are becoming more popular because of the portability, low initial cost, and production capacity. The stockpiling operations in some locations were satisfactory while some locations were less than desirable. The guidance provided by GDOT is a good guide for the contractor to use but in many cases he was not following the GDOT guidance. For example the contractor should maintain separate stockpiles for various size aggregates, especially for drum mix plants. The contractor often used one coarse aggregate which contained several aggregate sizes making it difficult to control aggregate gradation and minimize aggregate segregation. In a few cases the contractor used crusher run material which was graded from coarse to fine. There is no doubt that segregation will occur when crusher run material is used with a drum mix plant.

Many segregation problems that occurred in the field seemed to be a result of the storage silo. All drum mix plants have some sort of storage silo while most batch plants also use one. Segregation was observed in some cases to be caused by non-symmetrically loading the conveyor belt carrying material to the silo. In at least one case the batcher at the top of the silo was not functioning correctly which resulted in segregation. Again, the guidance provided by GDOT is comprehensive and it does provide guidance to troubleshoot these problems. The major problem however is that on many projects segregation problems are either not seen as they occur or

nothing is done to correct them during construction. Many contractors will not correct a problem as long as he is allowed to operate with the problem hence the state usually has to take the initiative in getting a problem solved.

In some cases the asphalt mixtures segregated as it was loaded from the storage silo to the truck. One reason for this segregation was the length of time the gate at the bottom of the silo remained open. Ideally the material should be dropped in batches to minimize segregation caused by the large aggregate rolling down the side of the asphalt mixture to the edge of the truck bed. Most contractors used the suggested method of loading trucks that is front first, back second, and middle last; however, there were some exceptions.

Regardless of the source of segregation it was always highlighted at the end of truck loads. If this one problem could be solved segregation would no longer be a major problem. Several steps have been taken that have reduced the amount of segregation at end of loads. One method that has been partially successful is the use of Flo-Boys to haul the asphalt mixtures. The mixture is extruded out of the Flo-Boys and hence separation of materials is minimized. On one project that was observed the contractor was using dump trucks with long bodies which seemed to increase the amount of observed segregation.

Another step that was observed was to keep the paver hopper relatively full so that any segregated material is mixed with the additional material in the paver and hence the amount of segregation is reduced.

The paver wings should not be lifted during asphalt placement to minimize segregation. Lifting the wings causes the excess coarse aggregate

adjacent to the wings to be fed through the paver at one time causing segregation to occur.

On one project the asphalt paver was traveling too fast allowing the material being fed to the screed to run low. The auger was turning rapidly trying to feed the two ends of the screed and as a result was throwing coarse aggregate to the outside plate.

In general the contractor and GDOT personnel were paying close attention to any segregation problem when paving projects were observed. Many times segregation is difficult to see during construction and when it is observed it is not always a simple matter to correct.

Conclusions

Based on the observation of Paving Projects in Progress, Analysis of Tests Conducted by GDOT, and Analysis of Tests Conducted at Auburn University the following conclusions are made concerning segregation:

1. Segregated areas that are not overlaid do tend to ravel under traffic.
2. Laboratory tests showed that the loss of desirable mixture properties is significant when the gradation of the segregated mixture is approximately 10 percent coarser than the job mix formula on the No. 8 sieve.
3. Test results show that quality control is very important in reducing segregation. Either type asphalt plant can be controlled to produce a good product or if not controlled can produce a bad product. Generally the batch plant produces a more consistent product (with less segregation) than the drum mix plant. Generally the drum mix plant with a coater produces a more consistent mixture with less segregation than the drum mix plant without a coater.
4. Segregated areas are generally 8-15 percent coarser on the No. 8 sieve than non-segregated areas; the voids are typically 3-5 percent higher; and the asphalt content is often 1-2 percent lower.
5. There is no correlation between the variability of plant sample gradations and the amount of segregation. There is a general correlation for random in-place gradation and segregation.

The following conclusions are made based on the evaluations of data representing rutted pavement:

1. The average in-place voids after initial compaction was generally 5-7 percent. The few test results of in-place voids after traffic show 1.5-3 percent which is probably a little too low to prevent plastic flow.
2. Several projects had deviations of plant produced material of 2-5 percent on the No. 200 sieve from the job mix formula developed in mix design. This may have been a major contributor to rutting on some of the projects if the mix design was not modified to reflect the changes in amount of material passing the No. 200 sieve.

Recommendations

The following recommendations are made concerning segregation:

1. The best approach to minimize segregation is to use a batch plant without silo and utilize good stockpiling techniques (separate stockpiles for individual aggregate sizes formed in layers). If a drum mix plant is used a coater is preferred and good stockpiling techniques are a necessity. A well controlled mixture can segregate when placed into the storage silo if not properly operated or when removed from the silo.
2. Since normal quality control tests can not be utilized to predict segregation some other method must be used. Test results in this study showed that it is difficult in some cases to visually locate segregated areas. It is recommended that a nuclear gage be considered for use in identifying segregated areas since one will likely be on the project for density measurement. Based on the results of this study any segregated area that has a density 4-5 pcf lower than the adjacent non-segregated material will have a significant reduction in mix properties and therefore should be removed and replaced.

The following recommendations are made concerning rutting:

1. Quality control tests during construction should include preparation and testing of asphalt mixtures in the laboratory. The results of tests such as asphalt content, gradation, and in-place voids should be plotted on control charts to show any trends that may be developing and to provide a summary of all data for easy review and analysis.

2. On some of the projects reviewed some of the in-place air voids appeared to be low. Generally the in-place air voids should be approximately 5-7 percent to allow for some additional compaction without plastic flow.

3. Some work should be performed to compare voids in asphalt mixtures after traffic to the original mix design voids. If the field voids after traffic is approximately the same as mix design voids then laboratory compactive effort is satisfactory; however, if field voids are lower than mix design voids then compactive effort should be increased in the laboratory until it provides a density simulating field density.

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APPENDIX A

Gradation, Asphalt Contents, and Voids for all Projects Tested

Record#	JOBNAME	TEST	SS1.5	SS1	SS3.4	SS1.2	SS3.8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
538	ZB-FR-26-2(49)CT.1	P1	0.00	100.00	100.00	0.00	62.00	0.00	39.00	0.00	18.00	0.00	5.80	4.40		19
539		P2	0.00	100.00	100.00	0.00	66.00	0.00	33.00	0.00	17.00	0.00	5.60	4.20		19
540		P3	0.00	100.00	98.00	0.00	63.00	0.00	32.00	0.00	16.00	0.00	5.30	4.20		19
541		P4	0.00	100.00	99.00	0.00	68.00	0.00	37.00	0.00	17.00	0.00	5.40	4.60		19
542		P5	0.00	100.00	100.00	0.00	71.00	0.00	37.00	0.00	16.00	0.00	5.40	4.90	0.00	19
543		P6	0.00	100.00	100.00	0.00	68.00	0.00	38.00	0.00	15.00	0.00	3.90	4.50		19
544		P7	0.00	100.00	100.00	0.00	69.00	0.00	38.00	0.00	17.00	0.00	5.60	4.40		19
545		P8	0.00	100.00	100.00	0.00	72.00	0.00	40.00	0.00	18.00	0.00	6.00	4.60		19
546		P9	0.00	100.00	100.00	0.00	62.00	0.00	33.00	0.00	16.00	0.00	5.30	4.40		19
547		P10	0.00	100.00	100.00	0.00	68.00	0.00	35.00	0.00	15.00	0.00	4.70	4.80		19
548		P11	0.00	100.00	99.00	0.00	65.00	0.00	39.00	0.00	17.00	0.00	5.10	4.60		19
549		P12	0.00	100.00	98.00	0.00	66.00	0.00	40.00	0.00	18.00	0.00	6.70	4.70		19
550		P13	0.00	100.00	98.00	0.00	65.00	0.00	37.00	0.00	18.00	0.00	5.70	4.40		19
551		P14	0.00	100.00	99.00	0.00	64.00	0.00	38.00	0.00	17.00	0.00	5.60	4.20		19
552		P15	0.00	100.00	98.00	0.00	65.00	0.00	39.00	0.00	17.00	0.00	5.80	4.50		19
553		P16	0.00	100.00	97.00	0.00	62.00	0.00	40.00	0.00	19.00	0.00	5.90	4.60		19
554		P17	0.00	100.00	98.00	0.00	62.00	0.00	36.00	0.00	17.00	0.00	5.30	4.20		19
555		P18	0.00	100.00	99.00	0.00	74.00	0.00	42.00	0.00	19.00	0.00	6.00	4.90		19
556		P19	0.00	100.00	100.00	0.00	65.00	0.00	37.00	0.00	18.00	0.00	5.30	4.50		19
557		P20	0.00	100.00	100.00	0.00	64.00	0.00	38.00	0.00	18.00	0.00	5.80	4.30		19
558		P21	0.00	100.00	98.00	0.00	70.00	0.00	33.00	0.00	16.00	0.00	6.60	4.40		19
559		A1	0.00	100.00	99.50	75.40	63.70	45.00	36.30	30.00	16.40	8.00	4.70	4.37	5.70	19
560		A4	0.00	100.00	96.70	79.80	68.70	49.30	40.20	32.90	17.90	8.60	5.10	4.73	5.80	19
561		B3	0.00	100.00	98.50	85.70	75.70	50.70	39.90	32.70	18.10	8.80	5.10	4.64	6.30	19
562		B5	0.00	100.00	99.10	85.70	73.50	47.60	37.40	30.70	17.20	8.60	5.00	4.53	7.70	19
563		C2	0.00	100.00	99.00	87.20	77.10	50.20	40.30	32.80	18.20	9.80	5.90	4.64	5.10	19
564		C5	0.00	100.00	99.50	83.40	68.30	46.30	37.40	30.50	17.30	9.50	5.80	4.35	7.70	19
565		D2	0.00	100.00	98.40	83.90	71.00	49.20	39.50	32.30	17.80	9.40	5.30	4.68	5.40	19
566		D3	0.00	100.00	98.80	84.10	73.70	50.10	39.90	32.80	18.10	9.60	5.60	4.68	5.40	19
567		E1	0.00	100.00	99.00	82.70	72.80	50.60	40.20	32.80	18.30	9.00	5.20	4.74	5.80	19
568		E4	0.00	100.00	98.80	85.80	75.00	51.60	40.50	33.10	18.60	8.90	5.40	4.83	6.40	19
569		S1	0.00	100.00	99.10	82.70	71.30	46.70	37.40	30.40	16.70	8.60	5.10	4.87	7.00	19
570		S2	0.00	100.00	98.60	76.90	64.30	43.40	34.90	28.60	15.90	8.40	5.10	4.22	7.10	19
571		S3	0.00	100.00	98.40	81.40	69.00	45.40	36.00	29.20	16.60	9.00	5.80	4.38	7.60	19
572		S4	0.00	100.00	99.40	84.10	70.90	46.50	37.70	30.70	17.20	9.10	5.30	4.64	7.00	19

Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
502	MLP-FR-7-1(52)CT.1	P1	100.00	100.00	0.00	64.00	0.00	0.00	32.00	0.00	13.00	0.00	4.00	3.32		18
503	MLP-FR-7-1(52)CT.1	P2	100.00	100.00	0.00	62.00	0.00	0.00	32.00	0.00	13.00	0.00	4.00	3.81		18
504	MLP-FR-7-1(52)CT.1	P3	100.00	100.00	0.00	68.00	0.00	0.00	35.00	0.00	13.00	0.00	4.00	3.88		18
505	MLP-FR-7-1(52)CT.1	P4	100.00	100.00	0.00	57.00	0.00	0.00	26.00	0.00	11.00	0.00	3.00	3.23		18
506	MLP-FR-7-1(52)CT.1	P5	100.00	100.00	0.00	64.00	0.00	0.00	36.00	0.00	14.00	0.00	4.00	4.20		18
507	MLP-FR-7-1(52)CT.1	P6	100.00	100.00	0.00	53.00	0.00	0.00	22.00	0.00	11.00	0.00	4.00	3.19		18
508	MLP-FR-7-1(52)CT.1	P7	100.00	100.00	0.00	52.00	0.00	0.00	24.00	0.00	12.00	0.00	4.00	3.45		18
509	MLP-FR-7-1(52)CT.1	P8	100.00	99.00	0.00	46.00	0.00	0.00	20.00	0.00	11.00	0.00	4.00	3.02		18
510	MLP-FR-7-1(52)CT.1	P9	100.00	99.00	0.00	34.00	0.00	0.00	13.00	0.00	8.00	0.00	3.00	2.37		18
511		P10	100.00	100.00	0.00	55.00	0.00	0.00	23.00	0.00	13.00	0.00	4.00	3.42		18
512		P11	100.00	100.00	0.00	52.00	0.00	0.00	26.00	0.00	11.00	0.00	4.00	3.82		18
513		P12	100.00	100.00	0.00	45.00	0.00	0.00	20.00	0.00	13.00	0.00	4.00	3.17		18
514		P13	100.00	99.00	0.00	53.00	0.00	0.00	26.00	0.00	10.00	0.00	4.00	3.73		18
515		P14	100.00	100.00	0.00	44.00	0.00	0.00	17.00	0.00	12.00	0.00	3.00	2.91		18
516		P15	100.00	100.00	0.00	52.00	0.00	0.00	23.00	0.00	12.00	0.00	4.00	2.95		18
517		P16	100.00	100.00	0.00	63.00	0.00	0.00	28.00	0.00	13.00	0.00	4.00	3.94		18
518		P17	100.00	100.00	0.00	70.80	0.00	0.00	38.50	0.00	17.60	0.00	5.60	4.37		18
519		P18	100.00	100.00	0.00	69.60	0.00	0.00	38.30	0.00	17.90	0.00	5.60	4.43		18
520		P19	100.00	100.00	0.00	67.60	0.00	0.00	32.60	0.00	15.60	0.00	5.30	4.54		18
521		P20	100.00	98.60	0.00	69.00	0.00	0.00	35.40	0.00	16.30	0.00	5.50	4.62		18
522		P21	100.00	100.00	0.00	67.80	0.00	0.00	39.40	0.00	17.50	0.00	5.90	4.67		18
523		P22	100.00	100.00	0.00	69.20	0.00	0.00	38.40	0.00	16.60	0.00	5.30	4.60		18
524		A1	100.00	100.00	91.40	69.90	60.00	45.50	38.20	32.90	16.80	9.50	5.80	4.70	4.90	18
525		A4	100.00	98.30	88.60	64.20	53.80	39.80	34.00	29.50	15.20	8.40	4.80	4.39	3.90	18
526		B3	100.00	98.70	92.00	74.30	63.10	47.60	39.70	34.00	16.30	8.80	5.10	4.79	4.60	18
527		B5	100.00	98.70	92.00	74.30	63.10	47.60	40.10	34.00	16.30	8.80	5.10	4.79	4.60	18
528		C2	100.00	100.00	86.70	66.40	56.40	41.30	34.80	29.80	14.90	8.00	4.60	4.13	4.90	18
529		C5	100.00	100.00	95.10	73.70	62.90	43.60	39.30	33.60	16.60	9.00	5.20	4.71	6.40	18
530		D2	100.00	94.90	86.40	68.50	54.80	39.40	32.90	28.00	14.40	7.90	4.50	4.12	5.30	18
531		D3	100.00	99.00	88.10	66.50	55.80	40.60	32.70	28.80	14.60	8.10	4.80	4.09	2.80	18
532		E1	100.00	100.00	96.00	78.00	66.30	47.40	39.10	33.00	16.50	9.10	5.40	4.57	5.60	18
533		E4	100.00	98.60	89.20	69.60	57.40	41.80	33.90	28.90	14.60	8.00	4.70	4.21	4.20	18
534		S1	100.00	97.70	82.20	60.30	48.50	35.30	30.40	26.60	14.20	7.80	4.50	3.93	7.90	18
535		S2	100.00	100.00	91.30	62.50	51.20	35.20	29.70	25.90	14.00	7.80	4.50	3.69	8.40	18
536		S3	100.00	97.20	86.00	58.90	45.70	31.90	26.80	23.50	12.50	6.90	4.10	3.39	8.80	18
537		S4	100.00	98.20	83.50	55.00	42.30	29.50	25.10	22.00	11.70	6.40	3.70	3.17	9.90	18

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	4C	VOIDS	VVVV
479	EDS-TSAP-15(73)	A1	0.00	0.00	97.00	82.00	74.00	52.00	38.00	30.00	17.00	10.00	5.60	5.50		17
480		A4	0.00	0.00	97.00	82.00	72.00	52.00	39.00	30.00	17.00	11.00	5.70	5.20		17
481		B3	0.00	0.00	99.00	83.00	72.00	50.00	36.00	28.00	16.00	9.00	5.30	5.20		17
482		B5	0.00	0.00	98.00	83.00	72.00	52.00	37.00	29.00	16.00	10.00	5.40	5.20		17
483		C2	0.00	0.00	94.00	81.00	74.00	54.00	39.00	31.00	18.00	10.00	5.90	5.40		17
484		C5	0.00	0.00	97.00	84.00	75.00	53.00	38.00	30.00	16.00	10.00	4.80	5.90		17
485		D2	0.00	0.00	99.00	90.00	79.00	53.00	39.00	30.00	17.00	11.00	5.50	5.70		17
486		D3	0.00	0.00	95.00	80.00	68.00	43.00	31.00	26.00	15.00	9.00	5.00	4.80	0.00	17
487		E1	0.00	0.00	98.00	72.00	62.00	50.00	33.00	26.00	15.00	9.00	5.30	5.40		17
488		E4	0.00	0.00	99.00	88.00	78.00	53.00	36.00	28.00	15.00	10.00	5.20	5.40		17
489		C3	0.00	0.00	97.00	84.00	75.00	53.00	38.00	30.00	16.00	10.00	4.80	5.90		17
490		D4	0.00	0.00	94.00	77.00	67.00	44.00	32.00	26.00	15.00	10.00	5.00	4.90		17
491		P1	0.00	0.00	98.00	0.00	75.00	0.00	36.00	0.00	0.00	0.00	4.50	5.30		17
492		P2	0.00	0.00	93.00	0.00	74.00	0.00	38.00	0.00	0.00	0.00	6.40	5.40		17
493		P3	0.00	0.00	96.00	0.00	72.00	0.00	34.00	0.00	0.00	0.00	4.40	5.20		17
494		P4	0.00	0.00	98.00	0.00	73.00	0.00	36.00	0.00	0.00	0.00	5.10	5.30		17
495		P5	0.00	0.00	95.00	0.00	71.00	0.00	37.00	0.00	0.00	0.00	4.60	5.20		17
496		P6	0.00	0.00	94.00	0.00	68.00	0.00	38.00	0.00	0.00	0.00	4.30	5.00		17
497		P7	0.00	0.00	96.00	0.00	73.00	0.00	35.00	0.00	0.00	0.00	4.40	5.10		17
498		P8	0.00	0.00	100.00	0.00	76.00	0.00	34.00	0.00	0.00	0.00	4.40	5.20		17
499		P9	0.00	0.00	98.00	0.00	75.00	0.00	36.00	0.00	0.00	0.00	5.80	5.20		17
500		P10	0.00	0.00	95.00	0.00	70.00	0.00	35.00	0.00	0.00	0.00	5.50	5.00		17
501		P11	0.00	0.00	97.00	0.00	74.00	0.00	37.00	37.00	0.00	0.00	6.20	5.20		17

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
457	AC1-ID-I-85 1(204)CT	A1	0.00	97.00	81.00	67.00	57.00	42.00	34.00	28.00	16.00	11.00	7.60	4.30	2.30	16
458		A4	0.00	99.00	82.00	69.00	58.00	40.00	33.00	27.00	15.00	10.00	6.10	4.30	2.40	16
459		B3	0.00	99.00	78.00	66.00	56.00	40.00	33.00	27.00	15.00	11.00	6.20	4.40	2.50	16
460		B5	0.00	99.00	81.00	67.00	58.00	41.00	33.00	27.00	16.00	11.00	7.60	4.20	2.30	16
461		C2	0.00	100.00	81.00	67.00	58.00	40.00	33.00	26.00	14.00	10.00	5.50	4.20	4.10	16
462		C5	0.00	98.00	79.00	67.00	55.00	40.00	33.00	26.00	14.00	10.00	5.60	4.10	5.00	16
463		D2	0.00	98.00	82.00	70.00	59.00	44.00	37.00	29.00	16.00	11.00	7.10	4.60	2.30	16
464		D3	0.00	99.00	81.00	69.00	58.00	41.00	34.00	28.00	16.00	11.00	7.30	4.50	1.40	16
465		E1	0.00	98.00	81.00	66.00	55.00	39.00	33.00	26.00	14 00	10.00	6.60	4.00	4.00	16
466		E4	0.00	97.00	83.00	70.00	58.00	41.00	34.00	28.00	15.00	10.00	6.00	4.40	4.20	16
467		P1	0.00	96.00	0.00	68.00	0.00	0.00	35.00	0.00	0.00	0.00	5.50	4.60		16
468		P2	0.00	98.00	0.00	75.00	0.00	0.00	34.00	0.00	0.00	0.00	5.00	4.30		16
469		P3	0.00	98.00	0.00	72.00	0.00	0.00	37.00	0.00	0.00	0.00	5.60	4.00		16
470		P4	0.00	96.00	0.00	74.00	0.00	0.00	35.00	0.00	0.00	0.00	5.70	4.30		16
471		P5	0.00	99.00	0.00	73.00	0.00	0.00	37.00	0.00	0.00	0.00	7.70	4.30		16
472		P6	0.00	96.00	0.00	71.00	0.00	0.00	39.00	0.00	0.00	0.00	6.30	4.20		16
473		P7	0.00	98.00	0.00	75.00	0.00	0.00	39.00	0.00	0.00	0.00	5.70	4.20	0.00	16
474		P8	0.00	96.00	0.00	76.00	0.00	0.00	40.00	0.00	0.00	0.00	6.80	4.60		16
475		P9	0.00	100.00	0.00	75.00	0.00	0.00	36.00	0.00	0.00	0.00	5.70	4.90		16
476		P10	0.00	96.00	0.00	66.00	0.00	0.00	33.00	0.00	0.00	0.00	5.80	4.40		16
477		P11	0.00	100.00	0.00	73.00	0.00	0.00	34.00	0.00	0.00	0.00	6.20	4.80		16
478		P12	0.00	98.00	0.00	69.00	0.00	0.00	34.00	0.00	0.00	0.00	6.00	4.40		16

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
409	IR-ACIR-75-3(158)C13	A1	0.00	100.00	89.00	82.00	74.00	54.00	40.00	27.00	13.00	9.00	6.00	4.20	3.60	15
410		A4	0.00	98.00	82.00	73.00	66.00	47.00	34.00	24.00	12.00	8.00	5.50	3.80	3.60	15
411		B3	0.00	97.00	87.00	81.00	72.00	52.00	38.00	26.00	12.00	8.00	5.80	4.20	7.40	15
412		B5	0.00	100.00	88.00	80.00	72.00	52.00	38.00	26.00	12.00	9.00	5.90	4.20	2.50	15
413		C2	0.00	99.00	86.00	76.00	68.00	49.00	37.00	27.00	13.00	9.00	5.80	4.20	12.90	15
414		C5	0.00	100.00	88.00	80.00	69.00	47.00	36.00	26.00	13.00	8.00	5.40	4.30	6.90	15
415		D2	0.00	97.00	85.00	78.00	71.00	54.00	40.00	28.00	13.00	9.00	6.30	4.10	3.60	15
416		D3	0.00	99.00	90.00	81.00	73.00	56.00	42.00	30.00	14.00	10.00	6.50	4.10	10.50	15
417		E1	0.00	99.00	89.00	78.00	68.00	48.00	35.00	25.00	12.00	8.00	5.40	4.00	2.20	15
418		E4	0.00	100.00	86.00	77.00	66.00	45.00	32.00	23.00	11.00	8.00	5.00	3.90	2.20	15
419		S1	0.00	99.00	75.00	59.00	47.00	31.00	27.00	17.00	9.00	6.00	4.00	3.00	3.80	15
420		S2	0.00	100.00	80.00	66.00	57.00	38.00	28.00	20.00	10.00	7.00	4.70	3.50	1.90	15
421		P1	0.00	100.00	0.00	72.00	0.00	0.00	33.00	0.00	12.00	0.00	5.40	3.80		15
422		P2	0.00	96.00	0.00	72.00	0.00	0.00	34.00	0.00	13.00	0.00	6.30	4.20		15
423		P3	0.00	98.00	0.00	79.00	0.00	0.00	37.00	0.00	14.00	0.00	6.70	4.00		15
424		P4	0.00	99.00	0.00	75.00	0.00	0.00	33.00	0.00	12.00	0.00	5.80	4.00		15
425		P5	0.00	98.00	0.00	71.00	0.00	0.00	33.00	0.00	13.00	0.00	6.10	4.00		15
426		P6	0.00	99.00	0.00	76.00	0.00	0.00	34.00	0.00	12.00	0.00	5.80	4.20		15
427		P7	0.00	99.00	0.00	75.00	0.00	0.00	34.00	0.00	12.00	0.00	5.70	4.10		15
428		P8	0.00	99.00	0.00	75.00	0.00	0.00	35.00	0.00	12.00	0.00	5.60	4.00		15
429		P9	0.00	100.00	0.00	79.00	0.00	0.00	35.00	0.00	11.00	0.00	5.10	4.30		15
430		P10	0.00	98.00	0.00	75.00	0.00	0.00	31.00	0.00	11.00	0.00	5.20	3.60		15
431		P11	0.00	100.00	0.00	77.00	0.00	0.00	37.00	0.00	14.00	0.00	6.70	3.90		15
432		P12	0.00	97.00	0.00	74.00	0.00	0.00	34.00	0.00	12.00	0.00	5.70	3.80		15
433		P13	0.00	97.00	0.00	74.00	0.00	0.00	36.00	0.00	13.00	0.00	6.10	3.40		15
434		P14	0.00	98.00	0.00	77.00	0.00	0.00	33.00	0.00	12.00	0.00	5.80	4.00		15
435		P15	0.00	99.00	0.00	75.00	0.00	0.00	36.00	0.00	13.00	0.00	5.20	4.20		15
436		P16	0.00	98.00	0.00	73.00	0.00	0.00	35.00	0.00	13.00	0.00	5.60	3.90		15
437		P17	0.00	96.00	0.00	73.00	0.00	0.00	33.00	0.00	12.00	0.00	5.40	4.10		15
438		P18	0.00	98.00	0.00	74.00	0.00	0.00	33.00	0.00	12.00	0.00	5.60	4.10		15
439		P19	0.00	99.00	0.00	74.00	0.00	0.00	31.00	0.00	11.00	0.00	4.60	3.60		15
440		P20	0.00	99.00	0.00	80.00	0.00	0.00	34.00	0.00	12.00	0.00	5.30	4.00	0.00	15
441		P21	0.00	100.00	0.00	74.00	0.00	0.00	32.00	0.00	11.00	0.00	5.10	3.80		15
442		P22	0.00	97.00	0.00	74.00	0.00	0.00	34.00	0.00	11.00	0.00	5.30	4.20		15
443		P23	0.00	98.00	0.00	74.00	0.00	0.00	34.00	0.00	11.00	0.00	5.30	4.10		15
444		P24	0.00	100.00	0.00	74.00	0.00	0.00	35.00	0.00	12.00	0.00	5.70	4.50		15
445		P25	0.00	99.00	0.00	76.00	0.00	0.00	35.00	0.00	11.00	0.00	5.30	3.90		15
446		P26	0.00	100.00	0.00	79.00	0.00	0.00	36.00	0.00	12.00	0.00	5.60	4.10		15
447		P27	0.00	99.00	0.00	79.00	0.00	0.00	37.00	0.00	12.00	0.00	5.50	3.90		15
448		P28	0.00	98.00	0.00	76.00	0.00	0.00	35.00	0.00	12.00	0.00	5.40	4.00		15
449		P29	0.00	100.00	0.00	79.00	0.00	0.00	32.00	0.00	11.00	0.00	4.80	3.90		15
450		P30	0.00	98.00	0.00	79.00	0.00	0.00	35.00	0.00	12.00	0.00	5.30	3.80		15
451		P31	0.00	95.00	0.00	72.00	0.00	0.00	36.00	0.00	12.00	0.00	5.40	4.00		15
452		P32	0.00	97.00	0.00	74.00	0.00	0.00	36.00	0.00	12.00	0.00	5.20	4.10		15
453		P33	0.00	99.00	0.00	74.00	0.00	0.00	35.00	0.00	12.00	0.00	5.60	3.90		15
454		P34	0.00	99.00	0.00	77.00	0.00	0.00	34.00	0.00	12.00	0.00	5.60	3.90		15
455		P35	0.00	98.00	0.00	76.00	0.00	0.00	34.00	0.00	12.00	0.00	5.70	3.90		15
456		P36	0.00	99.00	0.00	77.00	0.00	0.00	38.00	0.00	12.00	0.00	5.70	4.00		15

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
364	IR-ACIR-85-2(103)CT6	A1	0.00	98.00	92.00	70.00	62.00	46.00	36.00	29.00	16.00	10.00	5.30	4.70		14
365		A4	0.00	97.00	82.00	65.00	56.00	41.00	32.00	26.00	15.00	9.00	4.70	4.80		14
366		B3	0.00	96.00	82.00	63.00	54.00	39.00	31.00	25.00	15.00	10.00	5.60	3.40		14
367		B5	0.00	100.00	87.00	68.00	58.00	43.00	34.00	28.00	16.00	10.00	6.00	3.30		14
368		C2	0.00	98.00	89.00	71.00	63.00	46.00	36.00	30.00	18.00	12.00	6.90	3.40		14
369		C5	0.00	98.00	87.00	71.00	61.00	44.00	37.00	28.00	16.00	11.00	5.90	3.80		14
370		D2	0.00	98.00	90.00	75.00	65.00	49.00	39.00	31.00	18.00	13.00	6.70	4.20		14
371		D3	0.00	92.00	79.00	61.00	53.00	37.00	28.00	23.00	13.00	8.00	3.10	5.90	8.50	14
372		E1	0.00	97.00	90.00	76.00	68.00	51.00	39.00	31.00	18.00	13.00	6.70	4.30		14
373		E4	0.00	94.00	79.00	58.00	50.00	36.00	28.00	23.00	10.00	7.00	4.50	3.40	6.10	14
374		A6	0.00	97.00	82.00	65.00	56.00	41.00	32.00	26.00	15.00	9.00	4.70	4.80		14
375		C6	0.00	99.00	82.00	62.00	53.00	38.00	30.00	24.00	15.00	9.00	5.40	3.30		14
376		E6	0.00	97.00	80.00	62.00	52.00	37.00	28.00	22.00	12.00	8.00	3.20	5.70	2.60	14
377		P1	0.00	99.00	0.00	78.00	0.00	0.00	38.00	0.00	0.00	0.00	5.80	4.10		14
378		P2	0.00	97.00	0.00	72.00	0.00	0.00	35.00	0.00	0.00	0.00	5.90	4.10		14
379		P3	0.00	98.00	0.00	64.00	0.00	0.00	33.00	0.00	0.00	0.00	5.10	3.90		14
380		P4	0.00	99.00	0.00	80.00	0.00	0.00	36.00	0.00	0.00	0.00	5.50	4.40		14
381		P5	0.00	96.00	0.00	74.00	0.00	0.00	33.00	0.00	0.00	0.00	5.30	3.90		14
382		P6	0.00	100.00	0.00	77.00	0.00	0.00	38.00	0.00	0.00	0.00	6.00	4.70		14
383		P7	0.00	98.00	0.00	79.00	0.00	0.00	37.00	0.00	0.00	0.00	5.70	4.60		14
384		P8	0.00	98.00	0.00	70.00	0.00	0.00	33.00	0.00	0.00	0.00	5.20	4.20		14
385		P9	0.00	100.00	0.00	67.00	0.00	0.00	34.00	0.00	0.00	0.00	5.20	4.20		14
386		P10	0.00	98.00	0.00	73.00	0.00	0.00	36.00	0.00	0.00	0.00	5.20	4.40		14
387		P11	0.00	97.00	0.00	71.00	0.00	0.00	33.00	0.00	0.00	0.00	3.70	4.10		14
388		P12	0.00	97.00	0.00	75.00	0.00	0.00	38.00	0.00	0.00	0.00	5.70	4.10		14
389		P13	0.00	96.00	0.00	70.00	0.00	0.00	34.00	0.00	0.00	0.00	5.20	4.00		14
390		P14	0.00	97.00	0.00	72.00	0.00	0.00	34.00	0.00	0.00	0.00	5.40	4.10		14
391		P15	0.00	96.00	0.00	70.00	0.00	0.00	33.00	0.00	0.00	0.00	4.80	4.00		14
392		P16	0.00	99.00	0.00	73.00	0.00	0.00	34.00	0.00	0.00	0.00	5.20	4.60		14
393		P17	0.00	99.00	0.00	78.00	0.00	0.00	33.00	0.00	0.00	0.00	5.80	4.00		14
394		P18	0.00	98.00	0.00	75.00	0.00	0.00	34.00	0.00	0.00	0.00	5.60	4.10		14
395		P19	0.00	99.00	0.00	77.00	0.00	0.00	37.00	0.00	0.00	0.00	5.70	4.30		14
396		P20	0.00	98.00	0.00	76.00	0.00	0.00	35.00	0.00	0.00	0.00	5.50	4.30		14
397		P21	0.00	100.00	0.00	74.00	0.00	0.00	38.00	0.00	0.00	0.00	5.90	4.30		14
398		P22	0.00	99.00	0.00	75.00	0.00	0.00	38.00	0.00	0.00	0.00	5.80	4.40		14
399		P23	0.00	97.00	0.00	69.00	0.00	0.00	33.00	0.00	0.00	0.00	4.80	4.10		14
400		P24	0.00	98.00	0.00	76.00	0.00	0.00	37.00	0.00	0.00	0.00	5.60	4.30		14
401		P25	0.00	99.00	0.00	75.00	0.00	0.00	37.00	0.00	0.00	0.00	5.40	4.20		14
402		P26	0.00	98.00	0.00	71.00	0.00	0.00	32.00	0.00	0.00	0.00	4.40	3.70		14
403		P27	0.00	100.00	0.00	76.00	0.00	0.00	37.00	0.00	0.00	0.00	4.80	3.70		14
404		P28	0.00	100.00	0.00	75.00	0.00	0.00	37.00	0.00	0.00	0.00	5.00	4.20		14
405		P29	0.00	100.00	0.00	78.00	0.00	0.00	38.00	0.00	0.00	0.00	5.70	4.40		14
406		P30	0.00	98.00	0.00	79.00	0.00	0.00	39.00	0.00	0.00	0.00	6.60	4.20		14
407		P31	0.00	98.00	0.00	71.00	0.00	0.00	35.00	0.00	0.00	0.00	5.60	4.30		14
408		P32	0.00	98.00	0.00	75.00	0.00	0.00	36.00	0.00	0.00	0.00	4.90	4.20		14

Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
341	APD-ACAPD-56-2(7)	A1	0.00	99.00	88.00	73.00	66.00	52.00	35.00	22.00	10.00	8.00	6.50	4.10		13
342		A4	0.00	100.00	89.00	74.00	65.00	50.00	35.00	21.00	10.00	7.00	5.80	4.00	4.00	13
343		B3	0.00	100.00	94.00	78.00	70.00	52.00	34.00	22.00	9.00	6.00	5.90	4.10	5.90	13
344		B5	0.00	100.00	92.00	80.00	72.00	55.00	38.00	23.00	10.00	8.00	6.30	4.30	3.30	13
345		C2	0.00	99.00	94.00	77.00	67.00	50.00	33.00	22.00	10.00	7.00	5.70	4.30	3.00	13
346		C5	0.00	98.00	93.00	80.00	72.00	56.00	38.00	24.00	12.00	10.00	8.00	2.50	6.30	13
347		D2	0.00	100.00	87.00	70.00	62.00	47.00	32.00	20.00	9.00	7.00	5.40	3.90	0.80	13
348		D3	0.00	100.00	96.00	81.00	73.00	55.00	38.00	23.00	10.00	8.00	6.10	4.50	6.40	13
349		E1	0.00	100.00	92.00	74.00	66.00	50.00	34.00	21.00	9.00	7.00	5.30	4.50	3.00	13
350		E4	0.00	100.00	92.00	78.00	70.00	47.00	36.00	22.00	10.00	7.00	5.80	4.20	4.00	13
351		S1	0.00	99.00	79.00	58.00	49.00	36.00	26.00	17.00	8.00	6.00	4.50	3.50	3.10	13
352		S2	0.00	99.00	86.00	65.00	57.00	44.00	30.00	19.00	9.00	7.00	5.20	3.70	5.10	13
353		S3	0.00	99.00	85.00	62.00	52.00	38.00	27.00	18.00	8.00	6.00	4.70	3.50	2.60	13
354		S4	0.00	98.00	87.00	65.00	57.00	41.00	29.00	18.00	8.00	7.00	5.10	3.50	6.80	13
355		P1	0.00	100.00	90.00	0.00	68.00	0.00	36.00	0.00	0.00	0.00	6.30	4.10		13
356		P2	0.00	100.00	91.00	0.00	70.00	0.00	36.00	0.00	0.00	0.00	6.00	4.60		13
357		P3	0.00	100.00	93.00	0.00	74.00	0.00	38.00	0.00	0.00	0.00	6.40	4.60		13
358		P4	0.00	100.00	94.00	0.00	73.00	0.00	36.00	0.00	0.00	0.00	5.00	4.60		13
359		P5	0.00	100.00	96.00	0.00	75.00	0.00	39.00	0.00	0.00	0.00	6.50	4.80		13
360		P6	0.00	99.00	92.00	0.00	73.00	0.00	36.00	0.00	0.00	0.00	5.40	4.50		13
361		P7	0.00	98.00	91.00	0.00	74.00	0.00	38.00	0.00	0.00	0.00	6.30	4.50		13
362		P8	0.00	100.00	93.00	0.00	70.00	0.00	36.00	0.00	0.00	0.00	6.20	4.30		13
363		P9	0.00	100.00	95.00	0.00	73.00	0.00	37.00	0.00	0.00	0.00	7.00	4.60		13

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
317	APD-ACAPD-56-1(7)CT5	A1	100.00	98.00	82.00	58.00	50.00	40.00	31.00	22.00	13.00	10.00	6.10	3.80	8.30	12
318		A4	100.00	90.00	77.00	56.00	50.00	40.00	31.00	25.00	12.00	10.00	6.00	3.80	7.80	12
319		B3	100.00	95.00	80.00	58.00	51.00	40.00	29.00	19.00	10.00	8.00	4.70	3.20	10.80	12
320		B5	100.00	96.00	82.00	59.00	51.00	41.00	31.00	23.00	12.00	9.00	6.00	4.00	9.70	12
321		C2	100.00	93.00	83.00	62.00	54.00	44.00	34.00	24.00	14.00	11.00	6.80	4.20	4.90	12
322		C5	100.00	93.00	79.00	60.00	53.00	45.00	35.00	24.00	13.00	10.00	6.50	4.30	7.00	12
323		D2	100.00	97.00	89.00	70.00	62.00	51.00	38.00	27.00	15.00	11.00	7.80	4.70	5.90	12
324		D3	100.00	96.00	85.00	64.00	57.00	46.00	35.00	25.00	14.00	11.00	7.40	3.40	7.40	12
325		E1	100.00	97.00	87.00	69.00	60.00	50.00	38.00	27.00	15.00	12.00	7.70	4.40	7.10	12
326		E4	100.00	94.00	83.00	65.00	57.00	48.00	36.00	26.00	14.00	11.00	7.00	4.20	6.30	12
327		S1	100.00	94.00	85.00	60.00	52.00	43.00	32.00	22.00	12.00	9.00	5.50	3.90	8.70	12
328		S2	100.00	93.00	79.00	57.00	49.00	40.00	30.00	22.00	12.00	10.00	7.20	3.90	6.60	12
329		S3	100.00	93.00	82.00	65.00	58.00	49.00	37.00	26.00	14.00	11.00	6.90	4.60	6.60	12
330		S4	100.00	92.00	74.00	55.00	46.00	38.00	29.00	21.00	12.00	9.00	5.70	3.60	9.10	12
331		P1	100.00	99.00	0.00	72.00	0.00	0.00	39.00	0.00	0.00	0.00	6.50	5.10		12
332		P2	100.00	96.00	0.00	64.00	0.00	0.00	33.00	0.00	0.00	0.00	5.10	5.20		12
333		P3	100.00	96.00	0.00	66.00	0.00	0.00	34.00	0.00	0.00	0.00	6.10	4.70		12
334		P4	100.00	96.00	0.00	62.00	0.00	0.00	34.00	0.00	0.00	0.00	6.20	4.20		12
335		P5	100.00	90.00	0.00	60.00	0.00	0.00	32.00	0.00	11.00	0.00	4.70	4.90		12
336		P6	100.00	97.00	0.00	64.00	0.00	0.00	32.00	0.00	13.00	0.00	6.00	5.00		12
337		P7	100.00	89.00	0.00	60.00	0.00	0.00	31.00	0.00	10.00	0.00	5.80	4.60		12
338		P8	100.00	94.00	0.00	65.00	0.00	0.00	31.00	0.00	12.00	0.00	5.60	4.70		12
339		P9	100.00	98.00	0.00	64.00	0.00	0.00	30.00	0.00	12.00	0.00	5.60	4.90		12
340		P10	100.00	92.00	0.00	67.00	0.00	0.00	33.00	0.00	12.00	0.00	5.70	4.70		12

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
303	FR-FRG-5-5(10)	A1	100.00	100.00	92.70	75.80	64.30	44.20	34.80	0.00	18.30	0.00	6.30	4.38	4.60	11
304		A4	100.00	100.00	93.60	77.90	65.90	45.90	36.30	0.00	18.80	0.00	6.50	4.54	3.68	11
305		B3	100.00	100.00	87.10	70.80	61.80	44.00	34.90	0.00	18.30	0.00	6.50	4.20	3.49	11
306		B5	100.00	100.00	89.30	74.90	65.50	48.90	38.50	0.00	19.80	0.00	6.20	4.57	2.96	11
307		C2	100.00	100.00	92.50	78.70	65.80	45.20	35.30	0.00	17.70	0.00	6.30	4.37	2.52	11
308		C5	100.00	97.50	90.70	79.30	66.90	47.00	36.80	0.00	18.10	0.00	6.30	4.63	3.77	11
309		D2	100.00	98.90	88.40	76.80	66.20	47.90	37.80	0.00	19.70	0.00	6.90	4.54	2.90	11
310		D3	100.00	100.00	90.60	81.20	70.70	51.00	40.70	0.00	20.90	0.00	7.20	4.87	2.87	11
311		E1	100.00	99.00	92.80	77.10	67.40	49.20	39.40	0.00	18.00	0.00	7.30	4.56	3.80	11
312		E4	100.00	98.90	83.90	67.50	57.40	42.30	34.20	0.00	16.90	0.00	6.50	4.01	4.09	11
313		S1	100.00	97.30	82.60	68.50	55.50	40.00	31.80	0.00	16.90	0.00	5.90	4.01	5.12	11
314		S2	100.00	95.30	83.00	66.00	54.90	38.50	30.60	0.00	16.50	0.00	6.00	3.86	4.86	11
315		S3	100.00	100.00	81.90	65.00	55.70	37.60	30.60	0.00	16.70	0.00	5.90	4.93	7.01	11
316		S4	100.00	97.30	76.80	56.80	46.30	32.70	26.40	0.00	14.50	0.00	5.40	4.89	6.16	11
573		S5	0.00	100.00	99.40	80.90	68.70	44.00	35.50	29.10	16.40	8.70	5.20	4.35	7.80	11

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
254	ZB-FR-26-2(59)CT.4	P1	0.00	0.00	100.00	98.80	84.40	0.00	48.20	0.00	18.60	0.00	7.00	5.37	5.50	10
255		P2	0.00	0.00	100.00	98.10	82.10	0.00	44.20	0.00	16.10	0.00	5.70	5.49	5.50	10
256		P3	0.00	0.00	100.00	98.20	85.00	0.00	45.90	0.00	16.60	0.00	5.90	5.35	6.30	10
257		P4	0.00	0.00	100.00	98.80	84.90	0.00	46.50	0.00	16.90	0.00	5.80	5.45	6.30	10
258		P5	0.00	0.00	100.00	99.30	85.20	0.00	46.40	0.00	16.70	0.00	6.10	5.39	6.30	10
259		P6	0.00	0.00	100.00	98.70	84.50	0.00	45.90	0.00	16.30	0.00	5.70	5.55	6.20	10
260		P7	0.00	0.00	100.00	99.30	87.10	0.00	46.90	0.00	17.40	0.00	6.30	5.39	6.20	10
261		P8	0.00	0.00	100.00	98.40	83.40	0.00	44.10	0.00	16.00	0.00	6.00	5.37	6.20	10
262		P9	0.00	0.00	100.00	99.10	85.00	0.00	43.40	0.00	15.50	0.00	5.50	5.87	6.90	10
263		P10	0.00	0.00	100.00	99.10	84.50	0.00	44.20	0.00	16.30	0.00	5.90	5.41	6.90	10
264		P11	0.00	0.00	100.00	98.40	85.40	0.00	48.40	0.00	18.00	0.00	6.60	5.65	6.90	10
265		P12	0.00	0.00	100.00	98.10	85.40	0.00	40.90	0.00	15.20	0.00	5.60	5.22	5.30	10
266		P13	0.00	0.00	100.00	99.20	89.20	0.00	42.90	0.00	15.90	0.00	6.00	5.47	5.30	10
267		P14	0.00	0.00	100.00	99.70	87.70	0.00	41.20	0.00	15.10	0.00	5.80	5.33	5.30	10
268		P15	0.00	0.00	100.00	97.90	87.30	0.00	42.50	0.00	16.40	0.00	6.40	5.15	6.20	10
269		P16	0.00	0.00	100.00	96.00	84.70	0.00	40.10	0.00	15.10	0.00	5.70	5.56	6.20	10
270		P17	0.00	0.00	100.00	98.80	86.50	0.00	39.50	0.00	14.50	0.00	5.60	5.17	6.20	10
271		P18	0.00	0.00	100.00	99.40	91.70	0.00	38.60	0.00	14.60	0.00	5.60	5.33	6.20	10
272		P19	0.00	0.00	100.00	98.60	88.60	0.00	42.10	0.00	16.30	0.00	6.20	5.48	6.00	10
273		P20	0.00	0.00	100.00	99.30	85.30	0.00	39.60	0.00	15.10	0.00	5.70	5.45	6.00	10
274		P21	0.00	0.00	100.00	99.00	86.50	0.00	41.10	0.00	15.70	0.00	6.00	5.28	6.00	10
275		P22	0.00	0.00	100.00	98.70	87.50	0.00	42.80	0.00	16.00	0.00	6.10	5.27	6.00	10
276		P23	0.00	0.00	100.00	99.00	84.70	0.00	41.60	0.00	16.00	0.00	6.10	5.24	4.40	10
277		P24	0.00	0.00	100.00	99.30	87.60	0.00	40.70	0.00	16.00	0.00	6.20	5.27	4.40	10
278		P25	0.00	0.00	100.00	100.00	88.10	0.00	42.60	0.00	16.70	0.00	6.60	5.51	4.40	10
279		P26	0.00	0.00	100.00	98.00	84.00	0.00	42.60	0.00	16.70	0.00	6.60	5.47	4.40	10
280		P27	0.00	0.00	100.00	99.90	82.90	0.00	41.00	0.00	16.00	0.00	6.60	5.45	8.00	10
281		P28	0.00	0.00	100.00	96.90	82.40	0.00	39.70	0.00	15.80	0.00	6.70	5.53	8.00	10
282		P29	0.00	0.00	100.00	98.40	86.50	0.00	43.50	0.00	16.90	0.00	6.50	5.29	8.00	10
283		P30	0.00	0.00	100.00	99.20	87.30	0.00	43.70	0.00	17.00	0.00	6.70	5.22	6.70	10
284		P31	0.00	0.00	100.00	99.20	85.80	0.00	44.60	0.00	17.00	0.00	6.40	5.34	6.70	10
285		P32	0.00	0.00	100.00	98.90	87.60	0.00	48.70	0.00	19.00	0.00	7.60	5.44	6.70	10
286		P33	0.00	0.00	100.00	99.10	87.40	0.00	45.10	0.00	17.10	0.00	6.80	5.41	6.70	10
287		P34	0.00	0.00	100.00	98.90	86.40	0.00	41.50	0.00	16.10	0.00	6.60	4.91	6.70	10
288		P35	0.00	0.00	100.00	99.10	83.20	0.00	42.70	0.00	16.30	0.00	6.10	5.30	6.70	10
289		A1	0.00	0.00	100.00	98.90	89.40	54.60	41.70	29.50	16.20	10.50	5.80	5.21	5.10	10
290		A4	0.00	0.00	100.00	98.80	88.70	56.30	43.10	30.40	16.50	10.80	6.00	5.25	4.80	10
291		B3	0.00	0.00	100.00	98.40	88.20	54.60	41.40	28.80	16.00	10.50	6.00	5.53	5.80	10
292		B5	0.00	0.00	100.00	99.10	89.30	58.20	44.40	31.00	17.00	11.00	6.30	5.29	7.10	10
293		C2	0.00	0.00	100.00	98.60	86.90	55.00	41.70	29.20	16.30	10.60	5.80	5.64	3.90	10
294		C5	0.00	0.00	100.00	99.10	88.50	57.00	43.00	30.00	16.70	11.00	6.30	5.59	4.20	10
295		D2	0.00	0.00	100.00	98.00	86.20	53.70	40.30	28.40	15.90	10.40	5.90	5.51	5.70	10
296		D3	0.00	0.00	100.00	98.70	85.30	54.70	41.70	29.80	16.60	10.80	6.00	5.53	5.60	10
297		E1	0.00	0.00	100.00	98.10	81.00	50.50	38.60	27.70	15.90	10.70	6.20	5.27	5.00	10
298		E4	0.00	0.00	100.00	98.70	85.90	55.30	41.90	29.40	16.60	11.20	6.60	5.33	4.60	10
299		S1	0.00	0.00	100.00	98.40	81.40	51.10	39.20	27.80	15.80	10.60	6.30	5.58	5.20	10
300		S2	0.00	0.00	100.00	98.20	86.60	58.20	44.30	31.10	17.20	11.30	6.50	5.54	2.90	10
301		S3	0.00	0.00	100.00	98.50	86.70	54.10	40.40	28.00	15.70	10.20	5.70	5.94	4.80	10
302		S4	0.00	0.00	100.00	98.50	87.00	58.10	43.90	30.60	17.00	11.10	6.30	5.74	4.10	10

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
215	ZB-FR-26-1(53)CT.2	P1	0.00	0.00	100.00	98.70	86.00	0.00	46.50	0.00	17.50	0.00	6.10	5.60	5.40	9
216		P2	0.00	0.00	100.00	98.90	86.90	0.00	46.30	0.00	17.50	0.00	6.20	5.58	5.40	9
217		P3	0.00	0.00	100.00	98.20	88.10	0.00	47.20	0.00	17.40	0.00	5.60	5.98	7.10	9
218		P4	0.00	0.00	100.00	98.60	86.70	0.00	46.90	0.00	17.30	0.00	5.50	5.66	7.10	9
219		P5	0.00	0.00	100.00	98.50	86.20	0.00	48.00	0.00	20.00	0.00	7.10	5.19	7.10	9
220		P6	0.00	0.00	100.00	98.60	89.30	0.00	51.30	0.00	20.80	0.00	7.90	5.54	7.30	9
221		P7	0.00	0.00	100.00	98.50	86.20	0.00	46.20	0.00	17.70	0.00	6.40	5.55	7.30	9
222		P8	0.00	0.00	100.00	98.10	84.70	0.00	44.40	0.00	18.80	0.00	6.30	5.06	7.30	9
223		P9	0.00	0.00	100.00	98.60	85.10	0.00	47.10	0.00	18.20	0.00	5.40	5.51	7.30	9
224		P10	0.00	0.00	100.00	98.70	87.70	0.00	46.00	0.00	18.50	0.00	7.40	5.80	4.80	9
225		P11	0.00	0.00	100.00	98.80	87.50	0.00	47.20	0.00	18.20	0.00	7.10	5.73	4.80	9
226		P12	0.00	0.00	100.00	99.30	87.80	0.00	49.10	0.00	19.30	0.00	7.30	5.74	4.80	9
227		P13	0.00	0.00	100.00	98.90	88.60	0.00	48.90	0.00	18.70	0.00	6.90	5.75	7.00	9
228		P14	0.00	0.00	100.00	98.80	90.10	0.00	50.80	0.00	20.60	0.00	7.40	5.36	7.00	9
229		P15	0.00	0.00	100.00	99.20	90.10	0.00	50.30	0.00	20.80	0.00	7.90	5.50	7.00	9
230		P16	0.00	0.00	100.00	98.60	86.40	0.00	47.20	0.00	20.70	0.00	7.30	4.96	7.00	9
231		P17	0.00	0.00	100.00	98.90	86.00	0.00	46.50	0.00	18.00	0.00	6.50	5.10	4.50	9
232		P18	0.00	0.00	100.00	97.50	85.30	0.00	47.10	0.00	19.40	0.00	7.20	5.63	4.50	9
233		P19	0.00	0.00	100.00	97.70	81.90	0.00	46.40	0.00	18.50	0.00	7.10	5.31	4.50	9
234		P20	0.00	0.00	100.00	98.00	80.20	0.00	42.90	0.00	16.80	0.00	4.90	5.55	4.50	9
235		P21	0.00	0.00	100.00	98.70	84.50	0.00	48.20	0.00	19.00	0.00	6.60	5.63	6.70	9
236		P22	0.00	0.00	100.00	98.70	86.60	0.00	50.50	0.00	20.40	0.00	7.00	5.78	6.70	9
237		P23	0.00	0.00	100.00	98.80	88.10	0.00	51.70	0.00	21.20	0.00	7.30	5.48	6.70	9
238		P24	0.00	0.00	100.00	98.90	87.00	0.00	49.00	0.00	18.80	0.00	6.80	5.35	6.70	9
239		P25	0.00	0.00	100.00	98.80	84.40	0.00	47.40	0.00	20.10	0.00	7.50	5.31	5.80	9
240		P26	0.00	0.00	100.00	98.00	84.30	0.00	47.00	0.00	18.50	0.00	6.80	5.51	5.80	9
241		P27	0.00	0.00	100.00	97.50	84.30	0.00	48.30	0.00	18.00	0.00	5.60	5.51	5.80	9
242		P28	0.00	0.00	100.00	98.90	88.10	0.00	50.30	0.00	20.60	0.00	7.70	5.52	6.10	9
243		P29	0.00	0.00	100.00	98.50	87.50	0.00	47.20	0.00	17.50	0.00	5.40	5.71	6.10	9
244		A1	0.00	0.00	100.00	98.70	86.10	62.30	48.90	39.20	20.90	12.60	7.20	5.62	5.10	9
245		A4	0.00	0.00	100.00	98.60	85.40	59.70	46.80	37.80	20.40	12.40	7.30	5.47	5.30	9
246		B3	0.00	0.00	100.00	98.20	86.90	61.20	48.00	38.20	20.20	12.50	7.30	5.83	6.60	9
247		B5	0.00	0.00	100.00	99.30	86.50	60.40	47.00	37.60	20.10	12.40	7.40	5.32	5.80	9
248		C2	0.00	0.00	100.00	99.10	86.90	61.80	47.90	38.70	20.30	12.50	7.40	6.01	5.20	9
249		C5	0.00	0.00	100.00	98.20	87.20	61.70	47.50	37.90	20.00	12.40	7.40	5.58	5.50	9
250		D2	0.00	0.00	100.00	98.30	85.90	61.00	46.90	36.90	19.10	12.00	7.50	5.53	4.80	9
251		D3	0.00	0.00	100.00	98.50	83.20	59.00	46.60	37.60	20.40	12.50	7.40	5.29	6.70	9
252		E1	0.00	0.00	100.00	99.40	86.70	62.70	48.60	38.90	20.50	12.40	7.20	5.65	5.50	9
253		E4	0.00	0.00	100.00	96.90	87.10	60.50	47.30	37.60	19.60	12.00	7.10	5.66	4.80	9

Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
188	TSAP-FR-104-1(27)CT2	A1	100.00	95.50	75.30	62.40	55.40	40.90	31.90	26.80	16.60	10.60	5.80	3.80	11.00	8
189		B3	100.00	94.20	83.80	71.60	65.80	49.70	38.60	32.10	19.50	12.30	6.80	4.40	6.90	8
190		B5	100.00	97.50	87.10	75.20	67.00	51.10	39.60	32.90	19.70	12.50	7.00	4.60	7.60	8
191		C2	100.00	94.70	84.30	68.30	61.90	46.70	35.80	29.80	17.90	11.10	6.00	4.40	6.10	8
192		C5	100.00	98.20	86.90	73.90	66.60	51.50	39.50	32.60	18.90	11.70	6.20	4.90	5.40	8
193		D2	100.00	97.90	87.60	72.60	65.30	51.50	39.90	32.90	19.60	12.40	6.70	4.60	7.70	8
194		D3	100.00	93.40	78.50	67.20	61.30	48.80	38.00	31.10	18.30	11.60	6.30	3.30	6.80	8
195		E1	100.00	96.30	91.00	78.70	72.20	55.80	43.40	35.50	20.80	13.00	7.10	5.00	5.40	8
196		B4	100.00	97.40	79.90	58.20	49.60	36.50	28.70	24.40	15.30	9.80	5.50	3.50	10.10	8
197		D4	100.00	97.20	75.30	56.70	49.00	35.70	28.00	23.50	14.80	9.60	5.30	3.30	6.90	8
198		E5	100.00	88.00	68.80	47.10	38.90	28.90	22.70	19.20	12.20	7.90	4.30	2.70	11.80	8
199		P1	100.00	100.00	0.00	71.10	0.00	0.00	34.40	0.00	0.00	0.00	5.80	4.41		8
200		P2	100.00	100.00	0.00	76.20	0.00	0.00	35.90	0.00	0.00	0.00	6.10	4.57		8
201		P3	100.00	96.80	0.00	70.30	0.00	0.00	35.00	0.00	0.00	0.00	6.20	4.33		8
202		P4	100.00	100.00	0.00	70.10	0.00	0.00	37.40	0.00	0.00	0.00	6.30	4.34		8
203		P5	100.00	97.30	0.00	68.80	0.00	0.00	32.60	0.00	0.00	0.00	5.30	4.18		8
204		P6	100.00	98.40	0.00	74.90	0.00	0.00	38.60	0.00	0.00	0.00	6.20	4.59		8
205		P7	100.00	96.20	0.00	68.00	0.00	0.00	36.60	0.00	0.00	0.00	6.10	4.45		8
206		P8	100.00	98.70	0.00	70.60	0.00	0.00	36.20	0.00	0.00	0.00	5.20	4.51		8
207		P9	100.00	100.00	0.00	71.20	0.00	0.00	34.30	0.00	0.00	0.00	5.80	3.99		8
208		P10	100.00	98.50	0.00	69.00	0.00	0.00	32.30	0.00	0.00	0.00	5.50	4.19		8
209		P11	100.00	100.00	0.00	77.40	0.00	0.00	40.30	0.00	0.00	0.00	5.40	4.77		8
210		P12	100.00	98.50	0.00	75.70	0.00	0.00	37.10	0.00	0.00	0.00	5.90	4.51		8
211		P13	100.00	98.70	0.00	75.60	0.00	0.00	37.70	0.00	0.00	0.00	6.30	4.40		8
212		P14	100.00	98.70	0.00	68.40	0.00	0.00	32.50	0.00	0.00	0.00	5.70	4.69		8
213		P15	100.00	98.60	0.00	75.10	0.00	0.00	40.00	0.00	0.00	0.00	5.60	4.64		8
214		P16	100.00	97.50	0.00	69.50	0.00	0.00	35.20	0.00	0.00	0.00	5.70	4.29		8

Record#	JOBNAME	TEST	SS1 5	SS1	SS3 4	SS1 2	SS3 8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
146	ZB-FR-26-2(51)CT.1	A1	0.00	100.00	98.30	77.10	62.70	46.10	36.00	25.60	13.80	8.40	4.90	4.71	5.90	7
147		A4	0.00	100.00	99.40	84.40	72.30	54.30	42.10	29.40	15.40	9.40	5.40	5.33	1.80	7
148		B3	0.00	100.00	98.20	81.50	67.90	51.70	40.00	28.10	14.70	9.40	5.60	5.17	5.00	7
149		B5	0.00	100.00	98.80	81.50	69.90	53.30	40.80	28.30	14.70	9.30	5.50	5.20	3.90	7
150		C2	0.00	100.00	98.60	81.00	65.20	49.10	38.10	26.80	14.10	8.60	5.00	4.97	4.90	7
151		C5	0.00	100.00	97.90	81.40	68.90	51.10	39.50	27.60	14.50	8.80	5.10	5.08	3.60	7
152		D2	0.00	100.00	97.60	78.10	68.70	51.70	39.70	27.70	14.80	9.10	5.30	4.91	4.60	7
153		D3	0.00	100.00	97.80	81.40	69.90	55.80	42.80	29.60	15.70	9.90	5.90	5.11	3.30	7
154		E1	0.00	100.00	95.60	77.00	64.30	48.30	37.80	26.70	14.20	8.80	5.20	4.81	5.30	7
155		E4	0.00	100.00	98.80	82.40	70.20	53.10	40.90	28.40	15.10	9.30	5.40	5.07	5.30	7
156		S1	0.00	100.00	96.70	70.40	56.60	38.20	30.50	22.20	12.20	7.50	4.30	4.42	6.10	7
157		S2	0.00	100.00	95.10	66.70	52.30	37.80	29.60	21.60	12.00	7.50	4.40	3.99	9.20	7
158		S3	0.00	100.00	95.00	68.90	55.40	39.50	31.30	22.80	12.50	7.70	4.40	4.50	4.70	7
159		S4	0.00	100.00	98.50	72.30	53.00	36.60	28.80	21.20	11.90	7.40	4.30	4.18	5.80	7
160		P1	0.00	100.00	97.60	0.00	62.40	0.00	35.40	0.00	0.00	0.00	4.80	4.94	6.10	7
161		P2	0.00	100.00	96.40	0.00	67.20	0.00	38.20	0.00	0.00	0.00	5.00	5.27	6.10	7
162		P3	0.00	100.00	97.20	0.00	61.80	0.00	35.10	0.00	0.00	0.00	4.70	4.70	6.10	7
163		P4	0.00	100.00	98.60	0.00	63.80	0.00	40.00	0.00	0.00	0.00	5.10	4.92	6.20	7
164		P5	0.00	100.00	98.90	0.00	70.00	0.00	41.40	0.00	0.00	0.00	4.40	5.21	6.20	7
165		P6	0.00	100.00	99.50	0.00	66.60	0.00	40.80	0.00	0.00	0.00	4.40	5.23	6.20	7
166		P7	0.00	100.00	98.40	0.00	64.80	0.00	35.60	0.00	0.00	0.00	4.90	5.25	6.00	7
167		P8	0.00	100.00	98.30	0.00	64.30	0.00	36.00	0.00	0.00	0.00	4.90	4.92	6.00	7
168		P9	0.00	100.00	98.80	0.00	67.80	0.00	39.80	0.00	0.00	0.00	4.90	5.06	6.00	7
169		P10	0.00	100.00	97.50	0.00	63.20	0.00	36.90	0.00	0.00	0.00	5.40	5.08	6.00	7
170		P11	0.00	100.00	98.20	0.00	65.00	0.00	37.30	0.00	0.00	0.00	4.90	5.21	6.60	7
171		P12	0.00	100.00	98.50	0.00	67.00	0.00	39.40	0.00	0.00	0.00	5.10	5.01	6.60	7
172		P13	0.00	100.00	99.30	0.00	67.70	0.00	39.60	0.00	0.00	0.00	5.30	4.96	6.60	7
173		P14	0.00	100.00	97.80	0.00	70.10	0.00	40.90	0.00	0.00	0.00	5.20	5.01	6.50	7
174		P15	0.00	100.00	98.40	0.00	67.80	0.00	40.60	0.00	0.00	0.00	5.00	5.08	6.50	7
175		P16	0.00	100.00	98.40	0.00	65.70	0.00	40.40	0.00	0.00	0.00	5.10	4.92	6.50	7
176		P17	0.00	100.00	100.00	0.00	70.00	0.00	42.60	0.00	0.00	0.00	5.40	5.34	6.50	7
177		P18	0.00	100.00	97.50	0.00	67.30	0.00	39.10	0.00	0.00	0.00	5.40	5.05	5.60	7
178		P19	0.00	100.00	97.60	0.00	67.80	0.00	38.90	0.00	0.00	0.00	5.40	4.83	5.60	7
179		P20	0.00	100.00	97.50	0.00	62.70	0.00	38.30	0.00	0.00	0.00	5.10	5.13	5.60	7
180		P21	0.00	100.00	98.10	0.00	65.30	0.00	37.20	0.00	0.00	0.00	5.20	4.82	5.60	7
181		P22	0.00	100.00	98.30	0.00	68.80	0.00	40.10	0.00	0.00	0.00	5.50	5.00		7
182		P23	0.00	100.00	98.50	0.00	67.80	0.00	38.20	0.00	0.00	0.00	5.20	5.07		7
183		P24	0.00	100.00	99.60	0.00	64.90	0.00	37.40	0.00	0.00	0.00	5.00	4.88	6.10	7
184		P25	0.00	100.00	98.50	0.00	61.10	0.00	35.80	0.00	0.00	0.00	4.50	4.87	6.10	7
185		P26	0.00	100.00	98.10	0.00	65.80	0.00	38.70	0.00	0.00	0.00	5.00	4.91	6.10	7
186		P27	0.00	100.00	98.00	0.00	62.30	0.00	36.90	0.00	0.00	0.00	4.60	4.89	4.80	7
187		P28	0.00	100.00	98.00	0.00	67.20	0.00	39.40	0.00	0.00	0.00	5.50	4.99	4.80	7

Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
129	BRF-5-3(12)	A1	0.00	100.00	100.00	0.00	70.00	0.00	44.00	0.00	18.90	0.00	6.60	4.97	6.10	6
130	BRF-5-3(12)	A4	0.00	100.00	96.90	0.00	67.80	0.00	41.40	0.00	17.70	0.00	6.20	4.88	6.90	6
131	BRF-5-3(12)	B3	0.00	100.00	98.80	0.00	67.70	0.00	42.90	0.00	18.60	0.00	6.60	4.97	6.40	6
132	BRF-5-3(12)	B5	0.00	100.00	96.20	0.00	63.30	0.00	40.20	0.00	17.30	0.00	5.70	4.80	7.80	6
133	BRF-5-3(12)	C2	0.00	100.00	96.00	0.00	52.90	0.00	29.60	0.00	13.50	0.00	5.10	3.84	11.00	6
134	BRF-5-3(12)	C5	0.00	100.00	98.80	0.00	71.60	0.00	41.90	0.00	17.40	0.00	6.20	4.91	7.40	6
135	BRF-5-3(12)	D2	0.00	100.00	94.60	0.00	70.80	0.00	43.50	0.00	17.80	0.00	6.30	4.78	6.90	6
136	BRF-5-3(12)	D3	0.00	100.00	99.30	0.00	69.20	0.00	41.80	0.00	17.80	0.00	6.10	4.88	5.50	6
137	BRF-5-3(12)	E1	0.00	100.00	98.90	0.00	75.20	0.00	48.40	0.00	19.30	0.00	6.80	5.23	7.30	6
138	BRF-5-3(12)	E4	0.00	100.00	93.40	0.00	73.20	0.00	43.60	0.00	17.80	0.00	6.40	5.03	7.30	6
139	BRF-5-3(12)	S1	0.00	100.00	98.70	0.00	60.70	0.00	36.60	0.00	16.10	0.00	5.70	4.40	8.40	6
140	BRF-5-3(12)	S2	0.00	100.00	95.80	0.00	61.80	0.00	36.50	0.00	15.70	0.00	5.50	4.37	9.30	6
141	BRF-5-3(12)	S3	0.00	100.00	93.80	0.00	53.90	0.00	18.30	0.00	13.80	0.00	4.70	3.91	11.00	6
142	BRF-5-3(12)	S4	0.00	100.00	92.50	0.00	56.00	0.00	32.50	0.00	0.00	0.00	5.20	3.76	9.30	6
143	BRF-5-3(12)	S5	0.00	100.00	95.50	0.00	46.30	0.00	25.10	0.00	11.70	0.00	4.00	3.17		6
144	BRF-5-3(12)	S6	0.00	100.00	98.90	0.00	42.30	0.00	24.60	0.00	12.00	0.00	4.40	3.12		6
145	BRF-5-3(12)	S7	0.00	100.00	90.90	0.00	52.60	0.00	21.80	0.00	10.90	0.00	4.10	2.82		6

Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS
75	ZB-FR-7-4(37)CT.3	A1	0.00	0.00	100.00	98.80	90.10	65.10	53.60	43.60	23.50	12.50	7.20	6.33	9.13
76	ZB-FR-7-4(37)CT.3	A4	0.00	0.00	100.00	97.40	85.70	61.60	51.50	42.40	22.90	12.20	7.10	5.85	8.31
77	ZB-FR-7-4(37)CT.3	B3	0.00	0.00	100.00	98.80	89.30	63.80	53.00	43.30	23.40	12.50	7.60	5.49	7.45
78	ZB-FR-7-4(37)CT.3	B5	0.00	0.00	100.00	98.80	88.70	62.90	52.30	43.00	23.30	12.70	7.40	5.50	10.27
79	ZB-FR-7-4(37)CT.3	C2	0.00	0.00	100.00	98.60	90.10	60.30	50.00	44.10	21.90	11.30	6.50	6.15	7.58
80	ZB-FR-7-4(37)CT.3	C5	0.00	0.00	100.00	98.70	89.20	62.80	51.50	42.00	22.80	12.30	7.20	6.34	7.62
81	ZB-FR-7-4(37)CT.3	D2	0.00	0.00	100.00	97.30	84.40	52.30	42.70	35.30	19.50	10.50	6.40	4.90	10.07
82	ZB-FR-7-4(37)CT.3	D3	0.00	0.00	100.00	98.20	85.00	57.20	47.10	38.70	21.10	11.40	6.60	5.23	9.94
83	ZB-FR-7-4(37)CT.3	E1	0.00	0.00	100.00	98.90	90.20	63.60	52.30	42.60	22.50	11.70	6.60	6.28	8.31
84	ZB-FR-7-4(37)CT.3	E4	0.00	0.00	100.00	97.30	89.20	61.60	50.80	41.40	22.10	11.70	6.80	5.95	7.09
85	ZB-FR-7-4(37)CT.3	P1	0.00	0.00	100.00	98.60	87.70	0.00	44.40	0.00	20.20	0.00	7.20	5.33	0.00
86	ZB-FR-7-4(37)CT.3	P2	0.00	0.00	100.00	99.20	88.90	0.00	41.30	0.00	19.40	0.00	7.10	5.26	0.00
87	ZB-FR-7-4(37)CT.3	P3	0.00	0.00	100.00	99.50	86.70	0.00	45.40	0.00	20.30	0.00	7.10	5.24	0.00
88	ZB-FR-7-4(37)CT.3	P4	0.00	0.00	100.00	97.90	87.90	0.00	53.90	0.00	23.60	0.00	7.70	5.50	0.00
89	ZB-FR-7-4(37)CT.3	P5	0.00	0.00	100.00	99.30	88.70	0.00	47.90	0.00	19.50	0.00	6.20	5.32	0.00
90	ZB-FR-7-4(37)CT.3	S1	0.00	0.00	100.00	97.70	85.60	59.30	49.30	40.30	21.50	11.40	6.60	6.08	8.19
91	ZB-FR-7-4(37)CT.3	S2	0.00	0.00	100.00	98.80	86.10	58.70	48.80	40.10	21.30	11.20	6.50	5.69	8.19
92	ZB-FR-7-4(37)CT.3	S3	0.00	0.00	100.00	98.00	89.80	65.10	54.50	44.60	23.70	12.60	7.50	6.49	8.47
93	ZB-FR-7-4(37)CT.3	S4	0.00	0.00	100.00	96.80	80.20	50.00	44.00	34.00	18.70	9.60	5.50	5.33	9.70

Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
56	EDS-TSAP-38(85)CT.1	A1	0.00	100.00	98.30	80.40	66.90	51.00	38.90	29.00	16.30	9.40	5.90	5.01	4.48	4
57	EDS-TSAP-38(85)CT.1	A4	0.00	100.00	99.20	78.20	64.30	48.90	37.20	28.00	15.80	9.10	5.70	4.93	5.14	4
58	EDS-TSAP-38(85)CT.1	B3	0.00	100.00	97.80	78.30	64.20	48.30	37.00	27.40	15.60	9.30	5.80	4.85	3.94	4
59	EDS-TSAP-38(85)CT.1	B5	0.00	100.00	97.50	82.90	69.30	52.50	39.90	29.50	16.50	9.50	5.90	5.36	5.73	4
60	EDS-TSAP-38(85)CT.1	C2	0.00	100.00	98.20	81.00	65.30	48.70	37.60	28.10	16.00	9.40	5.10	4.83	7.74	4
61	EDS-TSAP-38(85)CT.1	C5	0.00	100.00	98.60	78.50	64.10	48.70	37.60	28.10	15.80	9.20	5.70	4.87	9.32	4
62	EDS-TSAP-38(85)CT.1	D2	0.00	100.00	97.40	79.10	65.40	49.90	38.60	29.90	17.70	10.80	7.20	5.00	5.96	4
63	EDS-TSAP-38(85)CT.1	D3	0.00	100.00	99.40	80.10	67.20	52.30	40.40	30.90	18.00	11.10	7.20	5.33	5.72	4
64	EDS-TSAP-38(85)CT.1	E1	0.00	100.00	99.60	80.20	66.80	50.10	38.80	29.80	17.40	10.70	7.00	5.03	5.40	4
65	EDS-TSAP-38(85)CT.1	E4	0.00	100.00	98.90	80.20	64.20	47.20	36.20	28.00	16.90	10.60	7.00	4.77	10.31	4
66	EDS-TSAP-38(85)CT.1	S1	0.00	100.00	97.90	76.70	60.20	43.50	33.50	0.00	14.90	0.00	5.40	4.66	9.31	4
67	EDS-TSAP-38(85)CT.1	S2	0.00	100.00	99.50	69.90	46.10	30.60	24.30	0.00	12.10	0.00	4.60	3.73	11.00	4
68	EDS-TSAP-38(85)CT.1	S3	0.00	100.00	100.00	81.80	66.40	47.70	36.50	0.00	16.00	0.00	5.90	5.00	9.00	4
69	EDS-TSAP-38(85)CT.1	S4	0.00	100.00	99.50	71.20	52.00	37.50	29.50	0.00	14.20	0.00	5.50	4.06	11.63	4
70	EDS-TSAP-38(85)CT.1	P1	0.00	100.00	99.30	0.00	61.90	0.00	40.20	0.00	0.00	0.00	5.20	5.00	7.50	4
71	EDS-TSAP-38(85)CT.1	P2	0.00	100.00	99.50	0.00	57.40	0.00	39.10	0.00	0.00	0.00	6.10	5.00	8.10	4
72	EDS-TSAP-38(85)CT.1	P3	0.00	100.00	99.10	0.00	61.30	0.00	36.80	0.00	0.00	0.00	5.50	4.99	7.40	4
73	EDS-TSAP-38(85)CT.1	P4	0.00	100.00	99.40	0.00	63.30	0.00	37.70	0.00	0.00	0.00	5.70	5.01	7.40	4
74	EDS-TSAP-38(85)CT.1	P5	0.00	100.00	100.00	0.00	63.10	0.00	36.80	0.00	0.00	0.00	6.20	5.00	7.40	4

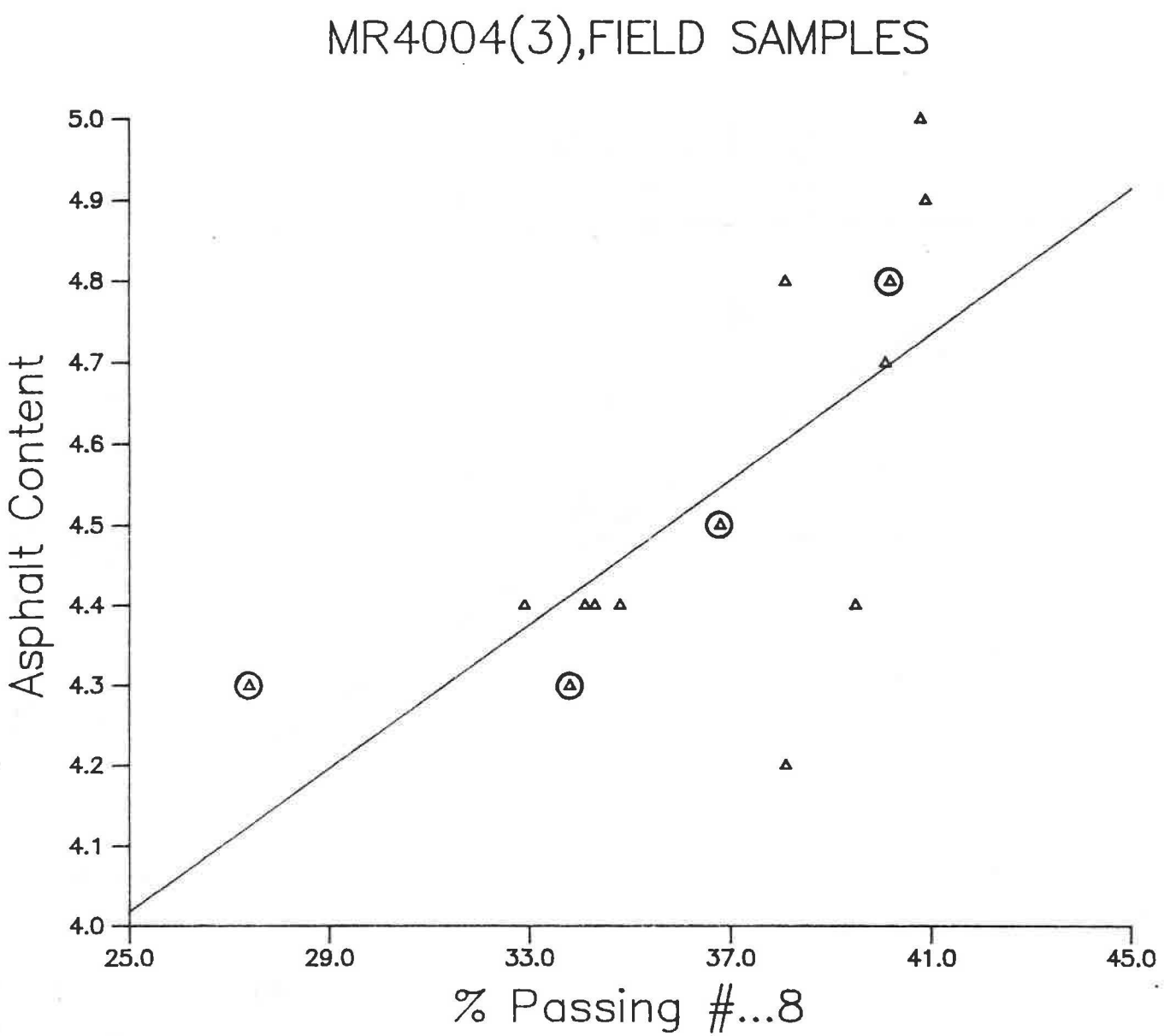
Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
40	GIP-TSAP-27(88)	P1	0.00	100.00	95.20	0.00	61.60	0.00	37.40	0.00	13.80	0.00	4.90	4.94		3
41	GIP-TSAP-27(88)	P2	0.00	100.00	96.80	0.00	62.60	0.00	36.10	0.00	16.50	0.00	5.40	4.92		3
42	GIP-TSAP-27(88)	A1	0.00	100.00	97.40	81.10	64.70	51.50	40.30	29.40	16.50	10.10	6.10	5.09	2.61	3
43	GIP-TSAP-27(88)	A4	0.00	100.00	96.60	80.30	63.20	50.90	40.00	29.30	16.40	10.00	6.00	5.02	2.97	3
44	GIP-TSAP-27(88)	B3	0.00	100.00	96.00	81.60	66.20	51.40	41.40	31.10	17.00	9.80	5.80	5.06	3.09	3
45	GIP-TSAP-27(88)	B5	0.00	100.00	93.30	76.90	63.60	50.20	40.00	30.30	16.50	9.30	5.50	6.10	3.85	3
46	GIP-TSAP-27(88)	C2	100.00	97.80	96.80	82.10	71.70	57.60	46.10	33.60	18.00	10.60	6.30	5.78	4.09	3
47	GIP-TSAP-27(88)	C5	100.00	99.10	95.50	77.80	64.20	51.10	41.00	30.40	16.30	9.50	5.60	5.27	5.09	3
48	GIP-TSAP-27(88)	D2	0.00	100.00	96.60	77.00	62.70	49.90	39.40	28.50	15.60	9.50	5.70	4.74	3.41	3
49	GIP-TSAP-27(88)	D3	100.00	98.90	95.30	78.90	65.40	51.40	41.20	29.60	16.10	9.80	5.80	5.06	3.65	3
50	GIP-TSAP-27(88)	E1	0.00	100.00	97.70	81.90	67.50	55.20	43.60	31.00	16.80	10.20	6.00	5.44	3.57	3
51	GIP-TSAP-27(88)	E4	100.00	97.10	91.80	79.70	66.80	53.80	42.80	30.80	16.80	10.10	6.00	5.32	4.57	3
52	GIP-TSAP-27(88)	S1	0.00	100.00	98.20	84.50	69.20	54.10	41.80	30.30	16.60	9.80	5.80	5.35	5.41	3
53	GIP-TSAP-27(88)	S2	0.00	100.00	95.00	76.00	63.80	49.80	39.80	29.60	16.40	9.60	5.70	4.94	3.65	3
54	GIP-TSAP-27(88)	S3	0.00	100.00	93.20	75.70	59.60	44.60	36.20	27.20	15.20	9.20	5.50	4.80	5.57	3
55	GIP-TSAP-27(88)	S4	0.00	100.00	95.30	75.60	62.60	47.20	37.70	27.70	15.30	9.30	5.60	5.05	5.53	3

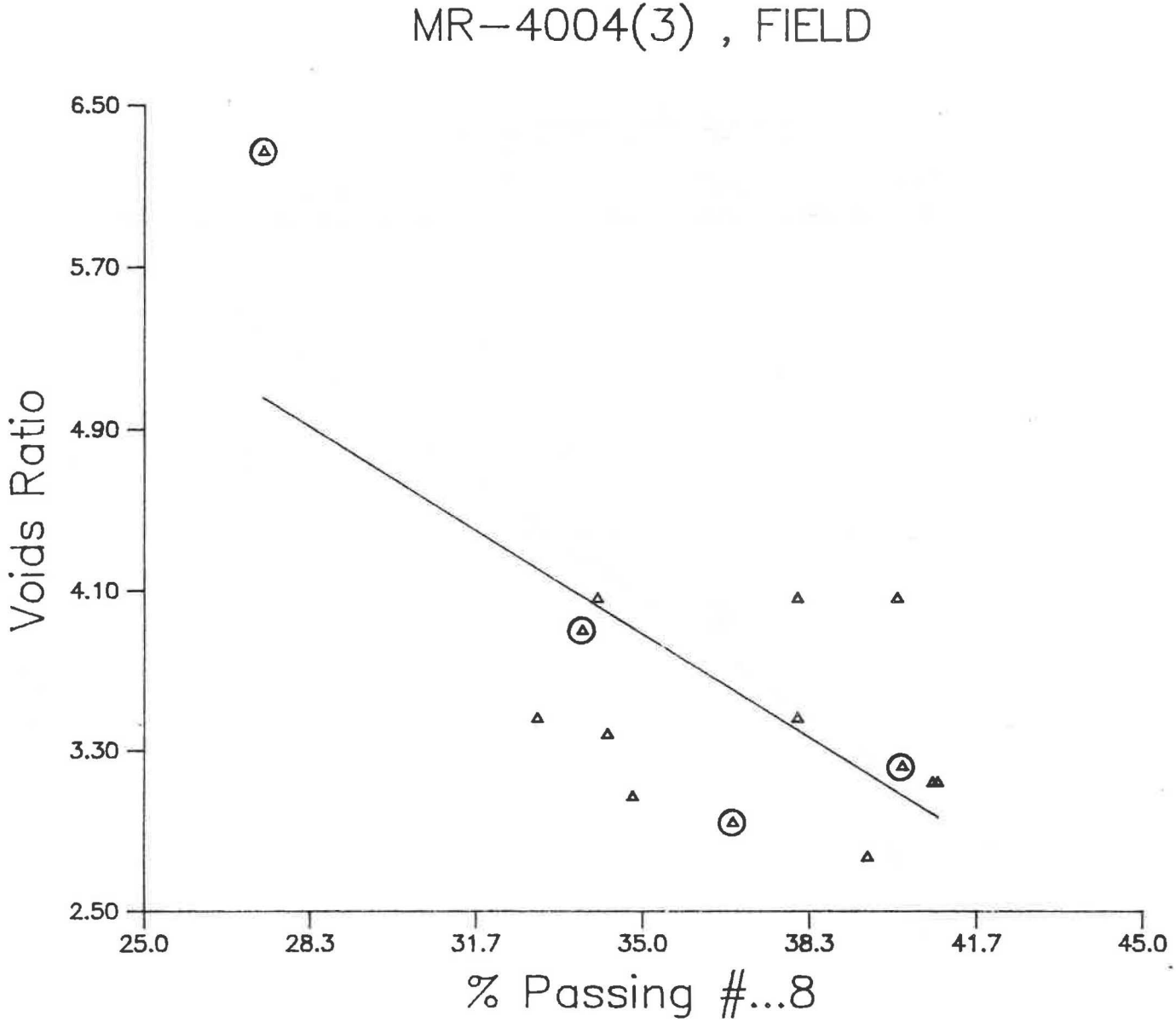
Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	S33_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS	VVVV
26	MLP-RS-1057(9)	A1	100.00	97.70	90.80	76.90	60.40	41.70	35.10	29.40	16.70	10.50	5.10	4.93	5.80	02
27	MLP-RS-1057(9)	A4	0.00	100.00	94.00	75.40	59.00	40.70	34.50	29.10	16.60	11.30	5.10	4.80	5.70	02
28	MLP-RS-1057(9)	B3	0.00	100.00	94.90	74.50	58.70	0.50	34.00	28.90	17.70	11.90	6.10	4.67	4.30	02
29	MLP-RS-1057(9)	B5	100.00	97.60	92.40	79.10	63.60	43.10	36.20	30.30	18.10	11.80	6.20	4.93	5.80	02
30	MLP-RS-1057(9)	C2	0.00	100.00	90.20	81.30	66.20	43.60	36.70	30.70	17.80	11.70	6.10	5.20	2.30	02
31	MLP-RS-1057(9)	C5	100.00	94.80	83.10	72.20	55.60	41.00	34.90	29.10	16.40	11.40	5.40	4.69	4.50	02
32	MLP-RS-1057(9)	D2	100.00	96.90	92.50	87.20	64.90	37.20	30.70	26.00	16.40	11.00	5.30	4.37	14.60	02
33	MLP-RS-1057(9)	D3	100.00	96.80	92.90	85.00	61.70	37.50	31.70	26.80	17.20	11.90	5.30	4.39	6.70	02
34	MLP-RS-1057(9)	E1	100.00	93.10	81.50	72.20	57.90	39.10	33.20	28.00	15.10	10.40	4.50	4.67	10.10	02
35	MLP-RS-1057(9)	E4	100.00	98.00	85.00	75.20	60.30	40.60	34.50	29.00	15.90	9.90	4.70	4.90	3.60	02
36	MLP-RS-1057(9)	P1	100.00	97.50	0.00	68.80	0.00	0.00	36.90	0.00	0.00	0.00	3.60	4.77		02
37	MLP-RS-1057(9)	P2	100.00	100.00	0.00	69.80	0.00	0.00	34.40	0.00	0.00	0.00	5.10	4.85		02
38	MLP-RS-1057(9)	P3	100.00	99.40	0.00	66.00	0.00	0.00	37.10	0.00	0.00	0.00	2.90	4.99		02
39	MLP-RS-1057(9)	P4	100.00	97.30	0.00	65.10	0.00	0.00	36.60	0.00	0.00	0.00	5.00	4.87		02

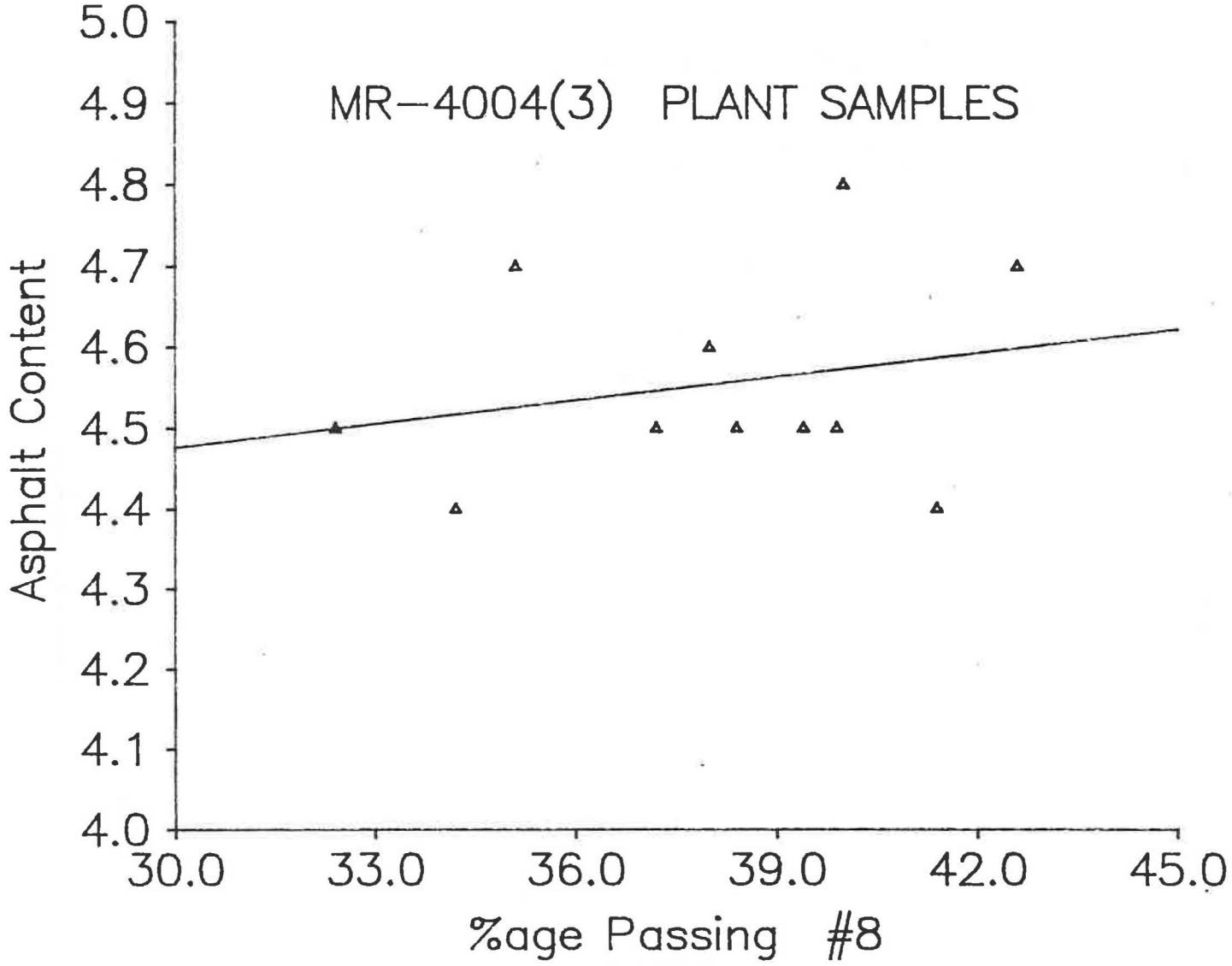
Record#	JOBNAME	TEST	SS1_5	SS1	SS3_4	SS1_2	SS3_8	SS4	SS8	SS16	SS50	SS100	SS200	AC	VOIDS
1	MR4004(3)	A1	100.00	100.00	94.40	71.90	58.60	44.90	38.10	35.10	23.10	9.20	5.60	4.80	3.46
2	MR4004(3)	A4	100.00	97.90	89.00	68.60	58.80	45.60	39.50	36.90	25.80	13.30	10.00	4.40	2.77
3	MR4004(3)	B3	100.00	98.00	91.20	65.90	55.30	40.40	34.30	31.70	20.20	7.50	4.60	4.40	3.38
4	MR4004(3)	B5	100.00	95.40	85.60	62.00	52.20	38.60	32.90	29.90	19.20	7.10	4.20	4.40	3.46
5	MR4004(3)	C2	100.00	100.00	94.40	70.40	60.10	46.70	40.10	37.00	22.90	9.10	5.80	4.70	4.06
6	MR4004(3)	C5	100.00	96.50	84.20	60.90	51.20	39.30	34.10	31.60	19.40	7.50	5.00	4.40	4.06
7	MR4004(3)	D2	100.00	100.00	94.60	71.60	61.10	47.70	40.80	37.40	23.20	8.60	5.20	5.00	3.14
8	MR4004(3)	D3	100.00	99.00	95.90	75.90	61.80	47.80	40.90	37.30	22.90	8.50	5.40	4.90	3.14
9	MR4004(3)	E1	100.00	100.00	100.00	79.60	63.40	46.20	38.10	34.90	21.70	8.20	5.20	4.20	4.06
10	MR4004(3)	E4	100.00	100.00	99.20	77.60	60.30	41.90	34.80	32.10	19.90	7.50	4.90	4.40	3.07
11	MR4004(3)	S1	100.00	100.00	91.00	72.30	57.70	41.00	33.80	30.90	19.20	6.40	3.00	4.30	3.90
12	MR4004(3)	S2	100.00	98.20	88.70	62.90	52.00	41.50	36.80	34.10	22.30	9.90	7.00	4.50	2.94
13	MR4004(3)	S3	100.00	100.00	90.00	70.50	60.90	47.20	40.20	37.00	23.10	9.20	5.70	4.80	3.22
14	MR4004(3)	S4	100.00	100.00	82.50	52.60	42.90	32.10	27.40	25.40	16.50	6.40	3.90	4.30	6.27
15	MR4004(3)	P1	100.00	95.50	0.00	65.50	0.00	0.00	39.90	0.00	0.00	0.00	4.80	4.50	4.00
16	MR4004(3)	P2	100.00	100.00	0.00	63.40	0.00	0.00	40.00	0.00	0.00	0.00	4.70	4.80	4.00
17	MR4004(3)	P3	100.00	100.00	0.00	79.80	0.00	0.00	34.20	0.00	0.00	0.00	4.30	4.40	3.80
18	MR4004(3)	P4	100.00	99.10	0.00	74.10	0.00	0.00	42.60	0.00	0.00	0.00	6.70	4.70	4.50
19	MR4004(3)	P5	100.00	96.20	0.00	68.40	0.00	0.00	38.40	0.00	0.00	0.00	4.70	4.50	4.50
20	MR4004(3)	P6	100.00	100.00	0.00	74.50	0.00	0.00	41.40	0.00	0.00	0.00	5.50	4.40	3.10
21	MR4004(3)	P7	100.00	100.00	0.00	69.50	0.00	0.00	37.20	0.00	0.00	0.00	5.10	4.50	3.10
22	MR4004(3)	P8	100.00	99.10	0.00	69.70	0.00	0.00	38.00	0.00	0.00	0.00	6.30	4.60	3.50
23	MR4004(3)	P9	100.00	98.00	0.00	69.90	0.00	0.00	39.40	0.00	0.00	0.00	5.30	4.50	3.50
24	MR4004(3)	P10	100.00	99.10	0.00	68.80	0.00	0.00	35.10	0.00	0.00	0.00	4.40	4.70	4.90
25	MR4004(3)	P11	100.00	97.60	0.00	68.40	0.00	0.00	32.40	0.00	0.00	0.00	3.80	4.50	4.90

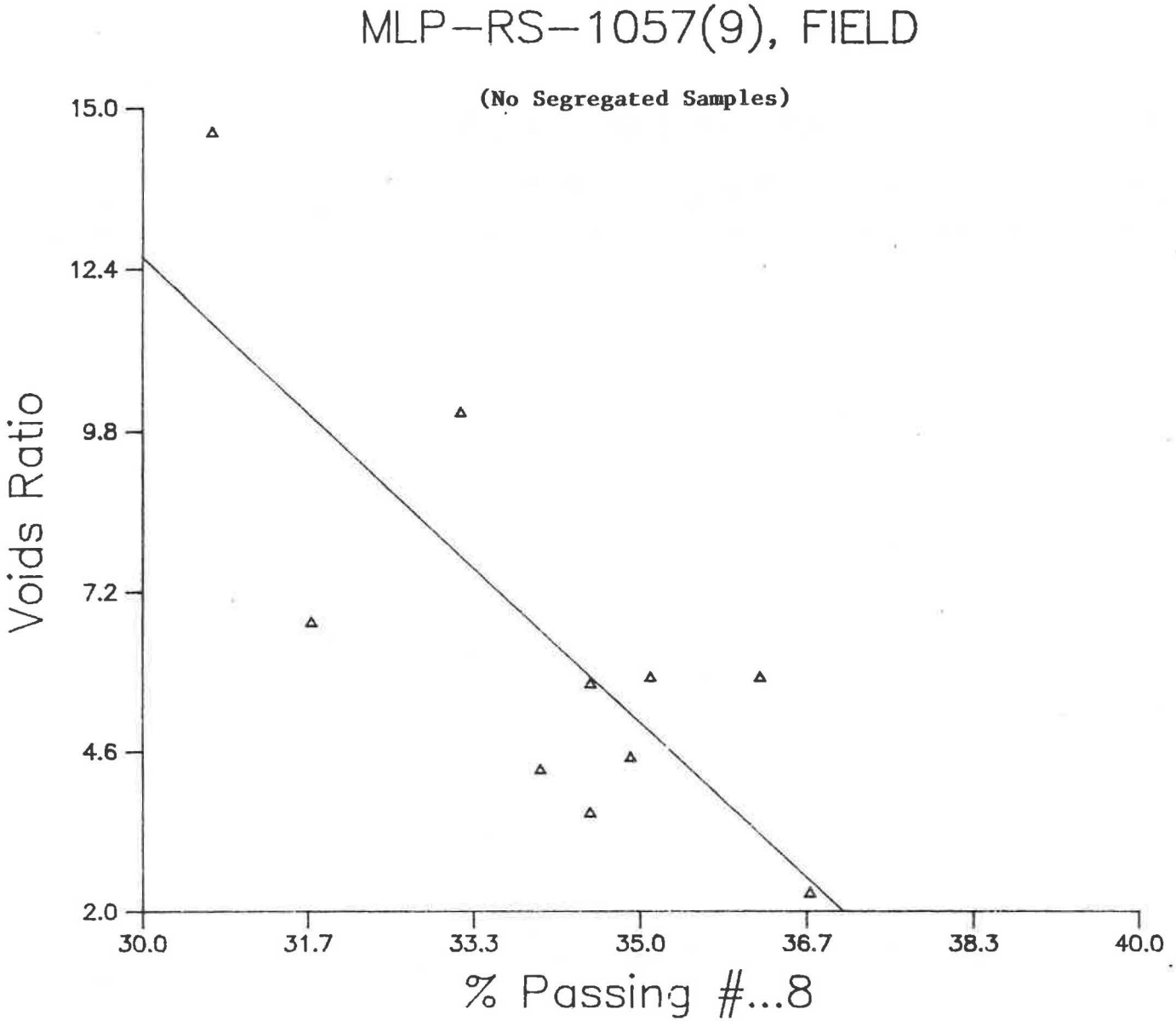
APPENDIX B

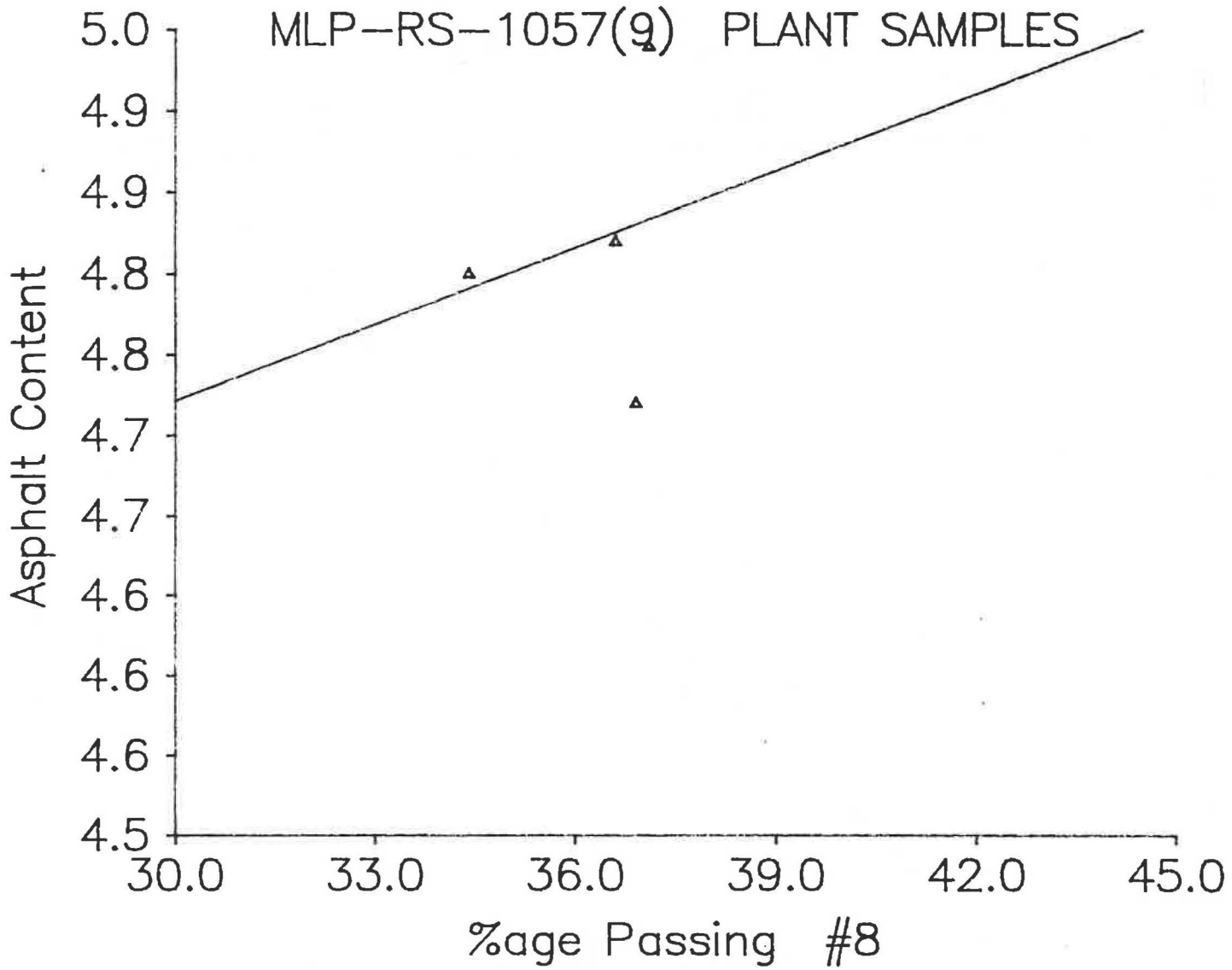
Plots of Asphalt Content and Voids Versus
Percent of Aggregate Passing No. 8 Sieve

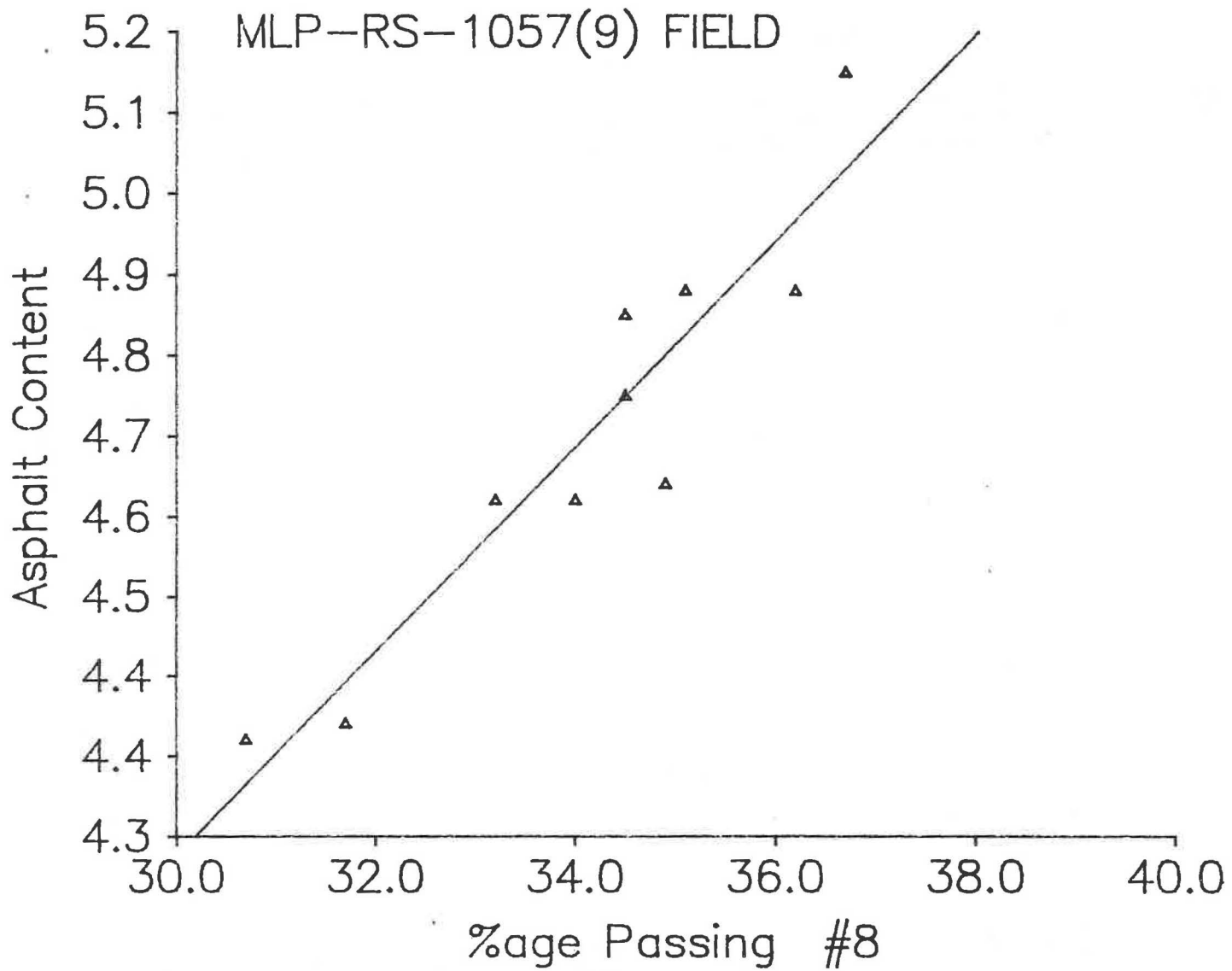

MR4004(3),FIELD SAMPLES
Asphalt Content
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
25.0
29.0
33.0
37.0
41.0
45.0
% Passing #...8

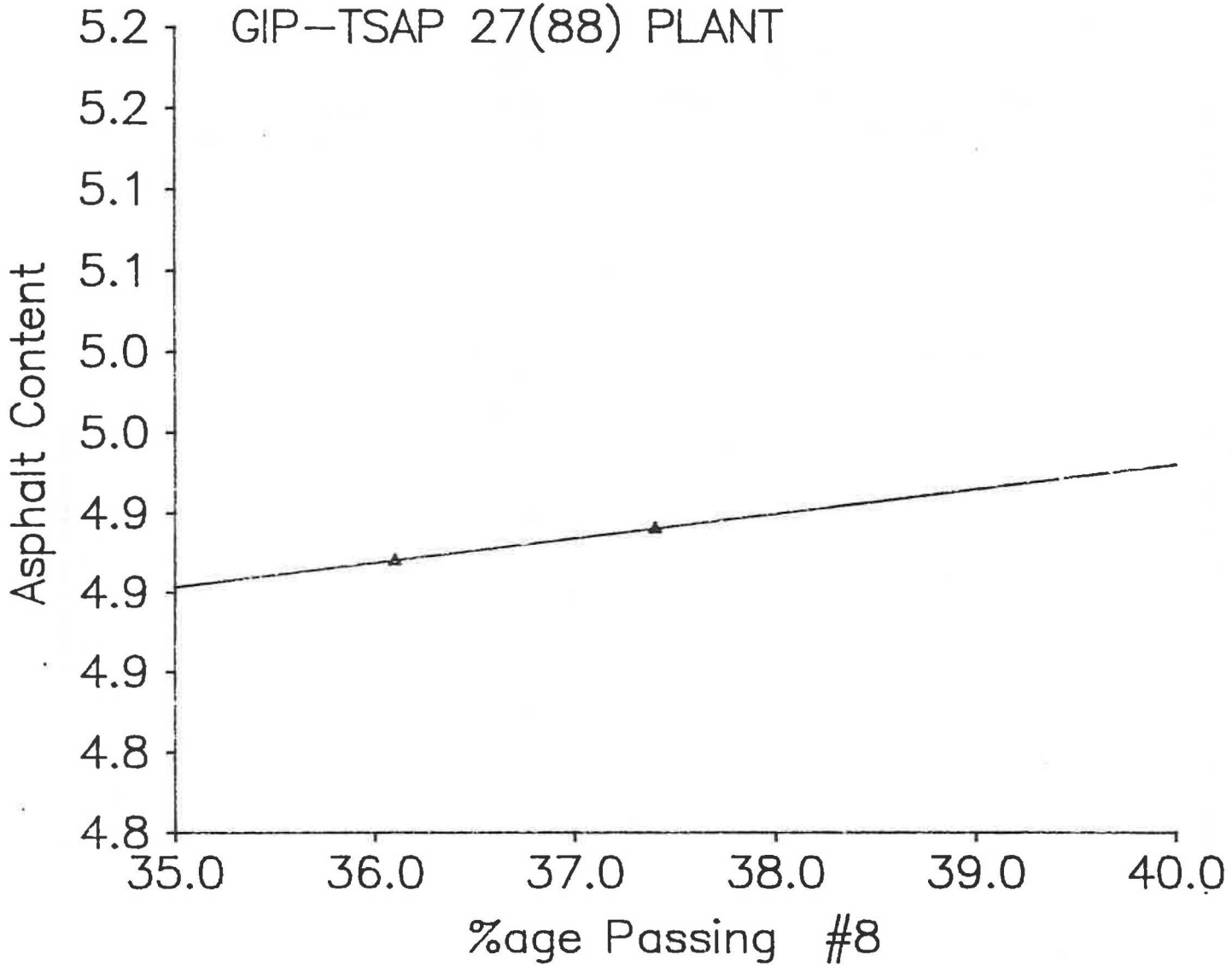

MR-4004(3) , FIELD
6.50
5.70
4.90
4.10
3.30
2.50
Voids Ratio
25.0
28.3
31.7
35.0
38.3
41.7
45.0
% Passing #...8

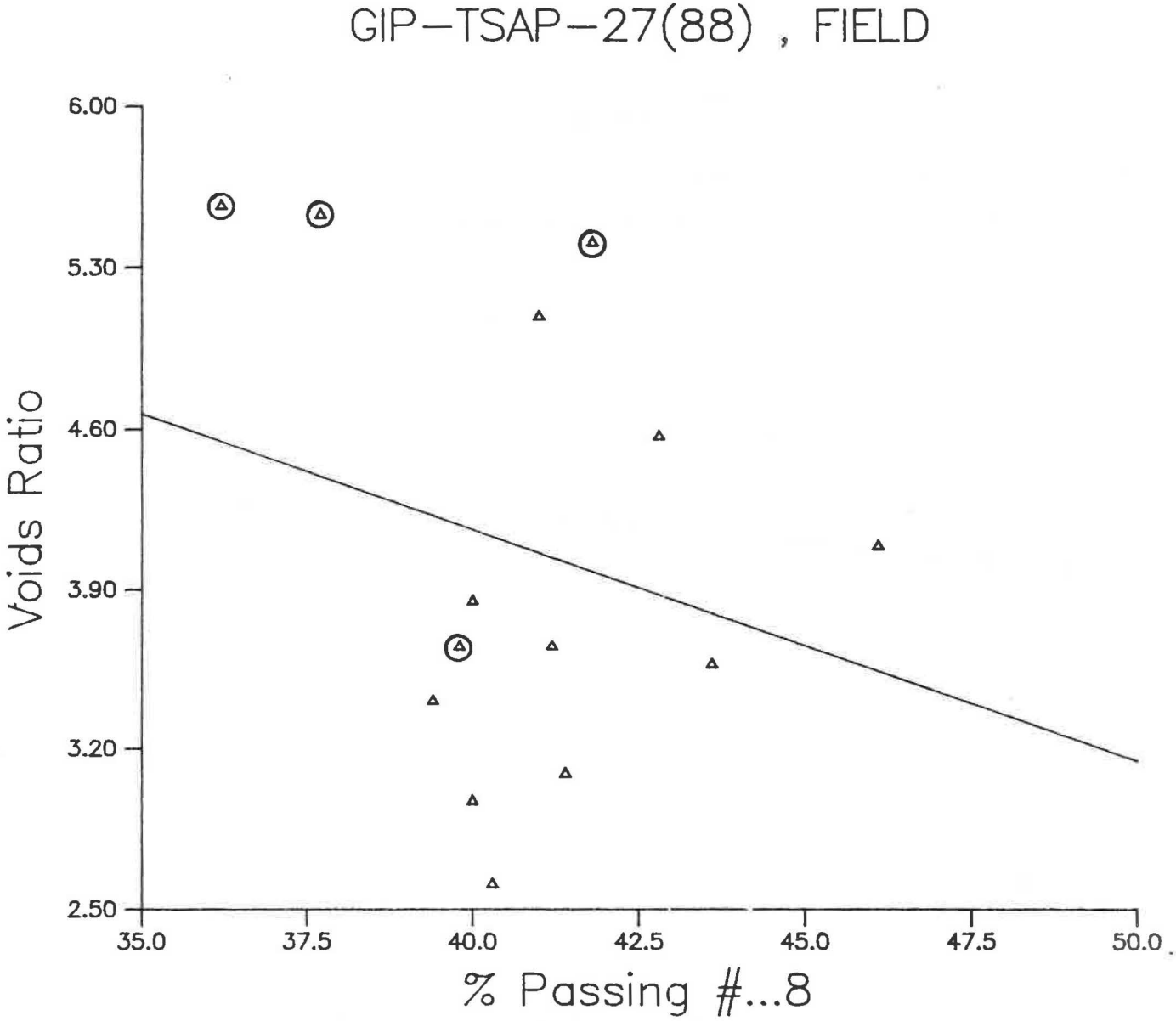

MR-4004(3) PLANT SAMPLES
Asphalt Content
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
30.0
33.0
36.0
39.0
42.0
45.0
%age Passing #8

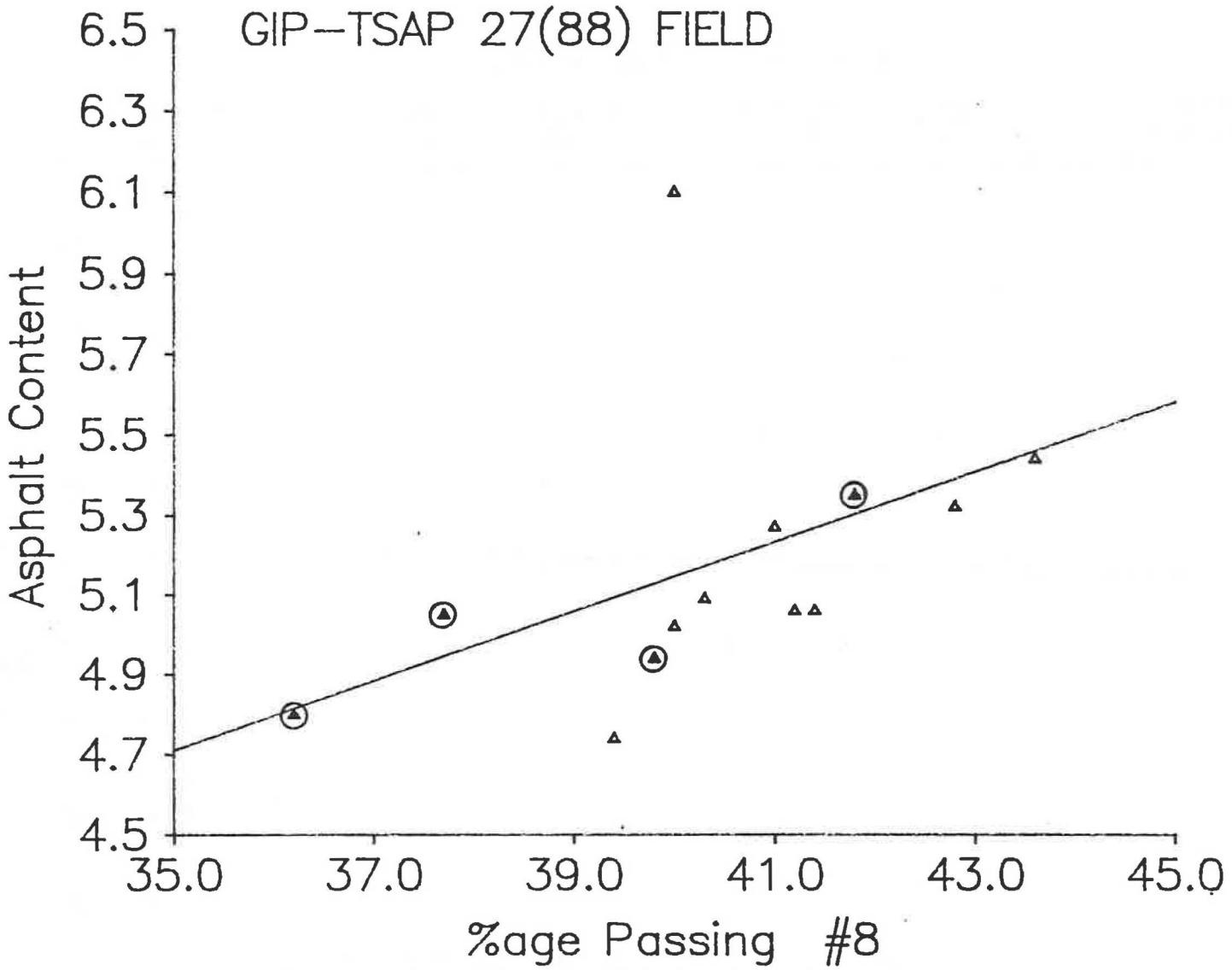

MLP–RS–1057(9), FIELD
(No Segregated Samples)
Voids Ratio
15.0
12.4
9.8
7.2
4.6
2.0
30.0
31.7
33.3
35.0
36.7
38.3
40.0
% Passing #...8
V02R

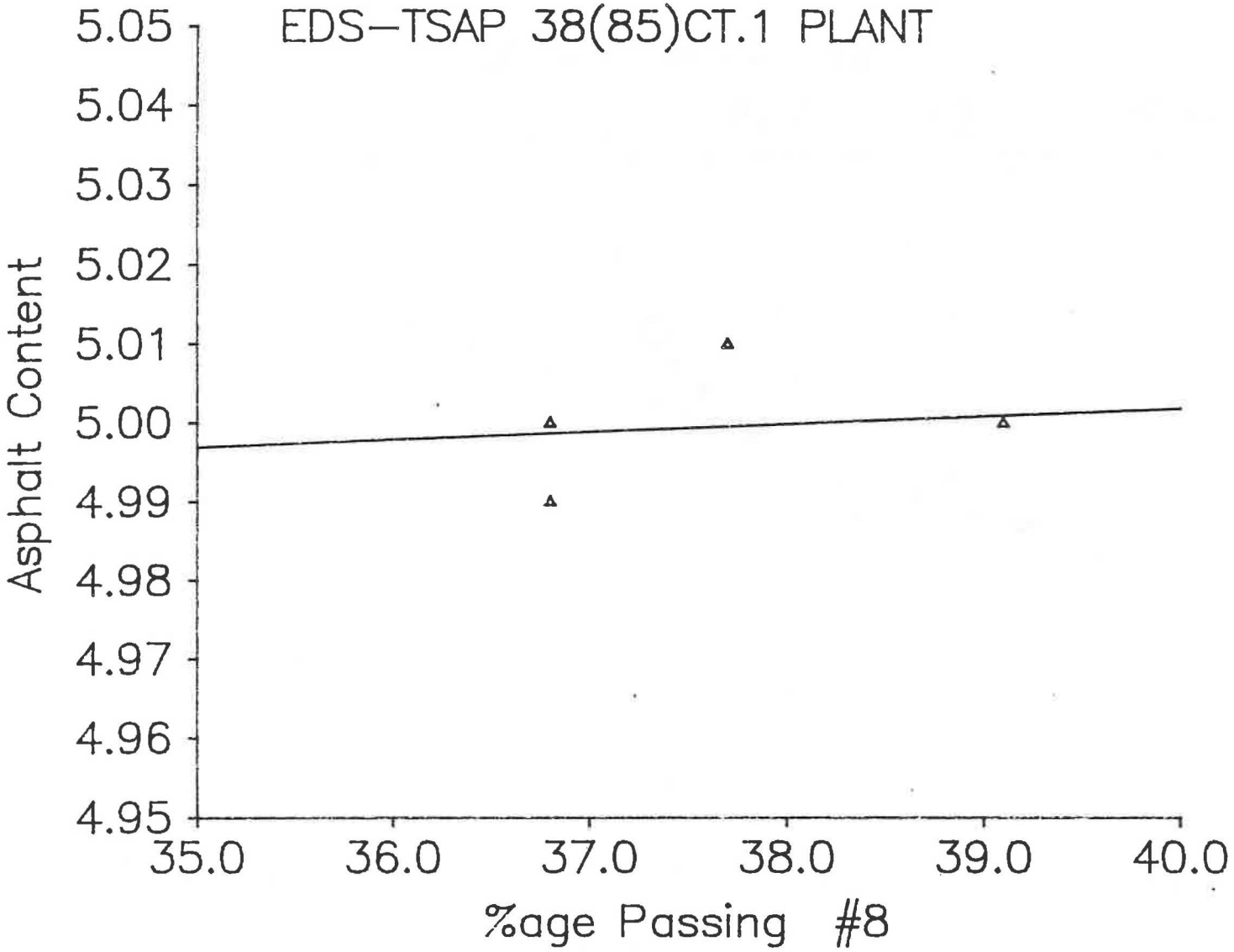

MLP-RS-1057(9) PLANT SAMPLES
Asphalt Content
5.0
4.9
4.9
4.8
4.8
4.7
4.7
4.6
4.6
4.6
4.5
30.0
33.0
36.0
39.0
42.0
45.0
%age Passing #8

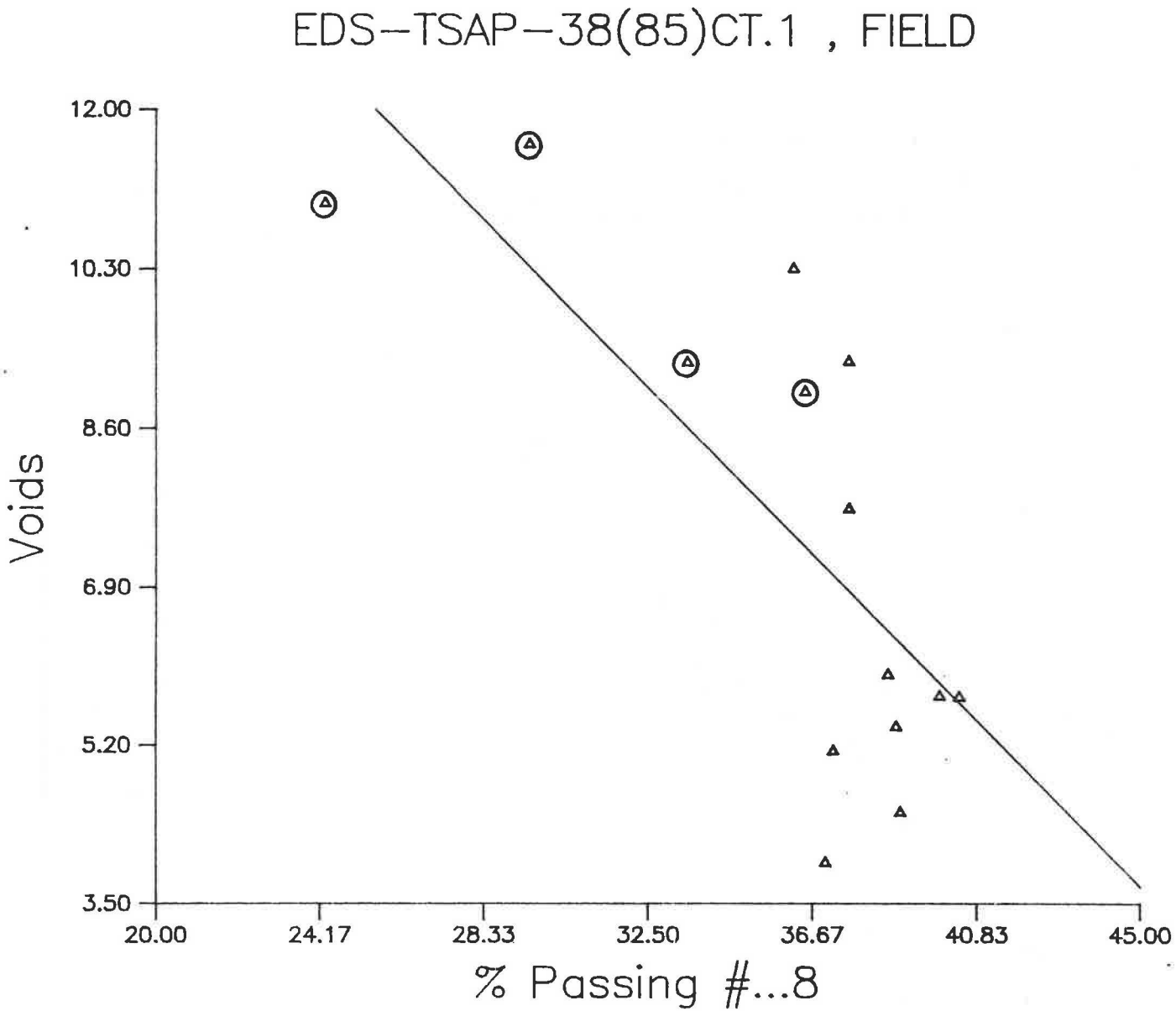

MLP-RS-1057(9) FIELD
Asphalt Content
5.2
5.1
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.4
4.3
30.0
32.0
34.0
36.0
38.0
40.0
%age Passing #8

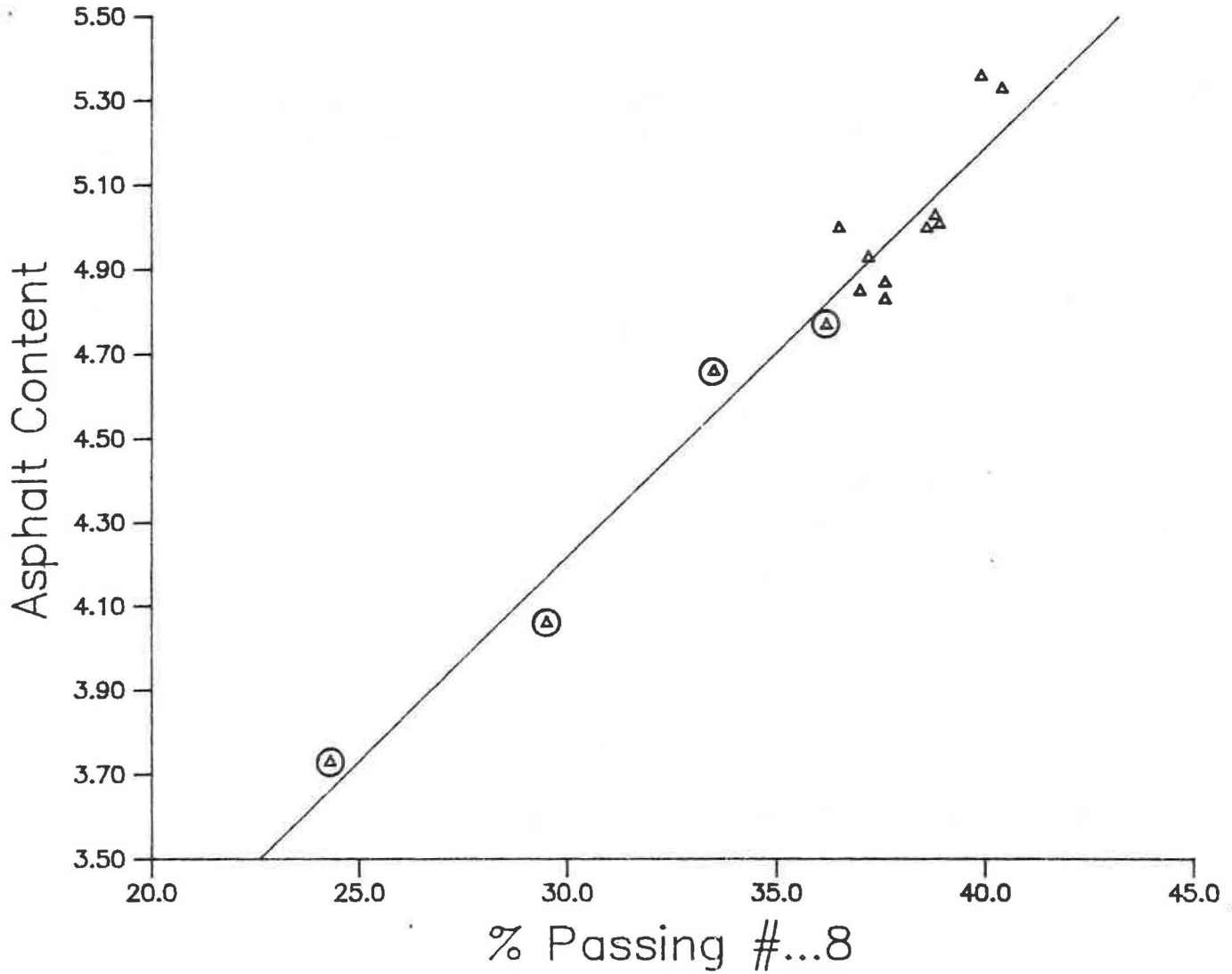

GIP–TSAP 27(88) PLANT
Asphalt Content
5.2
5.2
5.1
5.1
5.0
5.0
4.9
4.9
4.9
4.8
4.8
35.0
36.0
37.0
38.0
39.0
40.0
%age Passing #8

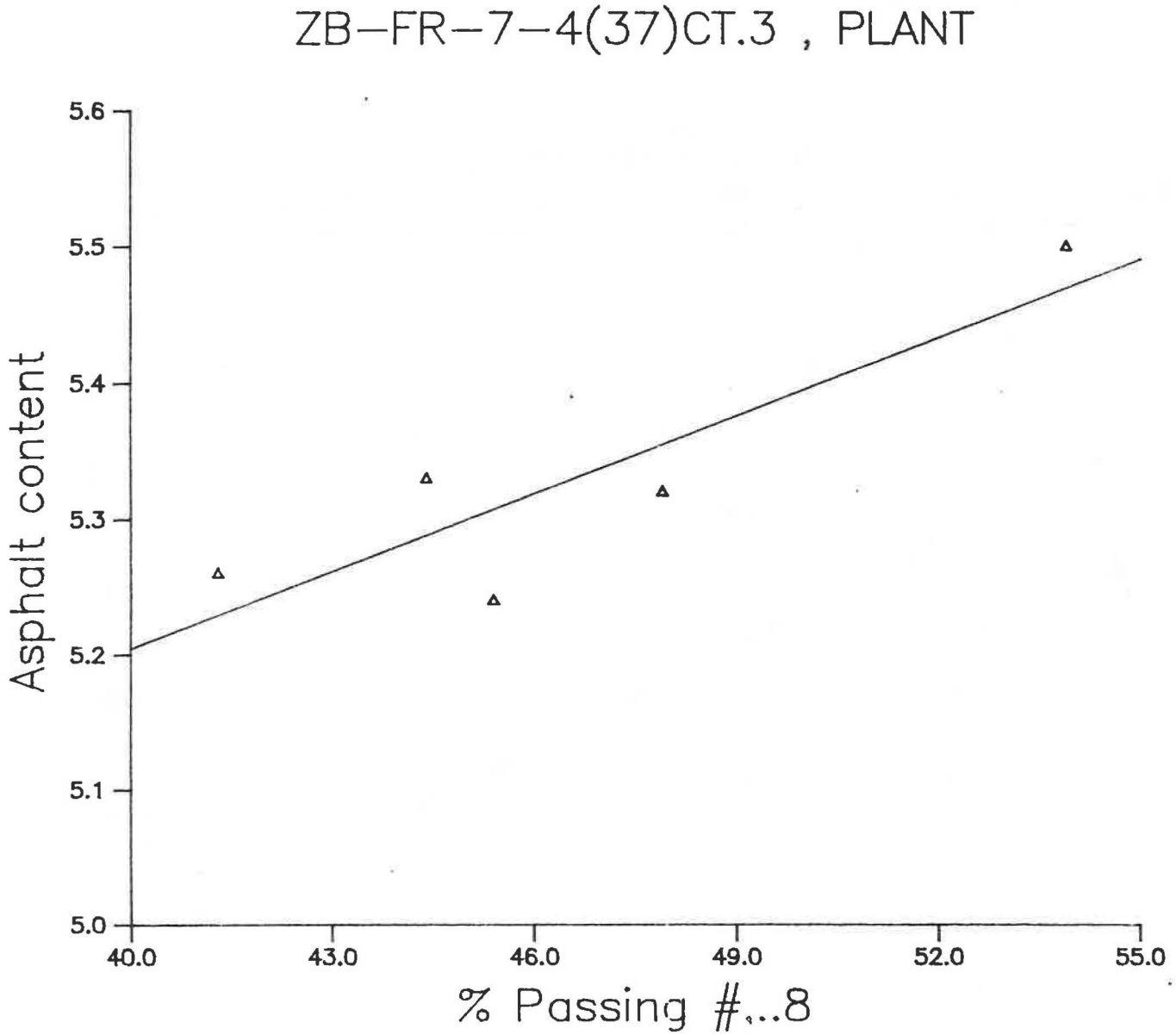

GIP-TSAP-27(88) , FIELD
Voids Ratio
6.00
5.30
4.60
3.90
3.20
2.50
35.0
37.5
40.0
42.5
45.0
47.5
50.0
% Passing #...8

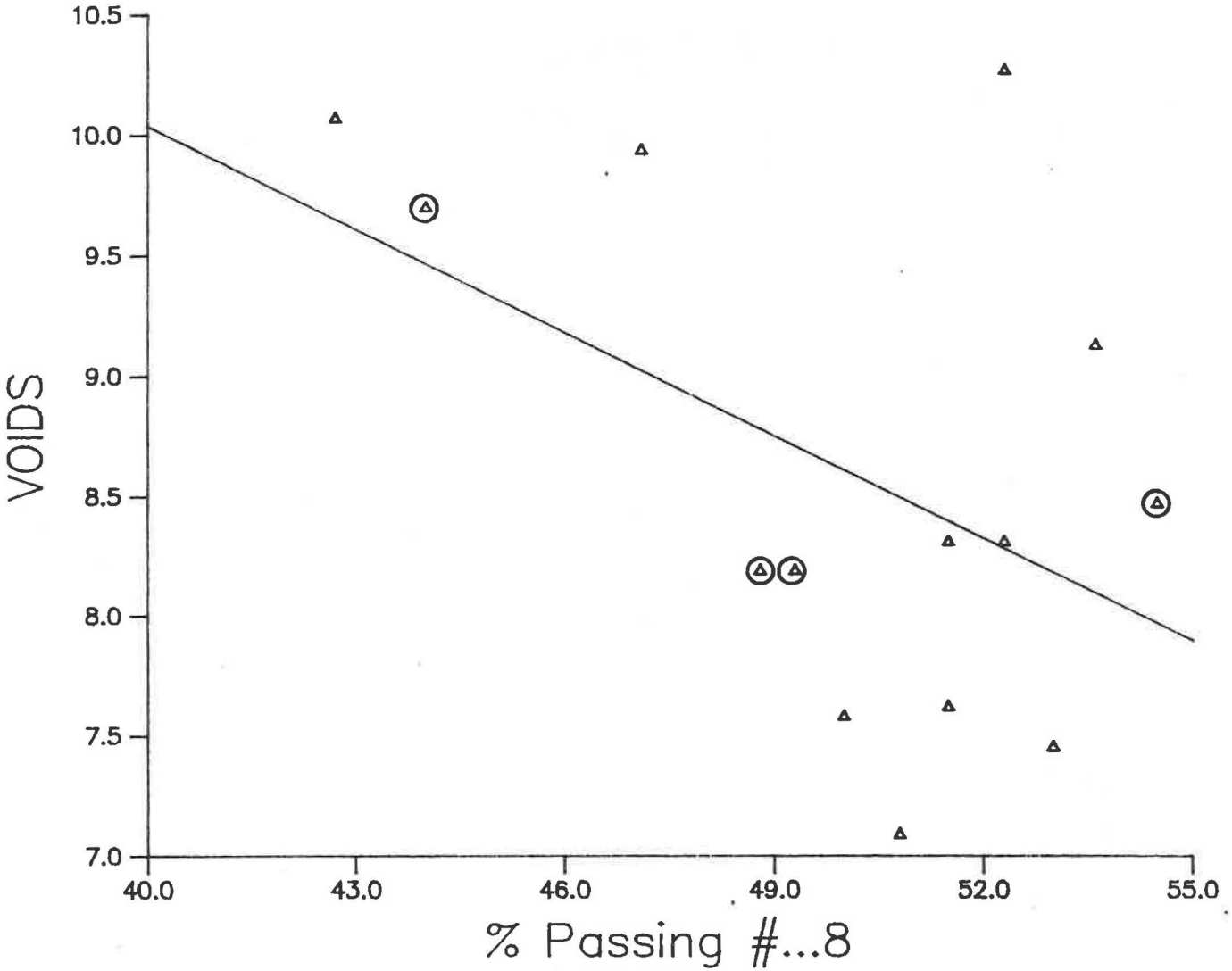

GIP–TSAP 27(88) FIELD
Asphalt Content
6.5
6.3
6.1
5.9
5.7
5.5
5.3
5.1
4.9
4.7
4.5
35.0
37.0
39.0
41.0
43.0
45.0
%age Passing #8

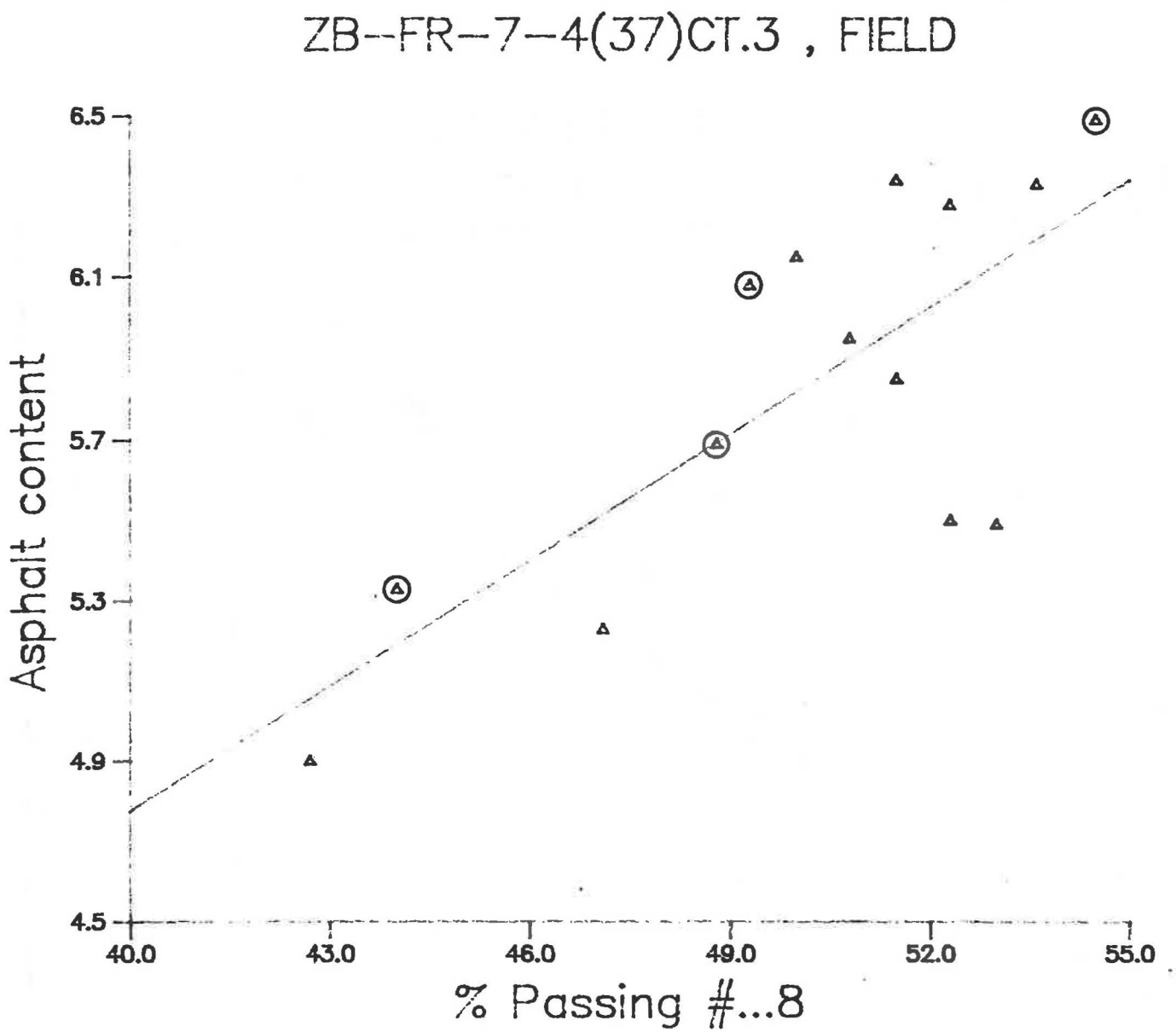

EDS–TSAP 38(85)CT.1 PLANT
Asphalt Content
5.05
5.04
5.03
5.02
5.01
5.00
4.99
4.98
4.97
4.96
4.95
35.0
36.0
37.0
38.0
39.0
40.0
%age Passing #8

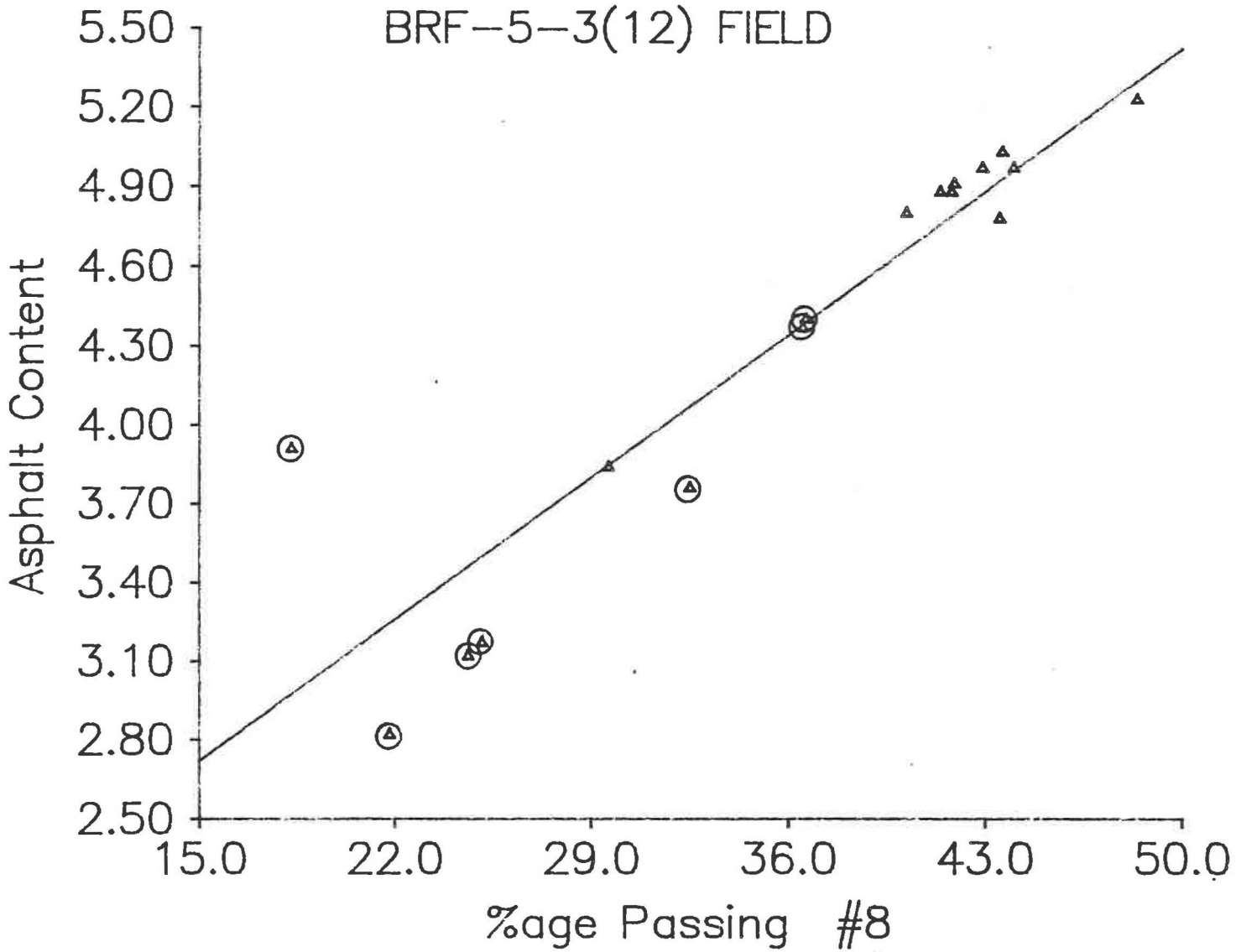

EDS-TSAP-38(85)CT.1 , FIELD
12.00
10.30
8.60
6.90
5.20
3.50
Voids
20.00
24.17
28.33
32.50
36.67
40.83
45.00
% Passing #...8

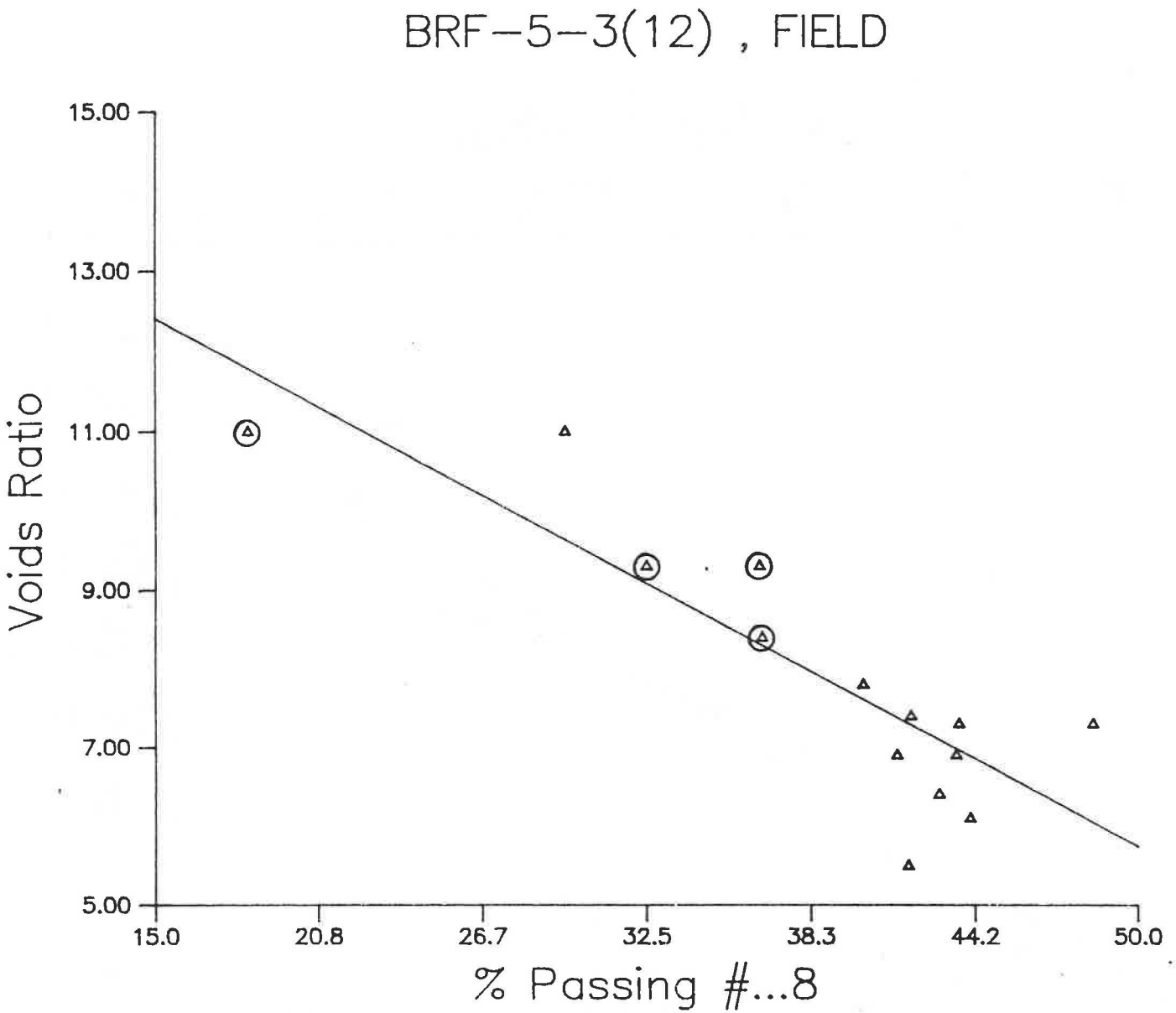

EDS–TSAP–38(85)CT.1,FIELD
Asphalt Content
5.50
5.30
5.10
4.90
4.70
4.50
4.30
4.10
3.90
3.70
3.50
20.0
25.0
30.0
35.0
40.0
45.0
% Passing #...8

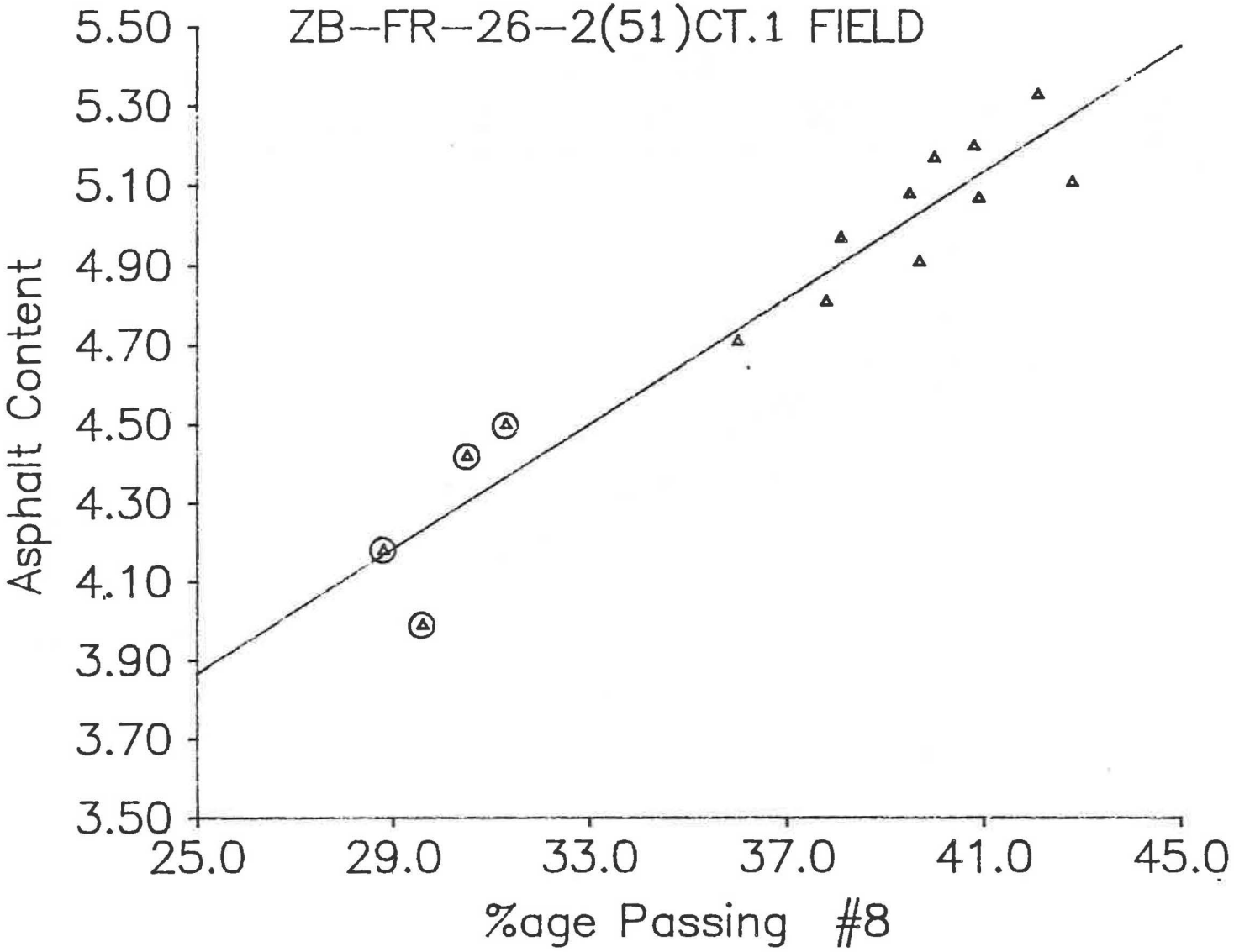

ZB–FR–7–4(37)CT.3 , PLANT
Asphalt content
5.6
5.5
5.4
5.3
5.2
5.1
5.0
40.0
43.0
46.0
49.0
52.0
55.0
% Passing #...8

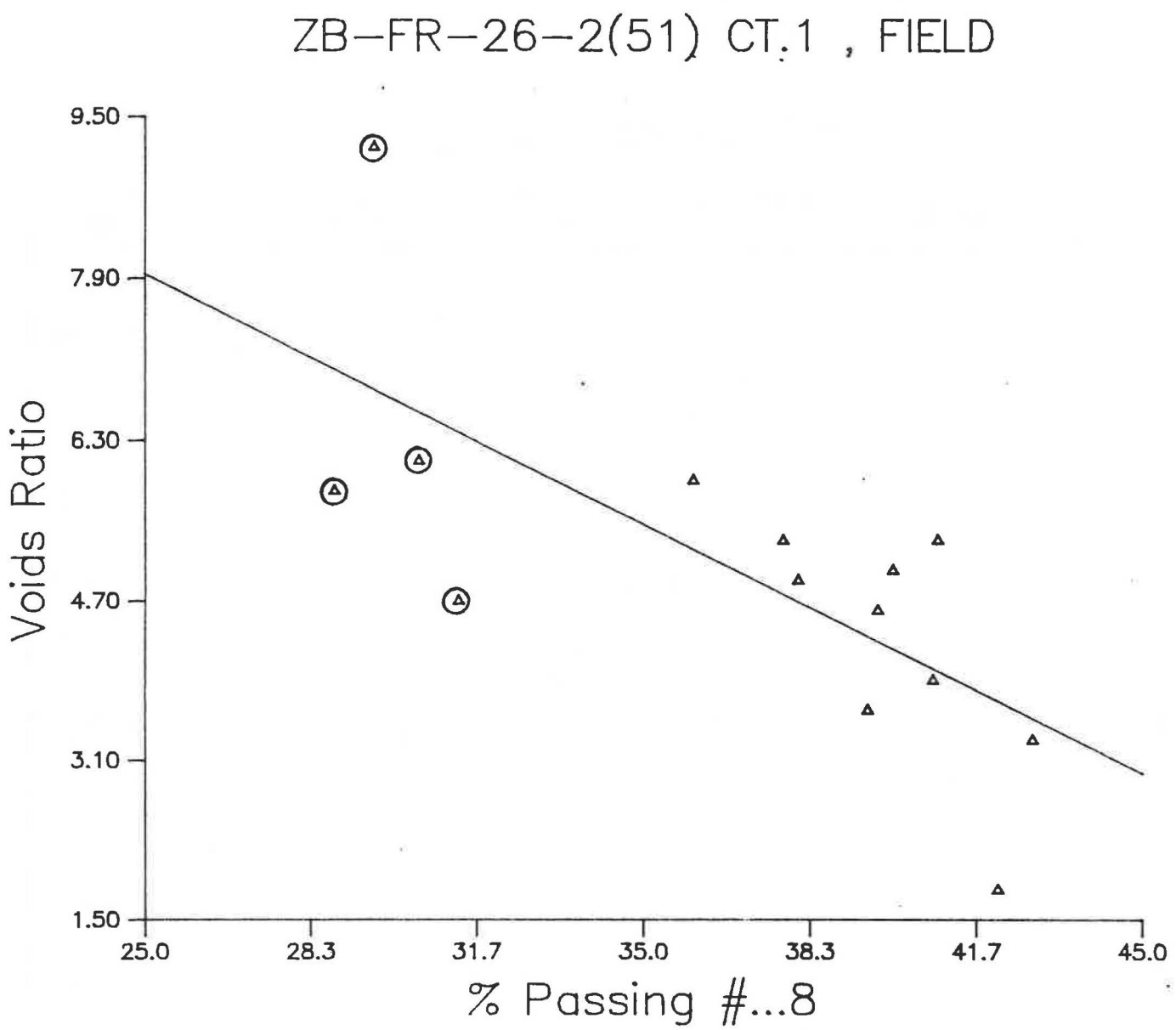

ZB-FR-7-4(37)CT.3 , FIELD
VOIDS
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
40.0
43.0
46.0
49.0
52.0
55.0
% Passing #...8

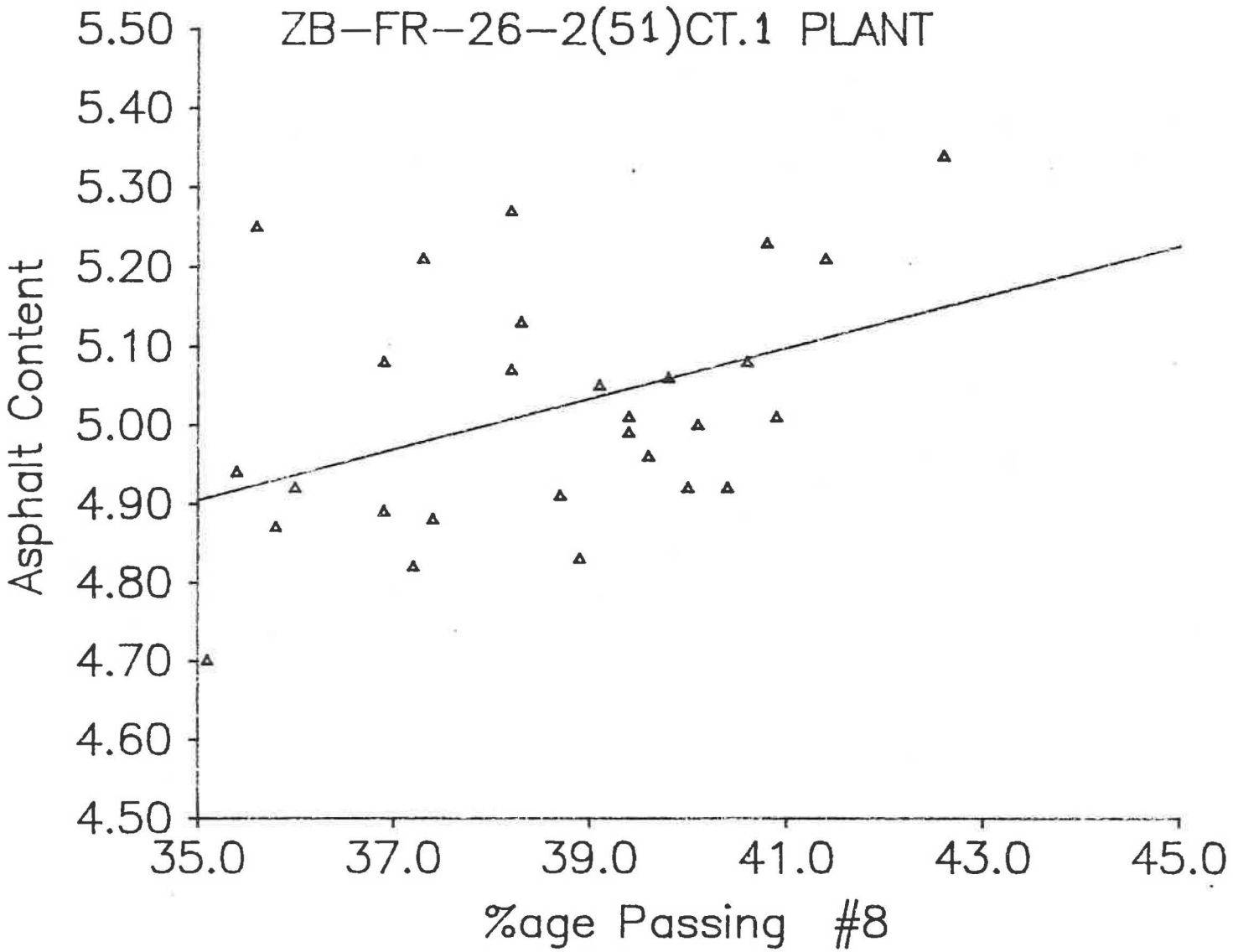

ZB--FR-7-4(37)CT.3 , FIELD
Asphalt content
6.5
6.1
5.7
5.3
4.9
4.5
40.0
43.0
46.0
49.0
52.0
55.0
% Passing #...8

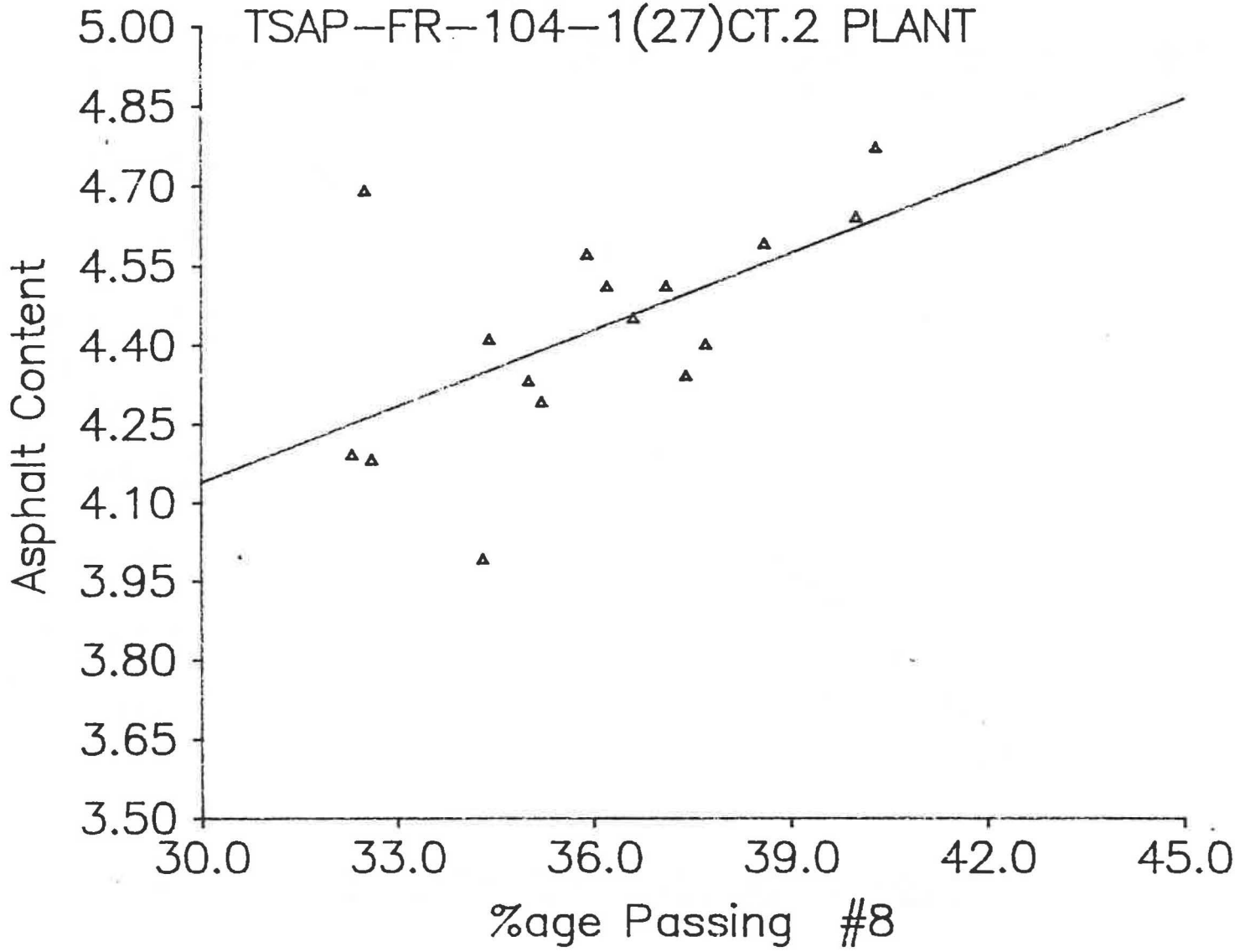

BRF-5-3(12) FIELD
5.50
5.20
4.90
4.60
4.30
4.00
3.70
3.40
3.10
2.80
2.50
Asphalt Content
15.0
22.0
29.0
36.0
43.0
50.0
%age Passing #8

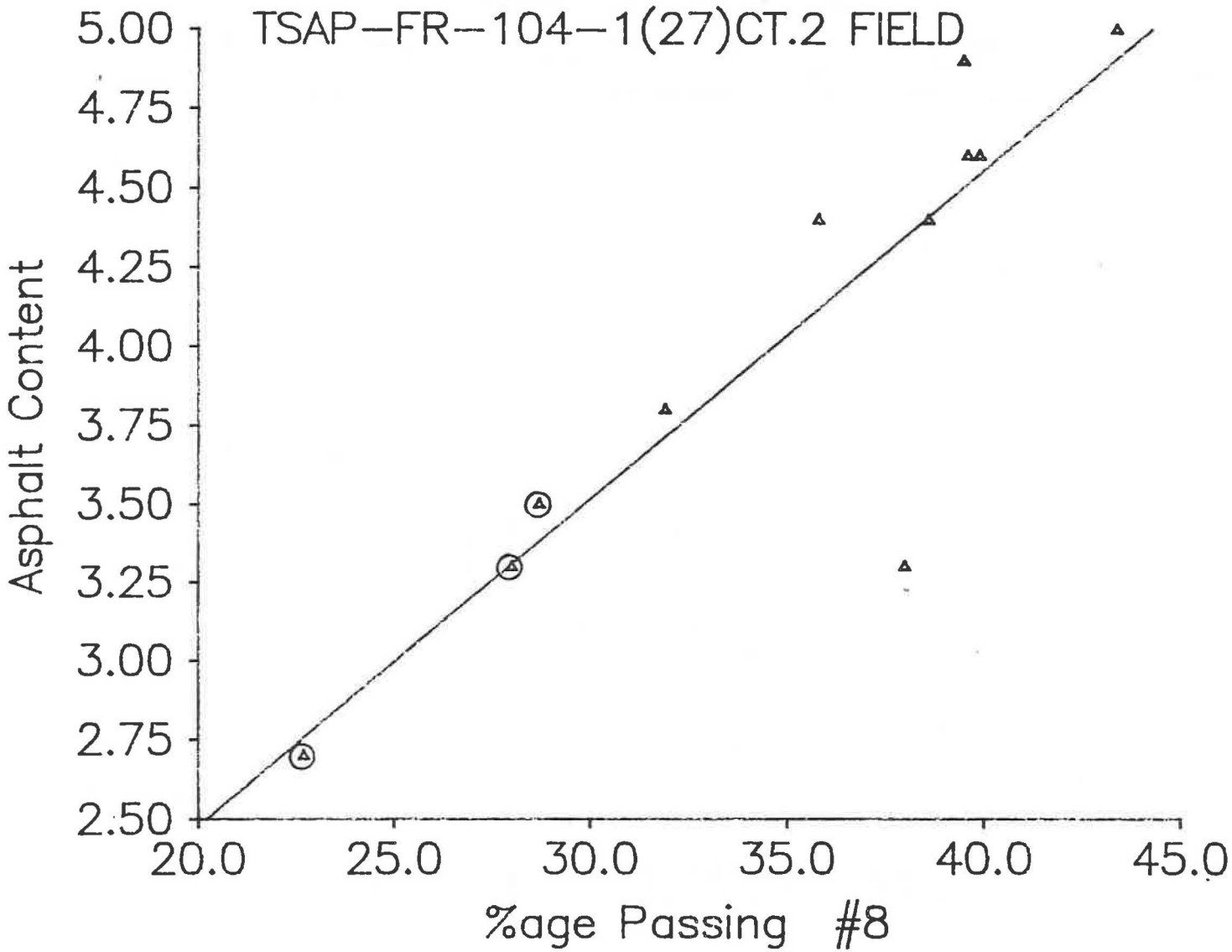

BRF-5-3(12) , FIELD
15.00
13.00
11.00
9.00
7.00
5.00
Voids Ratio
15.0
20.8
26.7
32.5
38.3
44.2
50.0
% Passing #...8

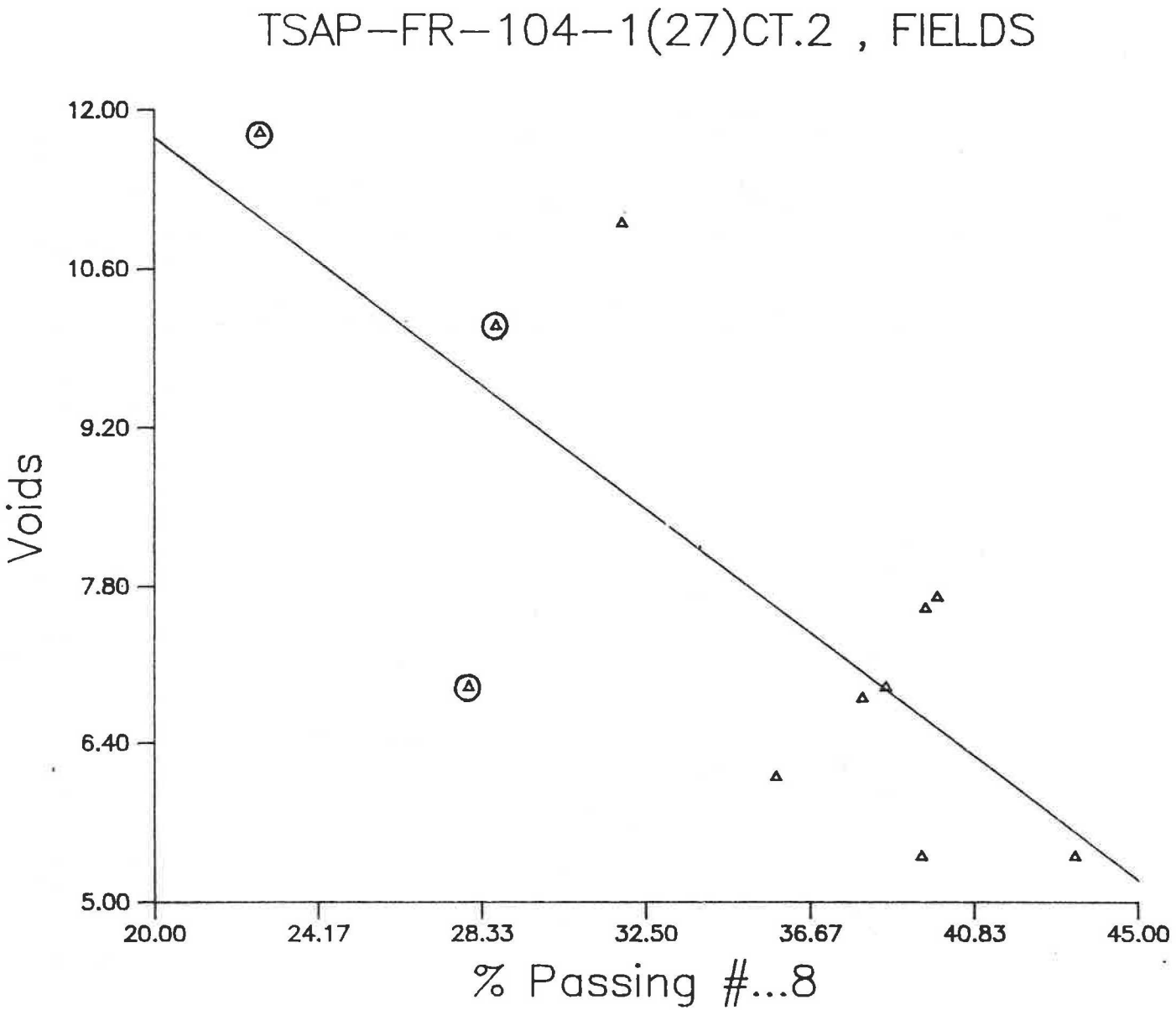

ZB--FR--26--2(51)CT.1 FIELD
Asphalt Content
5.50
5.30
5.10
4.90
4.70
4.50
4.30
4.10
3.90
3.70
3.50
25.0
29.0
33.0
37.0
41.0
45.0
%age Passing #8

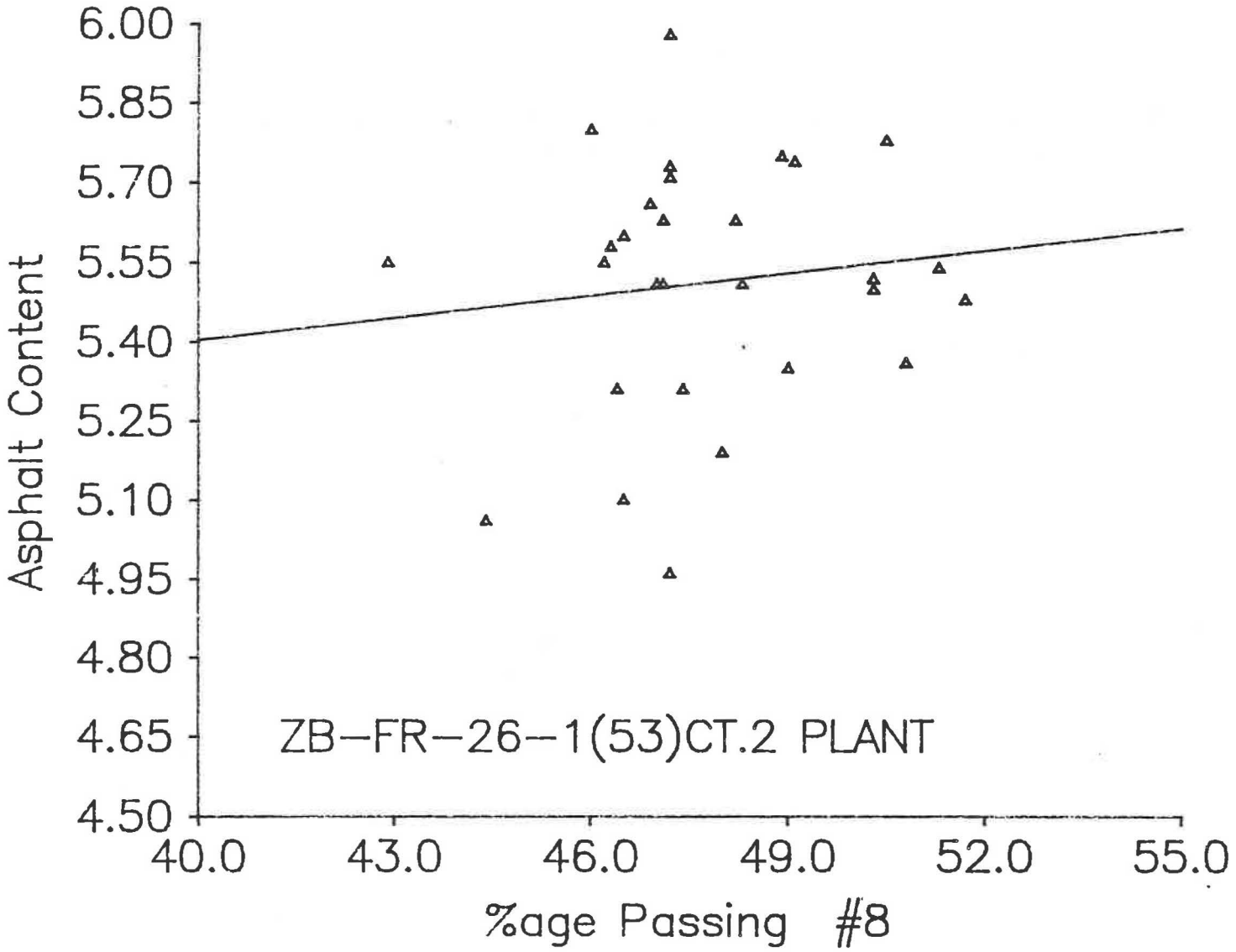

ZB-FR-26-2(51) CT.1 , FIELD
9.50
7.90
6.30
4.70
3.10
1.50
Voids Ratio
25.0
28.3
31.7
35.0
38.3
41.7
45.0
% Passing #...8

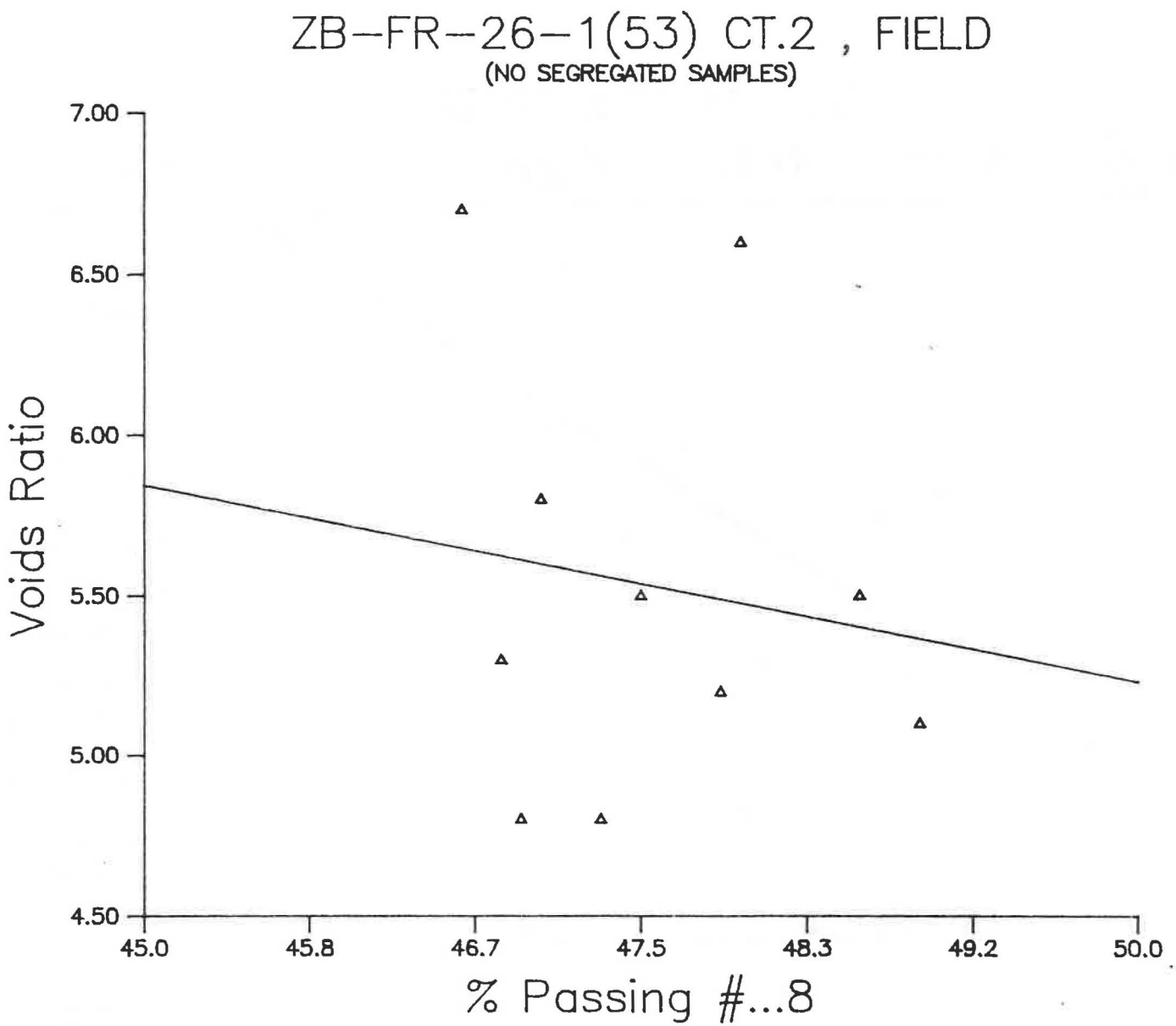

ZB–FR–26–2(51)CT.1 PLANT
Asphalt Content
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
4.50
35.0
37.0
39.0
41.0
43.0
45.0
%age Passing #8

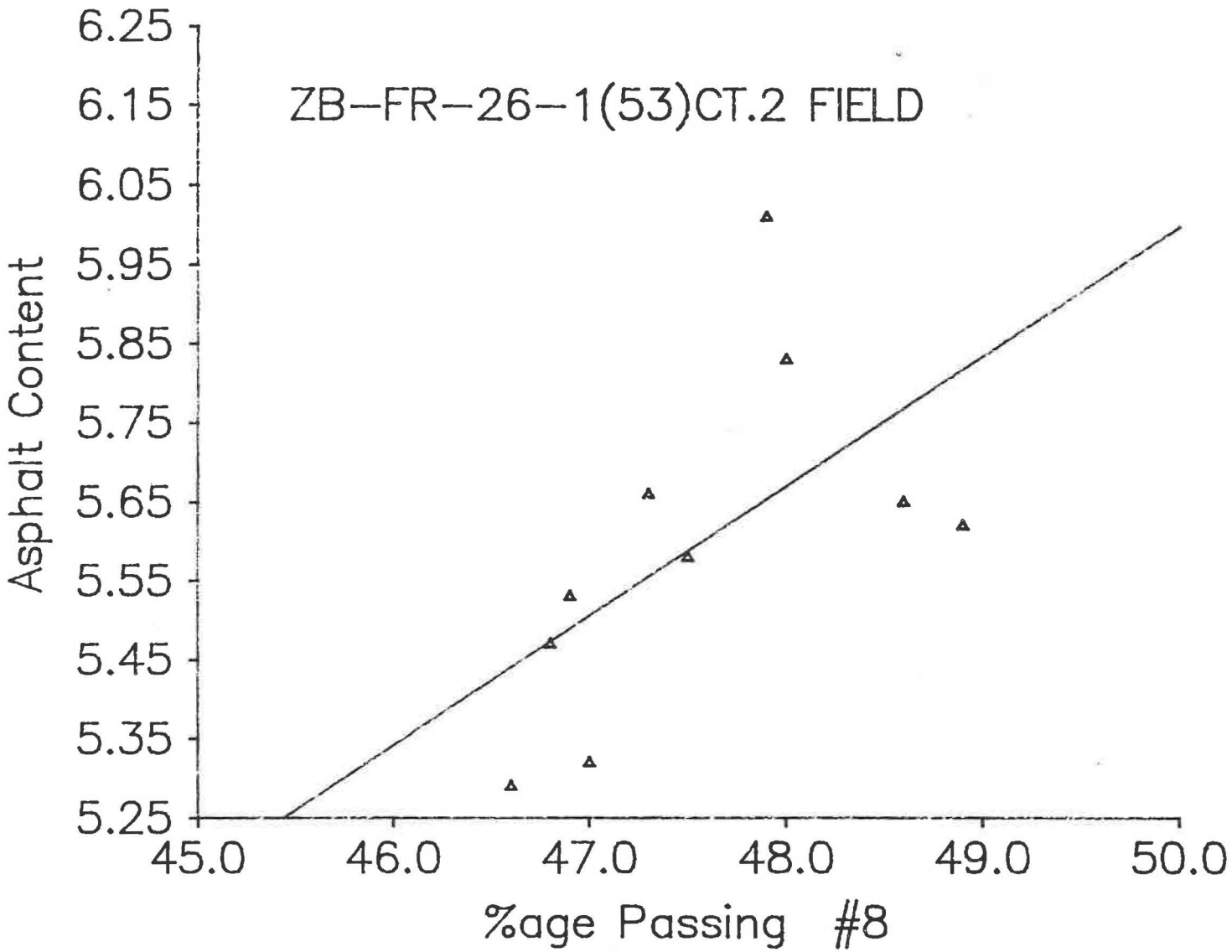

TSAP–FR–104–1(27)CT.2 PLANT
Asphalt Content
5.00
4.85
4.70
4.55
4.40
4.25
4.10
3.95
3.80
3.65
3.50
30.0
33.0
36.0
39.0
42.0
45.0
%age Passing #8

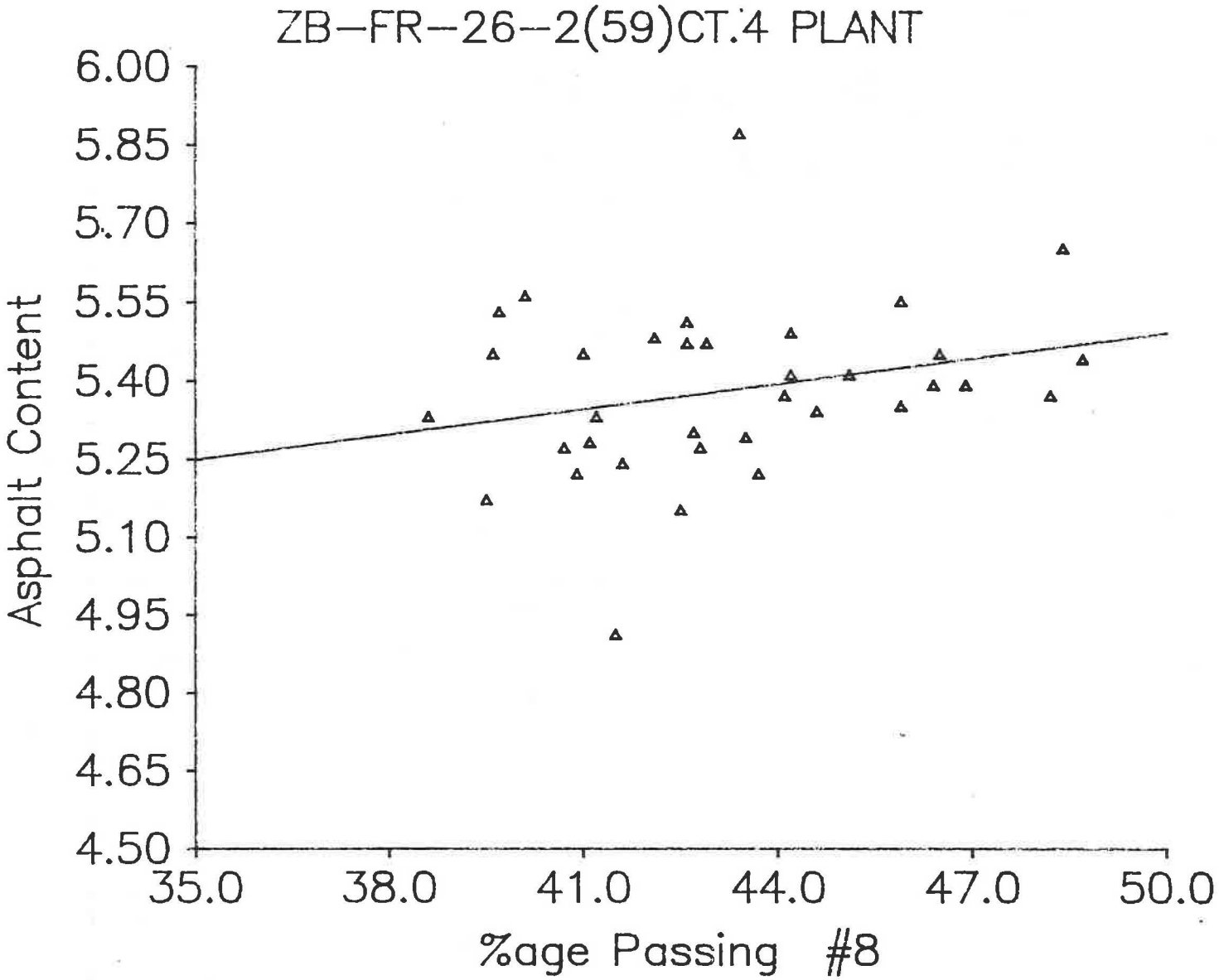

TSAP–FR–104–1(27)CT.2 FIELD
Asphalt Content
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
20.0
25.0
30.0
35.0
40.0
45.0
%age Passing #8

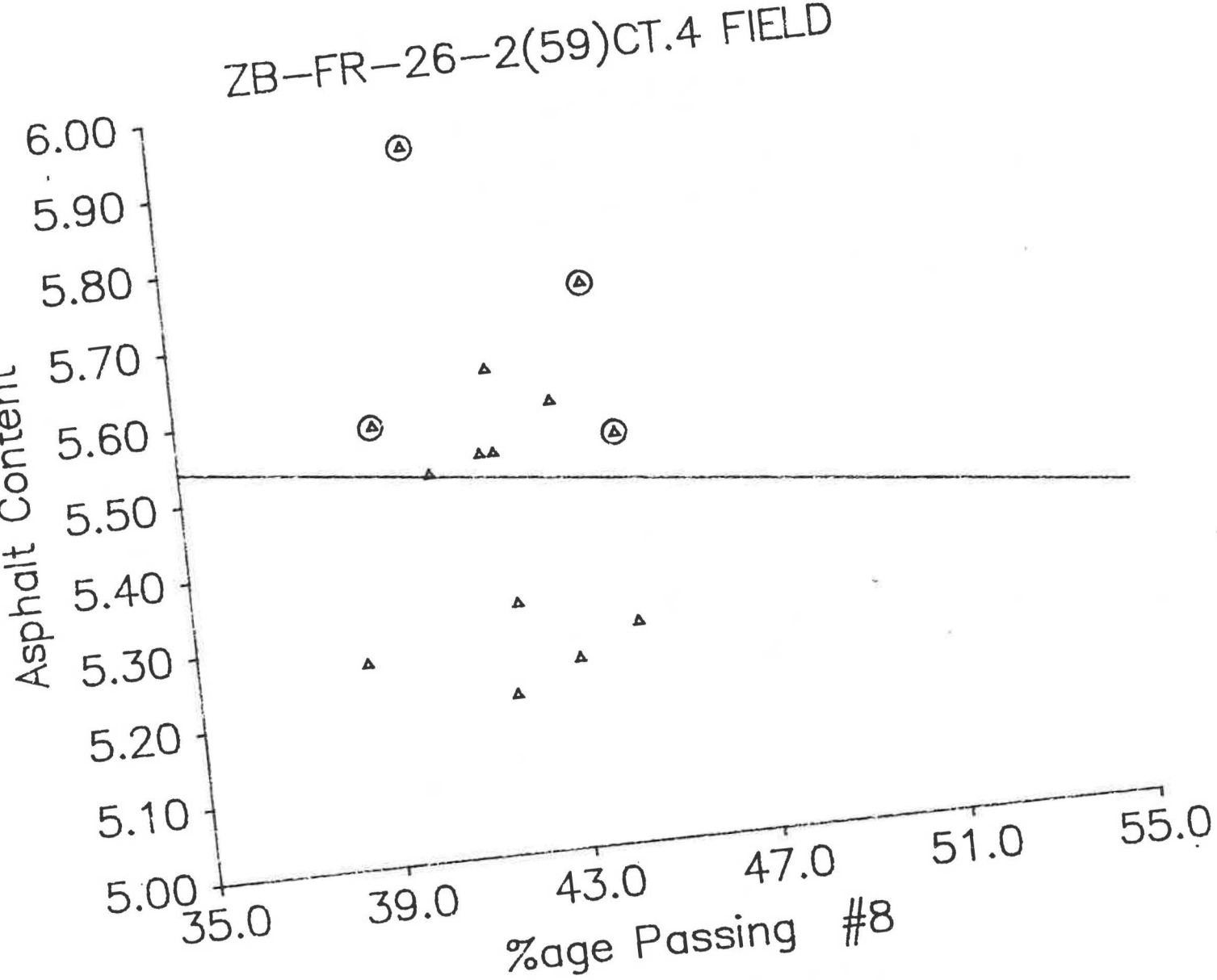

TSAP-FR-104-1(27)CT.2 , FIELDS
12.00
10.60
9.20
7.80
6.40
5.00
Voids
20.00
24.17
28.33
32.50
36.67
40.83
45.00
% Passing #...8

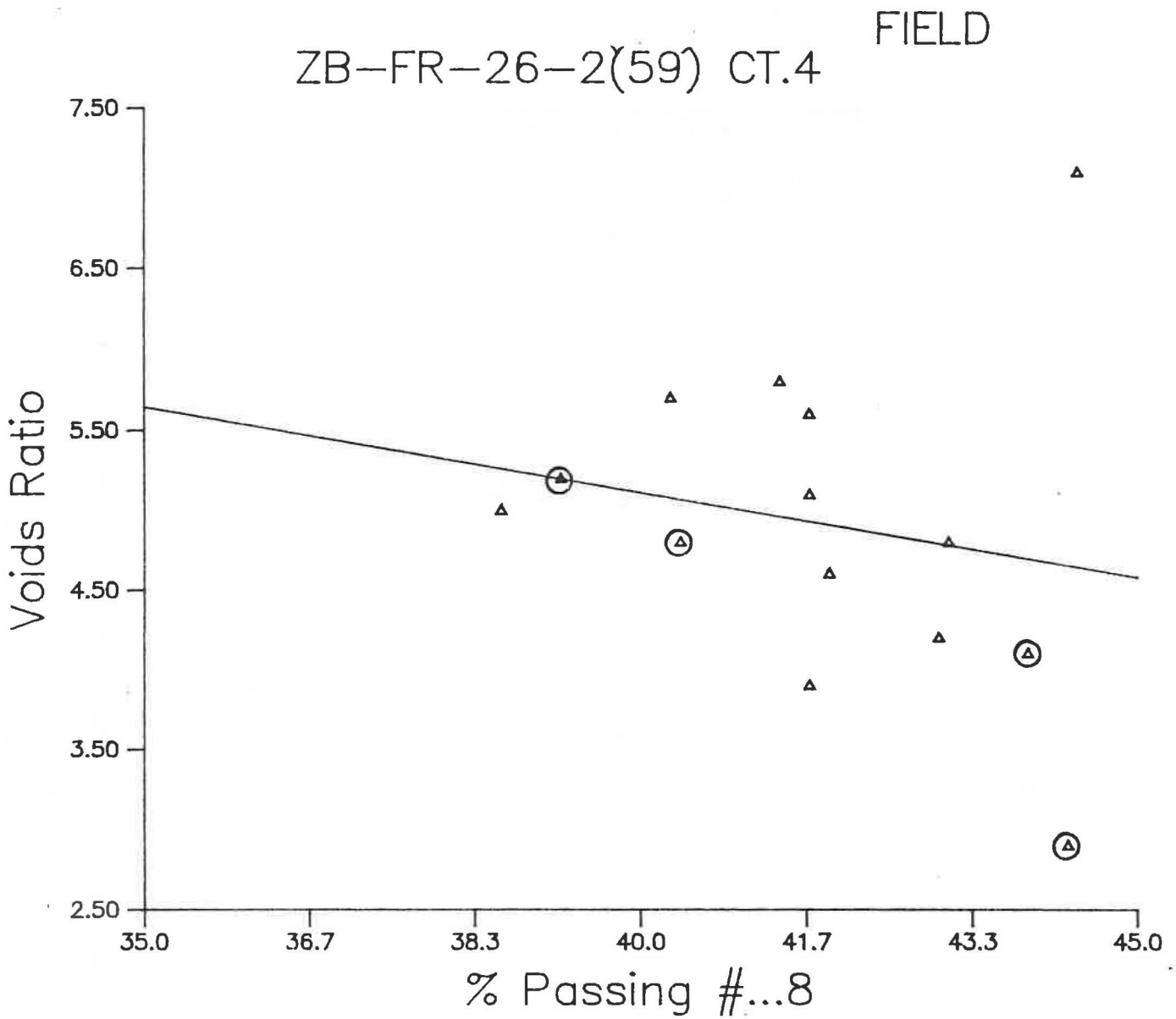

6.00
5.85
5.70
5.55
5.40
5.25
5.10
4.95
4.80
4.65
4.50
Asphalt Content
ZB-FR-26-1(53)CT.2 PLANT
40.0
43.0
46.0
49.0
52.0
55.0
%age Passing #8

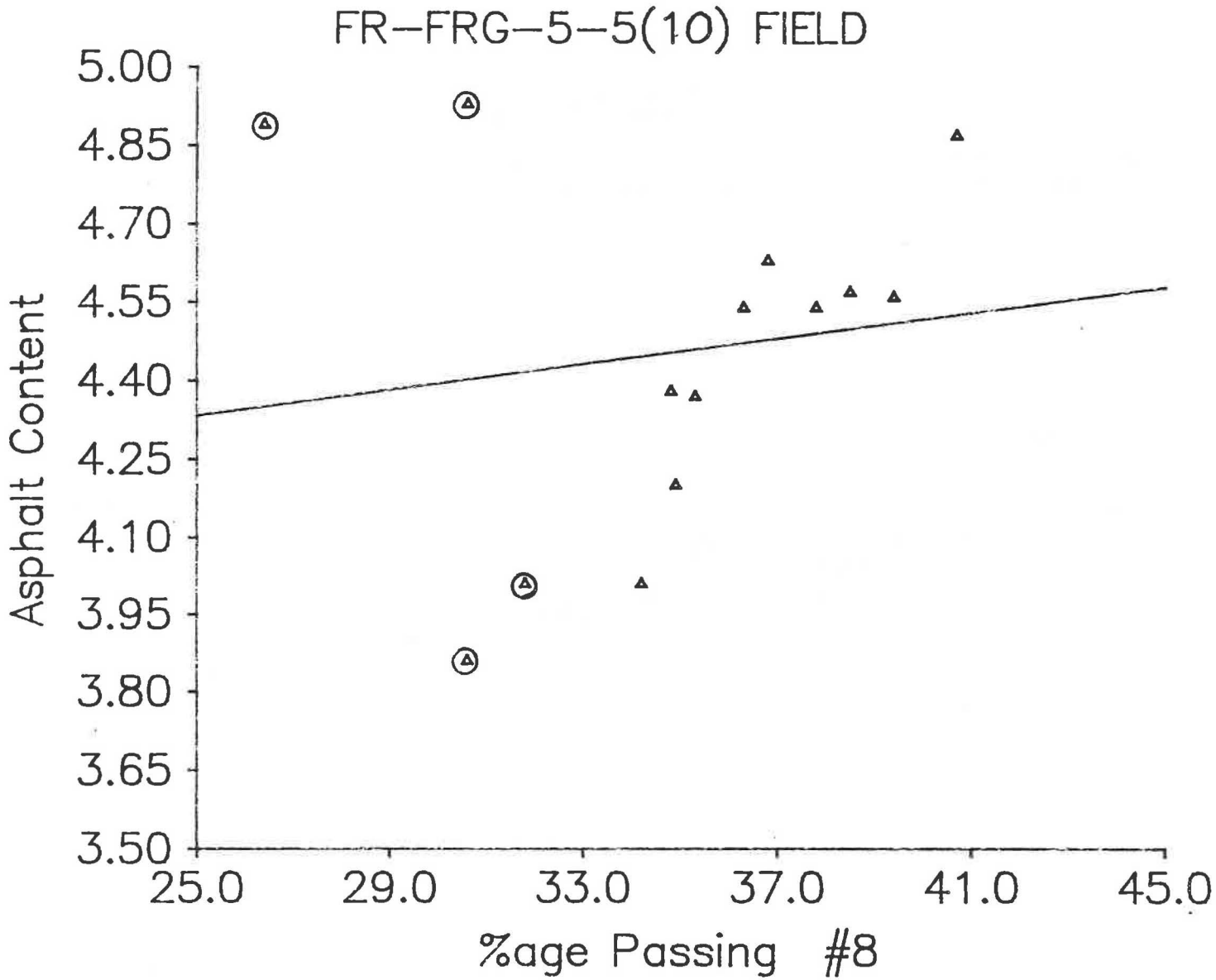

ZB-FR-26-1(53) CT.2 , FIELD
(NO SEGREGATED SAMPLES)
Voids Ratio
7.00
6.50
6.00
5.50
5.00
4.50
45.0
45.8
46.7
47.5
48.3
49.2
50.0
% Passing #...8

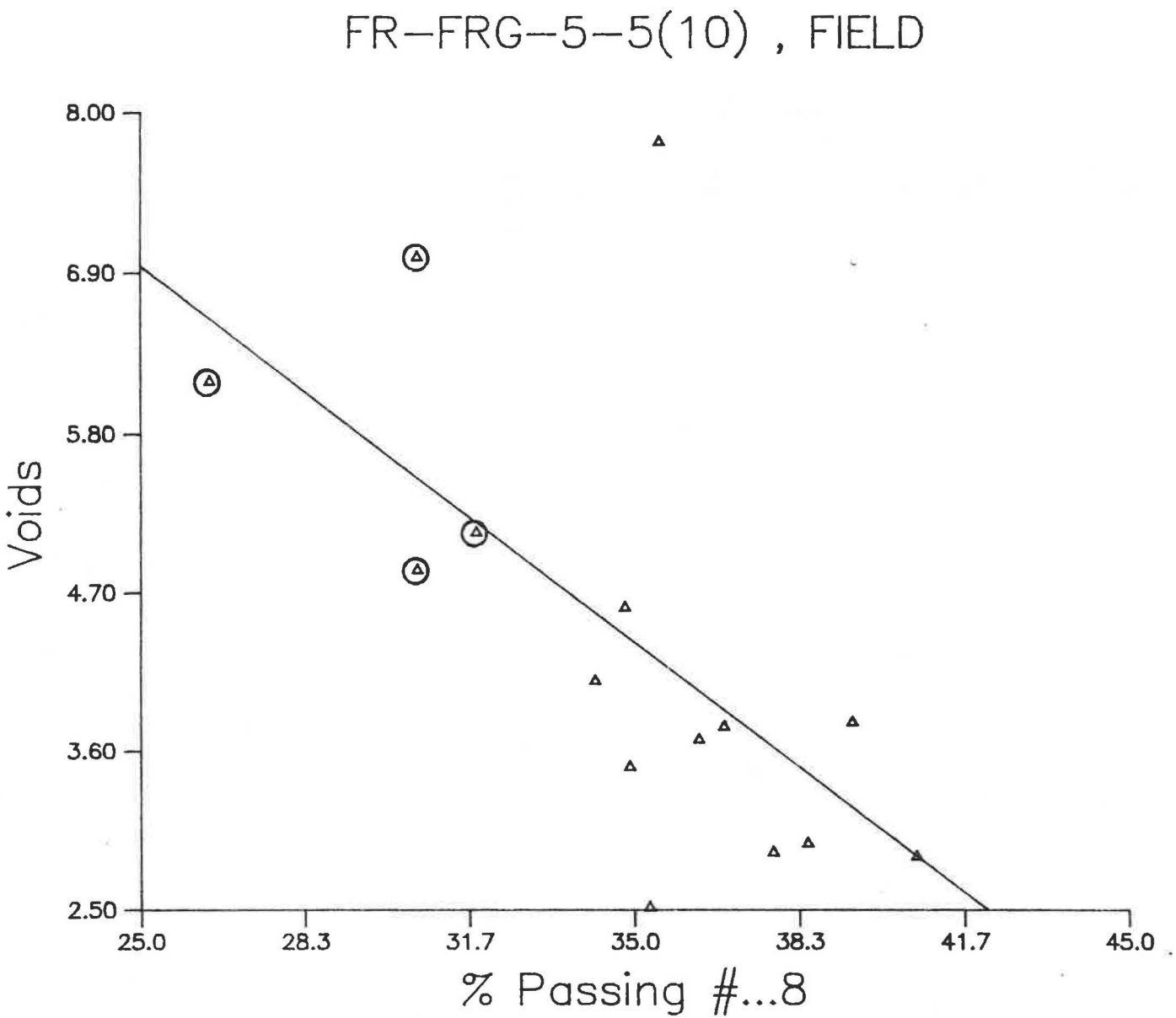

ZB–FR–26–1(53)CT.2 FIELD
Asphalt Content
6.25
6.15
6.05
5.95
5.85
5.75
5.65
5.55
5.45
5.35
5.25
45.0
46.0
47.0
48.0
49.0
50.0
%age Passing #8

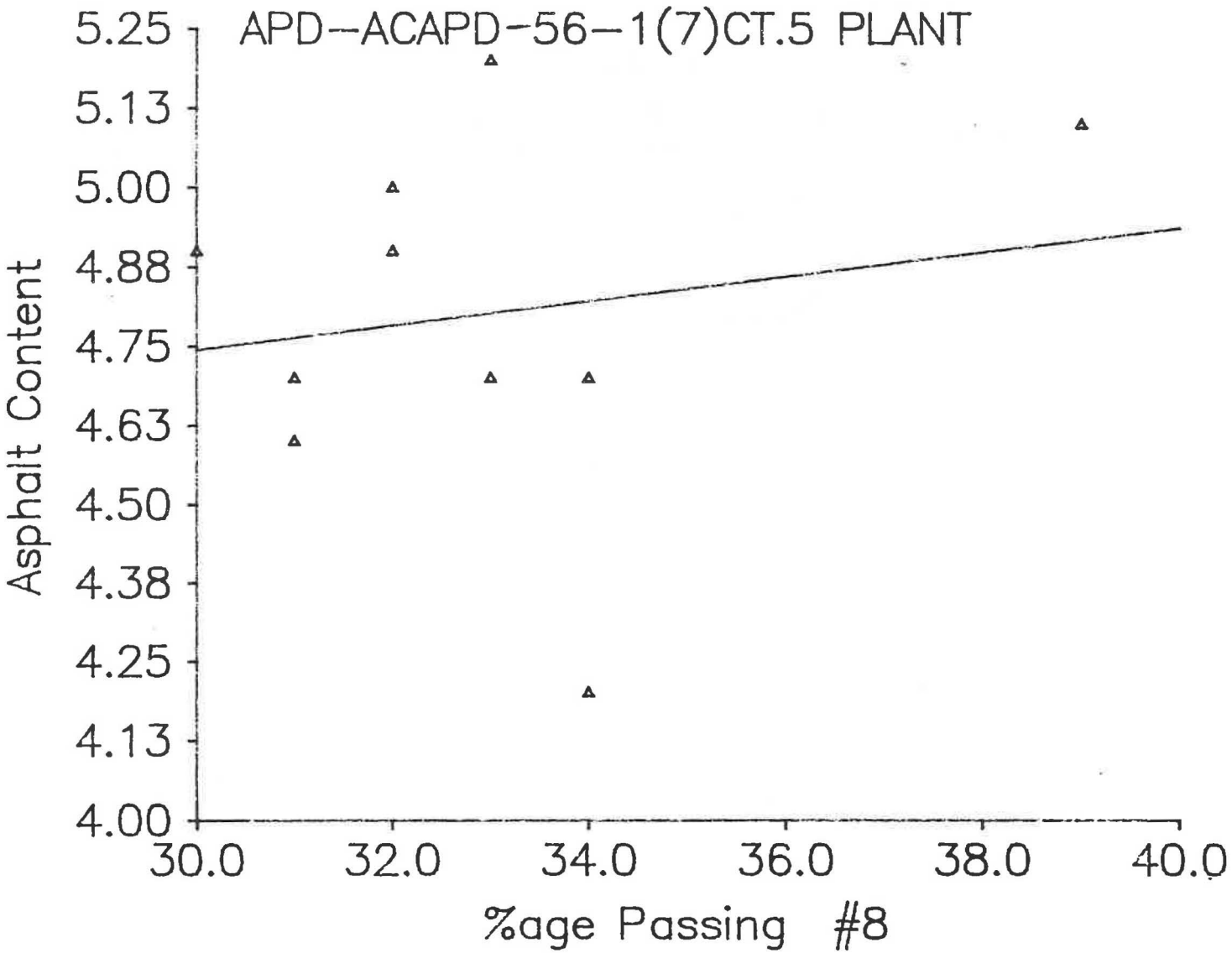

ZB–FR–26–2(59)CT.4 PLANT
Asphalt Content
6.00
5.85
5.70
5.55
5.40
5.25
5.10
4.95
4.80
4.65
4.50
35.0
38.0
41.0
44.0
47.0
50.0
%age Passing #8

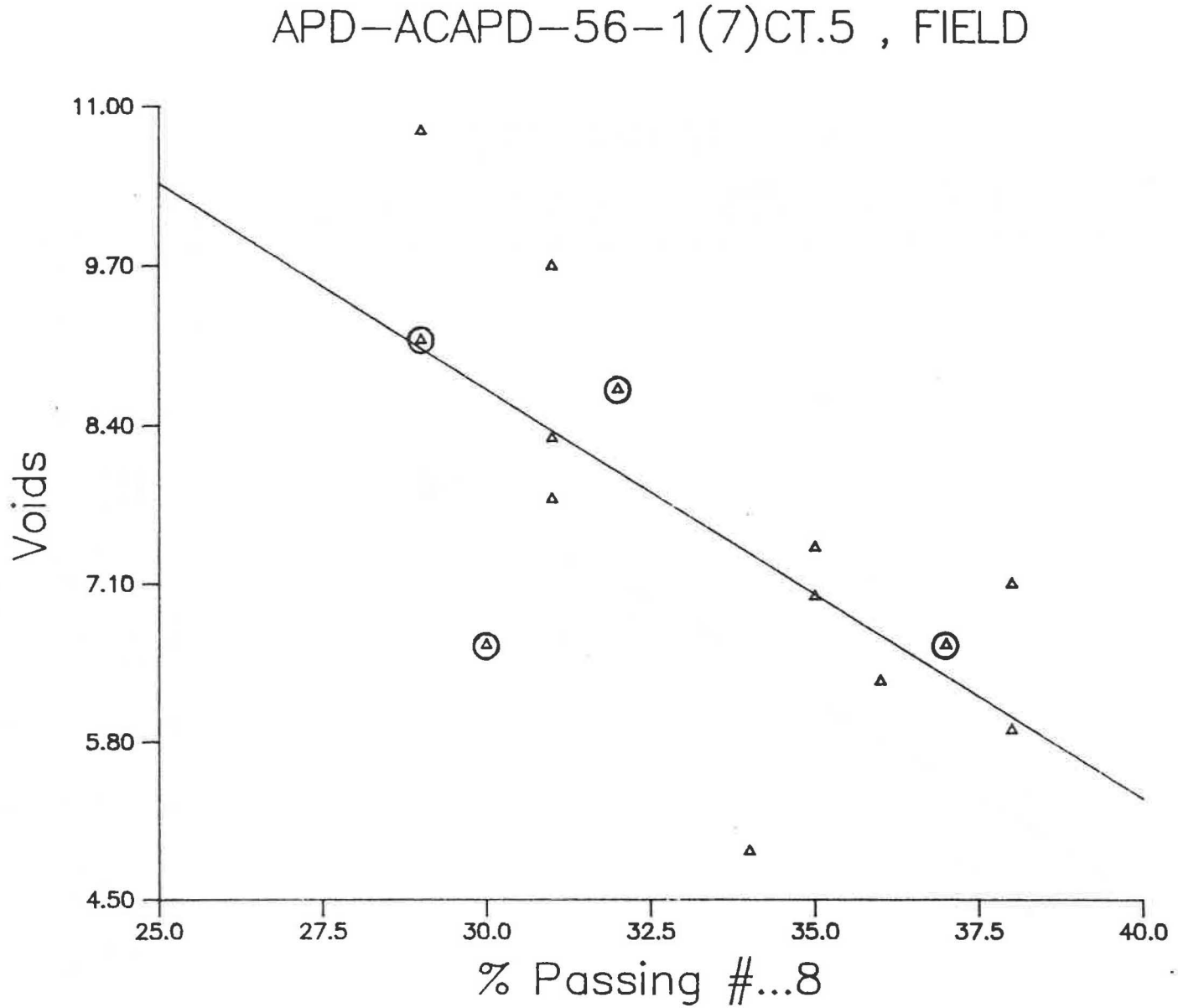

ZB-FR-26-2(59)CT.4 FIELD
Asphalt Content
6.00
5.90
5.80
5.70
5.60
5.50
5.40
5.30
5.20
5.10
5.00
35.0
39.0
43.0
47.0
51.0
55.0
%age Passing #8

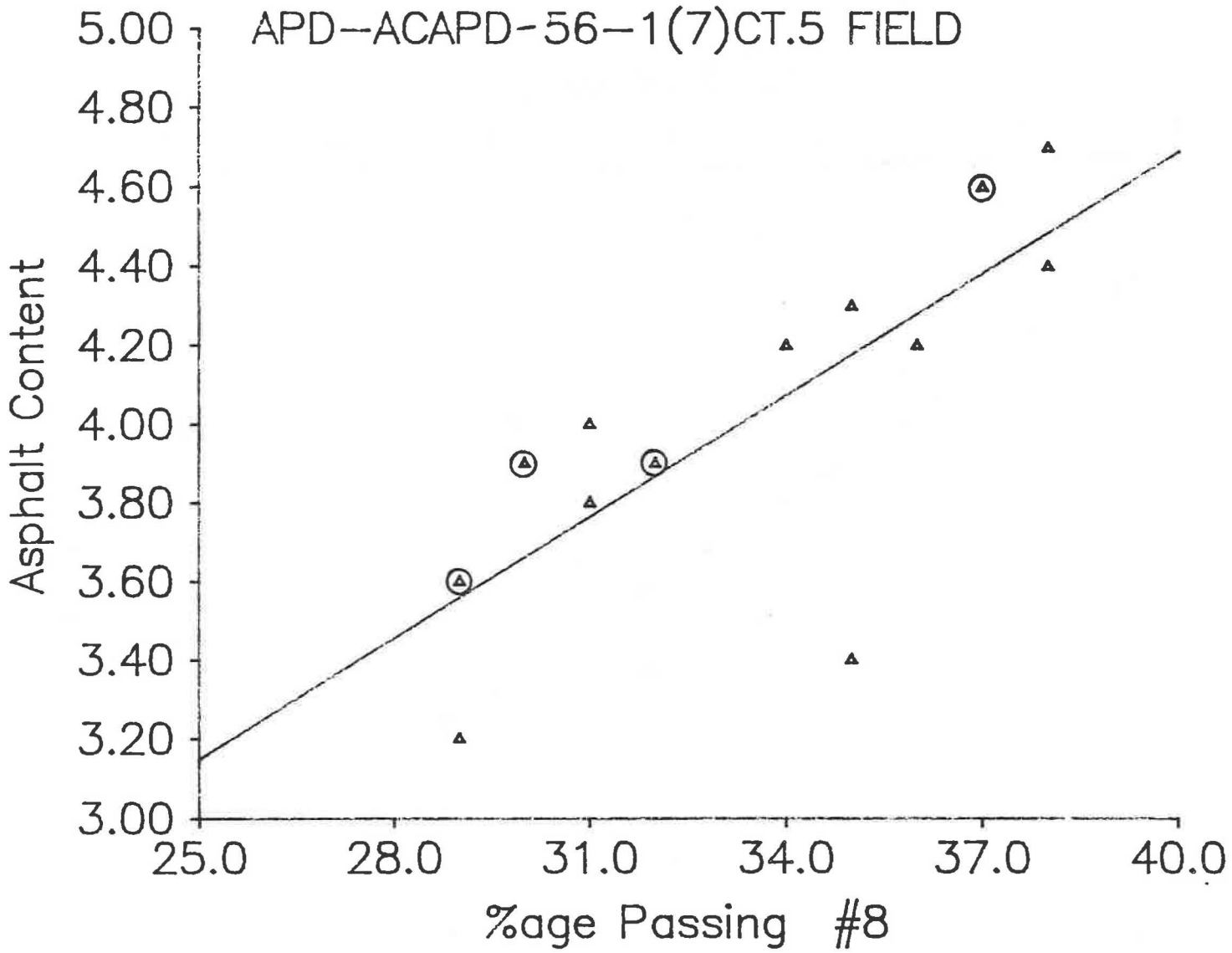

FIELD
ZB-FR-26-2(59) CT.4
7.50
6.50
5.50
4.50
3.50
2.50
Voids Ratio
35.0
36.7
38.3
40.0
41.7
43.3
45.0
% Passing #...8

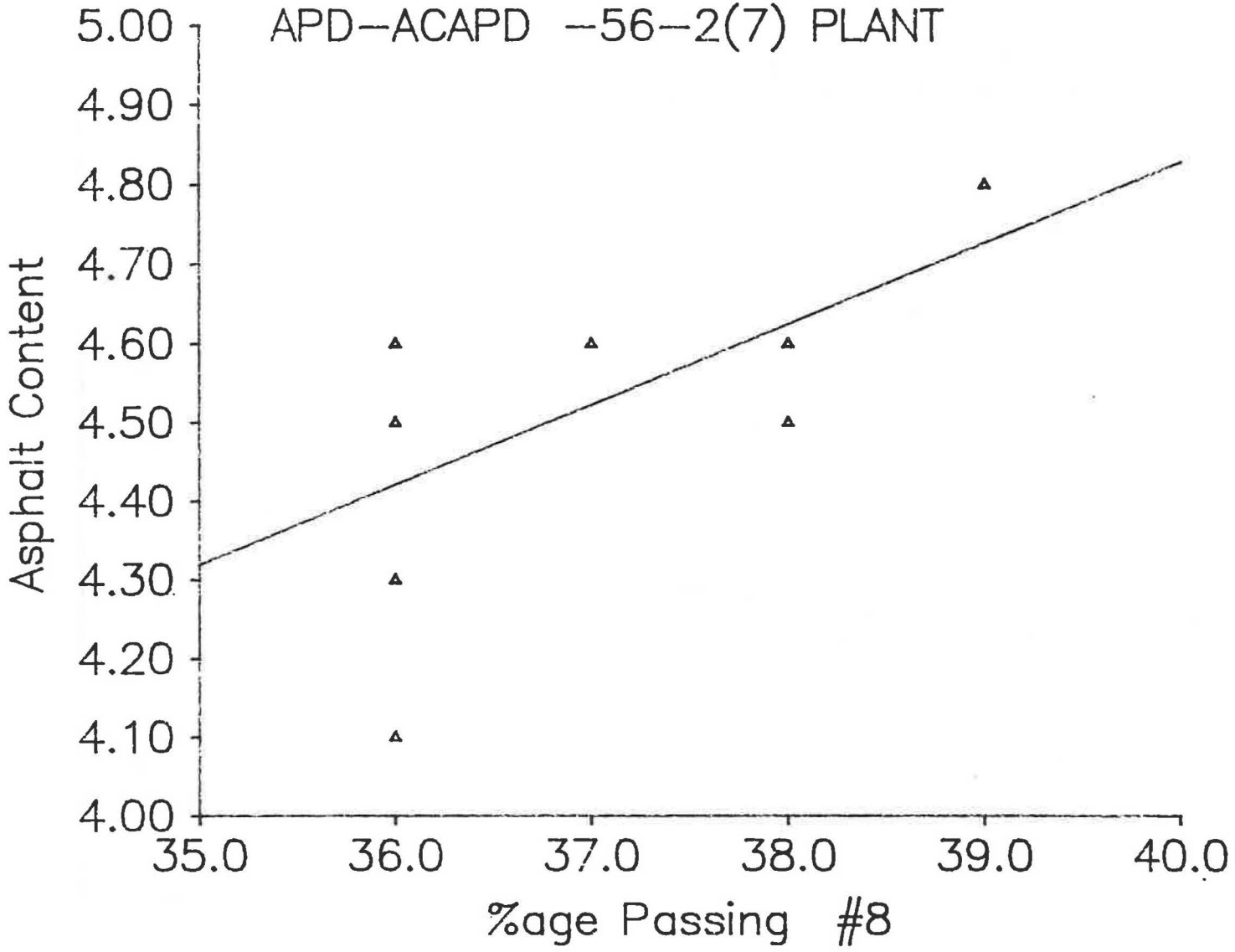

FR–FRG–5–5(10) FIELD
Asphalt Content
5.00
4.85
4.70
4.55
4.40
4.25
4.10
3.95
3.80
3.65
3.50
25.0
29.0
33.0
37.0
41.0
45.0
%age Passing #8

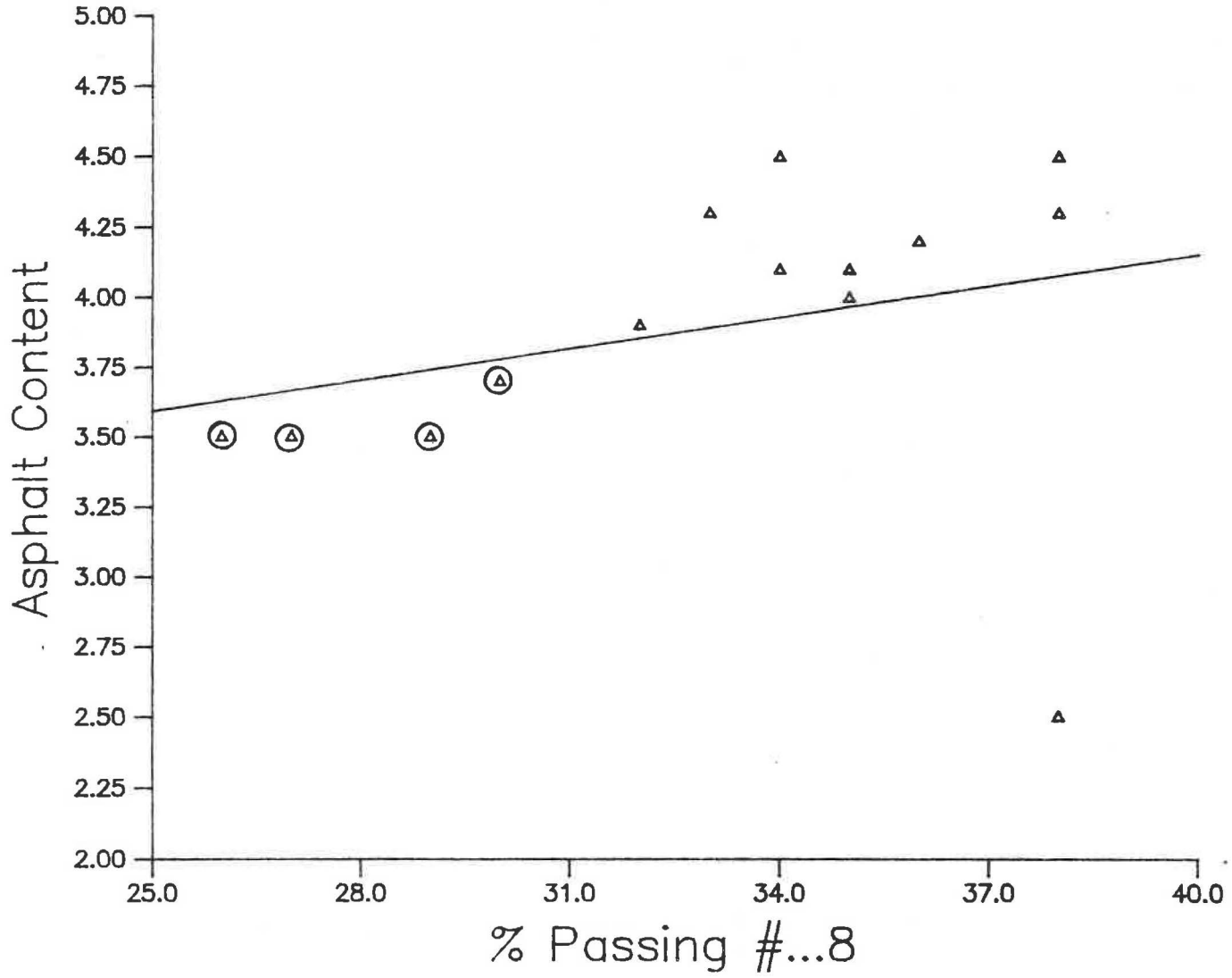

FR–FRG–5–5(10) , FIELD
8.00
6.90
5.80
4.70
3.60
2.50
Voids
25.0
28.3
31.7
35.0
38.3
41.7
45.0
% Passing #...8

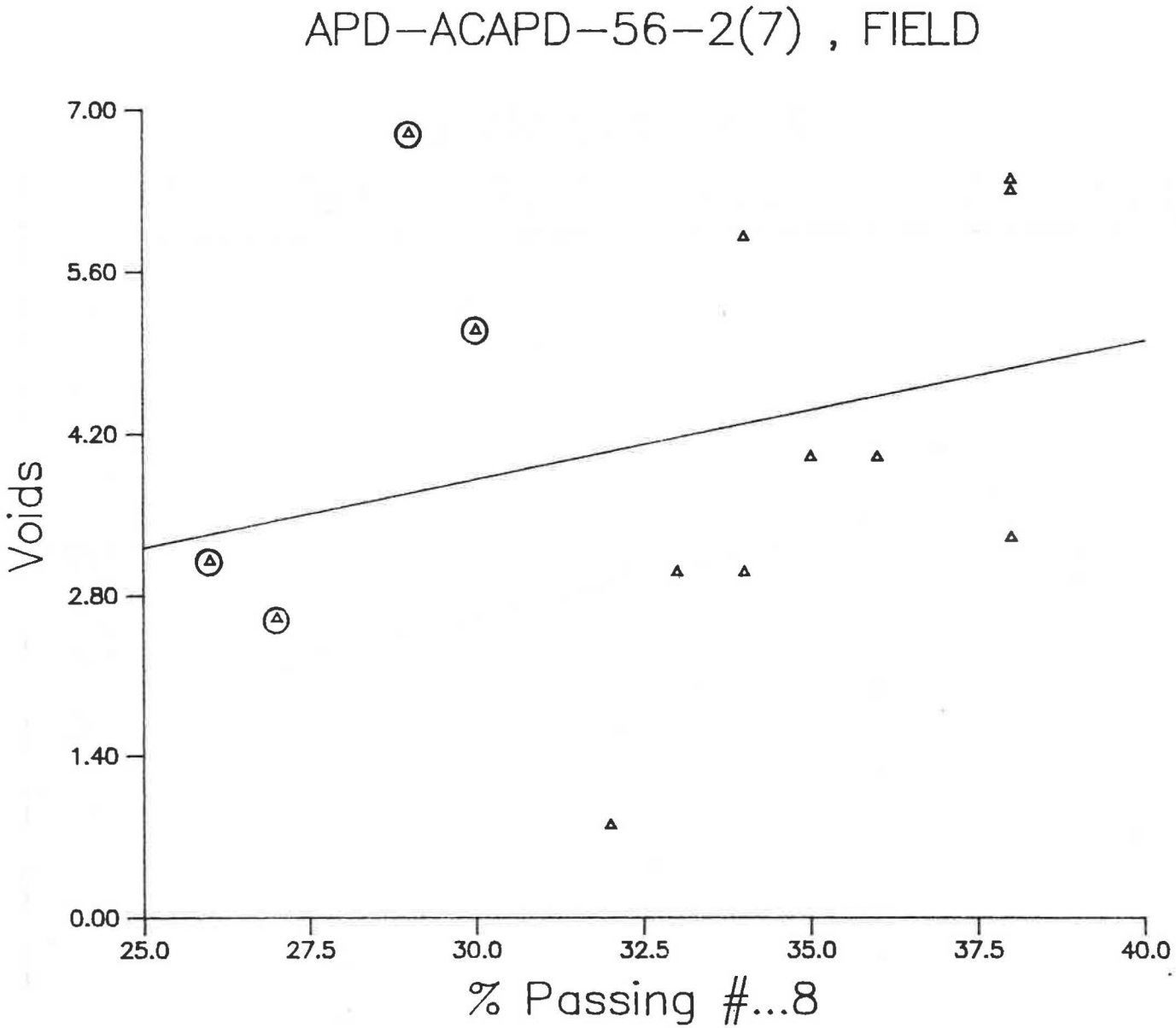

APD--ACAPD-56-1(7)CT.5 PLANT
Asphalt Content
5.25
5.13
5.00
4.88
4.75
4.63
4.50
4.38
4.25
4.13
4.00
30.0
32.0
34.0
36.0
38.0
40.0
%age Passing #8

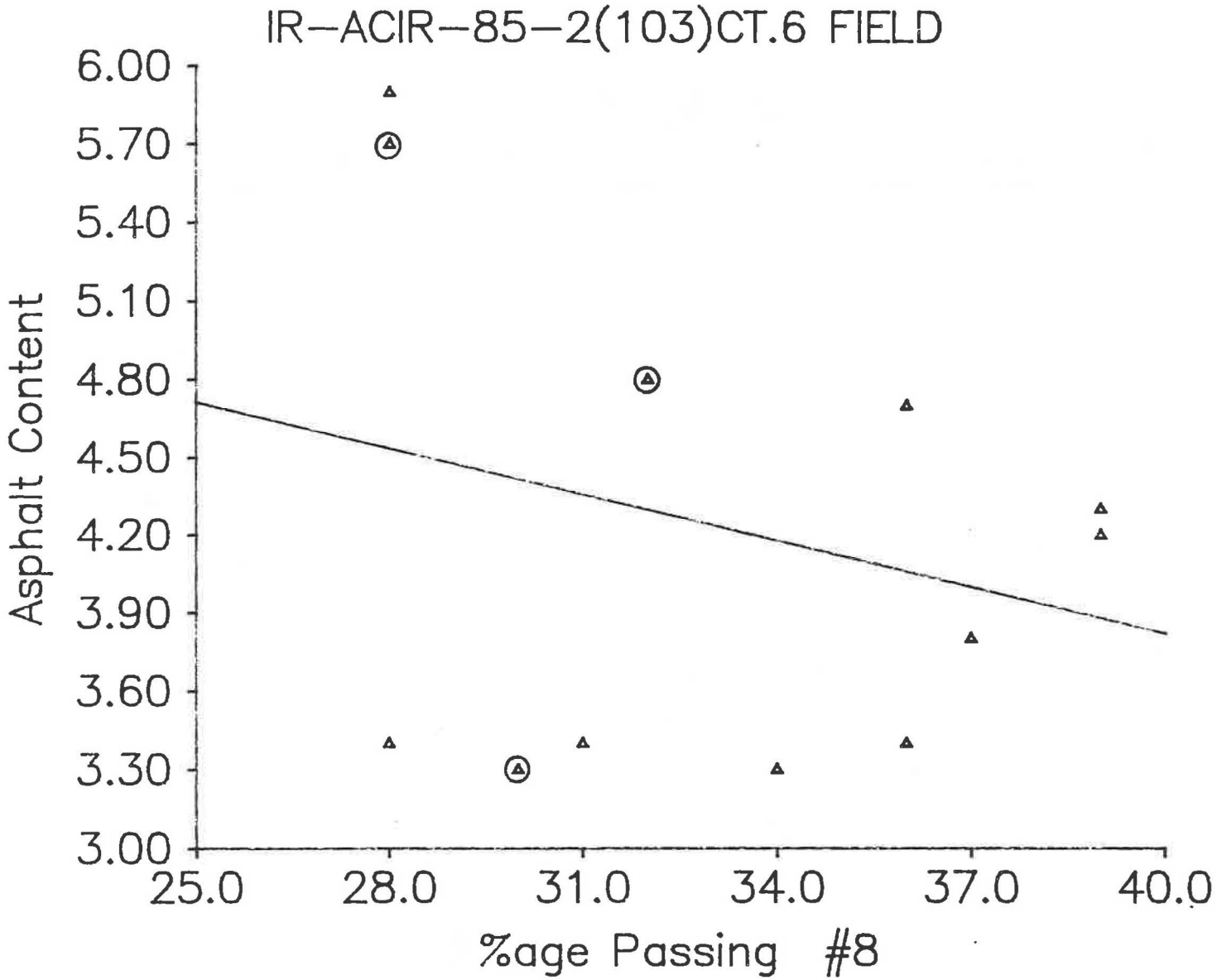

APD–ACAPD–56–1(7)CT.5 , FIELD
11.00
9.70
8.40
7.10
5.80
4.50
Voids
25.0
27.5
30.0
32.5
35.0
37.5
40.0
% Passing #...8

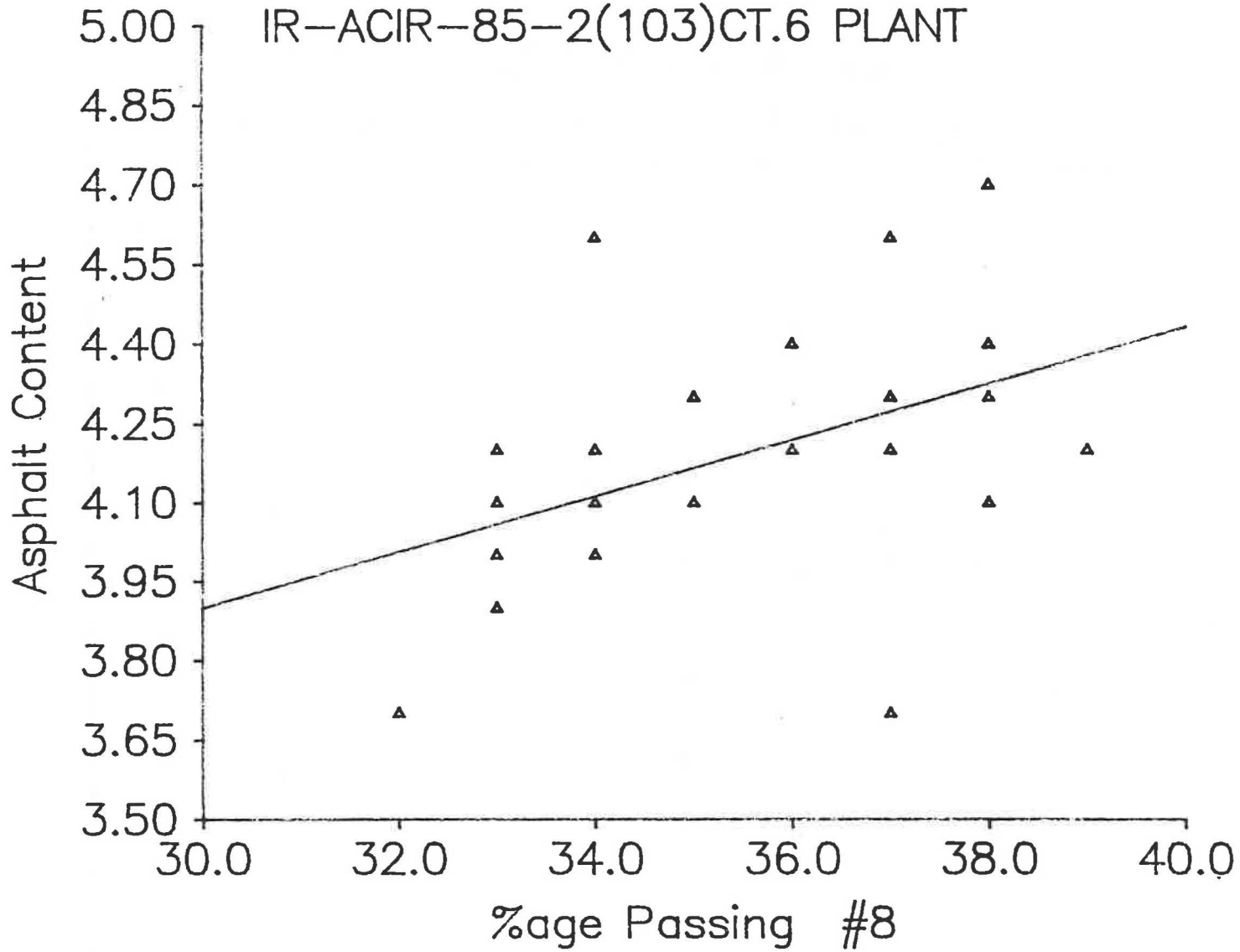

APD--ACAPD-56-1(7)CT.5 FIELD
Asphalt Content
5.00
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
3.00
25.0
28.0
31.0
34.0
37.0
40.0
%age Passing #8

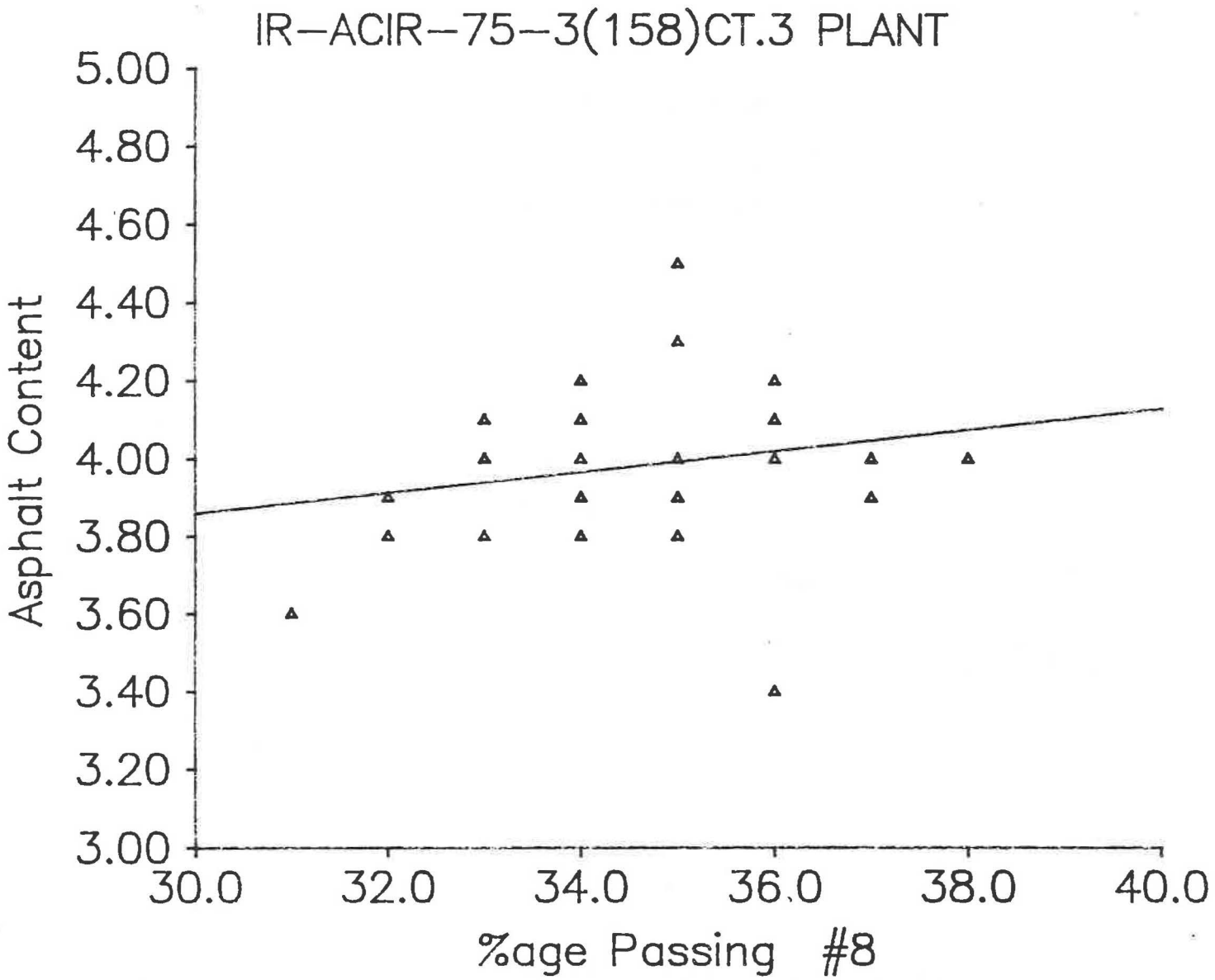

APD–ACAPD –56–2(7) PLANT
5.00
4.90
4.80
4.70
4.60
4.50
4.40
4.30
4.20
4.10
4.00
Asphalt Content
35.0
36.0
37.0
38.0
39.0
40.0
%age Passing #8

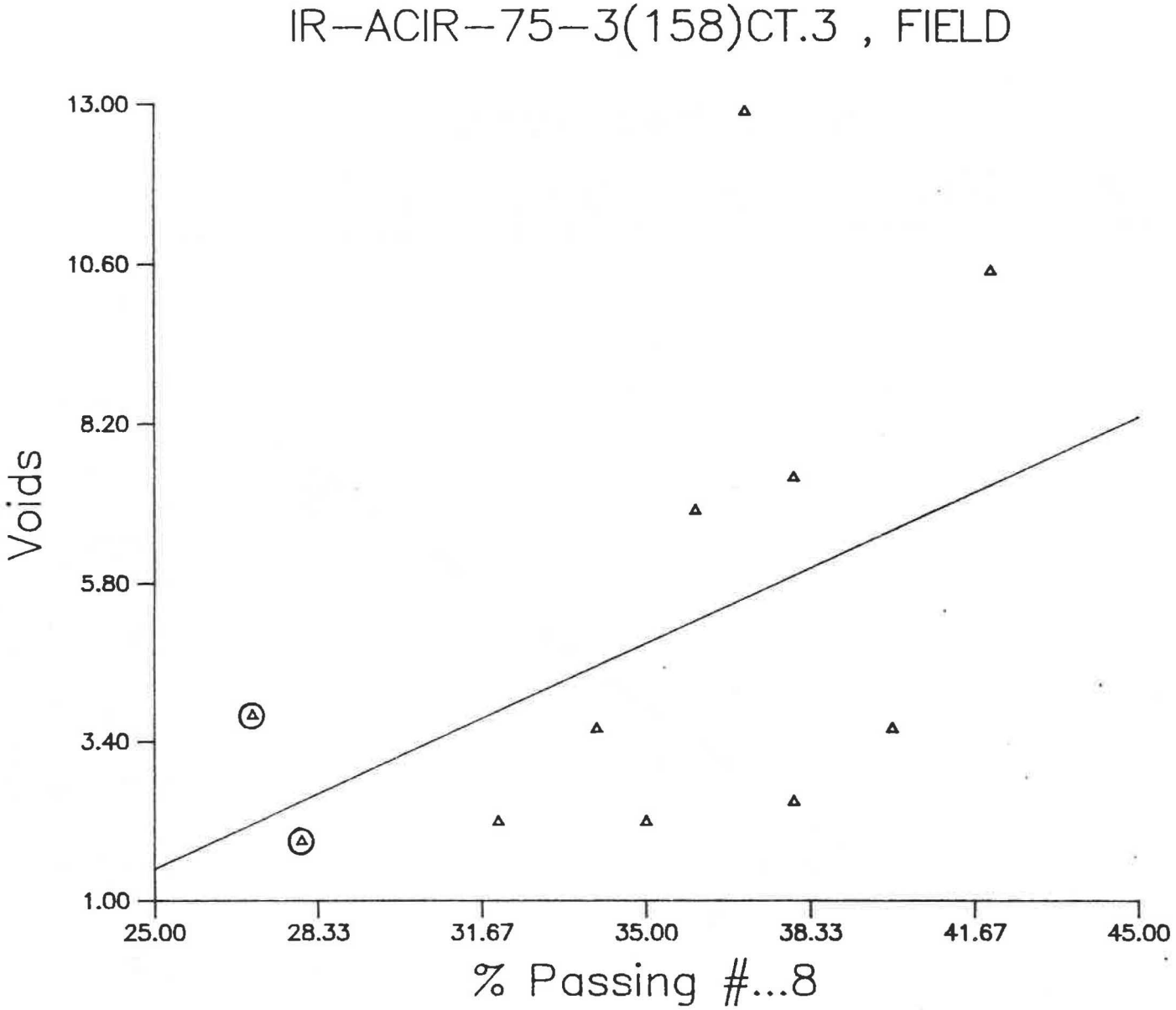

APD–ACAPD–56 –2(7)CT.5,FIELDS
Asphalt Content
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
25.0
28.0
31.0
34.0
37.0
40.0
% Passing #...8

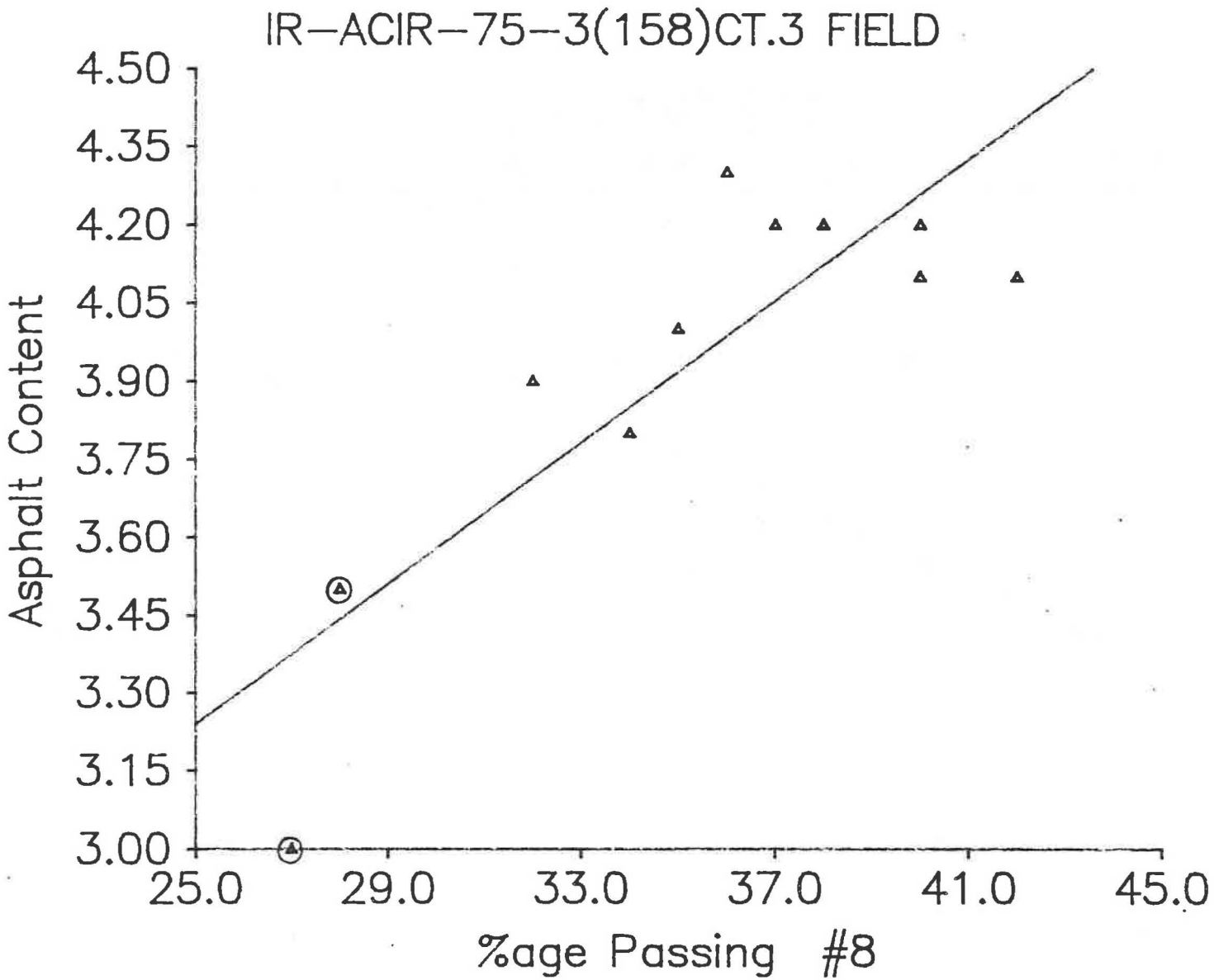

APD-ACAPD-56-2(7) , FIELD
7.00
5.60
4.20
2.80
1.40
0.00
Voids
25.0
27.5
30.0
32.5
35.0
37.5
40.0
% Passing #...8

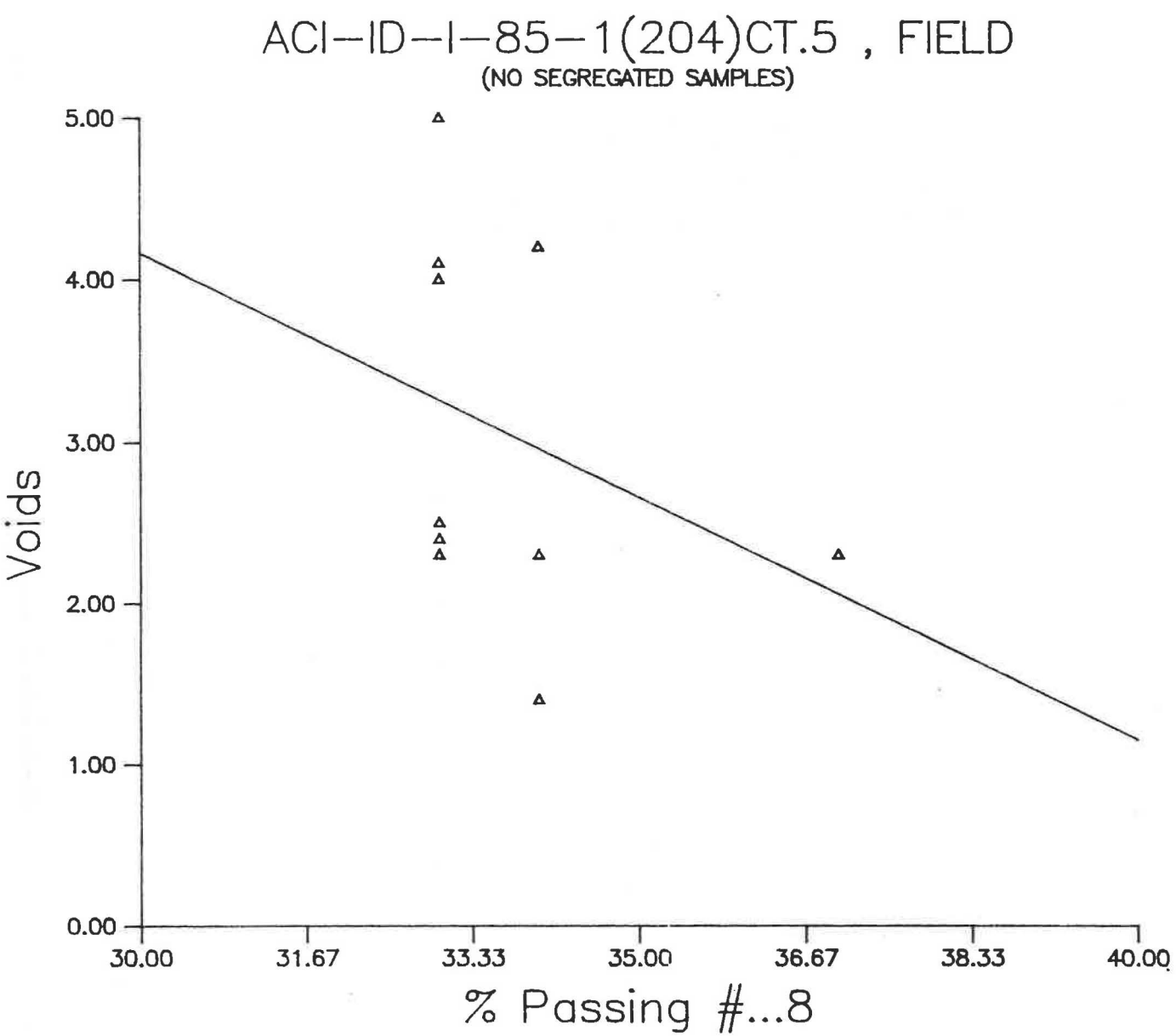

IR-ACIR-85-2(103)CT.6 FIELD
Asphalt Content
6.00
5.70
5.40
5.10
4.80
4.50
4.20
3.90
3.60
3.30
3.00
25.0
28.0
31.0
34.0
37.0
40.0
%age Passing #8

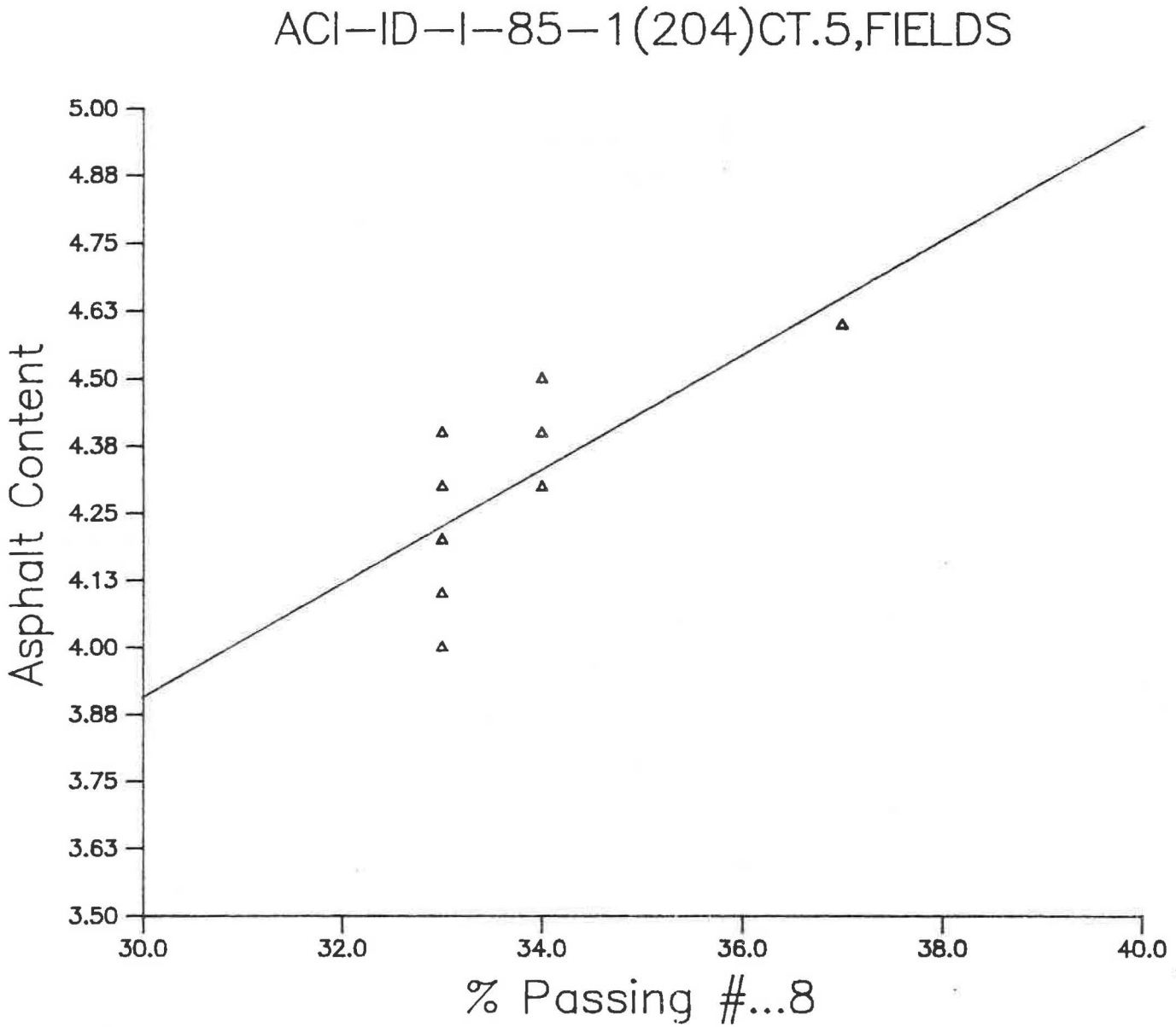

IR–ACIR–85–2(103)CT.6 PLANT
Asphalt Content
5.00
4.85
4.70
4.55
4.40
4.25
4.10
3.95
3.80
3.65
3.50
30.0
32.0
34.0
36.0
38.0
40.0
%age Passing #8

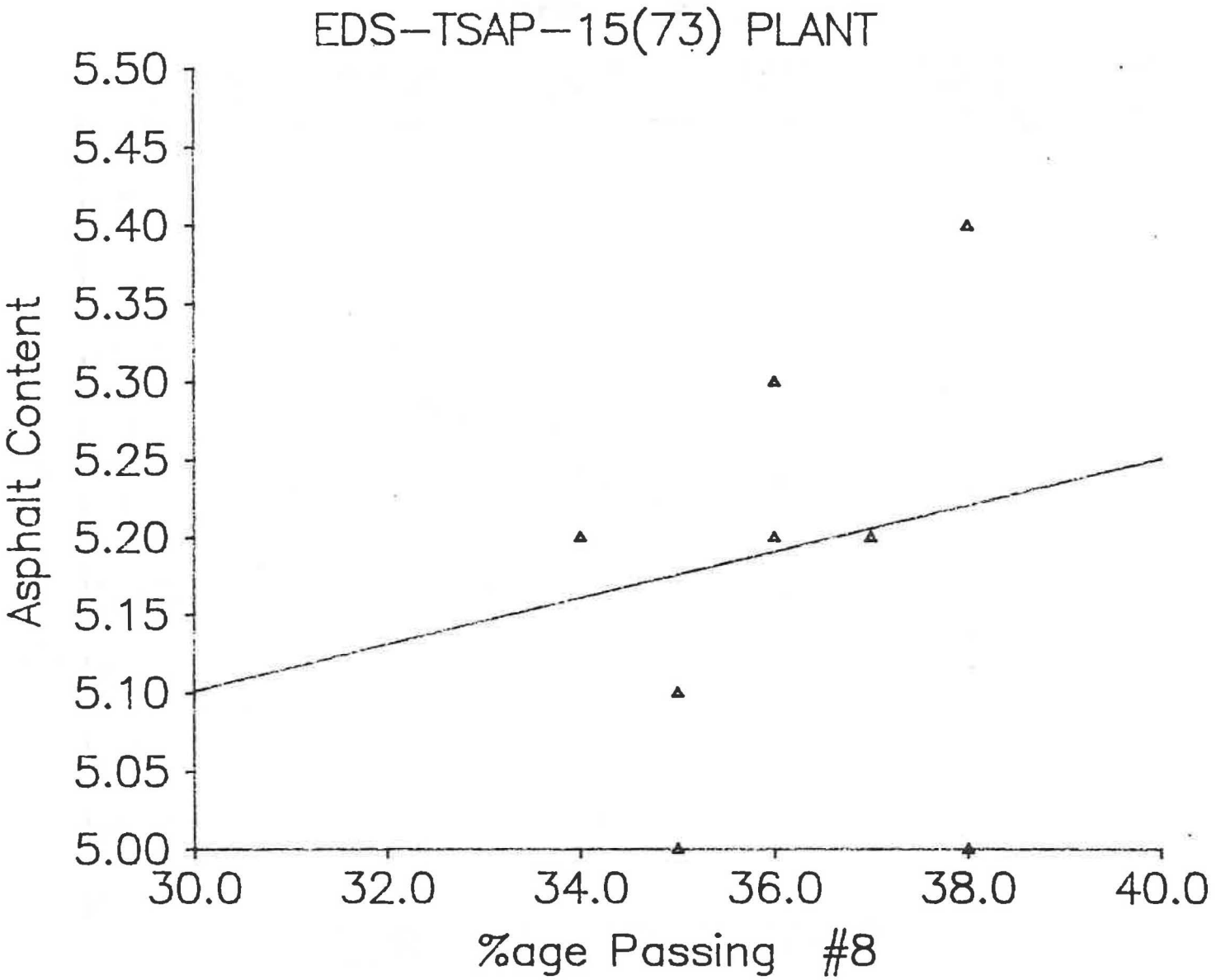

IR–ACIR–75–3(158)CT.3 PLANT
Asphalt Content
5.00
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
3.00
30.0
32.0
34.0
36.0
38.0
40.0
%age Passing #8

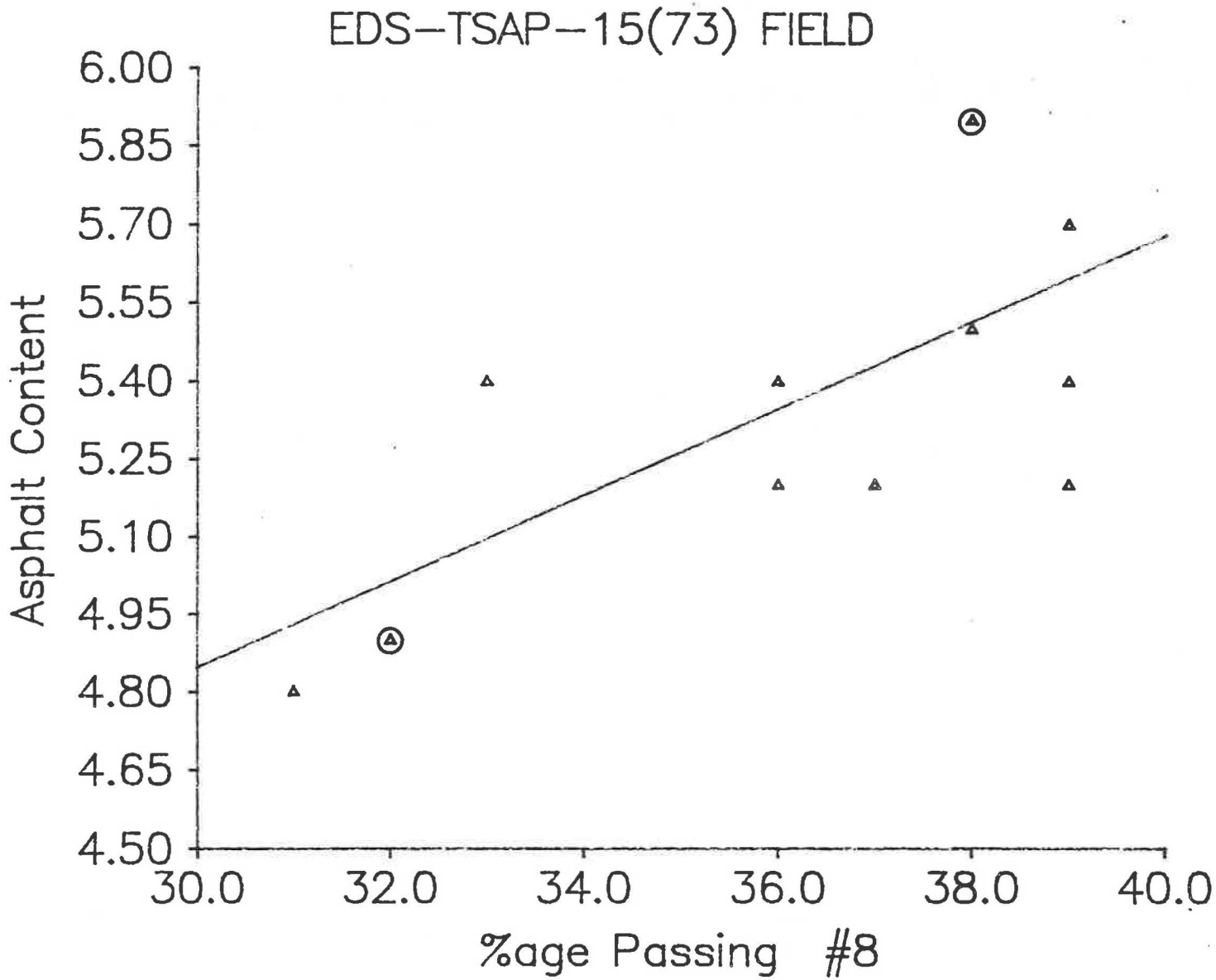

IR-ACIR-75-3(158)CT.3 , FIELD
13.00
10.60
8.20
5.80
3.40
1.00
Voids
25.00
28.33
31.67
35.00
38.33
41.67
45.00
% Passing #...8

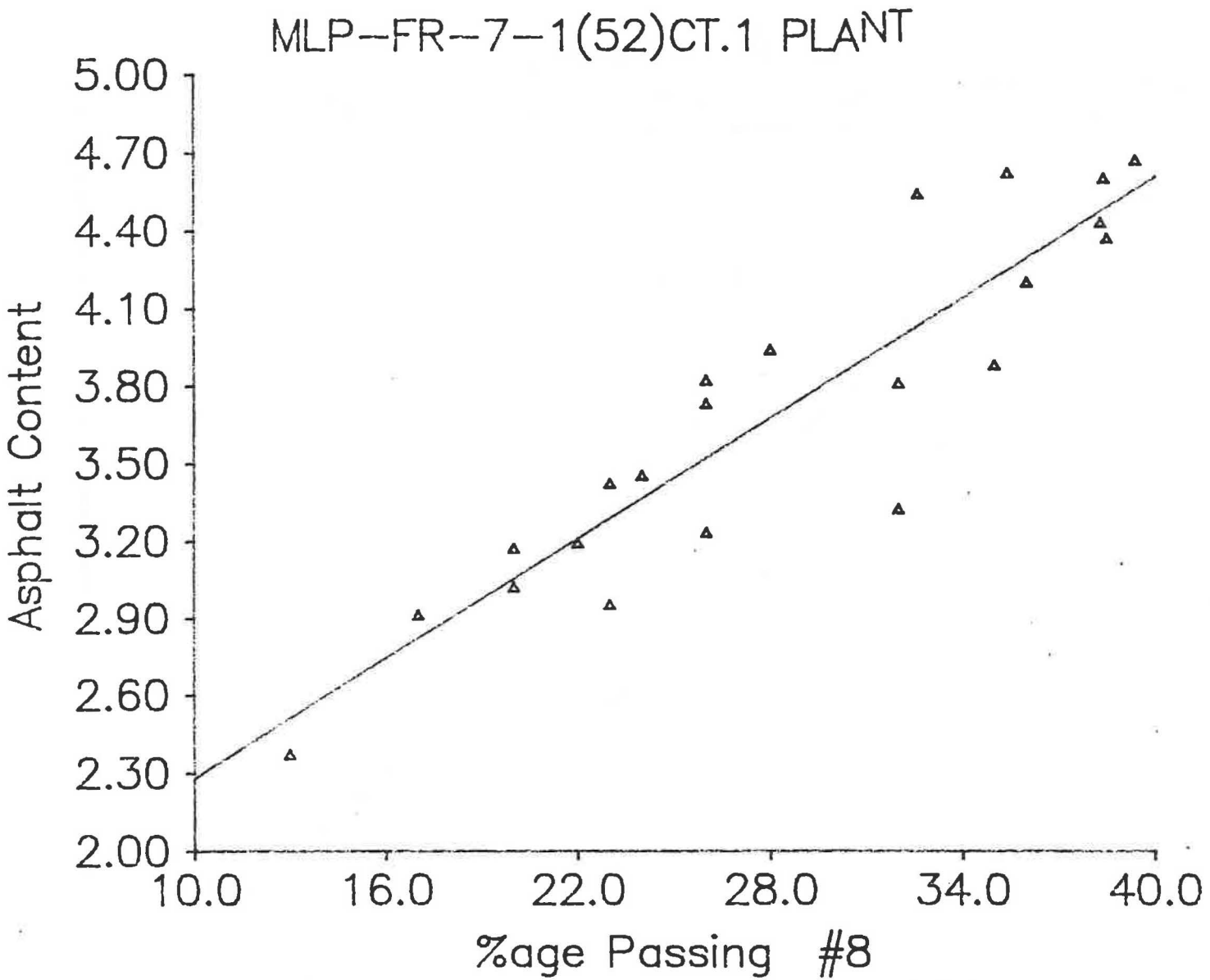

IR–ACIR–75–3(158)CT.3 FIELD
Asphalt Content
4.50
4.35
4.20
4.05
3.90
3.75
3.60
3.45
3.30
3.15
3.00
25.0
29.0
33.0
37.0
41.0
45.0
%age Passing #8

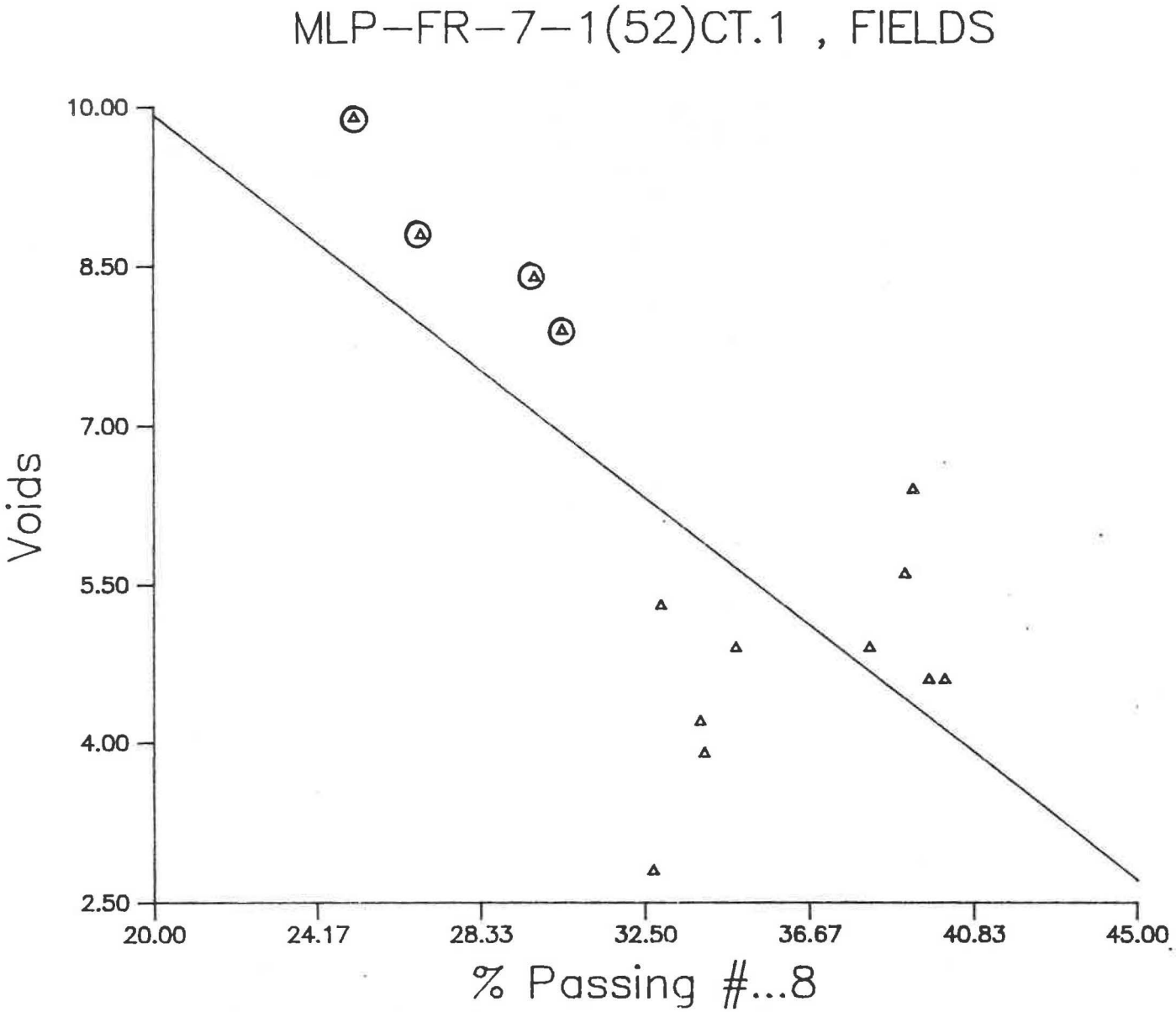

ACI-ID-I-85-1(204)CT.5 , FIELD
(NO SEGREGATED SAMPLES)
5.00
4.00
3.00
2.00
1.00
0.00
Voids
30.00
31.67
33.33
35.00
36.67
38.33
40.00
% Passing #...8

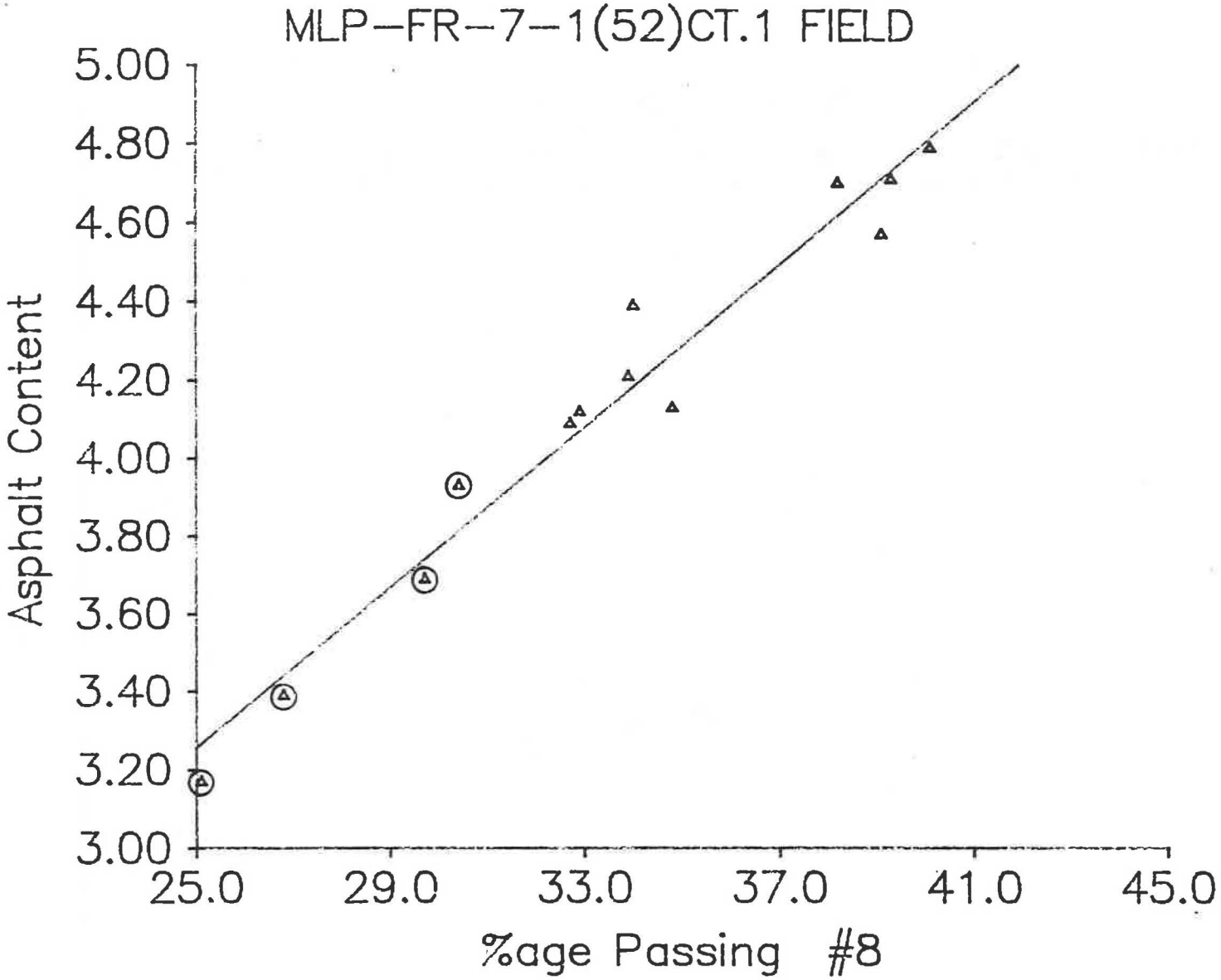

ACI-ID-I-85-1(204)CT.5,FIELDS
Asphalt Content
5.00
4.88
4.75
4.63
4.50
4.38
4.25
4.13
4.00
3.88
3.75
3.63
3.50
30.0
32.0
34.0
36.0
38.0
40.0
% Passing #...8

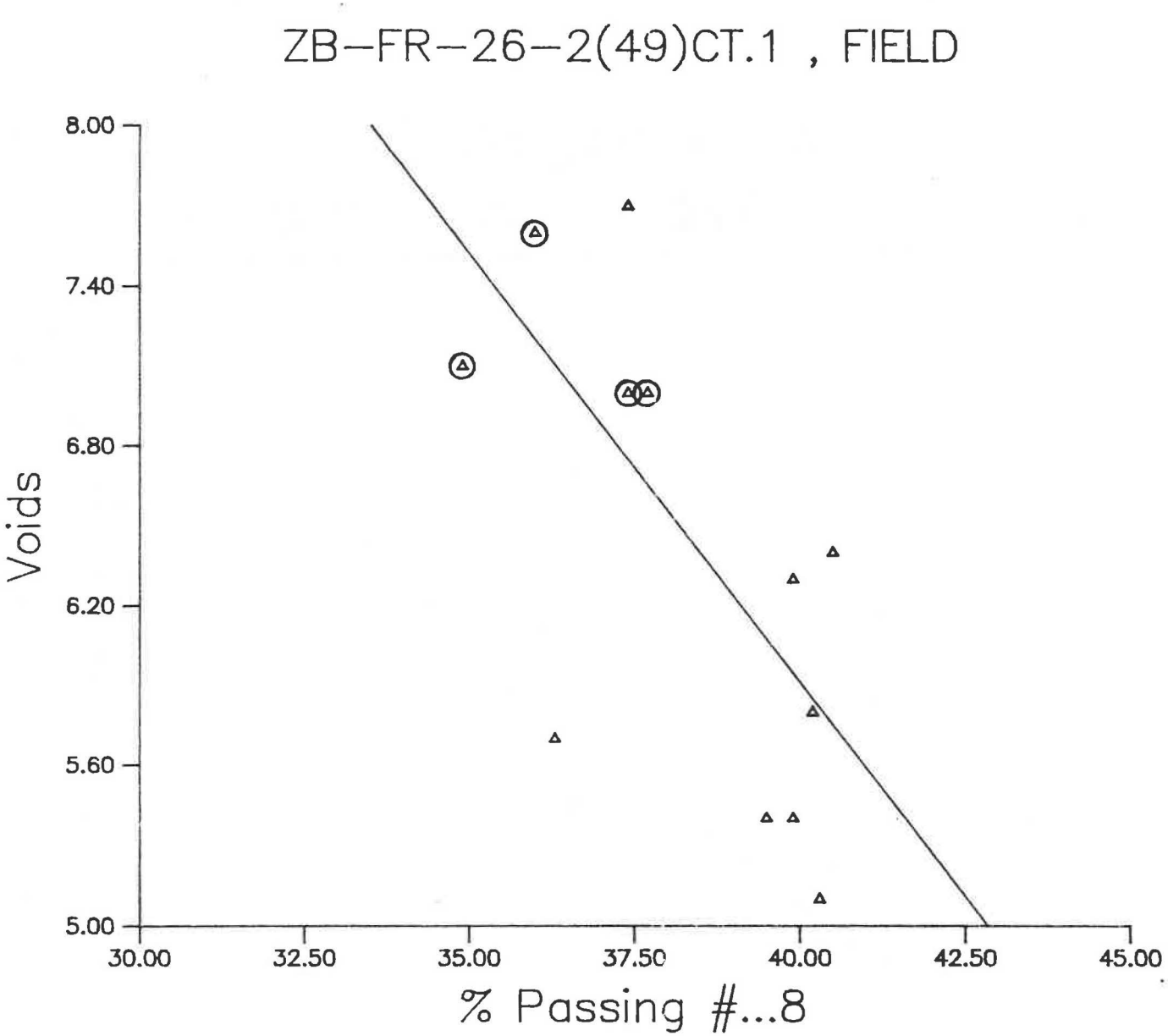

EDS–TSAP–15(73) PLANT
Asphalt Content
5.50
5.45
5.40
5.35
5.30
5.25
5.20
5.15
5.10
5.05
5.00
30.0
32.0
34.0
36.0
38.0
40.0
%age Passing #8


EDS–TSAP–15(73) FIELD
6.00
5.85
5.70
5.55
5.40
5.25
5.10
4.95
4.80
4.65
4.50
Asphalt Content
30.0
32.0
34.0
36.0
38.0
40.0
%age Passing #8


MLP--FR--7--1(52)CT.1 PLANT
Asphalt Content
5.00
4.70
4.40
4.10
3.80
3.50
3.20
2.90
2.60
2.30
2.00
10.0
16.0
22.0
28.0
34.0
40.0
%age Passing #8


MLP-FR-7-1(52)CT.1 , FIELDS
10.00
8.50
7.00
5.50
4.00
2.50
Voids
20.00
24.17
28.33
32.50
36.67
40.83
45.00
% Passing #...8


MLP–FR–7–1(52)CT.1 FIELD
Asphalt Content
5.00
4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40
3.20
3.00
25.0
29.0
33.0
37.0
41.0
45.0
%age Passing #8


ZB-FR-26-2(49)CT.1 , FIELD
8.00
7.40
6.80
6.20
5.60
5.00
Voids
30.00
32.50
35.00
37.50
40.00
42.50
45.00
% Passing #...8