

# INVESTIGATION OF CHANGES IN GROUP INDEX (GI) OF AASHTO CLASSIFICATION USED IN ROAD CONSTRUCTION

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**Abstract** – The soil classification methods used to identify the soil are an important criterion for predicting the physical behavior of the soils. The AASHTO classification system, widely used in road construction, divides the ground into seven main groups. The AASHTO classification system, the grain size distribution, and the Atterberg limits are derived from experiments, a system in which the soil group is identified from left to right. Group index (GI) value is a parametric value that determines the suitability of silty or clay-sanded ground materials for use as road infrastructure fill material. In this study, the variation of the group index value was investigated as the percentage of material passing under the number 200 mesh increased.

**Keywords** - AASHTO Classification System, Group index (GI), Road Construction, Fill Material.

## I. INTRODUCTION

In ground engineering; ground classification plays an important role in the construction of foundation design, slope stability, road construction and similar engineering structures. Classification of the ground in the examination area is important for many engineering uses. Ground classification systems generally classify the soil based on grain size distribution and Atterberg limits. Using soil particle size distribution and Atterberg limits, separating soil showing similar behavior into group and sub groups facilitate the use of the ground in engineering structures. Today's most widely used ground classification systems are; The Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Office (AASHTO) (Das, 1998). USCS is mainly used for ground engineering, AASHTO is mainly used for road construction works.

In the AASHTO ground classification method, in addition to the ground class, the group index (GI) value is also calculated. The group index is a value derived from the physical properties of the fill base soil and sub base; empirically calculated or determined from the graph. The value of the group index value arises when different grounds fall into the same group. If different grounds fall into the same group, the group index value plays an important role in separating these floors. The lower the index group a ground, to be used as sub-base material in road construction work means so convenient.

In this study, the variation of the group index value was investigated as the percentage of material passing under the number 200 sieve increased. In the study, the values of GI value were calculated by keeping fixed LL and PL values. Sieve 200 values are changed by %5 and changes of GI values calculated by Excel Table.

## II. DETAILS EXPERIMENTAL

In the AASHTO ground classification system, which is widely used in road construction, the grounds are divided into 7 main groups according to their granulometric properties, liquid limit and plasticity indices. The groups, A-1, A-2 and A-7, are subdivided into subgroups. A-1, A-2 and A-3 are granular materials of which 35% or less of the particles pass through the No. 200 sieve. Soils of which more than 35% pass through the No. 200 sieve are classified under groups A-4, A-5, A-6, and A-7. These soils are mostly silt and clay-type materials.

In the AASHTO classification, the group index, which is a criteria that can be used to evaluate the quality of a soil, is defined. Group index is a value empirically calculated according to the physical characteristics of the materials or determined from the graph. This index is written in parentheses after the group or sub group designation. The group index is given by the Eq. 1.

$$GI = (F - 35)[0.2 + 0.005(LL - 40)] + 0.01(F - 15)(PI - 10) \quad (1)$$

where;

F = Percentage passing through Number 200 sieve

LL = Liquid Limit

PL = Plasticity Index

- There are some rules in determining the group index. These are listed below.
- If the calculated group index is negative, then it is taken as 0.
- The calculated group index is rounded to the nearest number.

- If the ground sample is a non-plastic or the liquid limit can not be determined, then the group index is taken as 0.
- Group index value does not have any upper limit.
- For A-1, A-3 and some subgroups of A-2, the group index value is always zero.

The group index value can also be determined by the graph shown in Fig.1. There are 2 values according to the plasticity index and the liquid limit. Then the values are read and the group index is determined. One example is shown on the figure.

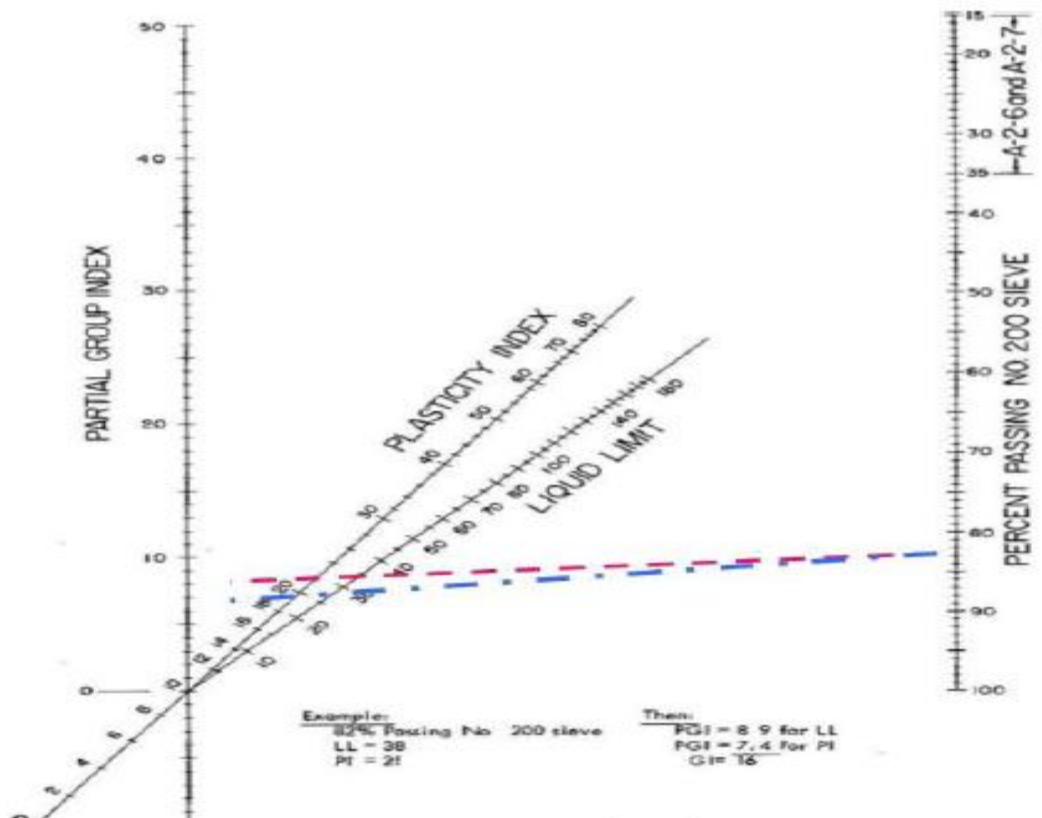


Figure 1: Group Index Chart

### III. RESULTS AND DISCUSSION

Group index values were calculated for different ground conditions according to the group index formula given in equation 1. Liquid Limit (LL) and Plasticity Index (PI) were determined fixed value and

They were 60 and 20, respectively. The percentage of material passing under the number 200 sieve increased from 0 to 100 by %5. Therefore, GI values of 21 different ground conditions were investigated. GI values are illustrated in Table 1.

	Term with LL						Term with PI					G I
	F	F-35	L	LL-40	$0,005*(LL-40)$	$0,2+0,005*(LL-40)$	P	P	PI-10	F-15	$0,01*(F-15)*(PI-10)$	
Nr. 200 %P=35	35	0	0	20	0,1	0,3	4	2	10	20	2	2
Nr. 200 %P=40	40	5	0	20	0,1	0,3	4	2	10	25	2,5	4
Nr. 200 %P=45	45	10	0	20	0,1	0,3	4	2	10	30	3	6
Nr. 200 %P=50	50	15	0	20	0,1	0,3	4	2	10	35	3,5	8
Nr. 200 %P=55	55	20	0	20	0,1	0,3	4	2	10	40	4	10
Nr. 200 %P=60	60	25	0	20	0,1	0,3	4	2	10	45	4,5	12
Nr. 200 %P=65	65	30	0	20	0,1	0,3	4	2	10	50	5	14

Nr. 200 %P=70	70	35	6	0	20	0,1	0,3	4	2	0	0	10	55	5,5	1	6
Nr. 200 %P=75	75	40	6	0	20	0,1	0,3	4	2	0	0	10	60	6	1	8
Nr. 200 %P=80	80	45	6	0	20	0,1	0,3	4	2	0	0	10	65	6,5	2	0
Nr. 200 %P=85	85	50	6	0	20	0,1	0,3	4	2	0	0	10	70	7	2	2
Nr. 200 %P=90	90	55	6	0	20	0,1	0,3	4	2	0	0	10	75	7,5	2	4
Nr. 200 %P=95	95	60	6	0	20	0,1	0,3	4	2	0	0	10	80	8	2	6
Nr. 200 %P=100	100	65	6	0	20	0,1	0,3	4	2	0	0	10	85	8,5	2	8
Nr. 200 %P=30	30	-5	6	0	20	0,1	0,3	4	2	0	0	10	15	1,5	0	0
Nr. 200 %P=25	25	-10	6	0	20	0,1	0,3	4	2	0	0	10	10	1	0	-2
Nr. 200 %P=20	20	-15	6	0	20	0,1	0,3	4	2	0	0	10	5	0,5	0	-4
Nr. 200 %P=15	15	-20	6	0	20	0,1	0,3	4	2	0	0	10	0	0	0	-6
Nr. 200 %P=10	10	-25	6	0	20	0,1	0,3	4	2	0	0	10	-5	-0,5	0	-8
Nr. 200 %P=5	5	-30	6	0	20	0,1	0,3	4	2	0	0	10	-10	-1	0	-10
Nr. 200 %P=0	0	-35	6	0	20	0,1	0,3	4	2	0	0	10	-15	-1,5	0	-12

Table 1: Group Index Chart

## CONCLUSIONS

AASHTO soil classification system is mainly used in road construction. This system divides grounds in 7 main groups and allows to know how useful the ground is. Grain size is one of the most important factors affecting the strength of the ground. That physical and mechanical properties of the grounds are at an adequate level is significant in determining the thickness of permanent way. Therefore, it is necessary to determine the value of the group index, which is one of the values indicating the ground class, in the determination of the road structure and in the road material selection. Calculating group index value is based on LL, PL and the percentage of material passing through number 200 sieve.

In this study, the change of the group index value, in the case of 21 different grounds, were examined by keeping constant LL and PL values. There results show that as the percentage of material passing through the 200 sieve increases, the group index value increases and the suitability of the material for road construction is reduced. When the LL and PL values are kept constant, it is considered that the portion of the material passing through the number 200 sieve

upto 50% percent is more suitable for use in road construction.

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