RESEARCH ARTICLE

RSP Science Hub

International Research Journal on Advanced Science Hub
2582-4376
www.rspsciencehub.com
Vol. 08, Issue 02 February

Check for updates

http://dx.doi.org/10.47392/IRJASH.2026.006

Analysis and Design of Rigid Pavement in Submerged Condition

V. Meghana[1], P. Uma SaiKrishna[2], Vakati RadhaKrishna[3], L. IndumathiDevi[4], D. Pavan Kumar[5]
[1,2,3,4,5] Assistant professor, Dept. of Civil, GIST, SPSR Nellore, Andhra Pradesh, India.
Emails: *meghana@gist.edu.in[1], umasaikrishna@gist.edu.in[2], vradhakrishna@gist.edu.in[3], indumathi@gist.edu.in[4], dpavankumar@gist.edu.in[5]*

Article history
Received: 05 December 2025
Accepted: 24 December 2025
Published: 04 February 2026

Keywords:
Pavement analysis, Pavement design, Submerged condition, Fatigue analysis.

Abstract
A pavement structure causes huge expense for their rehabilitation and maintenance because of flooding or improper drainage conditions. It has been in practice from the evolution of art to science design of rigid pavements is defined by an important experimentation phenomenon. In rigid pavements the cement concrete slab is placed either on a single layer of granular material or directly on the sub grade. In rigid pavement design, sub grade strength is obtained by modulus of sub grade reaction (K). It is determined by plate load tests of the foundation defined as the pressure per unit deflection. Temperature variations during day and night time causes temperature stresses due to curling occurs for cement concrete slabs. Due to seasonal temperature variations the concrete slab is subjected to contraction and expansion. Pavement causing damage due to the cyclic load applications of vehicles stressed are induced on the slab. In this study, an analysis is carried out to determine the effect on sub grade strength and its properties during pavement submergence period. An existing pavement structure suggested by the Indian Roads Congress standard is analyzed and compared with its submerged condition. New pavement sections were designed using the material properties under submerged cases, and fatigue analysis is done through IRC method.

1. Introduction

A typical Rigid pavement is constructed by using Portland cement concrete (PCC) and granular materials. Rigid pavement has long span of service of 30-40 years. The main design considerations for rigid pavement is to reduce the fatigue failure due to the cyclic stresses of traffic on the pavement. There are three main types of pavements used for construction of rigid pavement; namely jointed reinforced concrete pavement (JRCP), jointed plain concrete pavement (JPCP), and continuously reinforced concrete pavements (CRCP) [4]. Factors such as traffic volume, the capacity of the road, concern of traffic growth rate and the possibility of enlargement of capacity by widening are taken into consideration to the design engineer for design period of pavement. The soil sub grade, sub-base or base course and concrete slab are the layers of a typical rigid pavement. The performance of the sub grade is typically elastic under the transitory traffic loading with slight permanent deformation in a single pass. Due to load of vehicles and water submerged condition in seasonal time, the sub grade and granular base layer will be affected. The modulus of sub grade reaction (K) is a vital parameter for design and the behavior of rigid pavement. The sub grade soil strength and consequently the strength of the foundation as a whole, is affected by its moisture content. Determination of K value is generally carried out through plate load test. Another simple method to obtain K values is using its correlation between the California Bearing Ratio (CBR). For a rigid pavement, CBR of 8% is recommended as the minimum sub grade CBR for design [8]. In order to reduce the inter layer friction, the foundation layer below the concrete slab should be smooth. A membrane of 125 micron polythene is generally used as separation layer for this purpose. Modulus of elasticity, Poisson's ratio, coefficient of thermal expansion are the properties of concrete considered for design. The temperature differential, which is a function of solar radiation received by the pavement surface, wind velocity, thermal diffusivity of concrete, latitude, longitude and elevation of the place, etc. also affect pavement performance [8]. The analysis is done based on IRC 58-2011.

2. Literature Review

The determination of K value, which is used in road structures and foundation design, can be done through the interpretation of the K value and the modulus of elasticity (E) based on the CBR values [4]. The determination of effective K-values for different combination of sub-base or base layers using dry lean concrete (DLC), granular sub base and cement treated base can be done. A relative study is conducted for two types of loading single and tandem axle [3]. The AASHTO pavement design guide provides relation between K and E relationship [6]. A study on the strength of the soil samples under different deluge conditions was carried out by Naser and Ghani [1]. The strength of the soil in the pavement was decreased when they were in submerged state for longer period. The strength of sub grade, type of sub-base, axle load repetitions and shoulders are taken into considerations for concrete slab thickness of the rigid pavement. The different thickness with shoulder conditions of both tied and untied of pavement design has been carried out with DLC, Granular sub base (GSB) and Cement treated sub-base (CTSB) [5].

3. Objectives

The submersion of pavement structure due to rainfall adversely affects the pavement performance. The main objectives of the current study are:

- To analyze a pavement structure under conventional case and under partial and complete submerged conditions.
- To design required thickness for pavement structure under submerged conditions considering fatigue analysis.

4. Methodology

The study involves analyzing an existing pavement structure and to analyze layer thickness and calculate K value according to CBR value. Assigning the K value to calculate surface, base or sub base and sub grade course of pavement. Analyzing the responses and Damage Analysis in fatigue of rigid pavement. Figure 1 shows Pavement Layer

4.1. Study of Existing Pavement

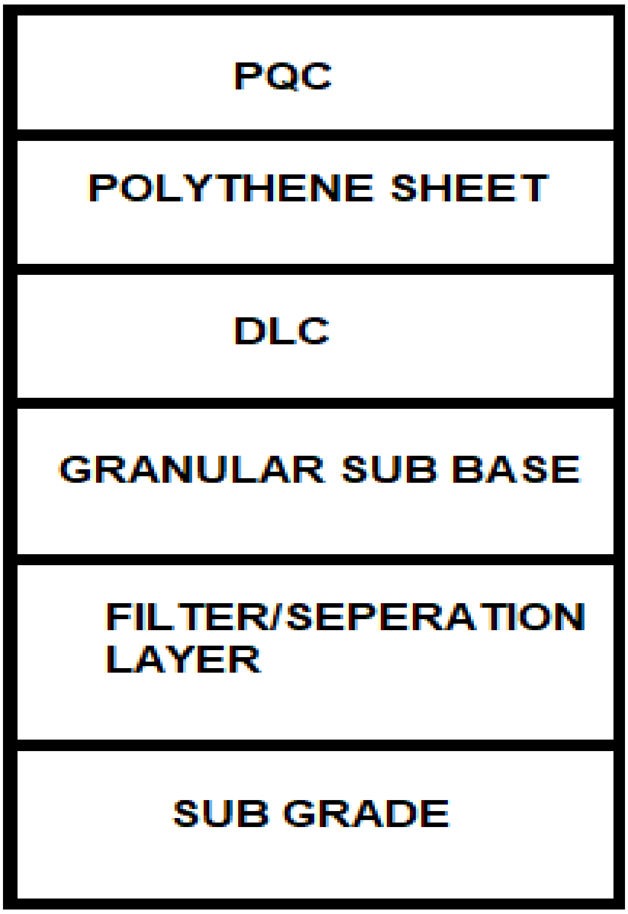

Figure 1 Pavement Layer

- The typical cross section of rigid pavement is aligned as shown in Fig. 1.
- The sub grade is considered as dense liquid foundation.

- Due to heavy traffic and environmental conditions like freezing, thawing and excessive moisture conditions, DLC acts as sub base to provide uniform, stable and permanent support to concrete slab and not to occur erosion.
- GSB and CTSB are also act as sub base above sub grade.
- A inter layer is provided between concrete slab and DLC of polythene sheet of 125 micron act as de-bonding.
- Pavement Quality Concrete is used as slab of rigid pavement attains flexure strength of concrete of 90 days is permitted for concrete pavement.

4.2. IRC 58-2011 Input Parameters

- Type of pavement considers of carriage way, shoulders provided, lane width, transverse joints.
- Design traffic estimation includes design period, cumulative number of commercial vehicles and rear single axle considered.
- Pavement structure details of CBR are taken as 10%, K value for sub grade, thickness of DLC, thickness of GSB, thickness of CTSB, effective K values, unit weight, flexure strength of concrete and temperature differential in slab of day and night time, trial thickness of slab is considered.
- The above input parameters are considered as conventional case and in case of submerged condition the reducing the K and effective K values of 25% and 50% of damage conditions of sub grade is analyzed.
- Fig2. Shows Fatigue analysis of rigid pavement in Bottom-up Cracking at day time and Top-Down Cracking at night time.

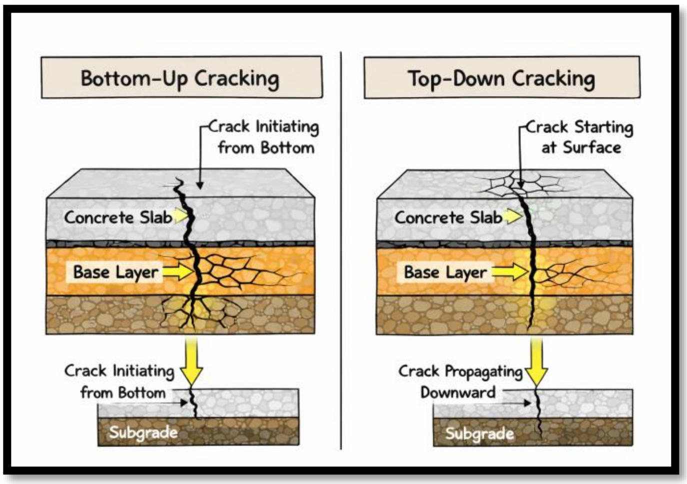

Figure 2 **Fatigue in Road Surface**

5. Results

The fatigue analysis of rigid pavements is carried out as per IRC:58-2011, considering submerged conditions and traffic loading, where subgrade damage may occur. Using a conventional case with DLC, CTSB, and GSB as sub-base layers, CBR is taken as 10% to determine the K-value and effective K-values. Fatigue damage is analyzed under conventional conditions and with 25% and 50% reductions in K and effective K-values. If damage occurs, slab thickness is increased by trial-and-error to protect the subgrade under repeated loading and submerged conditions. Tables 1–2 present bottom-up and top-down cracking for conventional DLC (100 mm) and 300 mm slab thickness. Tables 3–6 show analysis under 25% and 50% K reductions with increased slab thickness. Tables 7–12 cover CTSB sub-base, and Tables 13–18 cover GSB sub-base, with thickness adjustments to prevent subgrade damage. Fig. 3 indicates that the cumulative fatigue sum must be less than 1.0 for pavement safety.

Table 1 **Bottom-Up Cracking Fatigue Analysis of Conventional Case for Rear Single Axles (H=0.3m, DLC=0.1m)**

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.4	0.50	619200	0.241
175-185	143477	2.4	0.49	997574	0.144
165-175	150392	2.4	0.48	1743953	0.086
155-165	106846	2.3	0.47	3422273	0.031
145-155	24530	2.3	0.46	8009758	0.003
135-145	13335	2.2	0.45	25361184	0.001

125-135	21567	2.2	0.44	infinite	0.000
115-125	21814	2.1	0.43	infinite	0.000
105-115	21814	2.1	0.42	infinite	0.000
95-105	26753	2.0	0.41	infinite	0.000
85-95	26753	2.0	0.40	infinite	0.000
< 85	116477	1.9	0.39	infinite	0.000
Fatigue Damage					0.506

Table 2 Top-Down Cracking Fatigue Analysis of Conventional Case for Rear Single Axles (H=0.3m, DLC=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.5	0.51	478051	0.379
175-185	173912	2.4	0.49	924042	0.188
165-175	182293	2.3	0.48	2111519	0.086
155-165	129511	2.3	0.46	6399485	0.020
145-155	29734	2.2	0.45	34716227	0.001
135-145	16164	2.1	0.43	infinite	0.000
125-135	26142	2.1	0.42	infinite	0.000
115-125	26441	2.0	0.41	infinite	0.000
105-115	26441	1.9	0.39	infinite	0.000
95-105	32428	1.8	0.38	infinite	0.000
85-95	32428	1.8	0.36	infinite	0.000
< 85	141185	1.7	0.35	infinite	0.000
Fatigue Damage					0.674

Table 3 Bottom-Up Cracking Fatigue Analysis of 25% Reduction of K Value for Rear Single Axles (H=0.3m, DLC=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.5	0.514	415807	0.436
175-185	173912	2.4	0.500	779684	0.223
165-175	182293	2.4	0.485	1699368	0.107
155-165	129511	2.3	0.471	4736417	0.027
145-155	29734	2.2	0.457	21263981	0.001
135-145	16164	2.1	0.443	infinite	0.000
125-135	26142	2.1	0.428	infinite	0.000
115-125	26441	2.0	0.414	infinite	0.000
105-115	26441	1.9	0.400	infinite	0.000
95-105	32428	1.9	0.386	infinite	0.000
85-95	32428	1.8	0.372	infinite	0.000
< 85	141185	1.7	0.357	infinite	0.000
Fatigue Damage					0.795

Table 4 Top-Down Cracking Fatigue Analysis of 25% Reduction in K Value for Rear Single Axles (H=0.3m, DLC=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	451273	0.331
175-185	143477	2.4	0.50	693629	0.207
165-175	150392	2.4	0.49	1138007	0.132
155-165	106846	2.3	0.48	2040121	0.052
145-155	24530	2.3	0.47	4154459	0.006
135-145	13335	2.2	0.46	10323748	0.001
125-135	21567	2.2	0.45	36618494	0.001
115-125	21814	2.1	0.44	infinite	0.000
105-115	21814	2.1	0.43	infinite	0.000
95-105	26753	2.0	0.42	infinite	0.000
85-95	26753	2.0	0.41	infinite	0.000
< 85	116477	2.0	0.40	infinite	0.000
Fatigue Damage					0.730

Table 5 Bottom-Up Cracking Fatigue Analysis of 50% Reduction in K Value for Rear Single Axles (H=0.32m, DLC=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.3	0.48	2253755	0.080
175-185	173912	2.2	0.46	10398772	0.017
165-175	182293	2.2	0.44	infinite	0.000
155-165	129511	2.1	0.42	infinite	0.000
145-155	29734	2.0	0.40	infinite	0.000
135-145	16164	1.9	0.39	infinite	0.000
125-135	26142	1.8	0.37	infinite	0.000
115-125	26441	1.7	0.35	infinite	0.000
105-115	26441	1.6	0.33	infinite	0.000
95-105	32428	1.5	0.31	infinite	0.000
85-95	32428	1.4	0.30	infinite	0.000
< 85	141185	1.3	0.28	infinite	0.000
Fatigue Damage					0.097

Table 6 Top-Down Cracking Fatigue Analysis of 50% Reduction in K Value for Rear Single Axles (H=0.32m, DLC=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	351736	0.425
175-185	143477	2.5	0.50	519897	0.276
165-175	150392	2.4	0.49	810402	0.186
155-165	106846	2.4	0.48	1354716	0.079
145-155	24530	2.3	0.47	2493141	0.010
135-145	13335	2.3	0.47	5280810	0.003
125-135	21567	2.2	0.46	14013778	0.002
115-125	21814	2.2	0.45	56709020	0.000
105-115	21814	2.1	0.44	infinite	0.000

95-105	26753	2.1	0.43	infinite	0.000
85-95	26753	2.0	0.42	infinite	0.000
< 85	116477	2.0	0.41	infinite	0.000
Fatigue Damage					0.979

Table 7 Bottom-Up Cracking Fatigue Analysis of Conventional Case for Rear Single Axles (H=0.3m, CTSB=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.4	0.49	1108545	0.163
175-185	173912	2.3	0.44	3636543	0.048
165-175	182293	2.2	0.45	23961894	0.008
155-165	129511	2.1	0.43	infinite	0.000
145-155	29734	2.0	0.41	infinite	0.000
135-145	16164	1.9	0.40	infinite	0.000
125-135	26142	1.8	0.38	infinite	0.000
115-125	26441	1.8	0.36	infinite	0.000
105-115	26441	1.7	0.34	infinite	0.000
95-105	32428	1.6	0.32	infinite	0.000
85-95	32428	1.5	0.30	infinite	0.000
< 85	141185	1.4	0.29	infinite	0.000
Fatigue Damage					0.219

Table 8 Top-Down Cracking Fatigue Analysis of Conventional Case for Rear Single Axles (H=0.3m, CTSB=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	391032	0.382
175-185	143477	2.5	0.50	589341	0.243
165-175	150392	2.4	0.49	942189	0.160
155-165	106846	2.4	0.48	1629862	0.066
145-155	24530	2.3	0.47	3149805	0.008
135-145	13335	2.3	0.46	7195384	0.002
125-135	21567	2.2	0.45	21795320	0.001
115-125	21814	2.2	0.44	infinite	0.000
105-115	21814	2.1	0.43	infinite	0.000
95-105	26753	2.1	0.42	infinite	0.000
85-95	26753	2.0	0.41	infinite	0.000
< 85	116477	2.0	0.40	infinite	0.000
Fatigue Damage					0.861

Table 9 Bottom-Up Cracking Fatigue Analysis of 25% Reduction of K Value for Rear Single Axles (H=0.31m, CTSB=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.4	0.48	1741399	0.104
175-185	173912	2.3	0.46	7032640	0.025
165-175	182293	2.2	0.44	infinite	0.000

155-165	129511	2.1	0.43	infinite	0.000
145-155	29734	2.0	0.41	infinite	0.000
135-145	16164	1.9	0.39	infinite	0.000
125-135	26142	1.8	0.37	infinite	0.000
115-125	26441	1.7	0.35	infinite	0.000
105-115	26441	1.6	0.33	infinite	0.000
95-105	32428	1.5	0.32	infinite	0.000
85-95	32428	1.4	0.30	infinite	0.000
< 85	141185	1.4	0.28	infinite	0.000
Fatigue Damage					0.129

Table 10 Top-Down Cracking Fatigue Analysis of 25% Reduction in K Value for Rear Single Axles (H=0.31m, CTSB=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	351799	0.425
175-185	143477	2.5	0.50	521442	0.275
165-175	150392	2.4	0.49	815743	0.184
155-165	106846	2.4	0.48	1370251	0.078
145-155	24530	2.3	0.47	2539013	0.010
135-145	13335	2.3	0.47	5434106	0.002
125-135	21567	2.2	0.46	14677904	0.001
115-125	21814	2.2	0.45	61627688	0.000
105-115	21814	2.1	0.44	infinite	0.000
95-105	26753	2.1	0.43	infinite	0.000
85-95	26753	2.0	0.42	infinite	0.000
< 85	116477	2.0	0.41	infinite	0.000
Fatigue Damage					0.976

Table 11 Bottom-Up Cracking Fatigue Analysis of 50% Reduction in K Value for Rear Single Axles (H=0.32m, CTSB=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.3	0.46	7836106	0.023
175-185	173912	2.2	0.44	infinite	0.000
165-175	182293	2.1	0.42	infinite	0.000
155-165	129511	2.0	0.40	infinite	0.000
145-155	29734	1.9	0.38	infinite	0.000
135-145	16164	1.7	0.36	infinite	0.000
125-135	26142	1.6	0.34	infinite	0.000
115-125	26441	1.5	0.32	infinite	0.000
105-115	26441	1.4	0.30	infinite	0.000
95-105	32428	1.3	0.28	infinite	0.000
85-95	32428	1.2	0.26	infinite	0.000
< 85	141185	1.1	0.24	infinite	0.000
Fatigue Damage					0.023

Table 12 Top-Down Cracking Fatigue Analysis of 50% Reduction in K Value for Rear Single Axles (H=0.32m, CTSB=0.1m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.4	0.50	636890	0.235
175-185	143477	2.4	0.49	968493	0.148
165-175	150392	2.4	0.48	1566600	0.096
155-165	106846	2.3	0.47	2753909	0.039
145-155	24530	2.3	0.46	5448030	0.005
135-145	13335	2.2	0.46	12916901	0.001
125-135	21567	2.2	0.45	41891856	0.001
115-125	21814	2.1	0.44	infinite	0.000
105-115	21814	2.1	0.43	infinite	0.000
95-105	26753	2.1	0.42	infinite	0.000
85-95	26753	2.0	0.41	infinite	0.000
< 85	116477	2.0	0.40	infinite	0.000
Fatigue Damage					0.524

Table 13 Bottom-Up Cracking Fatigue Analysis of Conventional Case for Rear Single Axles (H=0.3m, GSB=0.15m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.1	0.43	infinite	0.000
175-185	173912	2.0	0.42	infinite	0.000
165-175	182293	1.9	0.40	infinite	0.000
155-165	129511	1.8	0.38	infinite	0.000
145-155	29734	1.7	0.36	infinite	0.000
135-145	16164	1.6	0.34	infinite	0.000
125-135	26142	1.6	0.32	infinite	0.000
115-125	26441	1.5	0.30	infinite	0.000
105-115	26441	1.4	0.28	infinite	0.000
95-105	32428	1.3	0.26	infinite	0.000
85-95	32428	1.2	0.24	infinite	0.000
< 85	141185	1.1	0.22	infinite	0.000
Fatigue Damage					0.000

Table 14 Top-Down Cracking Fatigue Analysis of Conventional Case for Rear Single Axles (H=0.3m, GSB=0.15m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	364473	0.410
175-185	143477	2.5	0.50	528408	0.272
165-175	150392	2.4	0.49	803499	0.187
155-165	106846	2.4	0.49	1299650	0.082
145-155	24530	2.3	0.48	2284487	0.011
135-145	13335	2.3	0.47	4518937	0.003
125-135	21567	2.2	0.46	10712410	0.002

115-125	21814	2.2	0.45	34732141	0.001
105-115	21814	2.2	0.44	infinite	0.000
95-105	26753	2.1	0.43	infinite	0.000
85-95	26753	2.1	0.42	infinite	0.000
< 85	116477	2.0	0.41	infinite	0.000
Fatigue Damage					0.967

Table 15 Bottom-Up Cracking Fatigue Analysis of 25% Reduction of K Value for Rear Single Axles (H=0.32 m, GSB=0.15m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	2.0	0.41	infinite	0.000
175-185	173912	1.9	0.39	infinite	0.000
165-175	182293	1.8	0.37	infinite	0.000
155-165	129511	1.7	0.35	infinite	0.000
145-155	29734	1.6	0.33	infinite	0.000
135-145	16164	1.5	0.32	infinite	0.000
125-135	26142	1.4	0.30	infinite	0.000
115-125	26441	1.4	0.28	infinite	0.000
105-115	26441	1.3	0.26	infinite	0.000
95-105	32428	1.2	0.24	infinite	0.000
85-95	32428	1.1	0.23	infinite	0.000
< 85	141185	1.0	0.21	infinite	0.000
Fatigue Damage					0.000

Table 16 Top-Down Cracking Fatigue Analysis of 25% Reduction in K Value for Rear Single Axles (H=0.32m, GSB=0.15m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	385071	0.388
175-185	143477	2.5	0.50	549697	0.261
165-175	150392	2.4	0.49	819644	0.183
155-165	106846	2.4	0.49	1292200	0.083
145-155	24530	2.3	0.48	2193319	0.011
135-145	13335	2.3	0.47	4124737	0.003
125-135	21567	2.2	0.46	9030603	0.002
115-125	21814	2.2	0.45	25367394	0.001
105-115	21814	2.2	0.44	infinite	0.000
95-105	26753	2.1	0.43	infinite	0.000
85-95	26753	2.1	0.43	infinite	0.000
< 85	116477	2.0	0.42	infinite	0.000
Fatigue Damage					0.933

Table 17. Bottom-Up Cracking Fatigue Analysis of 50% Reduction in K Value for Rear Single Axles (H=0.34m, GSB=0.15m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	181096	1.7	0.35	infinite	0.000

175-185	173912	1.6	0.34	infinite	0.000
165-175	182293	1.6	0.32	infinite	0.000
155-165	129511	1.5	0.31	infinite	0.000
145-155	29734	1.4	0.29	infinite	0.000
135-145	16164	1.3	0.27	infinite	0.000
125-135	26142	1.3	0.26	infinite	0.000
115-125	26441	1.2	0.24	infinite	0.000
105-115	26441	1.1	0.23	infinite	0.000
95-105	32428	1.0	0.21	infinite	0.000
85-95	32428	0.9	0.19	infinite	0.000
< 85	141185	0.9	0.18	infinite	0.000
Fatigue Damage					0.000

Table 18 Top-Down Cracking Fatigue Analysis of 50% Reduction in K Value for Rear Single Axles (H=0.34m, GSB=0.15m)

LG (kN)	ER (ni)	FS MPa	SR	AR (Ni)	FD (ni/Ni)
185-195	149404	2.5	0.51	451811	0.331
175-185	143477	2.4	0.50	628331	0.228
165-175	150392	2.4	0.49	906806	0.166
155-165	106846	2.4	0.48	1370928	0.078
145-155	24530	2.3	0.48	2200642	0.011
135-145	13335	2.3	0.47	3828007	0.003
125-135	21567	2.3	0.46	7457614	0.003
115-125	21814	2.2	0.45	17254098	0.001
105-115	21814	2.2	0.45	53485630	0.000
95-105	26753	2.1	0.44	infinite	0.000
85-95	26753	2.1	0.43	infinite	0.000
< 85	116477	2.1	0.42	infinite	0.000
Fatigue Damage					0.822

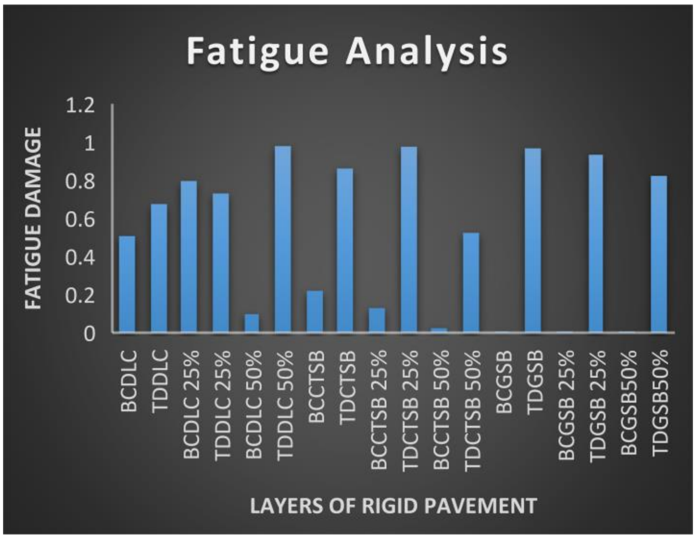

Figure 3 Fatigue Damage

Conclusions

Conclusions observed from the analysis of rigid pavement structure for sub grade having 10% CBR and for reduced K value and effective K values conditions are as follows

- From fatigue analysis of three types of materials used we can observe that the reduction in K value of 25% and 50% there will be increase in slab thickness to renew the strength of the sub grade.
- Fatigue damage is the ratio of expected repetitions and allowable repetitions, expected repetitions is based upon traffic design life and allowable repetitions is based upon stress ratio which depends on

thickness and grade of concrete is used in rigid pavement. So fatigue damage should be less than 1 then only sub grade can withstand in submerged and cyclic repetitions of load.

Acknowledgement

We are truly thankful to and grateful to Geethanjali institute of science and technology for their unwavering support and provision of resources throughout the course of this research. The research facilities and infrastructure provided by Institute have played a significant role in the successful completion of this study.

References

[1]. Naser,A. and Ghani,A. (2023). "Road submergence during flooding and its effect on sub grade strength", Vol.10 (IJGE).

[2]. Benrazavi,R.S and Dola,K.B (2023), "Effect of pavement materials on surface temperatures in tropical environment", Vol.22 (Elsevier).

[3]. Kundan,M. and Poddar,A. (2021) "Stress Analysis and Determination of Effective k-vale for Rigid Pavement", Vol.5 (IJEST).

[4]. Putri,E.E. and Mannan,M.N (2021). "Evaluation of Modulus of Elasticity and Modulus of Sub grade Reaction of Soils Using CBR Test", Vol.2 (JERC).

[5]. Singh,S. and Sachdeva,S.N (2020)."Thickness Requirement of a Rigid Pavement with varying Conditions of Sub grade, Sub-Base and Shoulders", PP 52-57 (IOSR-JMCE).

[6]. Setiad Ji,B.H. (2019) "Estimating modulus of sub grade reaction for Rigid pavement design" Vol.8 (JEAST).

[7]. Huang,Y.H. (2004). Pavement analysis and design. Pearson Prentice Hall, USA.

[8]. IRC: 58 (2011). Tentative guidelines for the design of rigid pavements. The Indian Roads Congress, New Delhi.