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INFLUENCE OF WHEEL LOAD STRESS ON RIGID PAVEMENT CORNER FAULTING ON LOW VOLUME ROADS

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Abstract
In the current practices failures on the pavement quality concrete are more due to improper mix design, lack of the support, low strength in below layers and due to heavy loads. Due to this rigid pavement deflects and causes failures at corner, edge and center. During the field survey we encountered that percentage of corner failures are grater when compare to the other failures. To overcome this failure strengthen the below layers and use of rigid lean concrete (RLC) as base course to avoid maximum failures at corners in the pavement quality concrete (PQC).Deflection can be found by using strain gauges in the base course layers and falling weight deflectometer can also be used. Layer of (RLC) below (PQC) gives the good strength and can reduce the deflection and failures. Rigid pavement has sufficient flexural strength to transmit the wheel load stresses to wider below. In a rigid pavement, load is distributed by the slab action rigid pavements are constructed by portable cement concrete and should be analyzed by plat theory instead of layer theory. Bending of the slab due to wheel load on temperature variation and the resulting tensile and flexural stresses.

Keywords- Use about five key words or phrases in alphabetical order, Separated by Semicolon.

Introduction
By the use of (RLC) as a multilayer in the base course which gives good support and strength the base course, due this corner faulting can controlled, deflections on the PQC reduces, mud pumping can be controlled and due to variation of moisture content shrinkage in the slabs can be reduced, prevention of volume changes in the sub grade can be decreased .rigid lean concrete is more suitable for heavy loads. For the past fifty years the Indian villages remain unconnected by all-weather roads. The Indian Road Congress has prepared a manual for low volume rural roads in the year 2002 which provides planning, design and constructions details for rural roads.

Normally rural roads have less traffic volume, most of the rural transport vehicles are Tractor, Trailers, goods vehicle, buses, bullock carts and two wheelers. In some of the rural roads light and medium trucks also ply which transports sugar cane, grocery, quarry materials, wood etc. These rural roads are not maintained well due to insufficient funds.

Rigid pavements provide an alternative to flexible pavement in places where the strength of the soil is very less and the condition of the drainage is also very poor and the high price of the available aggregates. Depending upon these factors we can consider a cost effective Rigid Pavement for the rural roads. As per the guidelines of IRC: SP: 62-2004, the general axial load in India is 102 km and for a low volume rural road the wheel load capacity is 30 KN. We can consider the tyre pressure as 0.5MPa. The design life of the Rigid Pavement will not be less than 20 years.

objectives
Deflections can be found by the use of strain gauges beside or below the PQC slab the deflection can be found which the deflection results. By the use of FWD deflections can be found by dropping weight from certain height by the wave formation in the deflection sensor deflections can be noted down.

1. High resistance to the deformation of the slabs.
2. Provision of uniform and strong support.
3. Detailed study on RLC and PQC behaviour, Filed study.
4. Detailed study on combination of wheel loads.
5. Detailed study on temperature contraction on corner failures in PQC.

Methods

Field Investigations

Location- Parle-G Toll

- Total length of rigid pavement - 600m
- Total number of slabs – 550m
- Type of pavement – continuous reinforcement concrete pavement

Table No.1 Parle-G Toll Slab Failures

Corner Failures	Edge Failures	Centre Failures	Total failures	Sum
16	13	3	4	36

Percentage of Failures

1) Corner Failures - 45%
2) Edge Failure – 36%
3) Centre Failure – 8%
4) Total Failure – 11%

Location- Nelmangala Toll

- Total length of rigid pavement – 500 m
- Total number of slabs – 500
- Type of pavement-continuous reinforcement concrete pavement

Table No.2 Nelmangala Toll Slab Failures

Corner failures	Edge Failures	Centre Failures	Total Failures	Sum
13	11	4	4	32

Percentage of Failures

1) Corner failures - 43%
2) Edge failure - 37%
3) Centre failure – 13%
4) Total failure – 7%

Location- Jass Toll (Tumkur Road)

- Total length of rigid pavement – 500 m
- Total number of slabs – 400
- Type of pavement – continuous reinforcement concrete pavement

Table No.3 Jass Toll Slab Failures.

Corner failures	Edge failures	Centre Failures	Total failures	Sum
18	15	3	4	40

Percentage of Failures

1) Corner failures - 45%
2) Edge failure - 38%
3) Centre failure – 8%
4) Total failure – 2%

Location- New BEL Road Underpass

- Total length of rigid pavement – 1000 m
- Total number of slabs – 1260
- Type of pavement – joint plain concrete pavement

Table.4 New BEL Road Underpass Slab Failures

Corner failures	Edge failures	Centre failures	Total failures	Sum
17	15	8	4	44

Percentage of Failures

- Corner failures - 38%
- Edge failure - 34%
- Centre failure – 18%
- Total failure – 9%

Strain Gauges

In simple words, a strain gauge is a device used to measure the strain exerted on an object. It is widely used in experimental stress analysis to state the stress on the material and to predict its endurance level and safety. The Strain gauge determines the physical amount of pressure (stress) exerted on the material.

When a strain gauge device is placed under a material and force is exerted on the material, the device analyses the amount of stress being put on the material and gives the data on the display monitor.

Fig. .1

Loading Frame Details Apparatus Used-

- Loading frame
- Hydraulic system with loading jack
- LVDT displacement sensors and strain gauges connector

- Computer PC

Loading Frame

For testing of structural elements we use loading frame gear loading frames are especially designed to cover a large range of experiments on unlike structural elements such as column, beam and slabs that can be accommodated as fine as tested within the freedom and rated capacity. These are fabricated with rolled I-sections for self-straining, where no weight is transferred to the ground apart from its self weight. In adding to this, these are developed for a vertical load up to the normal range along with the flat load of up to a fifth of the vertical secure load. Moreover, these are designed for upright load applications for beams & columns, while the level loads simulate wind weight on portal frame and trusses.

Hydraulic System with Loading Jack

To give a wider range of testing option for the user, the scheme can provide steady radial stress through testing, removing the obligation for a fair ram system, with the ability to add an additional dynamic weight controller to cycle the back/pore pressure during testing.

LVDT Displacement Sensors and Strain Gauges Connector LVDT- dislocation sensors are fitted to the frame and phone with the tested sample and those wires connected to the pc then we can see the morals and then strain gauges are connected to the pc by responsibility soldering with the those wires provide for the strain gauges.

Computer Pc

This computer is associated to the hydraulic jack and the LVDT and strain gauges equipment we see the load deflection in LVDT and collapse in the strain gauge. This will gives total testing details of the loading frame.

Results And Discussion

- Laboratory investigation
- PQC deflection by destructive techniques (By loading frame)

M15 Mix Design Readings

Table no.5 M15 Mix Design Reading

RIGID LEAN CONCRETE FORM15 MIX				
	LVDT		STRAIN GAUGES	
LOAD	SLAB 1	SLAB 2	SLAB 1	SLAB 2
30	2.61	2.5	35	40
40	2.81	2.7	37	35
50	2.89	3.02	39	30
60	3.16	3.4	21	25
70	3.45	3.46	26	21
80	3.7	3.6	13	10
90	3.93	3.68	0	1
100	4.15	4.12	4	2
110	4.4	4.3	28	25
120	4.52	4.49	98	90
130	4.6	4.52	28	30
140	4.74	4.68	58	54
150	4.88	4.79	88	85
160	5.01	5.04	10	11
170	5.15	5.12	68	72
180	5.32	5.26	45	47
190	5.44	5.39	71	68
200	5.61	5.59	48	47
210	5.73	5.65	57	58
220	5.87	5.19	127	120
230	6.03	6.09	72	65
240	6.16	6.2	37	40
250	6.3	6.32	31	30
260	6.5	6.45	1	0
270	6.68	6.59	38	37
280	6.88	6.9	42	45
290	7.03	7.25	144	140
300	7.22	7.19	134	120
310	7.48	7.5	127	110
320	7.59	7.6	107	102
330	7.75	7.63	166	150
340	7.9	7.8	168	144
350	8	7.99	164	154
360	8.18	8.15	103	98
370	8.38	8.2	59	55
380	8.7	8.65	38	34
390	9.13	8.99	27	29
400	9.28	9.2	28	30
410	9.51	9.55	37	38
420	9.8	9.79	73	65
430	10.25	10.13	69	74
440	11.18	11.24	40	35
450	12.28	11.93	54	55
460	13.82	12.99	10	7
470	14	13.84	5	10
480	17.65	16.59	10	9

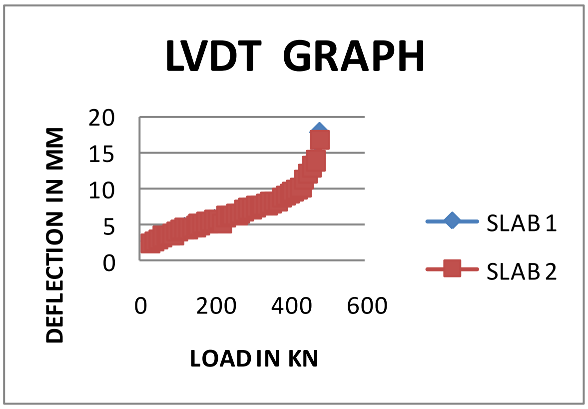

Fig.2 Graph-1

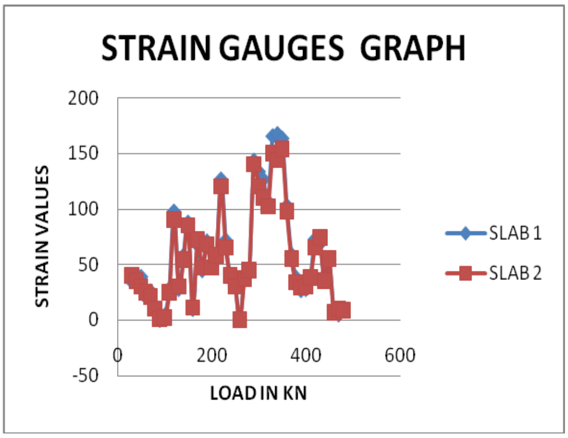

Figure.3 Graph-2

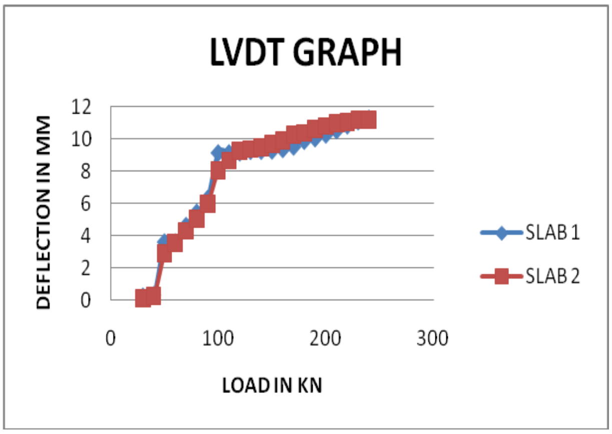

Figure.4 Graph.-3

M10 MIX DESIGN READINGS

Table No.6 M10 Mix Design Readings

	LVDT		STRAIN GAUGES	
LOAD	**SLAB1**	**SLAB 2**	**SLAB 1**	**SLAB 2**
30	0.28	0.1	3	5
40	0.37	0.25	19	24
50	3.64	2.89	21	30
60	3.64	3.55	25	43
70	4.66	4.3	37	17
80	5.48	5.02	33	23
90	6.32	5.96	33	5
100	9.16	8.01	11	19
110	9.16	8.64	9	26
120	9.17	9.23	30	39
130	9.27	9.36	22	43
140	9.28	9.45	41	48
150	9.29	9.67	44	40
160	9.38	9.89	23	36
170	9.53	10.23	19	28
180	9.89	10.34	44	42
190	10.05	10.58	55	36
200	10.28	10.76	51	47
210	10.54	10.94	25	32
220	10.84	11.02	65	55
230	11.1	11.15	34	24
240	11.3	11.18	21	19

Applications

- It is most suitable for low volume roads and toll roads (static loads) due to the good support in base layers failures in the PQC is reduced
- It provides firm base to support the traffic over PQC

Social Relevance

- Use of natural available material for the construction of pavement so that the transportation cost is reduced. Life span of a pavement is increased by the use of RLC.

Conclusion

- My Project shows the results of the effect on corner faulting, due to increased wheel load, due to change in the moisture content of the conventional DLC base course which leads to corner faulting.
- Base material changed from dry lean to rigid lean in nature. The moisture content is not the major cause of failure in corner region but it's the material specification and its properties.
- Rigid lean concrete will not alter its physical properties due to change in moisture content.
- Rigid Lean Concrete would be an ideal solution to avoid corner faulting.
- The life span of a multi layered Rigid Lean Concrete slab would be approximately 30 years.

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