THE INFLUENCE OF THECONFIGRATION OF HEAVY VEHICALES AND THE GRADE ON FLEXIBLE PAVEMENT

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Abstract One of the major sources of distress in roads is the rut that appear in flexible asphalt pavements. Combined wheel , thermal load , and grade induced rutting in the form of longitudinal rut and horizontal shoving . In this project, combined effect of wheel loads and grade is considered in field measurement of flexible pavement layers. The deformed effect (deflection) under various distance from the wheel load in order to draw the deflection basin curve predicting for the pavement .The maximum value has been recorded at center of wheel of heavy vehicle.

Since the AASHO road study was conducted in the late 1950s and early 1960s.,starting the creating prompted several researchers to investigate the impacts of track axle loads and configurations on pavement performance concerns about theirs effects on pavement's damage and performances representing in deflection phonemes, which is unaccounted for in the AASHTO procedure.[Belsley et. al.,1980]. However, there is still a need to strengthen the mechanistic findings using field data.

To focus and more detail on this subject, the study was conducted by often road has passed by heavy vehicles near cement plant in Najaf and collected field data and displacement measured under loads in a manner enunciated specifications when using Benkelman beam device.

The results appears that trucks with multiple axles produce more deflecteddamage than those with only single and tandem axles. On the other hand, heavy vehicles with single and tandem axles tend to cause more distresses.

Keywords: Flexible pavement, rut, wheel loads, deflection, .

Introduction

Due to the great importance of the effect of heavy loads vehicle weights and configuration, the analysis of this study has been limited on two locations near Al-cement factory in Al-Najaf city to indicate a relationship of these two variables with the amount of theirs deflection in the pavement layers in order to classify the corresponding shape of the curve with considerations of weakness in any of these layers.

The current trend in this study has investigation the pavement grade topographies as level , upgrade , and downgrade on field data at mention locations.

General description

One of the ways services are essential lifelines which indicate the country's development and economic growth. Either the maintenance of roads they maintain permanent roads after its creation and ensure continuity of service. Road maintenance is all of the work to the ways of functioning in excellent condition and resistant to traffic and weather conditions make periodic maintenance or repairs. [Kanna,1991]

it has developed the maintenance and there is a classification of these defects. And identify the causes of every defect and treatment methods and by taking a degree. And could recall some of the methods used to assess the status of appropriate maintenance tiling later and as follows:

the former road maintenance "routine approach taken to affected parts of tiling make some repairs after having identified limited shortcomings classification was not as it is at present. [Kanna,1991]

deflection method and nondestructive examination is used in the USA by Benkelman bridge (66.3 meter length) readings the deflection under wheel track. [Kanna,1991]

Modulus of Pavement Unevenness is not tiling tropical Index:(But the staff association method

ASSHTO () and made survey the paving by bale called (Integrator or Unevenness Profilometer banned car and compare the values obtained from this device used in units of cm/km of road length specifications to determine if paving the way. [Kanna,1991]

level of service (performance) method or Present Serviceability Rating or PSR meeting the way ASSHTO also dependent on measuring instruments to determine its surface roughness and tiling defects and had considered this way recently but comprehensive directly and objectively path variables or sleeve [Turkeyr, 2005]

paver method initially computer program called Micro Paver for road maintenance and was developed by the American Society of engineers Army Corps Engineers (U.S and use a wide [Www cctexas.com. and ASTM , D5623 ,2006]

Tiling surface roughness measuring device (Pavement Roughness or Riding Quality . it's a developed device used to evaluate the paving quality and determine the level of service or estimate the remaining cycle life and the quality of the work during construction or when it repaired a laptop on a private car. [2005, Turkey]

Weight Deflectometer (a device used to evaluate the structural capacity for paving roads to determine the need for reform to locate bugs by predicting the flexibility coefficient (Modulus of Elasticity for pavement layers) in order to design the overlay thickness.

The mechanism employed is measuring the deflection of flexible pavements in between of moving wheel loads is similar to Benkelman beam strategies since the operation has recorded thedisplacementjust as the vehicle passes over the test area at radial distance measure from central maximum deflection by placing the apparatus between the tires of the heavy vehicle and in contact with the pavement.

Field test has been conducted in order to achieve more details data of affect the truck configuration on structure pavement, as well as the analyses conducted,

Depending on the phoneme of dial gauge reading to measure the of the precipitation the flexible pavement , the available illustrated in Figure (1) has been used in this study .

Figure (1) Local using available device

Aims of study

This research has many aims as follows:

- investigate the effect of different truck axles and configurations on flexible pavement damage in terms of deflection.
- Study the effect of pavement grade type when was ascending or descending on the results of deflection.
- definitionof the road user the seriousness of non-compliance with distasteful regimes road and traffic.

- The deflection is the vertical displacement of the surface under the central external appliedwheel load on the pavement surface developing a significant stress and strain in each flexible layer as shown in Figure (2).[Allen,2001]

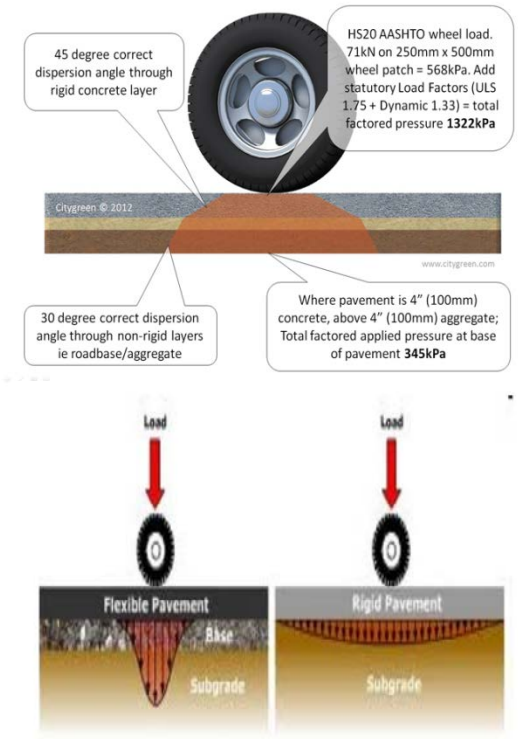


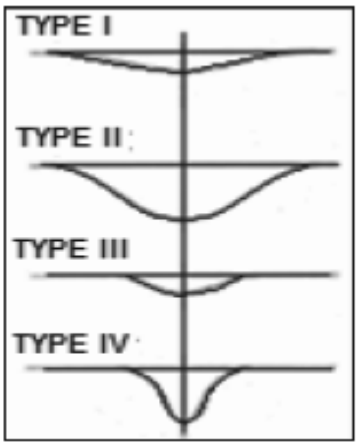
Figure (2)the mechanisms of deflection[Chatti, and Mohtar,2004]

Mechanistic Analysis

Hajek and Agarwal _1990_ highlighted the factors to be considered in calculating the load equivalency factors for various axle configurations and developed those factors using strain criteria. It was concluded that pavement response parameters such as deflections and strains have considerable influence on LEFs, and that

axle weight and spacing significantly contribute to pavement damage. Chatti and Lee _2003_ studied the effects of various truck and axle configurations on flexible pavement fatigue using different summation methods to calculate damage. Gillespie et al. [1993] analyzed the effect of various axle and truck configurations on pavement damage using different performance measures[fatigue, rutting, and roughness]. One of the conclusions of the study by Gillespie and co-workers was that pavement rutting is influenced by the total vehicle gross weight [i.e., the heavier the vehicle, the more pavement rutting impact]. All these studies were based on mechanistic [static or dynamic] analyses.)).[Allen,2001]'

The dimension and shape of the deflection basin explains lots information and indicates to the structural elements of both subgrade and the pavement. Any points at the ends of the deflection basin are related to subgrade while those near the center of load application reflect the pavement's conditions. This phenomena displayed at Figure (3) appearing (Lo) radial distance from the center of load applications as well as a maximum displacement in terms of (Do). [Chatti, and Mohtar,2004]



Type	Do	Lo	EVALUATION
I	Low	High	Good subgrade soil/ Good pavement
II	High	High	Poor subgrade soil/ Good pavement
III	Low	Low	Good subgrade soil/Poor pavement performance
IV	High	Low	Poor subgrade soil /Poor pavement performance

Figure(3) deflection basincurves[Chatti, and Mohtar,2004]

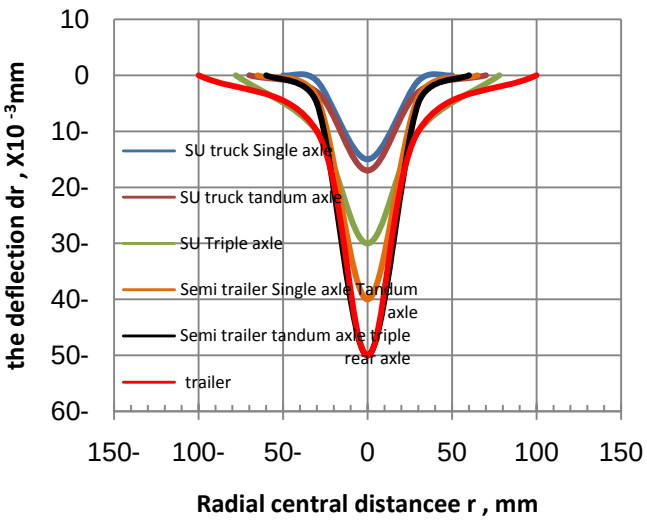
Many surveying measurement have been conducted at Holey Al-Najaf Al-Ashraf near Al-cement factory where the heavy vehicles were available with huge number and configurationin order to get almost

types of loaded trucks. The results recorded with the available instrument have been crystallized to predict the deflection basin curves as shown in Table (1) and the next Figures(4) to (12).

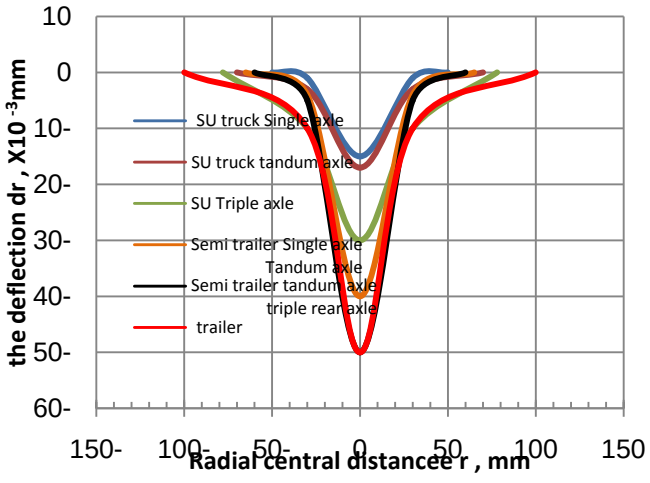
The first three figures indicates the effect of the configuration of trucks on the flexible pavement presented with deflection displacement forms , while the other six figures demonstrated the effect of position pavement grade on the truck damage on that flexible pavement which have the same condition.

Table (1) percentile effect of the configuration and grade on the deflection results

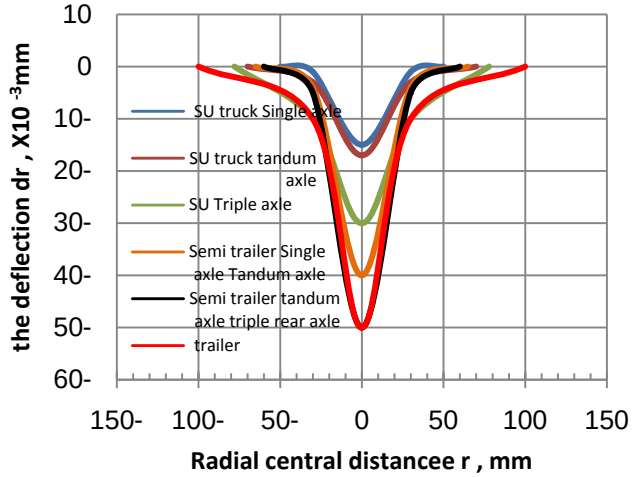
Available Truck type	topography	% deflection with respect to its SU single axle value		% deflection with respect to its level grade value	
		Dist. from the dial gauge center			
		0	30	0	30
SU single axle	Level	0	0	0	0
	upgrade	0	0	-6.7	100
	downgrade	0	0	-26.7	200
SU tandem axle	Level	200	13.3	0	0
	upgrade	0	165	-17.6	76.7
	downgrade	27.7	100	-17.6	100
SU triple axle	Level	900	100	0	0
	upgrade	92.9	100	-10	-60
	downgrade	90.9	66.7	-30	-50
Semi-trailer single tandem axle	Level	300	166.6	0	0
	upgrade	121.4	150	-22.5	25
	downgrade	236.4	33.3	-7.5	0
Semi-trailer tandem triple axle	Level	233.3	400	0	0
	upgrade	192.9	60	-72	6
	downgrade	236.36	66.7	-26	0
trailer	Level	233.3	900	0	0
	upgrade	171.4	550	-24	30
	downgrade	90.9	33.3	-58	0



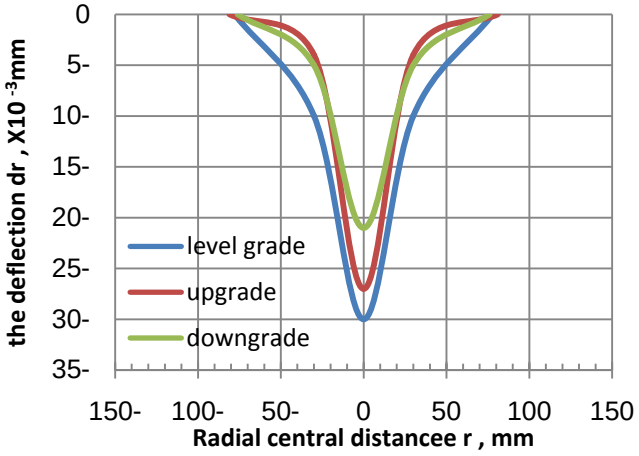
Fig(4) deflection basin curve for various HV at level grade



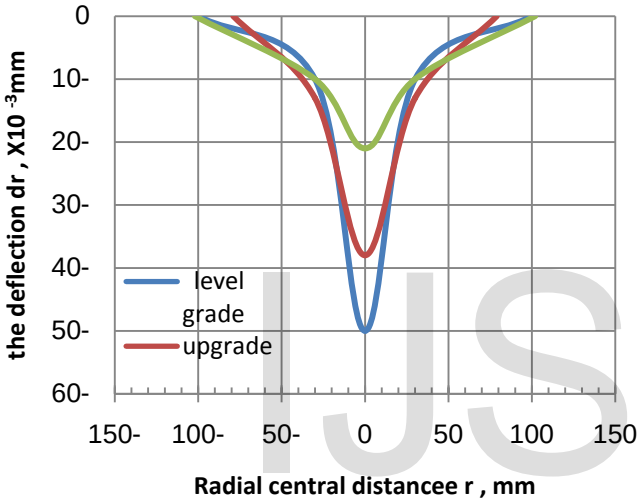
Fig(5) deflection basin curve for various HV at ascending grade



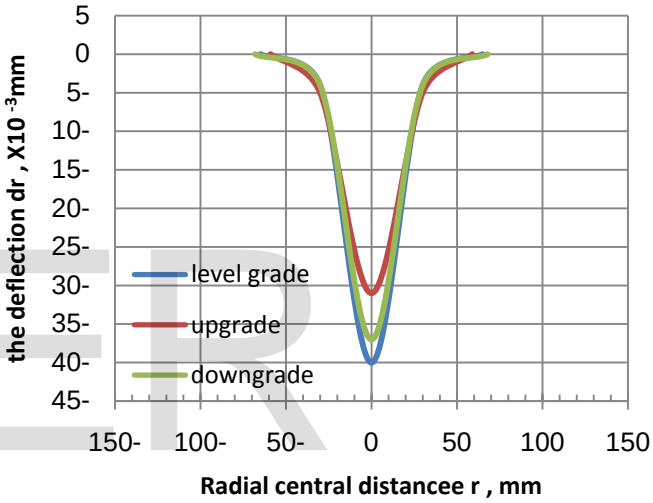
Fig(6) deflection basin curve for various HV at descending grade



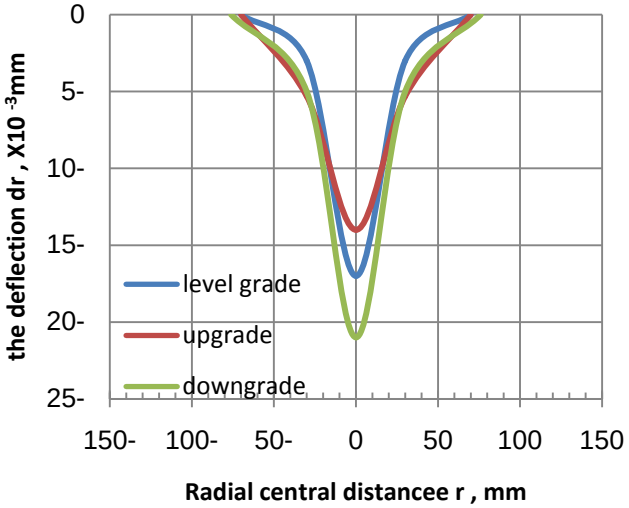
Fig(9) deflection basin curve for SU truck tandem axle



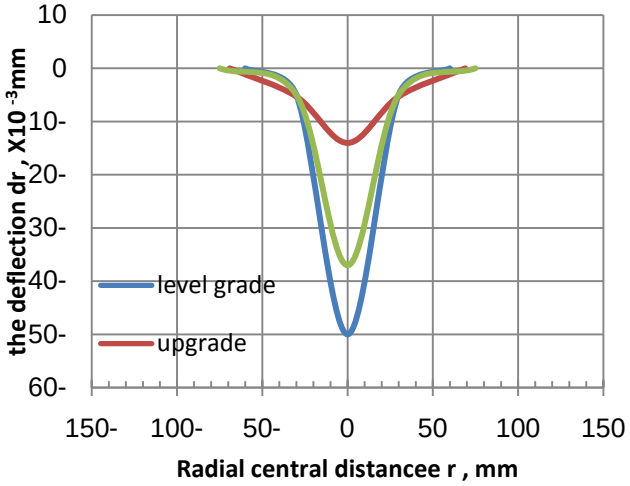
Fig(7) deflection basin curve for SU truck single axle



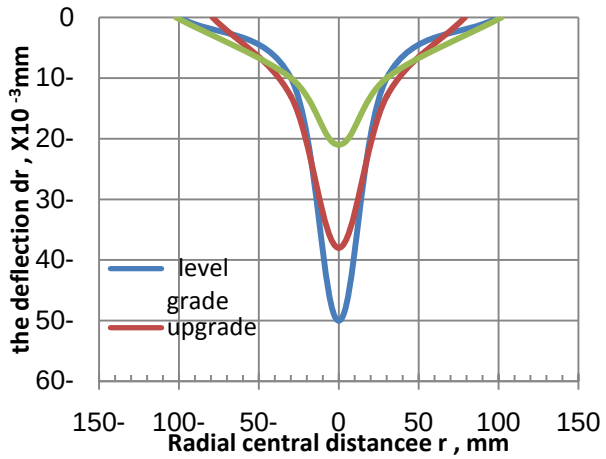
Fig(10) deflection basin curve for SU triple axle



Fig(8) deflection basin curve for semi-trailer single axle tandem axle



Fig(11) deflection basin curve for semi-trailer tandem axle triple axle



Fig(12) deflection basin curve for trailer HV

Conclusions

From the investigations be conducted and data recorded with the analysis ,the following conclusions were obtained

1. the heavy loads led to high damage on the flexible pavement.
2. the trailer class has more damage on the pavement than the semi-trailer which in turn more damage from the single unit trailer.
3. Higher deflection measurement recorded when the vehicle climbing the grade than that level grade
4. The deflection that be measured on downgrade pavement have significant damage on it from level grade for all truck configurations.
5. In spite of multi- truck configurations considered by AASHTO Guide 1993 , but the sample available in this research restricted with six types only respect to that available in local study.
6. All figures of the deflection basin curve presented type IV according to the classification of as mention in chapter two, this indicate to poor subgrade soil poor performance pavement.

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