

Evaluation of Asphalt Road Cracks, Damages and the reasons for its occurrence using visual inspection Technology (PCR)

Case study The Existing Road linking between (Fam Molga and Soug El Ahead) Area, Tarhunah- Libya

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Abstract: Due to the long period of time since the construction of the existing Road connected between (Fam Molga and Soug El Ahead) Area and as The Roads have known for thousands of years as above-ground passages for vehicles and pedestrians to pass through and transport goods from one place to another. The road has evolved from dirt paths and stone roads to concrete roads and asphalt-paved roads, and has witnessed many stages of development until roads became in need of providing strong pavements, with longer durability and to withstand all the conditions for which they were designed until the end of their useful life

Paving engineers take into consideration that the pavement is considered a living structure exposed to frequent traffic movements, and with the passage of time, the pavement will deteriorate because of these loads and environmental impacts, causing damage to road facilities, which in turn leads to damage. This damage must be treated in its early stages before it reaches a late stage that makes it difficult to treat and eliminate it. Periodic and effective maintenance must be prepared, and it is not possible to prepare a maintenance or rehabilitation program cannot be implemented without an assessment of the condition of the pavement. Therefore, assessing pavement damage is one of the most important steps that must be taken before the maintenance process. One of the most important points in the study is that roads are of great importance to daily life, as they serve as a link between cities and villages. Their importance increases with the increase in transportation and communication traffic resulting from increased population growth and interaction between cities, which results in damage. Therefore, assessment is one of the most important steps that we must undertake before the maintenance process. Maintenance and rehabilitation process to facilitate the maintenance process and reduce the economic cost.

Keywords. Road Cracks 1, Pavement Condition 2, Types of Road Cracks 3, Asphalt Road Damage 4.

الملخص: ما للطريق من أهمية كبيرة في الحياة اليومية يُعد تقييم حالة الطريق خلال كل فترات من الزمن أحد أهم عمليات الفحص الدوري للطرق بما في ذلك الفحص البصري (PCR) وذلك من أهم مهام مهندس الطرق لمعرفة أنواع وشدة الأضرار المختلفة التي يتعرض لها الرصيف سواء كانت إنشائية أو وظيفية وذلك لوضع برنامج صيانة متكامل. لما له من دور هام في سلامة الطرق والمرافق الأخرى ومستخدميها. ولهذا يعد التقييم من أهم الخطوات التي يجب أن تجرى قبل عملية الصيانة وإعادة التأهيل لكي تسهل عملية الصيانة وتقلل من التكلفة.

تهدف هذه الورقة العلمية إلى دراسة وتحديد أنواع التشققات والأضرار الناتجة عنها وتحليل أسبابها واقتراح الحلول المناسبة لصيانتها في الطريق الرابط بين منطقتي فم ملغة وسوق الأحد ترهونة -ليبيا. تم تقسيم مسار الطريق إلى عدد 6 قطاعات كم هو موضح بالجدول رقم (3) وأجراء الفحص البصري (PCR) للطريق لمعرفة أنواع التشققات والأضرار وحدتها ومدى انتشارها وبناء على هذه البيانات المجمعة بنماذج الفحص البصري لكل القطاعات وعلى طول طريق الدراسة تم التوصل إلى النتائج والاستنتاجات بحسب حالة النسبة المئوية (%) لكل قطاع وصولاً لتوصيات علمية ليلي مستقبل راحة المستخدمين ومؤشر ودليل لتوجهات الجهات ذات العلاقة بالصيانة الدورية.

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I. INTRODUCTION

The Roads are one of the most important infrastructures ^[2] that contribute to the economic and social development to any region or Urban Community. Roads have evolved from dirt paths to asphalt paved roads ^[3], which require regular maintenance to maintain their efficiency. Over time, roads deteriorate. Due to frequent traffic loads and environmental factors such as climate change and humidity, cracks are one of the most common defects in asphalt pavement ^[5], resulting from frequent traffic loads and environmental factors. In this paper, we aim to study Cracks in the road linking the areas of Fam Molga and Souk El Ahad, Tarhuna (منطقة فم ملغة ومنطقة سوق الاحد), Libya, analyzing the causes of these cracks and proposing appropriate solutions for their maintenance.

Area of Study.

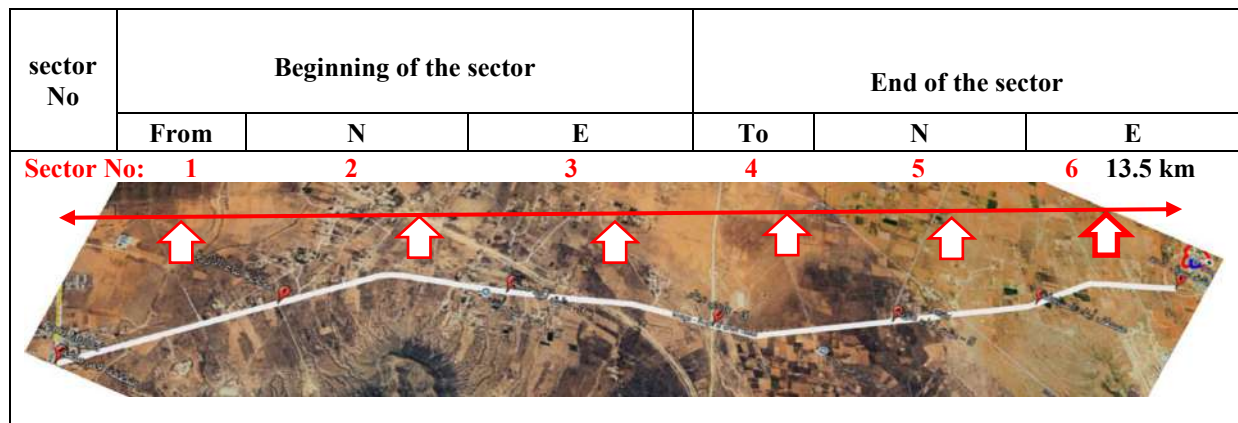
The study area is the road linking the two areas of Fam Molga and Souk El Ahad, as shown in the map attached to Figure No 1 and the table of geographic coordinates for the starting point and the ending point, Table No. 1.

Table (1). Table of coordinates of the starting and ending points of the case study



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Figure No (1) Location of the study area.
Length extends (13,500) kilometers in Two direction (one lane each)
Start Point- N 32° 26' 29.55" E 13° 22' 11.41"
End Point - N 32° 32' 55.34" E 13° 26' 17.77"



Research Problem.

Due to the long period of time that has passed since the construction of the road. and as a result of its exposure to several factors that lead to causing great damage to it, and every road needs many maintenance operations during its lifespan in order to preserve it, and the maintenance process is not carried out except after evaluating the paving of the road to be maintained and knowing the type of damage.

This topic considered of particular importance in Libya in general and in the study area in particular, as it suffers from problems that appear on the surface of city roads.

For this reason we tested one of the important and main roads ^[4] in the Area of Tarhuna to evaluate it, which is the road linking Faculties of Engineering, Law, Economics and Media with the Surrounding area (Fam Molga and Souq Al Ahad) so that it can be used in the maintenance of this important road.

The Objectives of this scientific paper and studies and its importance .

This research paper is investigates in the causes and implications of asphalt road cracks to achieving a set of scientific and practical objectives that contribute to developing knowledge and improving practical reality, improving infrastructure, and developing scientific knowledge, thus benefiting society as a whole. The following are the most prominent objectives that can achieved through this paper:

1. Prepare scientific material for the benefit of students and researchers in the field of road engineering at Libyan universities.

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2. Study the types of cracks and their causes on the road linking Fam Mulga and Souq al-Ahad.
3. Evaluate the pavement condition of the Fam Molga and Souq al-Ahad roads using modern methods such as PCR and PCI.
4. Propose effective maintenance solutions to improve the condition of the road linking Fam Mulga and Souq al-Ahad.

This is in addition to some unforeseen short-term goals. The following are the most prominent of the goals that can achieved through these studies in the long term:-

<u>Improving infrastructure</u> - Assessing road conditions - Improving road quality	<u>providing practical solutions</u> - Efficient maintenance - Using modern Materials and Technologies	<u>Supporting Decision-Making</u> - Providing Accurate Data - Long-Term Planning
<u>Enhancing Safety and Security</u> - Reducing Accidents - Improving Traffic	<u>Supporting the National Economy</u> - Facilitating Trade and Transportation - Attracting Investment	<u>Sustainable Development</u> - Environmental Protection - Improving Quality of Life
<u>Developing scientific knowledge</u> - Enriching scientific literature - Encouraging scientific research	<u>Achieving local development</u> - Improving local services - Enhancing social communication	<u>Meeting future needs</u> - Planning for the future - Adapting to climate change

Methodology of this scientific paper.

The study methodology is as follows:

1. Review local and international research on road pavement maintenance and evaluation.
2. Visual inspection to evaluate road paving Using damage assessment models using visual inspection (PCR)^[1].
3. Dividing the study area (the Road) into sectors from south to north, with a length of 2.25 km for each sector based on the damage in each sector and determining the causes of its occurrence.
4. Tabulating and cataloging damages and cracks, and researching their causes and most common types.
5. Writing a summary based on the results obtained and appropriate recommendations.
6. There are Three types of evaluation methods are used:
 - A) - Exploratory Survey. B) - Surface survey. C) - Evaluation survey.

A) - Exploratory Survey.

We used The PCR Pavement Condition Assessment Method ^[1]; this method relies on a visual inspection of the pavement and a precise determination of the damage condition. It provides numerical values for the damage, known as the damage weight, and several other values for both the damage unit and its extent. The severity of the damage is divided into three levels (high,

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medium, and low), and the damage spread can be divided into three degrees (low, medium, and severe). This method evaluates the condition of the pavement on a scale of 0-100.

This type of survey designed to determine the surface condition of the road and not to evaluate the structural condition of the pavement. It done by using visual inspection and recording the types of defects present on the pavement surface in a special form. Visual inspection systems for assessing pavement condition, the most important of which are: PCR - PCI - IRI – PSI, The most important thing that can be determined using the Exploratory Survey:

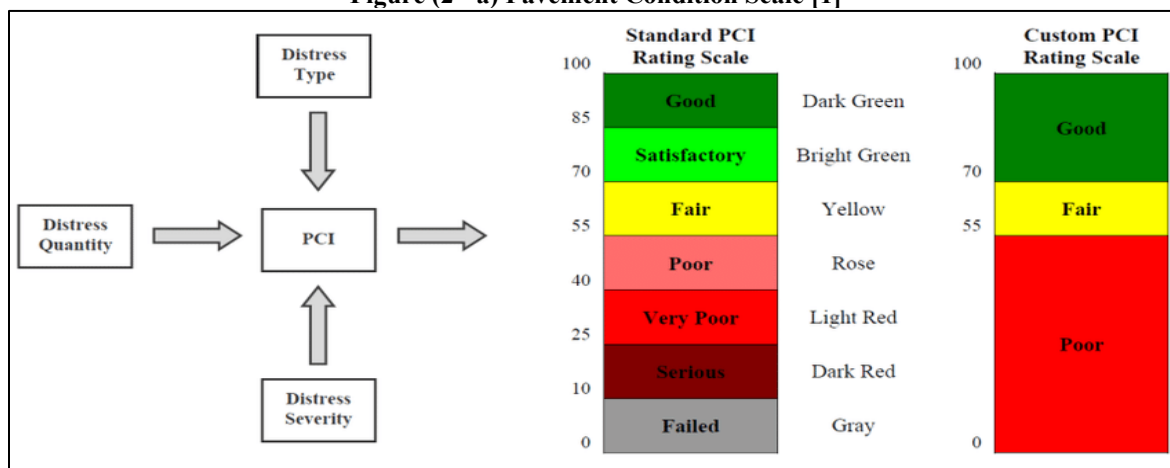
- ✓ Type of damage.
- ✓ Damage severity level.
- ✓ Damage intensity

Visual inspection to evaluate road paving Using damage assessment models using visual inspection (PCR).

Pavement Condition Assessment (PCR)

Pavement assessment relies on a visual inspection of the pavement and a precise determination of the damage level. The damage level divided into three levels (high, medium, and low). The extent of the damage can also divided into three degrees (emergency, moderate, and severe). This method evaluates the condition of the pavement on a scale of (0-100). Where 100 means newly paved roads. As shown in Figure No2, the dimensions of the pavement (a and b)

Figure (2 - a) Pavement Condition Scale [1]



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Figure (2 - b) Pavement Condition Scale

Pavement Condition Index		
Good		86-100
Satisfactory		71-85
Fair		56-70
Poor		41-55
Very Poor		26-40
Serious		11-25
Failed		0-10

B) - Surface survey.

This type of survey carried out using some modern techniques such as roughness, slip resistance and settlement measuring devices. It does not provide an assessment of the structural condition of the pavement and does not investigate the reasons behind the appearance of deterioration in the pavement. Rather, the information from this survey is useful in determining maintenance priorities and estimating costs

C) - Evaluation survey. Practical part and field survey.

(We were able to conduct a complete, accurate and comprehensive visual survey, and we recorded the data in a special form for road evaluation using the PCR method)

This method considered the practical part of this research paper. It relies on visual inspection of the pavement and accurate determination of the damage status. It provides numerical values for the damage, known as the damage weight, and several other values for both the damage unit and its extent. The damage severity divided into three levels (high, medium, and low).

The spread of damage can divided into three degrees (low, medium and heavy). In this method, the condition of the pavement evaluated on a scale of (0-100), where the pavement considered being in very good condition when the value of the pavement condition evaluation is between. (90-100), and the pavement is in a state of collapse if it is less than 20. This method assumes that the ideal condition of the pavement is when the value of (PCR) is equal to 100, and it reduced as shown in Table No (2).

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Table (2) showing the pavement condition survey form.
Field survey schedule using the condition assessment method (PCR) Fieldwork.



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The Asphalt Road Crack and Damage and the reasons for its occurrence in Libya
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* Basheer Mesbha Khalifa ALNNAAS * Rafiq Aldin Mohammed Juma. 2

PAVEMENT CONDITON SURVEY FORM FOR FLEXIBLE PAVEMENTS

اسم المشروع:
 تاريخ التشخيص: الموقع: الطريق:
 القطاع: (.....) رقم القطاع: مسافة القطاع:
 نوع الرصف المسطحي: عدد الحارات في كل اتجاه: العرض:
 نوع أكتاف الطريق: عرض الاكتاف:

ملاحظات	نقاط التفتيش	انتشار الضرر			حدة الضرر			وزن الضرر	نوع الضرر
		كثيف E	متكرر F	طارئ O	عالي H	متوسط M	منخفض L		
								15	Longitudinal Cracks تشققات طولية
								15	Transverse Cracks تشققات عرضية Crocodile Cracks تشققات تماسيح
								15	Blocks cracks تشققات الكتل
								15	Edge Cracks تشققات الحواف Grescent Cracks تشققات هلالية
								5	Rutting التآكل Shoving الانزياح
								5	Depression التهبط
								2.5	Corrugations التموج
								2.5	Bleeding النزول
								5	Polishing البلي
								2.5	Raveling التفتت
								2.5	Delamination التقشير
								5	Patching الترميم
								5	Pat Holes الحفر
								5	Edge Break كسر حواف الرصف
تقييم حالة الرصف PCR (100 - مجموع نقاط التفتيش)									

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Table (3). Geographic coordinates. To divide road sections.

sector No	Beginning of the sector			End of the sector		
	From	N	E	To	N	E
1	منطقة فم ملغة	N 32° 26' 29.75"	E 13° 22' 11.72"	محجر أبناء الأزرق	N 32°27'37.35"	E 13°22'29.60"
2	محجر أبناء الأزرق	N 32°27'37.35"	E 13°22'29.60"	الى مثلث لود دمنة	N 32°28'45.84"	E 13°23'13.81"
3	مثلث لود دمنة	N 32°28'45.84"	E 13°23'13.81"	الى وادي دينار	N 32°29'41.87"	E 13°24'16.31"
4	وادي دينار	N 32°29'41.87"	E 13°24'16.31"	مثلث أبناء عون	N 32°30'44.06"	E 13°25'0.52"
5	مثلث أبناء عون	N 32°30'44.06"	E 13°25'0.52"	منعطف أبناء المزاوغة	N 32°32'12.28"	E 13°25'41.16"
6	منعطف أبناء المزاوغة	N 32°32'12.28"	E 13°25'41.16"	مثلث سوق الاحد	N 32°32'44.24"	E 13°26'8.30"

Sector No: 1 2 3 4 5 6 13.5 km



Below table No (4 & 5) are some pictures of cracks Type and defects on the road in their actual locations with geographical events and photographs of samples of the road's condition. The title of this research paper is (Fom Molga Souk El Ahad Road).

Table (4). Pictures of cracks and defects on the road in their actual locations

sector No	LOCATION		Crack Type	Photograph of the case
	North	East		
2	N 32° 30' 37.35"	E 13° 24' 50.20"	High intensity crocodile cracks in the road shown.	

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3	N 32° 30' 37.3"	E 13° 24' 50.7"	Shows the drop in tire track on the road	
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Table (5). Pictures of cracks and defects on the road in their actual locations

sector No	LOCATION		Crack Type	Photograph of the case
	North	East		
4	N 32° 30' 37.11"	E 13° 24' 51.21"	High intensity descent on the way	
2	N 32° 30' 37.11"	E 13° 24' 51.21"	Shows transverse cracks in the road	
5	N 32° 30' 37.11"	E 13° 24' 51.21"	Shows crocodile cracks and potholes in the road	

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1	N 32° 30' 37.11"	E 13° 24' 51.21"	Shows the drop in tire track on the road	
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Results and Discussion.

When a road is constructed, its service level is at its highest. However, as the road ages and becomes misused, its pre-service level declines. These impacts may be structural, resulting in the pavement's inability to withstand the loads, or functional, resulting in a reluctance to adhere to the pavement. These impacts are likely due to poor surface layer implementation or failure to meet standard specifications. In general, we can summarize the types of asphalt cracks and their severity in the following table: Table No 6

Table (6). Types of asphalt cracks and their severity.

Type and name of crack	Alligator or reticular cracks التشققات التماسكية أو الشبكية			Longitudinal and traverse cracks الشقوق الطولية والعرضية		
	Low intensity	Medium intensity	High intensity	Low intensity	Medium intensity	High intensity
Pictures from the field survey of the study area						
				N 32° 30' 33" , E 13° 24' 51.4" 		
Type and name of crack	Bleeding of flushing النزيف أو طفح الإسفلت			Side slits الشقوق الجانبية		
	Low intensity	Medium intensity	High intensity	Low intensity	Medium intensity	High intensity

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Pictures from the field survey of the study area						
Type and name of crack	Cracks of the wild type or pebble polishing البري أو صقل الحصى			The ripples التموجات		
Crack severity level	Low intensity	Medium intensity	High intensity	Low intensity	Medium intensity	High intensity
Pictures from the field survey of the study area	N 32° 30' 33" , E 13° 24' 51.4"					
						

Table (6). Types of asphalt cracks and their severity.^[8]

Type and name of crack	Pushing shoving delaminating زحف الطبقات			Rutting التخدد		
Crack severity level	Low intensity	Medium intensity	High intensity	Low intensity	Medium intensity	High intensity
Pictures from the field survey of the study area						
Type and name of crack	Thermal Cracking التشققات الناتجة عن الحرارة			Potholes الحفر		
Crack severity level	Low intensity	Medium intensity	High intensity	Low intensity	Medium intensity	High intensity

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Pictures from the field survey of the study area																								
				Severity levels for holes less than 750 mm in diameter																				
				<table><tr><th colspan="3">متوسط القطر (ملم)</th><th rowspan="2">أقصى عمق (ملم)</th></tr><tr><th>750-451</th><th>450-201</th><th>200-100</th></tr><tr><td>متوسط</td><td>منخفض</td><td>منخفض</td><td>25-13</td></tr><tr><td>عالي</td><td>متوسط</td><td>منخفض</td><td>50-26</td></tr><tr><td>عالي</td><td>متوسط</td><td>متوسط</td><td>أكثر من 50</td></tr></table>			متوسط القطر (ملم)			أقصى عمق (ملم)	750-451	450-201	200-100	متوسط	منخفض	منخفض	25-13	عالي	متوسط	منخفض	50-26	عالي	متوسط	متوسط
متوسط القطر (ملم)			أقصى عمق (ملم)																					
750-451	450-201	200-100																						
متوسط	منخفض	منخفض	25-13																					
عالي	متوسط	منخفض	50-26																					
عالي	متوسط	متوسط	أكثر من 50																					
Type and name of crack	Reflection cracks الشقوق الانعكاسية			Slip cracks الشقوق الانزلاقية																				
Crack severity level	Low intensity	Medium intensity	High intensity	Low intensity	Medium intensity	High intensity																		
Pictures from the field survey of the study area																								
																								

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Results of the field survey using the Pavement Condition Measurement (PCR) Method.

Table (7). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 1 of the Road

Project: A scientific research paper entitled The Asphalt Road Crack and Damage

Date of diagnosis: 10 /4/2025r		Location: Tarhuna		Road: Fam Malga, Souk El A					
Sector: First sector		Sector number: 1		Sector distance: 2.3 km					
Surface paving type:		Number of lanes in each direction: 2		Width: 8 m					
Notes ملاحظات	Reduction Points نقاط التخفيض	Damage Spread انتشار الضرر			Damage Severity حدة الضرر			Damage Weight وزن الضرر	Type of Damage نوع الضرر
		كثيف E	متكرر F	طارئ O	عالي H	متوسط M	منخفض L		
								15	
	12.15			0.9		0.9		15	تشققات طويلة Longitudinal Cracks
	12			0.8		1		15	تشققات عرضية Transverse Cracks
								15	تشققات تماسحيه Crocodile Cracks
								15	تشققات الكتل Blocks cracks
	10.8			0.9			0.8	15	تشققات الحواف Edge Cracks
									تشققات هلالية Crescent Cracks
								5	التخدد Rutting
	3.15			0.7			0.9	5	الانبعاج Shoving
								5	الهبوط Depression
								2.5	التموج Corrugations
	1.4			0.7			0.8	2.5	النزف Bleeding
	2.8			0.7			0.8	5	البري Polishing
	1.225			0.7			0.7	2.5	التطاي Raveling
	0.75			0.6			0.5	2.5	التقشر Delamination
								5	الترقيع Patching
	4.05			0.9		0.9		5	الحفر Pat Holes.
	4.05			0.9		0.9		5	تكسر حواف الرصف Edge Break
Poor	(PCR) Evaluation of pavement condition Total discount points = = (100 – 52.375) = 47.6 %								

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Figure No (3) is a graph showing (the condition of the pavement in the first sector).

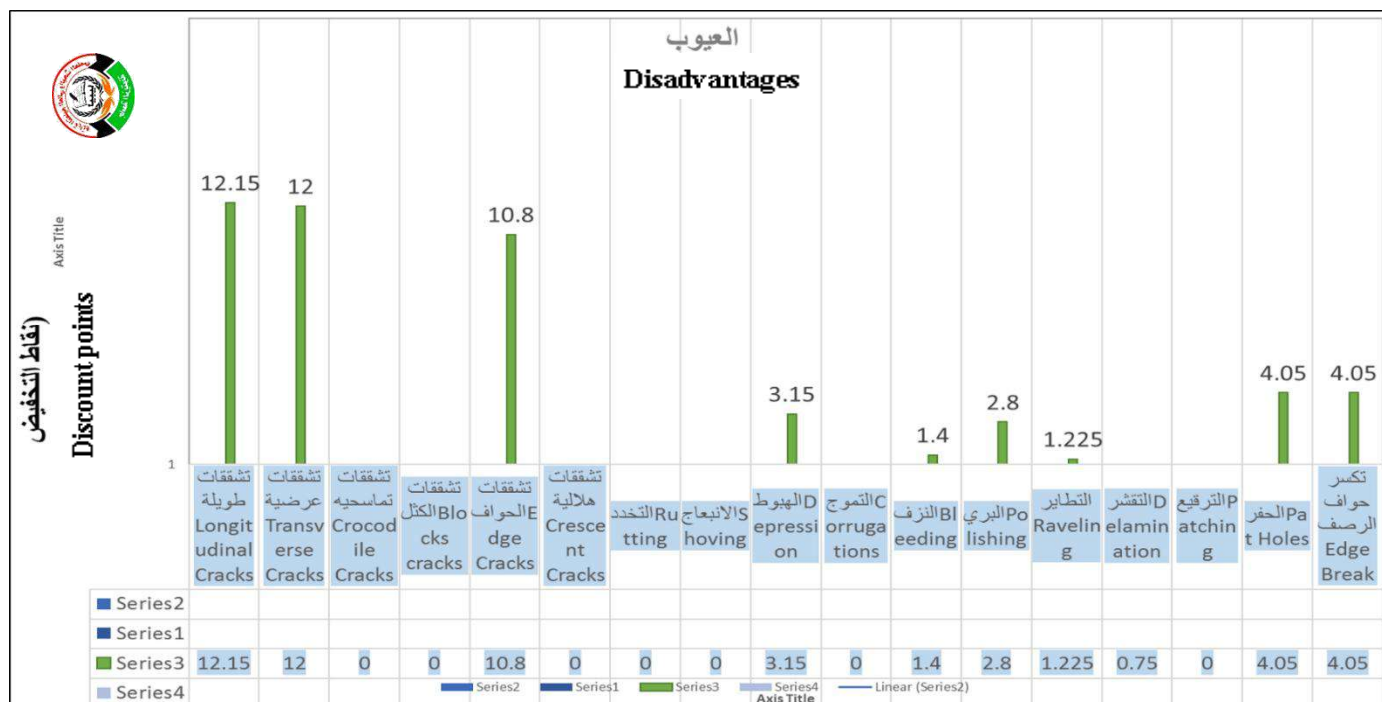
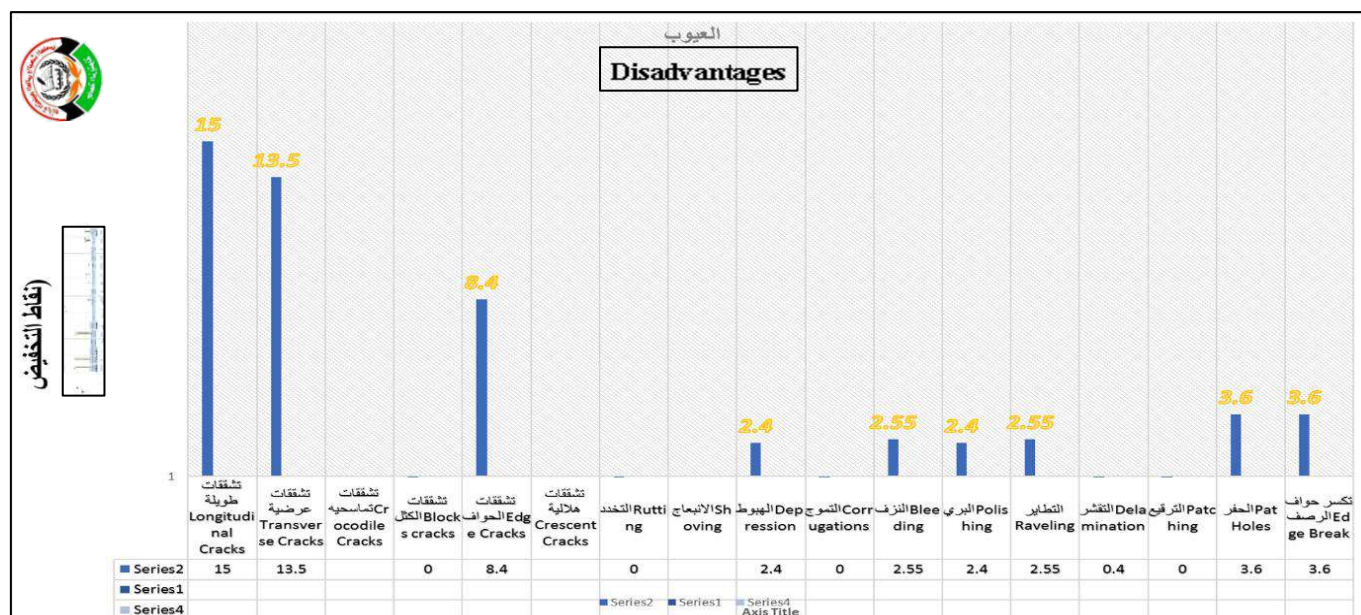


Figure No (4) is a graph showing (the condition of the pavement in the Second sector of the Road).



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Tables No (8). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 2 of the Road

Project: A scientific research paper entitled The Asphalt Road Crack and Damage									
Date of diagnosis: 10 /4/2025r			Location: Tarhuna		Road: Fam Malga, Souk El Ahad				
Sector: The Second			Sector number: 2		Sector distance: 2.3 km				
Surface paving type:			Number of lanes in each direction: 2				Width: 8 m		
Not es ملاح ظات	Reducti on Points نقاط التخفيض	Damage Spread انتشار الضرر			Damage Severity حدة الضرر			Damage Weight وزن الضرر	Type of Damage نوع الضرر
		كثيف E	متكرر F	طارئ O	عالي H	متوسط M	منخفض L		
		15			1		1		
	15			1		1			Longitudinal Cracks تشققات طويلة
	13.5			0.9		1		15	Transverse Cracks تشققات عرضية
								15	Crocodile Cracks تشققات تماسحية
								15	Blocks cracks تشققات الكتل
	8.4			0.7			0.8	15	Edge Cracks تشققات الحواف
									Crescent Cracks تشققات هلالية
								5	Rutting التحدد
	2.4			0.6		0.8		5	Shoving الانبعاج
								5	Depression الهبوط
								2.5	Corrugations التموج
	2.55			0.8			0.7	2.5	Bleeding النزف
	2.4			0.6		0.8		5	Polishing البري
	2.55			0.7			0.8	2.5	Raveling التطاير
	0.4			0.4			0.4	2.5	Delamination التقشر
								5	Patching الترقيع
	3.6			0.8		0.9		5	Pat Holes الحفر
	3.6			0.9		0.9		5	Edge Break تكسر حواف الرصف
Poo r	(PCR) Evaluation of pavement condition								
	= 100 - Total discount points								
	= (100 – 54.4)								
	= 45.6 %								

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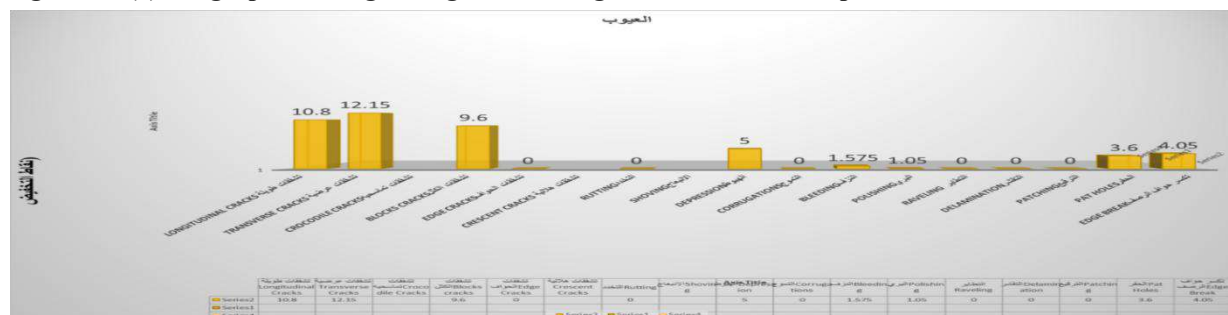
Tables No (8). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 3 of the Road

Project: A scientific research paper entitled The Asphalt Road Crack and Damage Date of diagnosis: 10 /4/2025r Location: Tarhuna Road: Fam Malga, Souk El Ahad Sector: The Second Sector number: 3 Sector distance: 2.3 km Surface paving type: Number of lanes in each direction: 2 Width: 8 m									
Notes ملاحظات	Reduction Points نقاط التخفيض	Damage Spread انتشار الضرر			Damage Severity حدة الضرر			Damage Weight وزن الضرر	Type of Damage نوع الضرر
		كثيف E	متكرر F	طارئ O	عالي H	متوسط M	منخفض L		
	10.8			0.8		0.9		15	Longitudinal Cracks تشققات طويلة
	12.15			0.9		0.9		15	Transverse Cracks تشققات عرضية Crocodile Cracks تشققات تماسحية
	9.6			0.8			0.8	15	Blocks cracks تشققات الكتل
								15	Edge Cracks تشققات الحواف Crescent Cracks تشققات هلالية
								5	Rutting التخذد Shoving الانبعاج
	5			1	1			5	Depression الهبوط
								2.5	Corrugations التموج
	1.575			0.7		0.9		2.5	Bleeding النزف
	1.05			0.7		.09		5	Polishing البري
								2.5	Raveling التطاير
								2.5	Delamination التقشر
								5	Patching الترقيع
	3.6			0.9		.08		5	الحفر Pat Holes
	4.05			0.9		0.9		5	Edge Break تكسر حواف الرصف
Poor	(PCR) Evaluation of pavement condition = 100 - Total discount points = (100 – 51.87) = 48.1 %								

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Figure No (6) is a graph showing A diagram showing the condition of the pavement in the third section



Tables No (9). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 4 of the Road

Project: A scientific research paper entitled The Asphalt Road Crack and Damage Date of diagnosis: 10 /4/2025r Location: Tarhuna Road: Fam Malga, Souk El Ahad Sector: The Second Sector number: 4 Sector distance: 2.3 km Surface paving type: Number of lanes in each direction: 2 Width: 8 m									
									
Notes ملاحظات	Reducti on Points نقاط التخفيض	Damage Spread انتشار الضرر			Damage Severity حدة الضرر			Damage Weight وزن الضرر	Type of Damage نوع الضرر
		كثيف	متكرر	طارئ	عالي	متوسط	منخفض		
		E	F	O	H	M	L		
	13.5			0.9		1			Longitudinal Cracks تشققات طويلة
	13.5			0.9		1		15	Transverse Cracks تشققات عرضية Crocodile Cracks تشققات تماسحيه
								15	Blocks cracks تشققات الكتل
	10.8			0.8			0.4	15	Edge Cracks تشققات الحواف Crescent Cracks تشققات هلالية
								5	Rutting التخدد Shoving التخدد الانبعاج
	3.6			0.9	0.8			5	Depression الهبوط
								2.5	Corrugations التموج
	1.8			0.8	0.9			2.5	Bleeding النزف
	4.05			0.9	0.9			5	Polishing البري
	1.05			0.6			0.7	2.5	Raveling التطاير
								2.5	Delamination التقشر
								5	Patching الترقيع
	4.05			0.9		0.9		5	Pat Holes الحفر
	4.05			0.9		0.9		5	Edge Break تكسر حواف الرصف
Poor	(PCR) Evaluation of pavement condition = 100 - Total discount points = (100 – 56.4) = 43.6 %								

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Figure No (7) is a graph showing A diagram showing the condition of the pavement in the third section



Tables No (10). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 5 of the Road

Project: A scientific research paper entitled The Asphalt Road Crack and Damage

Date of diagnosis: 10 /4/2025r

Location: Tarhuna

Road: Fam Malga, Souk El Ahad

Sector: The Second

Sector number: 5

Sector distance: 2.3 km

Surface paving type:

Number of lanes in each direction: 2

Width: 8 m



Notes ملاحظات	Reduction Points نقاط التخفيض	Damage Spread انتشار الضرر			Damage Severity حدة الضرر			Damage Weight وزن الضرر	Type of Damage نوع الضرر
		كثيف	متكرر	طارئ	عالي	متوسط	منخفض		
		E	F	O	H	M	L	15	
	9.6			0.8		0.8			Longitudinal Cracks تشققات طويلة
	10.8			0.8		0.9		15	Transverse Cracks تشققات عرضية
								15	Crocodile Cracks تشققات تماسحية
								15	Blocks cracks تشققات الكتل
								15	Edge Cracks تشققات الحواف
								5	Crescent Cracks تشققات هلالية
								5	Rutting التخدد
	1			0.5			0.4	5	Shoving الانبعاج
								5	Depression الهبوط
								2.5	Corrugations التموج
	1.4			0.7			0.8	2.5	Bleeding النزف
	2.8			0.8		0.7	0.7	5	Polishing البري
								2.5	Raveling التطاير
	0.5			0.5			0.4	2.5	Delamination التقشر
								5	Patching الترقيع
	1			0.5			0.4	5	Pat Holes الحفر
	2.8			0.8		0.7		5	Edge Break تكسر حواف الرصف

Poor

(PCR) Evaluation of pavement condition

= 100 - Total discount points

= (100 - 29.9)

= 70.1%

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Case study The Existing Road linking between (Fam Molga and Soug El Ahead) Area, Tarhunah- Libya

Figure No (8) is a graph showing A diagram showing the condition of the pavement in the third section Tables No (10). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 5 of the Road Tables No (11). Pavement Condition Assessment (PCR) Field Survey Results. For Sector 5 of the Road

Project: A scientific research paper entitled The Asphalt Road Crack and Damage

Date of diagnosis: 10 /4/2025r

Location: Tarhuna

Road: Fam Malga, Souk El Ahad

Sector: The Second

Sector number: 6

Sector distance: 2.3 km

Surface paving type:

Number of lanes in each direction: 2

Width: 8 m



Notes ملاحظات	Reducti on Points نقاط التخفيض	Damage Spread انتشار الضرر			Damage Severity حدة الضرر			Damage Weight وزن الضرر	Type of Damage نوع الضرر
		كثيف E	متكرر F	طارئ O	عالي H	متوسط M	منخفض L		
	10.8			0.9		0.8			Longitudinal Cracks تشققات طولية
	12.15			0.9		0.9		15	Transverse Cracks تشققات عرضية Crocodile Cracks تشققات تماسحيه
								15	Blocks cracks تشققات الكتل
								15	Edge Cracks تشققات الحواف Crescent Cracks تشققات هلالية
								5	Rutting التخدّد Shoving الانبعاج
	2.8			0.7			0.8	5	Depression الهبوط
								2.5	Corrugations التمجّج
	1.6			0.8		0.8		2.5	Bleeding النزف
	3.6			0.8		0.9		5	Polishing البري
								2.5	Raveling التطاير
	0.75			0.5			0.6	2.5	Delamination التقشر
								5	Patching الترقيع
	1.5			0.5		0.6		5	Pat Holes الحفر
	3.6			0.8		0.9		5	Edge Break تكسر حواف الرصف

Poor

(PCR) Evaluation of pavement condition

= 100 - Total discount points

= (100 – 36.8)

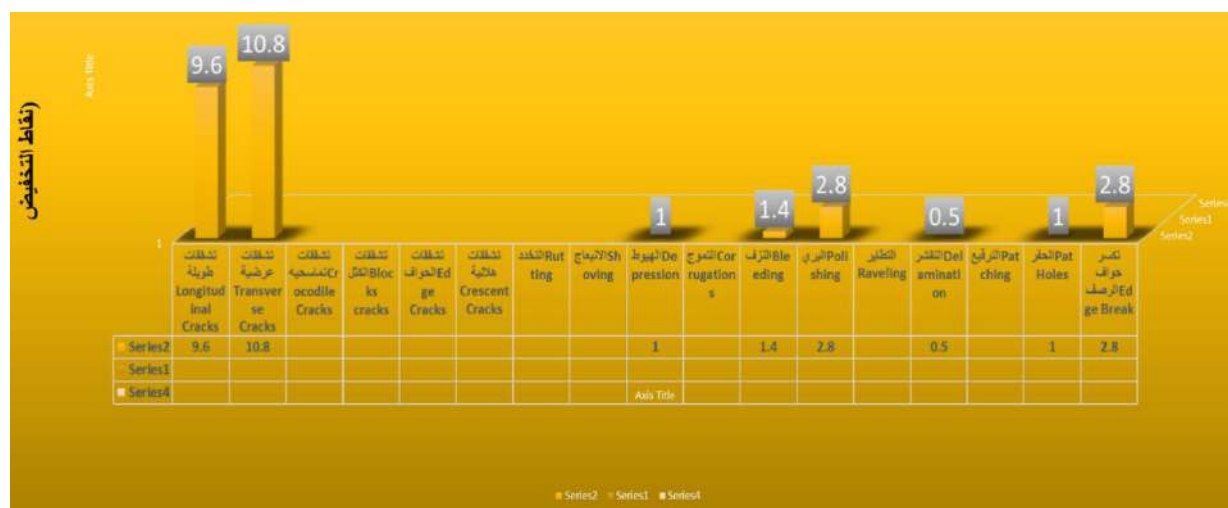
= 63.2%



Evaluation of Asphalt Road Cracks, Damages and the reasons for its occurrence using visual inspection Technology (PCR)

Case study The Existing Road linking between (Fam Molga and Soug El Ahead) Area, Tarhunah- Libya

Figure No (9) is a graph showing A diagram showing the condition of the pavement in the third section



After visually surveying. The pavement condition and recording the readings in the forms, as previously explained, and entering the damages, their severity and extent in the program and obtaining the values in the previous forms, we will compare the value of the pavement condition to determine the quality level of the area to evaluate for the six sections from south to north.

Tables No (12). Shows the PCR value for each sector of the road and indicates the quality level of the PCR scale for that sector.

Sector status and level according to the PCR scale	PCR value	No of Road section
Poor	47.6	1
Poor	45.6	2
Poor	48.1	3
Poor	43.6	4
GOOD	70.1	5
FAIR	63.2	6

Conclusion.

The examination of asphalt road cracks throughout study area reveals that the decline of infrastructure poses significant challenges the findings of the study highlight the urgent need for both immediate Short-Term repair and long-term strategies effectively address these issues.

Additionally, it is essential to adopt an approach that considers the ongoing impacts of climate change on infrastructure. The cyclical nature of environmental issues requires regular evaluation and refinement of maintenance strategies to ensure that road systems remain functional amid increasing natural disasters.

After a visual survey of the road and its evaluation, as shown in Table No12, we found that:

1. Sectors 6 and 5 have relatively good pavement surfaces that require some maintenance.

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2. Sectors 1, 2, and 3 have poor and weak pavement and require extensive maintenance due to extensive damage.
3. Sector 4 has poor and weak pavement and requires further rehabilitation due to high subsidence, transverse and longitudinal cracks, crocodile-shaped holes, erosion, and extensive edge cracks.

Through this research paper and field study, the following was concluded:

1. The pavement are exposed to many damages, which may be structural and lead to the collapse of the road structure, or functional and do not affect the formation of the pavement, but rather lead to a decrease in performance efficiency and jeopardize the safety of road users.
2. Business management and maintenance of Road considered one of the most important branches of road engineering, as they are responsible for organizing work and preparing administrative and technical personnel capable of carrying out maintenance work.
3. Any delay in maintenance work met with an annual reduction in the level of service.
4. Correct diagnosis of the damage results in correct and effective treatment
5. Maintenance work is routine and is divided into:
6. - Preventive maintenance - Curative maintenance - Serviceability maintenance
7. Shoulders must maintained periodically, including maintaining the shape and leveling of the shoulder so that:
 - The shoulder can used for safe passage in an emergency.
 - Roadway water can drained into the canal beside the road.
 - The paved road has adequate lateral support.

Recommendations:

A- Short-Term Repair Techniques:

1. Patching and Sealing Cracks. A highly effective method is crack sealing, which involves injecting sealants into fissures to prevent water penetration. This technique is particularly important because neglecting cracks can lead to damage that is more extensive. Ultimately increasing maintenance costs due to the need for larger repairs or complete resurfacing.
2. We can use another widely used method is patching, which entails removing the damaged asphalt surrounding the cracks and replacing it with new material. Patching is beneficial for larger or more serious fractures, particularly those that threaten safety and driving conditions. When used alongside other techniques such as crack filling, where filler material applied to minor surface issues, these methods offer immediate solutions that can prolong the life of asphalt roads.
3. Completely repave the road due to the expiration of its service life and the proliferation of structural damage and defects.
4. Conduct further research to accurately predict future road conditions. This can achieved by studying the impact of other factors on road network performance, such as heavy trucks, the structural capacity of pavement layers, and the properties of the materials used to construct these layers.

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B- Long-Term Solutions:

5. Review the method of designing paving for local roads in a manner that is consistent with the nature of the loads and the type of vehicles used for it.
6. Rehabilitation Measures to roads
7. Cold In-Place Recycling (CIPR), which involves milling damaged pavement and remixing it with stabilization additives like emulsified asphalt or foamed bitumen. This method not only reclaims materials but also strengthens the underlying base, making it option for Libya

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