Evaluation of Flexible Road Pavement Condition Index and Life Cycle Cost Analysis of Pavement Maintenance: A Case Study in Kabul Afghanistan

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Abstract-- the pavement condition index (PCI) is an easy path, suitable and cheap way to evaluate the status of pavement surface distress because of maintenance and rehabilitation as well to predict the maintenance budget is sufficient or not. In this research paper evaluate the current condition of flexible pavement distresses existing in Kabul Afghanistan furthermore, to identify practically solution of road distress, and finally cost analyses of pavement maintenance and rehabilitation. The survey was conducted through Hammed Karzi Airport road to intercontinental Hotel road. Can be inspected and found diversity distress, consequently the values of PCI (45-67) was in a good condition and eventually compared with all road networks.

Index Terms— Flexible pavement evaluation, Life cycle cost analysis, Pavement condition index (PCI), Visual condition survey.

1 INTRODUCTION

A pavement management is a tool to improve the quality and efficiency of road surfaces and reduce the costs via a good management workouts. A Pavement Management System (PMS) [1], presented is an international procedure to help decision maker in "finding optimum approach" for pavement maintenance. Road failure is divided into two major parts. The first one is functional failure. In this matter, the road won't perform its intended function without either causing inconvenience to passengers and high impacts to vehicles [2]. The causes of functional failure is distress in pavement surface that these are depressions, cracks, rutting formation and poor riding quality [3]. The second one is structural failure, involves collapsing of pavement layer or breaking of one or two layer of pavement that makes the pavement unable to withstand loads on the surface of the pavement [4].

2 Research Problem

Road deteriorations are starting immediately since inaugurating the road traffic, these action at the beginning much leisurely since a "period of time" this action rapidity at quicker rates. Many studies describe the road deterioration to a limit which 60% of the road can be reached at this phase the pavement functional fails in 20 years, but pavement management maintenance system (PMMS) was accomplished thus, road status was significantly extend reconstruction and maintenance budget [5]. Plenty researches as shown which cost of maintenance, that is an extremely poor status, is 4-5 times higher that if the road is supported when in the batter status [6]. Thus, the efficiency of an effective maintenance system will reduce the cost of maintenance. Because of maintenance that it can be needed the rate of PCI based on PCI value which should be suggested alternative to pavement maintenance.

3 Literature Review

Functional failure appertain initially on rating of pavement surface roughness. The causes of structural failure in the flexible pavement as known fatigue, shear, or compaction moisture penetrating in the subgrade, hydraulic bond mixture, base course and surface course [7]. When distresses happing on flexible pavement surface, road deterioration immediately start when opening the traffic, this manner at the beginning much leisurely while passing time the distress goes to at the fast rate [3].

Pavements demand consecutively maintenance and rehabilitation (M, R) mechanism to prevent deterioration causes with reiterative traffic loads and environmental factors. Although, by constrained budget allocated to maintenance of pavement surface, its requirement to use the existent source as efficiently and effectively as feasible. To fulfill this purpose, it can be need a systematic method for planning and scheduling M, R activity, it has opportunity interests for pavement user and minimizing costs for organization because organization responsible for Pavement management to identify suitable quantity [8]. Pavement condition index (PCI) degree of pavements according to evaluation of road surface distress. The PCI dose not an accurate measurement of skid resistance, structural capacity and road roughness. Nevertheless, this is an objective tool for assessing the requirements of M- R in road section because of the perfect pavement approach [9]. Some maintenance agency used the advantages of PCI, recognizing the urgent works for M-R [10]. Development of pavement network, strategies and budget for preventive maintenance, as well as assessment of materials and pavement structure designs. The most common survey method used in the United States and universal is PCI method. First time in 1982 developing with American army. The PCI value is reduce

stored deduction value score based on type, amount severity phase of distress and types of road network. [11], presented strategy to Road Quality Index (RQI) for statistically significant taking data through an expert panel. [12], explained an index the total aggregation of various scale of road status. PCI is a measurement of road surface and ride quality on scale of 0 to 100 with an excellent. Based on PCI value the must be suggested alternative treatment method to whole arterial pavement network.

Life Cycle cost analysis (LCCA) "American Association of State Highway Officials" (AASHO) presented the advantage and significance of life cycle cost analysis in the "Red Book" in 1990. The LCCA by [13], offered on arterial pavement network investiture purpose and significant economic analysis of main road at the planning phase. Transportation of highway research and Texas institute of transportation improved the asphalt PMS based on computer evaluation and assortment alternative HMA pavement design thru the entirely life cycle cost [14]. The next project was by the "National Cooperative route analysis Program" (NCHRP) that tested the improvement of the LCCA implication [15]. The cost of pavement maintenance relates on some factors, such as volume and traffic intensity is much significant, as well materials cost and equipment, labor, soil types of surface course and, lastly, the minimum service stage acceptable for the road category and weather status [16]. [17], offered which a LCCA can be evaluated twenty- year's period of time, maintenance of flexible pavement approach could be saved more than 30% of Pavement Corporation cost after can be planned maintenance approach. [18], introduced a new model for optimizing the life cycle of the road property management mechanism.

Analysis period of highway LCCA by Federal Highway Administration (FHWA) "policy statement" in 1996, it was introduced the analysis period not less than 35 years be evaluated to whole highway projects, involve new projects for the rehabilitation, reconstruction and new build projects. The analysis period usually has to be longer than the design of the pavement. An evaluation method of LCCA divided into two parts the first one is Present worth (PW), the other one is "Equivalent Uniform Annual Cost" (EUAC) method. The EUAC approach identifies half-value the cost of organization each year during the analysis period. Whole costs, involves initial cost, construction cost and cost of maintenance in the future, and The PW method described the initial and future pavement costs as a lump sum amount in today's dollar [19], By the equations Eq 1 and Eq 2 can be calculated the evaluation method.

$$pw = \text{initial cost} + \sum_{k=1}^{n} \text{Rehab cost} * \left(\frac{1}{(1+i)}\right) \quad (1)$$

$$EUAC = PW * \left\{\frac{i(1+i)}{(1+j)^{n-1}}\right\} \quad (2)$$

Estimation cost of LCCA were divided into phase the as known cooperation cost and user cost. The cooperation cost are initial cost of M and R, the user cost was relate to the travel time and vehicle operating cost to depends traveling people duet to potential crowd associated with planning the construction within evaluation period [19].

Initial cost to carry out the LCCA for comparing road alternatives, the initial cost as show a percentage of PW or EUAC during the analyses to start from 0 to period of project to predict [20].

Maintenance costs involve routine costs, corrective, and costs of preventive maintenance, such as (joint and crack filling, chip sealing, patching, spall repairing, replacing individual slabs, thin HMA overlay, etc. Its purpose is to maintain or extend the useful life of the road) [20].

Cost of rehabilitation to determine activity as known "cost of project and drainage cost, safety and other features" of highway construction project [20].

4 Research Design

One type of research was implemented in this research paper, which an experimental design. The PMMS [21], introduced a procedure can be evaluated and maintenance pavement section as well used in this research paper thus strongly pursued for an objective of assessment and developing policy of maintenance.

This study was conducted on Hammed Karzi Airport road to intercontinental Hotel in the Kabul city. This arterial road network is one of the lengthy and most significant arterial road in Kabul city. This road was connected the most commercial and populated areas in Kabul. This arterial road is a dual carriageway and divided into 6 lanes, each lane is equal 3m width and total width is (3*6)*2= 36m with pavement shoulder is 40m width and length of this highway is 10 km. it can be done visual condition survey to observe characteristic features of each defect road surface distress and to identifying the PCI value.

4.1 Description of field area

It has classified the Hammed Karzi Airport road to intercontinental Hotel in one branch and separated into 3 sections (A, B, C) as shown in Figure 1 at the below and according to intensity of traffic volume moving on three section. Visual condition survey was accomplished by walking on the pavement area and accurately inspected, diagnosed and recorded all defect pavement surface distress.

Fig. 1. Description of field area in three section

4.2 Determination of PCI method

Visual condition survey is a method for inspection of pavement surface distress that it can be provided a suitable information to maintenance department then decision maker can be decided about the existing road status, forecast future condition of road, specify and "prioritize" road M-R because any pavement M-R needs. Determine the cost treatment and quantities, additionally investigate the efficiency of various M-R materials and techniques.

PCI is international procedure, can be used the pavement industry and military to visually inspect the existing status of road. This method introduced by [21], [22], and [23] as well use in this paper.

To assess the pavement surface, at the beginning the road network must be divided into the branches for instance (parking, street, etc.) and every branch must be divided into the sections as well each section should be divided into the sample unite however the sample unite is smallest component of pavement network.

Those above descriptions are the PCI procedures and determining the PCI rate developed based on literature review [21], [22], [23].

1. Sample unite must evaluation (specify type of distress and intensity level) and then can be measured the distress density [24].
2. Deduct value were specified through the deduct value curves to any distress types and intensity of distress.
3. Total deduct value (TDV) computed with summing all individual deduct values [24].
4. While TDV compute the Correct Deduct Value (CDV) must be specifying through correction curves. While specifying the CDV, if any individual deduct value higher than the CDV, the CDV is arrange equal to highest individual deduct value [24].
5. While PCI was calculated using the relevance PCI = 100 – CDV [24]
6. Whole sample unit is surveyed randomly. PCI section of road surface specified with averaging the PCI of sample units. If additional can be done it, the sample unites must be weighting value. The weighting averages are calculated with this Eq

$$PCI_f = \frac{(N-A)}{N} * PCI_1 + \frac{A}{N} * PCI_2 \quad (3)$$

Where (PCI_f is road section PCI and PCI1 = average PCI of random. PCI 2 is additional samples of average PCI. N is total samples number in section, and A is additional samples number as inspected). Distress density was measured in (m^2) and (ft^2), was computed by Eq

$$\text{Density} = \left(\frac{\text{distress amount in m}^2,(\text{ft})^2}{\text{sample units area in m}^2,(\text{ft})^2}\right) * 100 \quad (4)$$

Distress density was measured in M and ft. (Joint reflection cracks, bumps, lane/shoulder drop off, edge cracks, transvers cracks and longitudinal cracks) was computing by Eq

$$\text{Density} = \left(\frac{\text{number of potholes}}{\text{sample units area in m}^2,(\text{ft})^2}\right) * 100 \quad (5)$$

At the end of completion of this procedure, the calculation of the subtraction value must be started, the subtraction values were taken from the distress value curves [24].

4.3 Data collection of PCI values on road section

First of all the sample size must be chosen correctly thus the road includes four-lane; the total width is 14m and the land of pavement has been selected 30 m, the result of sample equal (14m*30) = 420m^2. Additionally to decide about number of the sample unite to be selected for inspection.

Total samples number N in a branch should be dividing by length of the branch with length of the sample, as shown in the below of context:

$$N = \left(\frac{\text{lenght of section}}{\text{lenght of the sample}}\right), \quad N = \frac{3300}{30} = 110 \text{ samples.}$$

As shown in Figures 3, it can select the minimum number of sampling units to be observed. However the performance in the beginning inspection, the PCI rate into the road section (i.e. the PCI of the smallest sample unit subtracted from highest PCI sample unit) should be 25 for the asphalt surface. Whenever if the PCI rate is more than 25, it must to go back on Figure 3, start again on N scale, "proceed vertically" to the curves for PCI rate more than 25, read the number of samples for inspection on n scale and decide the additional sample involved.

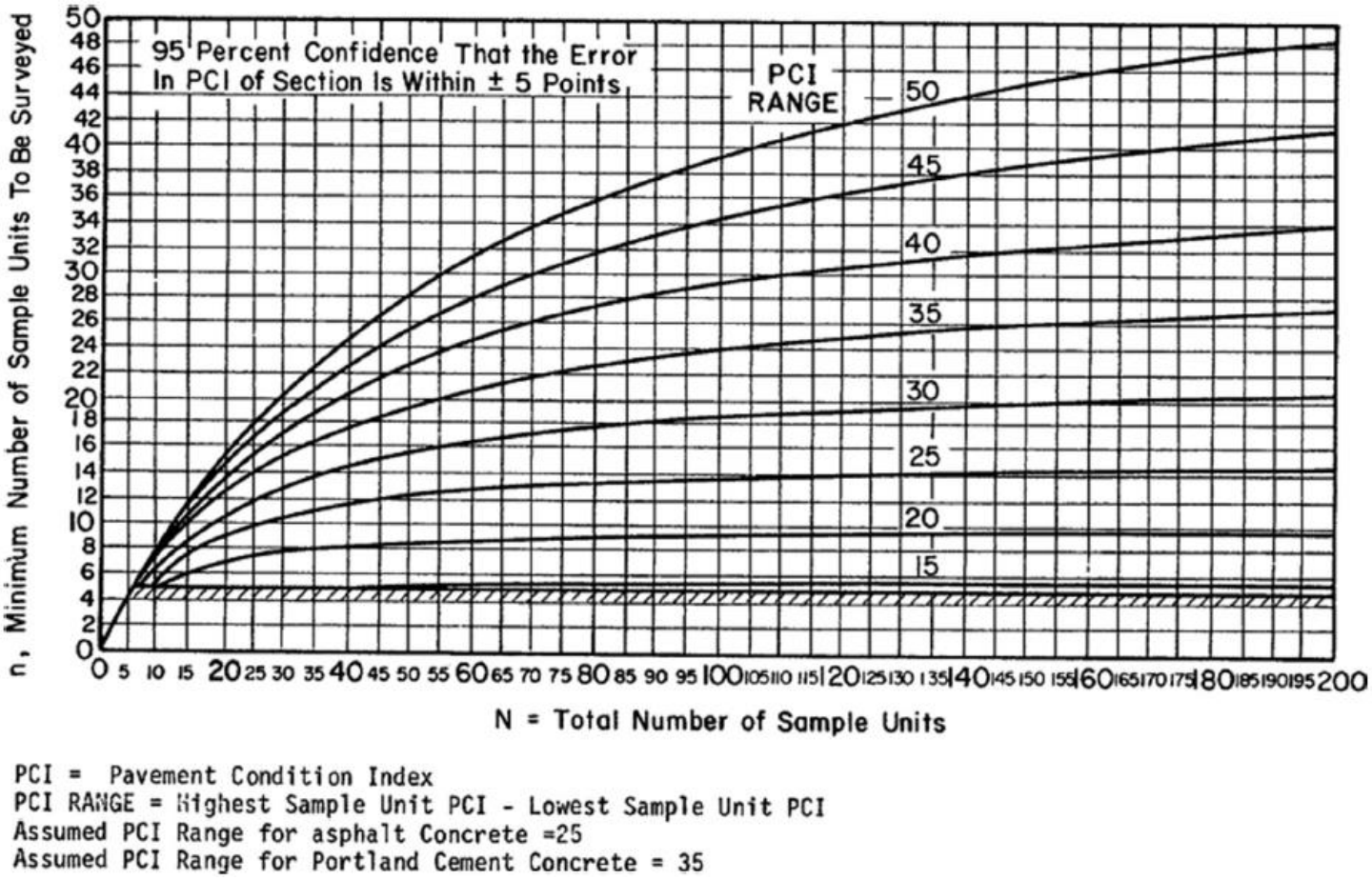

Fig. 2. Specifying the samples units' number to be inspected [25].

To detect the sample size for Hammed Karzi Airport road to intercontinental Hotel main arterial road, start 110 sample based on the N scale Figure 3, proceed vertically the suitable curves (PCI rate = 25) and read 15 on scale. It means 15 sample unite must be surveyed. In the spacing interval (*i*) of the units must be chosen and calculated through the following Eq

$$i = N/n \quad (8)$$

$$i = 110/15 = 8 \text{ m}$$

It means later 7m step would be took a sample from the major and minor arterial pavement network of Kabuli city, and start randomly survey from sample 2 and it only lasting 14 samples in section of one branch in Kabul city such as 2 + 8 = 10 and 10 + 8= 18, 26, 34, 42, 50, 58, 66, 74, 82, 90, 98, 106, 114), and 122 respectively.

Survey condition data sheet as shown in Figure 3 at the bellow of the text, in first step the condition data sheet as mention which a types of the pavement, branch name, section name, sample unite size, surveyor name, date, and sample area size, the second stage as mention the sketch of sample area specially length and width of the distress area, the next phase as described the shape types of the distresses like alligator, bleeding, depression and so forth. And finally, it was mentioned respectively column of distress severity, quantity of severity, total quantity, total density and deduct value column. When the surveyor start the survey may be by car and by walking measurement the distress and will write on the data condition sheet then start the calculation of the distress to understand the rate of PCI because of decision making optimum approach to suggest a best alternative treatment solution of distress, all those thing to do because of maintenance of pavement to have a better pavements for population of our city.

Asphalt surfaced roads

Condition survey data sheet for sample unit

Branch: *Airport Road* Section: *A* Sample unite: 2 to 107

Surveyed by: *Rustam* Date: *15, 6, 17* Sample area: *420m²*

Sketch: L 30m, W= 14m

1- Alligator cracks
2- Bleeding
3- Blocking cracks
4- Bumps and sage
5- Corrugation
6- Depression
7- Edge cracks
8- Jt Reflection cracks
9- lane/shoulder drop off
10- Long & Trans cracks
11 Patching & utility patch
12- Polished Aggregate
13-Pothole
14- Rutting
15- Railroad crossing
16- Shoving
17- Slippage
18- Sewell
19- Raveling & Weathering

Distress Severity	Quantity										Total	Density %	Deduct Value
1H	5*10										50	12	65
10H	30										30	7	28
3H	7*21.4										150	35	52

Fig. 3. Asphalt concrete road condition survey data sheet [25].

5 Result and Discussion

Recently the survey is done from each section of road network on March 2018 by temporary survey engineer as rented, it was found various distresses in different severity level such as fatigue (1H8, 1M8, 1L1), longitudinal and cracks of transvers (10H4,10M1), cracks of edge (7H3),rutting distress (14L2, 14M2),patching Distress (11H3), distress of potholes (13H3, 13M5, 13L1), block cracks (3H5, 3M3), and finally cracks of slippage (17H5). At the Figure 5 as shown the data condition survey sheet on above which started from sample number 2 to 107 samples have been inspected, the result of first section PCI was 47, and it means in fair condition. There is on important issue for calculating of PCI is DV because each types of distresses have various DV value, to identify the accurate DV must be observe the Figures of distresses at the bellow of the context is available only for flexible pavement, and then to understand the DV, additional the DV of all distresses must be summing that is called TDV and as well the result of TDV should be checking in the Figure 12 as shown CDV and finally would be got result of PCI from CDV Figure 12.

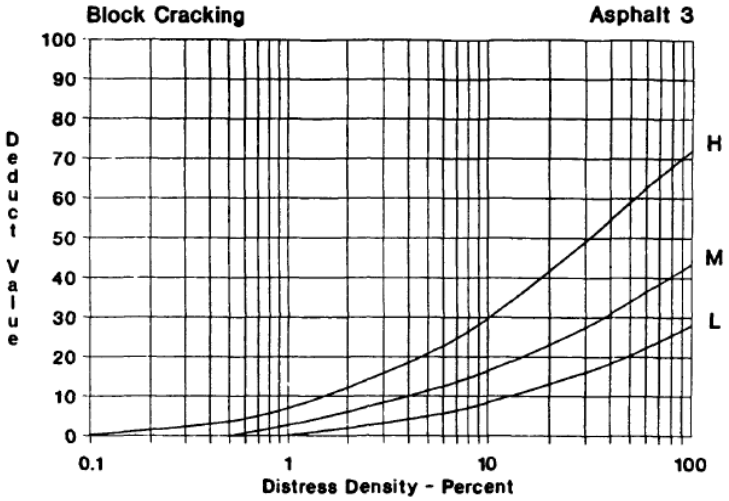

Fig. 4. Block DV [25].

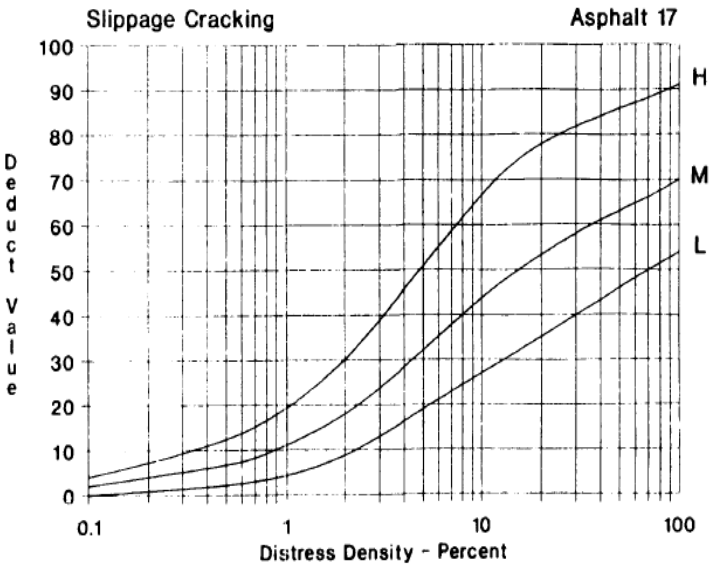

Fig. 5. Slippage DV [25].

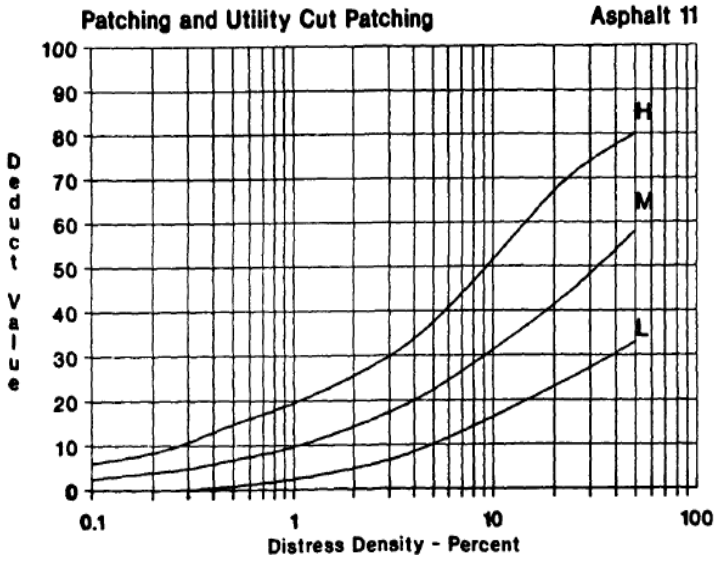

Fig. 6. Patching utility cut patching DV [25]

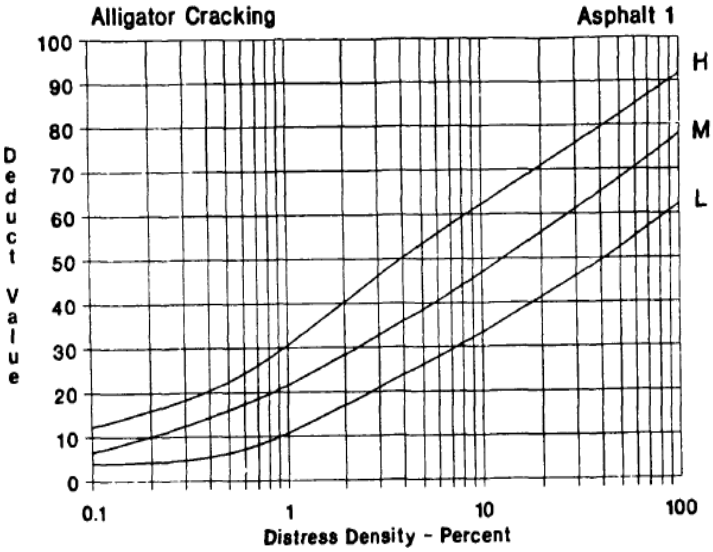

Fig. 7. Fatigue DV [25].

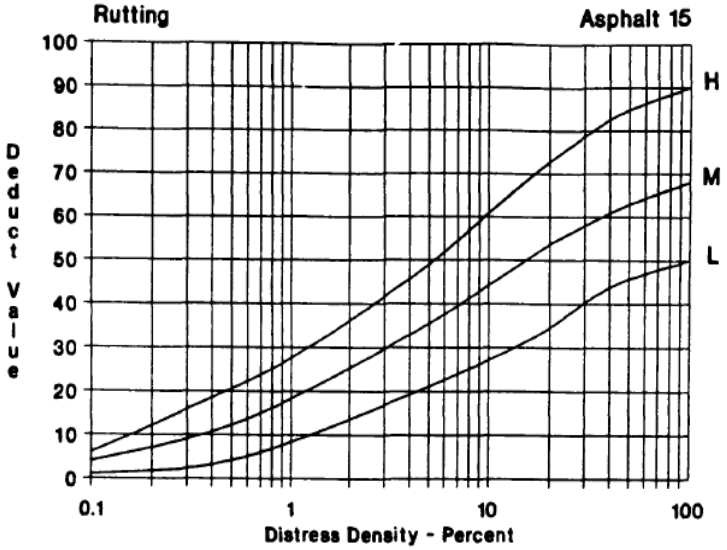

Fig. 8. Rutting DV [25].

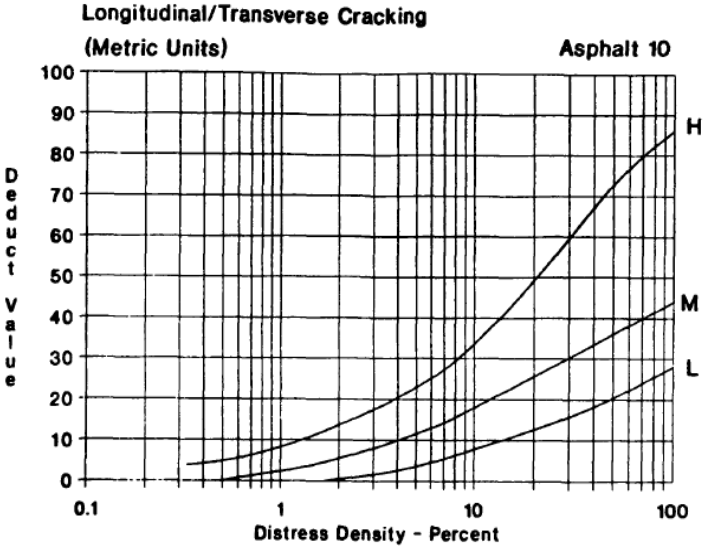

Fig. 9. Longitudinal and Transverse

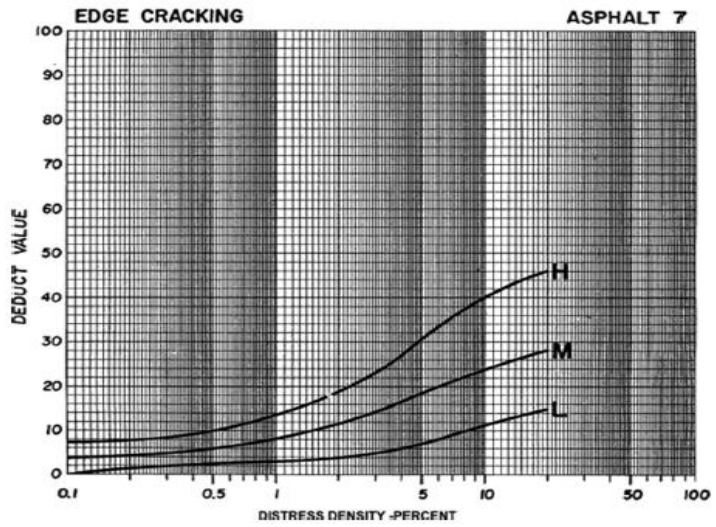

Fig. 10. Edge DV [25]

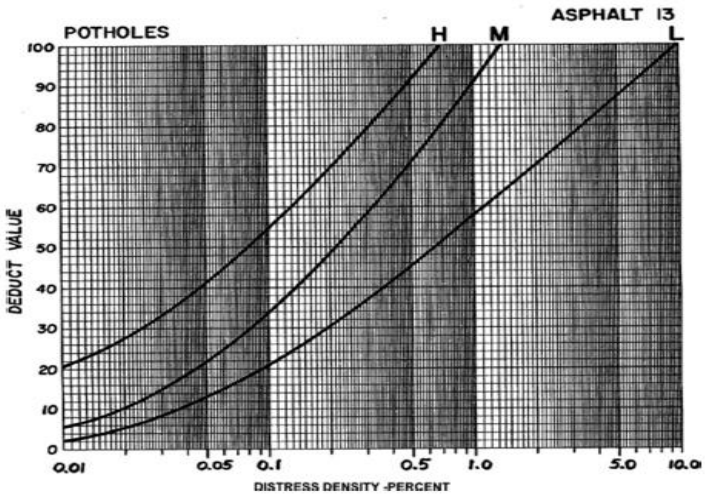

Fig. 11. Potholes DV [25].

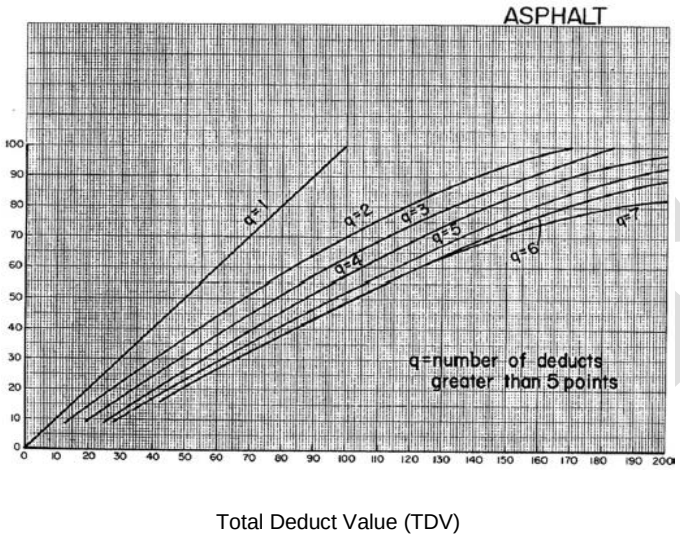

Fig. 12. Flexible pavement CDV [25].

Table 1. PCI rates on section A

PCI values of Hammed Karzi Airport Road Section A				
No	Sample No	Sample unit, m^2	PCI	Rating
1	2	421	58	Good
2	10	421	63	Good
3	18	421	58	Good
4	26	421	56	Good
5	30	421	55	Fair
6	37	421	56	Good
7	44	421	63	Good
8	51	421	75	Very Good
9	58	421	82	Very Good
10	65	421	89	Excellent
11	72	421	92	Excellent
12	98	421	85	Very Good
13	106	421	66	Good
14	114	421	62	Good
15	122	421	80	Very Good
Average PCI section			68	Very Good

PCI values of Hammed Karzi Airport Road Section B				
No	Sample No	Sample unit, m^2	PCI	Rating
1	2	421	37	Poor
2	10	421	62	Good
3	18	421	81	Very good
4	26	421	38	Poor
5	30	421	41	Fair
6	37	421	22	Very Poor
7	44	421	44	Fair
8	51	421	49	Fair
9	58	421	44	Fair
10	65	421	72	Very good
11	72	421	71	Very good
12	98	421	74	Very good
13	106	421	69	Good
14	114	421	81	Very good
15	122	421	35	Poor
Average PCI section			52	Fair

Table 2. PCI rates on section B

Table 3. PCI rates on section C

PCI values of Hammed Karzi Airport Road Section C				
No	Sample No	Sample unit, m^2	PCI	Rating
1	2	421	46	Fair status
2	10	421	41	Fair status
3	18	421	64	Good
4	26	421	51	Fair status
5	30	421	52	Fair status
6	37	421	54	Fair status
7	44	421	41	Fair status
8	51	421	41	Fair status
9	58	421	41	Fair status
10	65	421	39	Poor status
11	72	421	34	Poor status
12	98	421	35	Fair status
13	106	421	53	Good status
14	114	421	57	Good status
15	122	421	49	Fair status
Average PCI section			44	Fair status

However, it was assumed in Figure 3 the PCI values 25 for flexible pavement but the result as shown more the 25 in this matter must be calculating the (Maximum PCI- Minimum PCI) such as (100-55) = 45 PCI value, it must go back to Figure 3, at 110 on N scale proceed vertically the PCI is 45 and n scale 38, in this matter the PCI require to survey additional such as (38-15) =23, however it has been needed 23 samples more and divided 23 by 3 section equal to 8 sample in each section to added.

Table 3. Additional PCI rates on three section

PCI of additional samples from three section					
Sample No	PCI	Sample No	PCI	Sample No	PCI
108	34	108	23	108	39
118	43	118	44	118	41
122	36	122	36	122	36
128	51	128	59	128	44
136	54	136	54	136	56
143	56	143	56	143	36
150	36	150	37	150	35
153	41	153	38	153	40

The weighting of PCI through three section pulse additional calculated by this Eq

$$PCIf = \frac{(N-A)}{N} * PCI1 + \frac{A}{N} * PCI2 + \frac{A}{N} * PCI \qquad (9)$$

$$PCIf = \frac{(110-23)}{23} * 61 + \frac{23}{110} * 50 + \frac{23}{110} * 43. = 66 \text{ with Fair condition.}$$

5.1 Decision on critical point

Ministry of public work divided the pavement network into "five categories" the responsibility administrative relate to government such as these pavements are regional highway, national highway, provincial highway, urban road and rural road [26].

Pavements network in Kabul city developed from redial center within the city, such as (north, northwest, west, southwest, south, and east) [26]. Includes national and regional highways and provincial road which a Kabul- Kandahar, Kabul- Puli Khumri, Kabul-Gardez, Kabul-Bagrami, Kabul-Paghman, and Kabul-Bagram.

It was estimated the number of lanes in Kabul city based on roads width, without include the shoulders, as shown in Figure 13 furthermore, this shape has mentioned arterial pavement network lengths in the bellow of context.

Arterial Road Network with Length and Lane in Kabul City

Road classification	1 lane	2 lane	3 lane	4 lane	6 lane	Total Km
Major Arterial	-	87	4.2	33.8	12.4	137.4
Arterial	7.6	143.3	1.9	34.6	5.9	193.7
Total	7.6	230.3	6.1	68.4	18.3	330.7

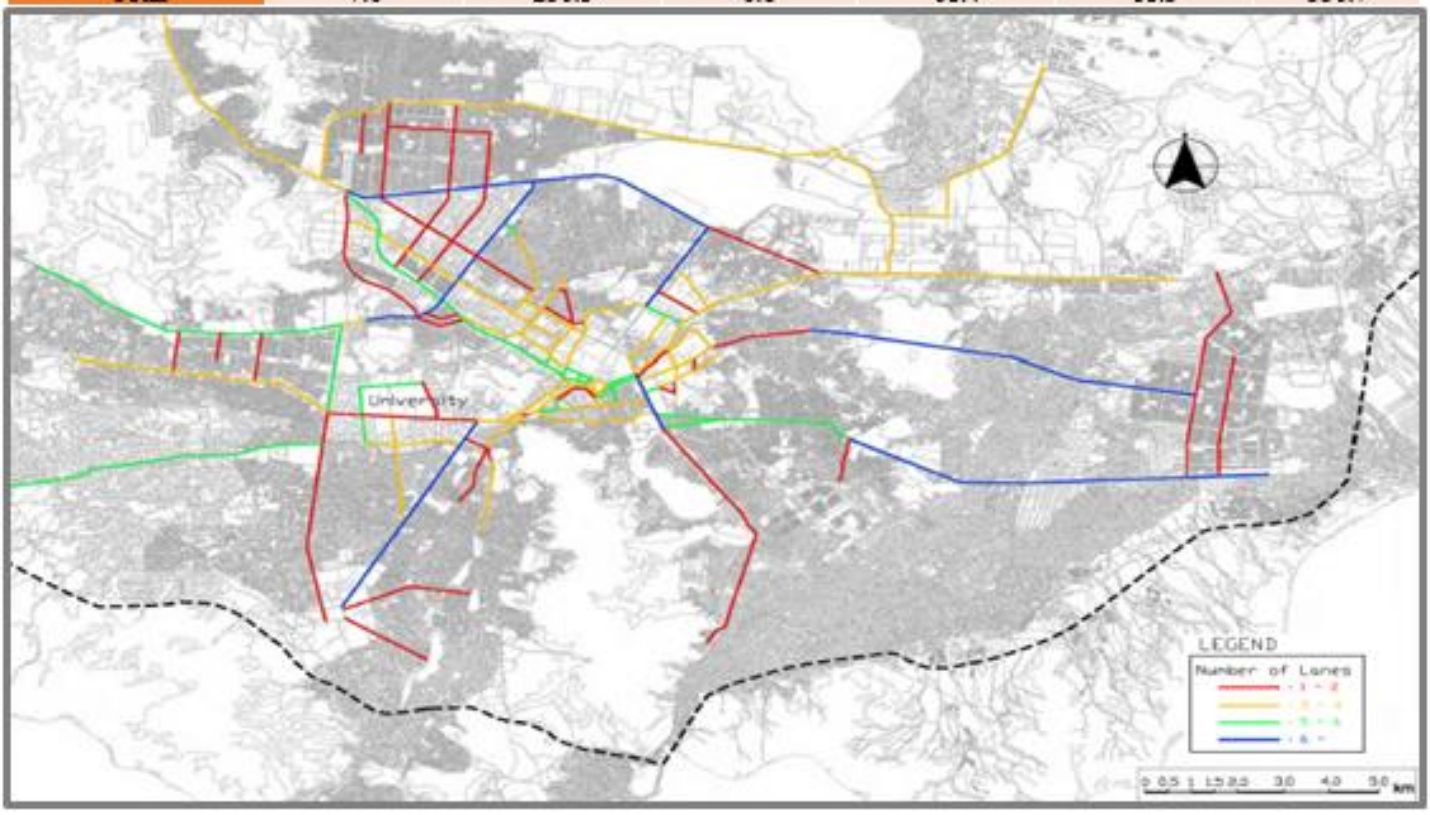

Fig. 13. Arterial network with number of lane [27].

5.2 Life Cycle Cost Analysis of Arterial Network in Kabul City

Life cycle cost analysis of Arterial Network in Kabul city, based on PCI values must be determining the types of maintenance treatment and then the life cycle cost analyses. The PCI vales of one branch in Kabul city was 67 with being fair status, such as length of branch is 10 Km, whole length of arterial network in Kabul city is 330.7 and divided by 10Km equal to 33 branches and length of each section is 3.33 km and multiply by 3 section to equal 99 section, it should be analyzing the life cycle cost of arterial pavement network of Kabul city. According PCI rate must be suggested alternative for treatment of arterial network in Kabul city, chip seal and overly is the best alternative for treatment of pavement than others alternatives. It was found the PCI value now match the rate of PCI with deterioration curves rate than understand to life cycle cost of pavement network as shown in figure 16 at the bellow.

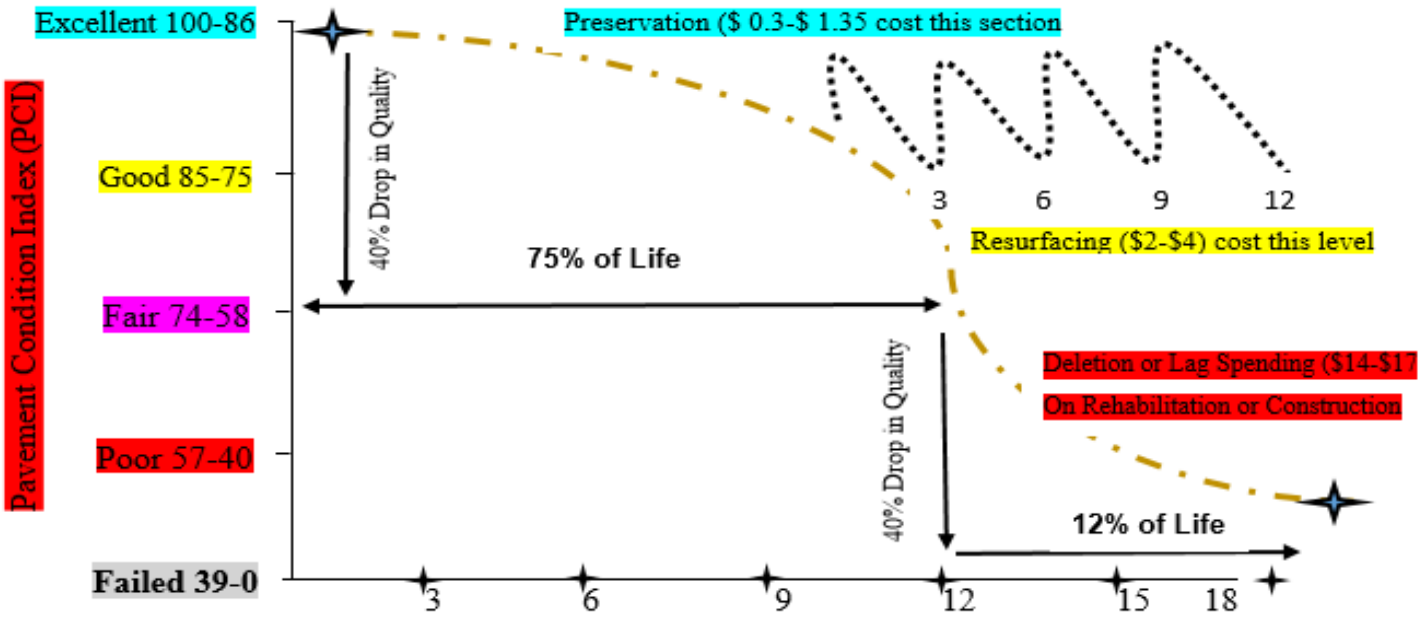

Figure 14. Curve of life cycle cost analysis [28].

5.3 Fist alternative chip seal

Chip seal is the most common types of seal coat and best treatment strategy for pavement maintenance. Chip seal is one of a light application of binder course and existent on pavement surface, the procedure of treatment followed by a placement of aggregate layer based on mix design and then placing the chips and finally compaction of the treatment as well chip seals can be provided a suitable surface for heavy traffic roadway and can be created a skid resistant surface, restore weathered surface, waterproof, correct bleeding, a temporary base course cover, and finally protected the shoulder of pavment furthermore ship seal is one of the economy path to treatment pavement, the cost of chip seal as mentioned on above duterioration curves and somebody called life cycle cos analysis curves approximatly $2-5 per square meter anther advantage of chip seal is lengthed the pavement round about 3-12 years, it was depend on maintenance of pavement, if maintained the roads, like routin manatenance, in table 1 shown the fixed cost materials and construction of all arterial pavement networl in kabul afghanistant, as estimated the length of pavement that it has required kabul pavement for maintenace such as 396201m and major arterial road network Length = 1473701m and total lenght= 473701m+396201m equal to 869902 m, additionally, it was estimated the fixed maintenece cost of chip seal for 12 years such as $182680, it means cost of routin mantenace like crack filling and sealing.

Table 5 Chip seal treatment cost

Teratment Cost of Chip Seal for kabul Pavement Network			
No	Treatment chip seal	Area, in m^2	Total cost
1	major aretial network	140093	$ 336221
2	minor arterial network	1736327	$ 4167183
Chip seal treatment total cost			$ 4503403

5.4 Second alternative overlay

An overlay place on top of existent asphalt pavement, and it has lengthen life of flexible pavement, and in the procedure first must be preparing pavement surface to treatment, and should be sweeping the dusty and loos debris as well filling the cracks and hole and any depressison then applyin prime coat by truck distributor on pavement surface and thickness of overlay must be (40mm-75mm) furthermore must be compacted the new pave with roll at right speed finally taking compaction test, it should be passed 50% the result of compaction test then opening the roadway for traffic.

Advantage of overlay gives high stranth and lenghten life for pavement round about (5-12) years and the second advantage of overly can be effective for repaire of pavement, finally can be repaired each width of road way, involve shoulder ramps, so forth. On Table 6 as shown cost of major arterial network of milling and resurfacing then applying HMA overlay and Table 7 as shown cost of minor arterial network of milling and resurfacing then applying HMA overlay, as well Table 8 as shown cost of marking and furniture of Pavement network in Afghanistan Kabul city at bellow of context.

Table 6. Cost of milling and resurfacing major arterial road

Major Arterial Network of Milling and Resurfacing					
No	Describition	Uint	Quantity	Rate $	Amount $
1	Milling machine	Cum	72506	1.8	130509
2	Cleaning and sweeping	Sq.m	1450093	0.05	72506
3	Prime coat (1.00lit/m^2).	Sq.m	1450093	0.8	1160074
4	HMA Overlay	Cum	72506	163	11818316
5	Total cost				13181403

Table 7. Cost of milling and resurfacing minor arteial raod

Minor Arterial Network Cost of Milling and Resurfacing					
No	Describition	Uint	Quantity	Rate $	Amount $
1	milling machine	Cum	86816.5	1.8	156270
2	Cleaning and sweeping	Sq.m	1736327	0.05	86817
3	Prime coat (1.00lit/m^2).	Sq.m	1736327	0.8	1389062
5	HMA Overlay	Cum	86861.5	163	14151042
Total cost					15783189

Table 8. Cost of road furniture and marking

Marking and Furniture of Road					
No	*Description*	*Unit*	*Quantity*	*Rate $*	*Amount $*
1	Yellow color for Edge line 100 mm	Linear-m	326693	0.5	163347
2	Intermitten line for lane 100 mm. white collor	Linear-m	3002201	0.5	1501103
3	Crosstion side walk for road 300mm wide. White collor	Linear-m	300	50	15000
Road furniture and marking total cost					1814447

On Table 9 as shown present worth chip sealing, HMA overlay, and future maintenace work 38 years for arterial pavement network in kabul city. As can be assumed based on standard of ASTAM ages of chip sealing are 5-12 years but it is essential to maintenance the pavement network otherwise the arterial network will be failed, as well treatment hot mix asphalt is sam issue, but whole responsibilty directly and indirectly related to maintenance copooration.

Table 9. Life cycle cost of chip seal and HMA overlay

Present Worth of Chip Sealing, HMA Overlay, and Future Maintenace Work					
No	Years	Work of Maintenace	Ages	Cost $	Cost of Present Worth
1	0	Construction Cost of Chip Seal	0	$ 6317849	*$ 6317849*
2	3	Sealing and filling of crack	(Age 3)	$ 456670	$ 406001
3	6	Sealing and filling of crack	(Age 6)	$ 913340	$ 72188
4	9	Sealing and filling of crack	(Age 9)	$ 1730040	$ 121553
5	12	Sealing and filling of crack	(Age 12)	$ 182678	$ 114101
6	15	Sealing and filling of crack	(Age >12)	$ 182678	$ 101436
7	18	Sealing and filling of crack	(Age >12)	$ 182677	$ 90176
8	20	Construction cost of HMA overlay	0	30779038	$ 14047148
9	23	Sealing and filling of crack	(Age 3)	$ 456670	$ 18528
10	26	Sealing and filling of crack	(Age 6)	$ 913340	$ 32944
11	29	Sealing and filling of crack	(Age 9)	$173004	$ 55474
12	32	Sealing and filling of crack	(Age 12)	$ 182677	$ 52075
13	35	Sealing and filling of crack	(Age >12)	$ 182675	$ 46295
14	38	Sealing and filling of crack	(Age >12)	$ 182678	$ 41153
Total Cost PW of HMA overlay and chip sealing					$ 21516918

6 CONCLUSION

This research paper carried out to identify and magnitude of flexible pavement distress, and used visual condition survey based on PCI methods and (following standard ASTAM D6433). PCI can evaluate the pavement surface, for instance (monitoring and evaluating of pavement effective and efficient, improvement of maintenance systems, Cooperation and preparation for rehabilitation approach), PCI values in Kabul city pavement networks are (45-67) that it means fair condition. Causes of road deterioration in Kabul city like fatigue, longitudinal, block Slippage, edge, thermal cracks, and Patch Patch deterioration, rutting, and pothole distresses for those distresses that have been suggested two alternative such as chip seal and HMA overlay treatment and estimated the fix cost either chip seal or HMA overlay. Life cycle cost analyses were calculated for 38 years and the total cost of road maintenance is $ 21516918. Based on result of this paper extremely recommended to improve current status of road M-R practice for arterial road network of Kabul city.

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