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Sustainable management and comprehensive administrative control of asphalt pavements case study, Perú

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Summary

The management of asphalt pavements is of great importance for the development of road, motorway and airport runway infrastructures. For the company to achieve its goals, the use of administrative control instruments or tools such as evaluations and follow-ups of employees. Such control begins with the design by the company of an organizational structure where activities are planned and their effectiveness with their subsequent evaluations. The study aimed to analyze the management of asphalt maintenance and its administration process in a pavement and construction company in the Lima region, Peru. The methodology used was the hypothetical deductivo. Thedesign was non-experimental and cross-sectional deliberating the variables in a single time of study in a descriptive way, the sample population was the administrative workers and workers to perform the research technique, the type of instrument used was the survey with anonymous questions and closed questions, or at least all those questions that best respond to the situation we want to know. An analysis of frequencies and weighting of percentages was made from which it obtained, the values that allowed us to know the problems of the company with respect to the variables under study such as administrative control and maintenance, the validity of the instrument had a degree of reliability of Cronbach's alpha of 0.879 for the variable Administrative control and maintenance of 0.849. In the research regarding the dimensions of asphalt pavement have a relationship with the administrative management of the company, having a positive significance.

Keywords: Administrative control, asphalt pavements, business sustainability, administrative management

Introduction

Asphalt is very beneficial in terms of the function it fulfills, which is an alternative of vital importance in the construction of pavements. However, for the production of pavements it is proposed to partially increase polymers such as recycled rubber that can modify the structure more favorably, improving the physical and mechanical properties of asphalt (1). The sustainability of pavements requires the application of different methods, which can be determined from instruments that are based on their parameters such as pressure, condition,

impact and their respective response (2). Currently, in modern practice to solve drainage problems in urban areas is the construction of pavements with sustainable drainage since, compared to the development of typical viabilities with conventional standards in the design and construction of their bearing surfaces, the various problems presented by drainage are not solved (3,4)

The purpose of pavement management has used safe and consistent information to develop decision criteria, enable realistic investment alternatives and contribute to efficiency in decision-making in the company (5).

The systems in asphalt pavement management, are used for the analysis of limited resources related to the administration of road structures, with the application of different strategies that allow the safety of the pavement in its use and its conservation over time (**8**). The data collection process is one of the most valuable and costly tasks within pavement management programs [6]. Every piece of data requires time, effort and money to be collected, stored and retrieved. Its use makes it possible to identify maintenance and rehabilitation needs, as well as to establish priorities for allocating funds (7). Automatic systems for road evaluation use various equipment to ensure reliability and efficiency in the evaluation of pavements. The determinations on the failures and their subsequent maintenance, allow the necessary analyzes in urban areas. However, it is necessary to consider the different factors that can affect the deterioration of asphalts and their degree of vulnerability of the roads in operation (8). Therefore, according to the review it was found that the indices are also considered a factor of pavement failures (9) considered factors such as the age of the pavement, the depth of the surface layer, the temperature and the volume of traffic to be developed during the analyses, which classifies the state of flexible pavements (8). The purpose of the research was to relate pavement management with administration control in an asphalt production company.

Method

The development of the research was transversal, correlational not experimental. The sample population in the study was 180 operators of an asphalt production company that carry out distribution to the different regions of the country. The information collected from the survey application was filled out by the workers of the asphalt production company.

Measuring instruments

The survey was used through the Likert scale. The questionnaire used buy the following scales, always=5; Almost always=4; Sometimes=3; Almost never=2; Never=1. Each variable was analyzed with its respective dimension.

Data analysis

The calculation of frequencies for the variables under study was developed; For categorical variables, a 95% confidence interval was determined. Quantitative variables were measured with central tendency and means of dispersion. The reliability of the questionnaires and the Cronbach's Alpha Reliability test, the SPSS Statistical Program version 25.0 was applied for both variables Administrative Control and Maintenance, a pilot test of 25 workers was applied, then the data were processed, using the SPSS Statistical Program version 25.0. In the statistical analysis, we sought to compare each of the variables with their categories using Chi-Square (^{X2}). Statistical comparisons and the application of Cronbach's alpha coefficient for the measurement of reliability with respect to pavement and administrative management were developed.

Results

This description is being presented with a respective descriptive analysis and in order to determine the level of managerial skills, this development was measured in organizational form and its dimensions according to what is established in the reliability of the instrument as shown in Table 1.

Table 1. Distribution of frequencies and percentages of administrative control.

Administrative Control					
		Frequency	Percentage	Percentage Valid	Percentage accumulated
Valid	Low	18	22.5	22.5	22.5
	Moderate	30	37.5	37.5	60.0
	High	32	40.0	40.0	100.0
	Total	80	100.0	100.0	

According to Table 1, the frequency of administrative control is shown, being from the sample under study 32 workers have a high administrative control, while 30 workers surveyed say they know moderately and 18 workers have a low administrative control.

Table 2. Distribution of frequencies and percentages of concurrent control of the company.

Concurrent Control					
		Frequency	Percentage	Percentage valid	Percentage accumulated
Valid	Low	17	21.3	21.3	21.3
	Moderate	25	31.3	31.3	52.5
	High	38	47.5	47.5	100.0
	Total	80	100.0	100.0	

Table 2 shows the concurrent control dimension of the study, which shows that 38 workers have a high concurrent asphalt control, while 25 workers indicate moderate and 17 workers have concurrent control as shown in Table 2.

Table 3. Frequency distribution and percentages of feedback control

Feedback Control					
		Frequency	Percentage	Percentage Valid	Percentage accumulated
Valid	Low	20	25.0	25.0	25.0
	Moderate	19	23.8	23.8	48.8
	High	41	51.3	51.3	100.0
	Total	80	100.0	100.0	

Table 3 shows the dimension control feedback with respect to the management variable, where it can be seen that 41 workers have high feedback controls, while 19 workers are in moderate and

20 workers are in low feedback control.

Table 4. Distribution of frequencies and percentages of maintenance.

Maintenance					
		Frequency	Percentage	Percentage Vpallid	Percentage accumulated
Valid	Low	8	10.0	10.0	10.0
	Moderate	30	37.5	37.5	47.5
	High	42	52.5	52.5	100.0
	Total	80	100.0	100.0	

According to Table 4, the frequencies of the maintenance dimension of the company can be appreciated. It can be seen that 42 workers of the company show a high maintenance of the company, while 30 workers are in moderate and 8 workers have a low knowledge in maintenance of the company.

Table 5. Distribution of frequencies and percentages of corrective maintenance of the company

Corrective Maintenance					
		Frequency	Percentage	Percentage Vpallid	Percentage accumulated
Valid	Low	28	35.0	35.0	35.0
	Moderate	25	31.3	31.3	66.3
	High	27	33.8	33.8	100.0
	Total	80	100.0	100.0	

Corrective maintenance allows the proper functioning of the company. Table 5 shows the corrective maintenance dimension of the company. Where of the 80 respondents 27 workers indicate that corrective maintenance is developed, while 25 workers know moderately and 28 workers have low level.

Table 6. Distribution of frequencies and percentages of the operational control of the company.

Opportunity Maintenance					
		Frequency	Percentage	Percentage valid	Percentage accumulated
Valid	Low	13	16.3	16.3	16.3
	Moderate	28	35.0	35.0	51.3
	High	39	48.8	48.8	100.0
	Total	80	100.0	100.0	

From the sample population of the study, Table 6 shows the dimension maintenance of opportunity, where the frequency is denoted. Of the workers surveyed, 39 present a high level and 28 moderate, however 13 workers indicate not knowing the maintenance of opportunity at the company level.

Table 7. Distribution of frequencies and percentages of the operational control of the company.

Fault detection					
		Frequency	Percentage	Percentage Vpallid	Percentage accumulated
Valid	Low	1	1.3	1.3	1.3
	Moderate	5	6.3	6.3	7.5
	High	74	92.5	92.5	100.0
	Total	80	100.0	100.0	

According to table 7, the dimension fault detection is shown, where it can be seen that 74 workers say they know the development of fault detection, however 5 workers know moderately and 1 worker does not know.

Table 8. Distribution of frequencies and percentages of the design modification of the company.

Design modification					
		Frequency	Percentage	Percentage valid	Percentage accumulated
Valid	Low	11	13.8	13.8	13.8
	Moderate	36	45.0	45.0	58.8
	High	33	41.3	41.3	100.0
	Total	80	100.0	100.0	

Table 8 shows the dimension design modification, where it can be seen that 36 workers have a moderate knowledge at the company level, however, it can also be seen that 33 workers have a moderate level.

Table 9. Relationship of the variables studied.

Correlations between administrative control and general repair				
			Control administrative	Reparation general
Spearman's Rho	Administrative control	Variable correlations	1,000	,634**
		Sig. (bilateral)	.	,000
		N	80	80
	Reparation General	Variable correlations	,634**	1,000
		Sig. (bilateral)	,000	.
		N	80	80

Table 9 shows the relationship of both variables studied, being statistically significant, contrasting therefore the statistical null hypothesis is rejected accepting the alternate hypotheses, therefore the existence of a relationship between both variables studied can be appreciated.

Discussion

With the results obtained, although the company under study does not have a training plan at the level of the partners, they try to give good customer service because an important value for them is responsibility is the most important value. However, they demonstrate the need to have at least induction talks to improve the offer of their urban transport services. Although the evaluation and monitoring of the activities is carried out on a semi-annual basis, it is required to be reduced to a monthly period because there is a greater flow of requirements and problems that need to be addressed before the biannual meeting of the assembly of partners. This demands that there be changes in the internal regulations of the cooperative. The scenario is to move from the state of a new pavement to the onset of fatigue, represented by the occurrence of visible surface defects, recoverable deflection on the surface above what is admissible, increasing stresses and deformations, depending on the reduction of the structural capacity of the layers and the pavement as a whole (9, 10,11). The study developed shows a framework of the administrative system in the management of asphalt pavements for its subsequent incorporation of an analysis from the workers who work in the company to reduce possible failures or uncertainties (12, 13). These subsidence in the pavement or ruts, in flexible pavements, result from the properties of the constituent materials of the pavement, such as the visco-plasticity of the upper asphalt mixtures and the natural plasticity of the other underlying layers (soil and granular materials), so that in some fatigue models this plastic deformation on the surface is determined by the individual contribution of each layer (14). The quality of the field information will then depend on the allocation and prioritization of resources for maintenance, as well as the reliability of the decisions made in terms of intervention.

The performance of GCR-modified asphalt responds to its structural properties of the material in pavements where, the effects of curing temperature, mixing time and shear on the development of its morphological chemical composition of granular rubbers in asphalt were investigated (15) . Over time, the number of cars in cities has increased, as well as the speed in which they circulate and the loads admitted, in pavement structures their durability has been limited and in the same way their useful life has been considerably reduced due to the different climates and microclimates to which they are subjected (16) . The disposal of used tyres is a major problem for both public bodies and companies that treat solid waste, which motivated them to look for solutions that allow them to be reused, such as on roads and improve their thermal and mechanical characteristics to achieve a sustainable transport infrastructure (17). n another investigation was carried out due to the problems that occur in asphalt pavements in China, during the service using a modifier of granular rubber and polymer fiber resulting in having a better behavior in cracking resistance (18). In another context, due to the impact of icing on roads, a technology using elastic polyurethane rubber particles (EPRP) was proposed, with an optimal dosage of 24.6% of the binder weight, to determine this value the adhesive mechanical properties, durability, ice-breaking performance, and roughness were tested considering tire friction and pavement surface (19).

Conclusion

The findings of the study show a direct relationship between Administrative Control and preventive maintenance of the company. The dimensions studied in the research presented a level of significance of medium to high by the workers of the company. Likewise, it was observed that corrective maintenance is important in the company to have a sustainable pavement management system.

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