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## Pavement Management System Research Output: A Scientometric Assessment

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### Abstract

Developing countries are struggling with cost management of pavement construction and rehabilitation. This case is similar to developed countries but developing countries are suffering issues of inadequate funds. Therefore, most of the countries started usage of Pavement Management Systems (PMS) to manage the decision-making process and alternate/priority assessments for pavement construction and rehabilitation. Hence, the PMS remains the topic of research interest for various researchers. This paper evaluates the scale and effectiveness of articles published by Web of Science (WoS) Group on PMS since 1990. The data has been collected from the WoS database from 1990 till 2020. The data was processed and analyzed by Microsoft excel. This paper concludes that the trend of publication PMS articles is increasing and researchers are publications in high-quality articles on the WoS. The citation trend is also increasing but it is analyzed that the WoS is not publishing the PMS conference articles as per the collected data. This paper compiles all the high-quality papers on PMS. It will also assist the authors to find a suitable publisher based on previously published work by the publisher.

**Keywords:** Pavement Management System, Scientometric, Web of Science, Publishers, Citations

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### Introduction

The maintenance management systems have been implemented into the roads since the 1970s and are usually considered a good and useful assist for the road managers. Since that time these systems have been commonly used in Pavement Management Systems, and the term PMS has become very popular in many countries in both America and Europe [1]. The road network is one of the most important assets of a region, even more so if it is a capital that directly affects the quality of life and local population conditions. This is the responsibility of both government and road management authorities to ensure that this important asset continues and is efficient [2]. Maintaining the road network is a very complex activity, where the most advanced technological approaches have to be used to maximize the benefits and reduce the cost.

PMS is a “collection of specified procedures for gathering, evaluating, maintaining and reporting pavement data to assist decision-makers in finding optimum strategies to keep pavements in a serviceable condition at the lowest cost over a given period of time”[3]. It needs up-to-date and reliable asset details, and it assists with scientific model-based analytics for decision-making processes. PMS gathers all these activities that support the decision-making processes of pavement management. It helps to allocate the limited financial and human capital available in a fair logic way assigned to any PMS model. For data collection, which is one of the most critical components of the PMS, the most advanced technology is currently available but it is a costly activity [4].

Until deciding on road maintenance, you need to know the actual condition of the pavement in a given area. Road authorities set up the PMS to ensure roads are in good shape and serve their purpose [6]. A successful PMS should be able to facilitate the decision-making process for restoring, restoring and rehabilitating sections of a pavement network under such budget constraints [5].

PMS design is a complex process due to each country varying criteria's. With the advancing age of pavements where various advance technologies are been used to design PMS and its associated activities. PMS remains the topics of research and its research trend is also increasing. Therefore, this paper investigates the publications trend on PMS in one of the highly ranked and reputed research article databases called Web of Science Group. All publications on this group are of high-quality research articles authored by different researchers around the globe. This paper will also assist the researchers to select a suitable publisher in future research articles on PMS.

### **Data Collection and Analysis**

The raw data for the period 1990 to 2020 has been collected from the Web of Science (WoS) group. The WoS formerly known as the Web of Information is an organization that offers subscription-based access to various databases, offering extensive citation data for several different academic disciplines. It was originally developed by the Scientific Information Institute (ISI) in 1900, and released in 1997. Clarivate Analytics currently maintains the WoS. Network of Science links publications and researchers in curated repositories spanning every discipline through citations and guided indexing. Use the referenced reference search to document prior work and monitor recent trends in material that is completely indexed for over 100 years, including documents and backfiles from 1898. The database covers almost 256 disciplines and it presents more than 161 million publication articles of different nature which includes journals, conference proceedings, reports, book chapter, notes etc. The total indexed journals on the WoS are around 34000 and total cited references of around 1.7 Billion [6]. The data was a collection on April 5, 2020. The specific term “Pavement Management System (PMS)” was used to find all the specific publication with PMS in their title. There were total 123 publications found and during data cleaning phase it was observed that 12 publications data was missing and only their titles were written so these were discarded from the core data file. In the next phase, the raw data was cleaned and the data bugs were removed. The data were replotted as per the scope of the research objectives of this paper. In the last phase, the complete data was processed in MS Excel to generate different data item trends and finally, they were plotted in various charts which are shared in the results section.

## Results and Discussion

The data has been carefully analyzed because synchronization was a major challenge. The raw data is not fit to be used directly to get the results. As discussed earlier, the data were screened and cleaned to get synchronized results. Table 1 shows the key features of publications published on PMS title.

Table 1: Key Features of PMS Publications on the WoS

Features	Value
Results found	111
Sum of the Times Cited	376
Average Citations per Item	3.38738739
h-index	12

Table 1 shows the key overall features of the data. Total 111 publications were published in the WoS in last 30 years with specifically PMS in their title. The total sum of the citations of all publications were 376 so it can be concluded that the average publication citation is 3.38. The publications have a total of 12 h-index.

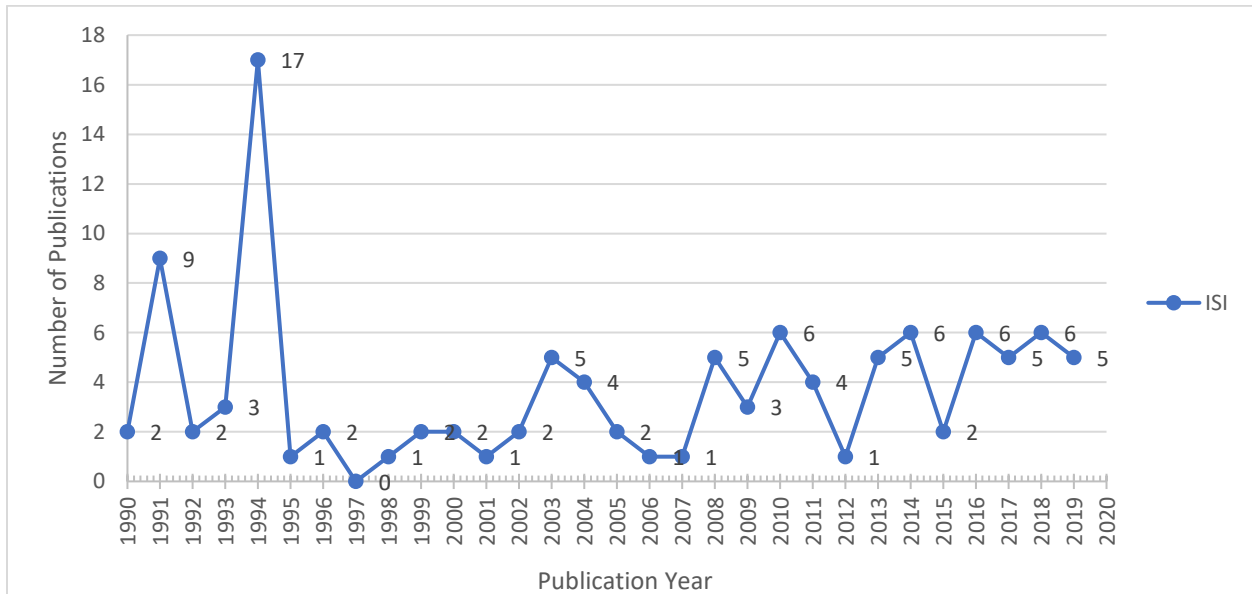


Figure 1: Total Published Articles from 1990 to 2020

Figure 1 shows the complete roadmap of the past 30 years of the WoS papers on PMS. It has been observed that the publication trend is quite better in last one decade. It was investigated that why 1994 has a higher number of publications and it was concluded that most of the publications in 1994 were conference proceedings. It is also observed that PMS has been the topic of interest for various researchers in the world.

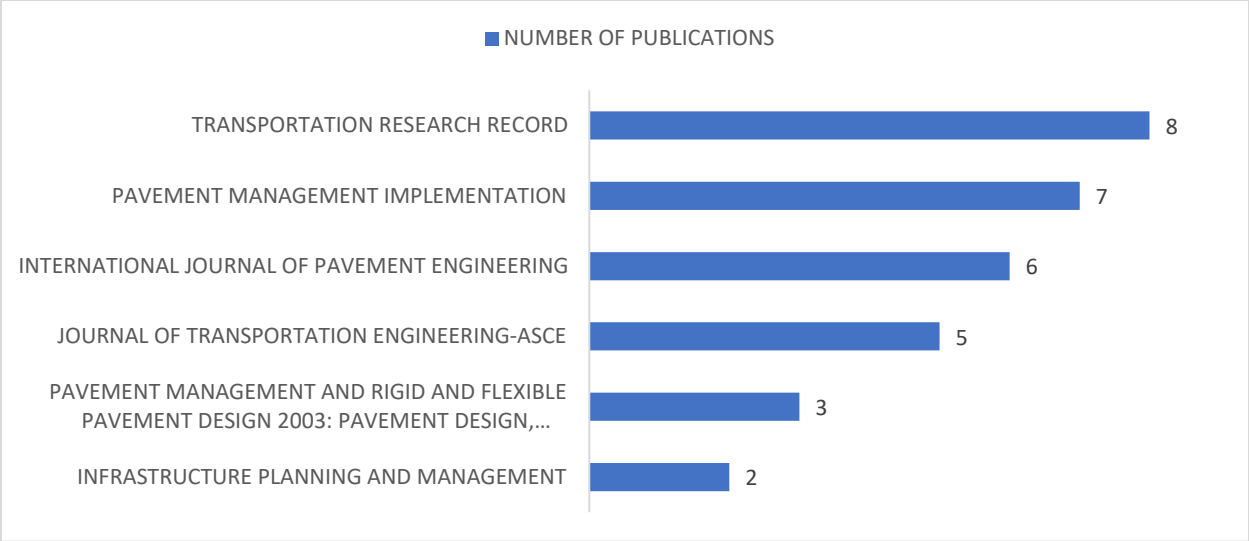


Figure 2: Key Source Titles (Journals)

Figure 2 shows the major publisher sources who published a higher number of journal articles on PMS in the last 30 years. It is analyzed that Transportation Research Record has published higher number of articles on PMS followed by Pavement Management Implementation, International Journal of Pavement Engineering and Journal of Transportation Engineering by American Society of Civil Engineering.

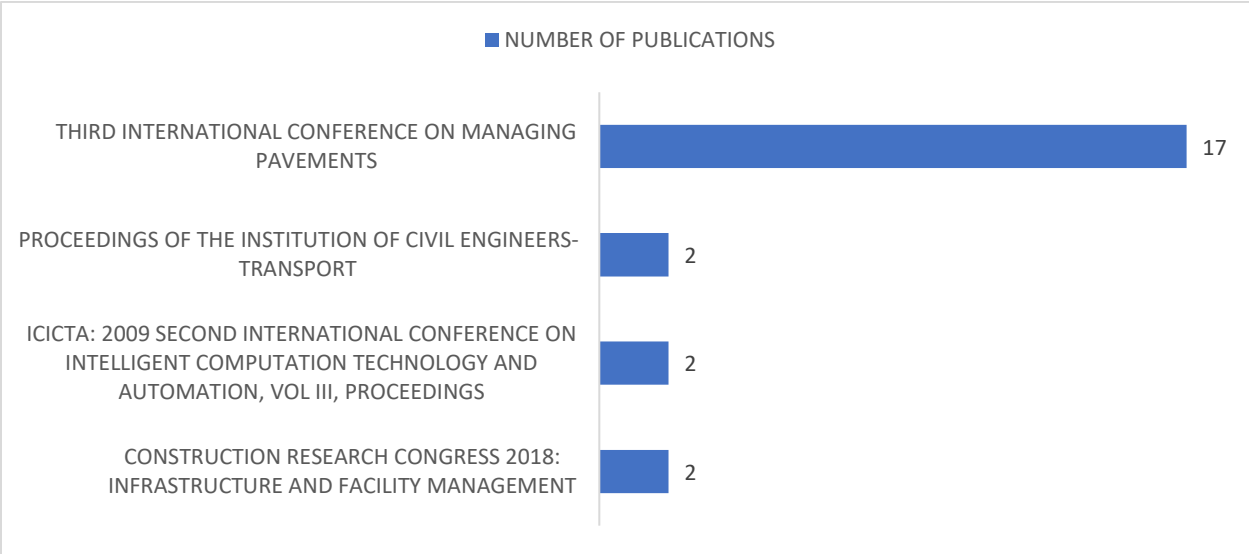


Figure 3: Key Source Titles (Conferences)

Similarly, Figure 3 shows the major publisher sources who published a higher number of conference proceedings on PMS in the last 30 years. It is analyzed that the Third International Conference on Managing Pavements is the only conference series who published a higher number of conference proceedings on PMS. As per data trend either the WoS is not publishing conference proceedings on PMS or there are very few conference series on PMS title.

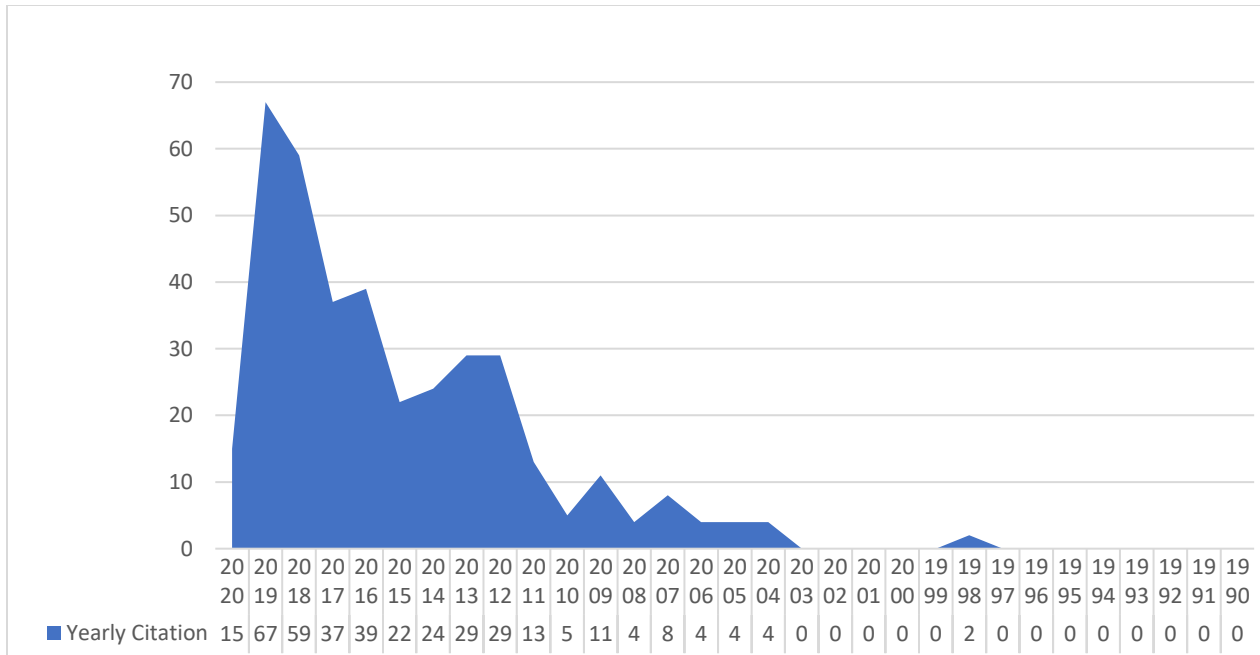


Figure 4: Yearly Citation

Figure 4 shows a very interesting trend of total citations of articles published in various sources on PMS using the WoS database. It is quite evident in the data that the trend of PMS related research is increasing. Especially, PMS related research got boost in last one decade and it is also encouraging that PMS is one the interesting topics of research for the authors.

Table 2: Most Cited Articles Details

Article Title	Authors	Article Publisher	Year	Citation
Integrated pavement management system with a Markovian prediction model [7]	Abaza, KA; Ashur, SA; Al-Khatib, IA	Journal of Transportation Engineering-ASCE	2004	65
Investigating effects of asphalt pavement conditions on traffic accidents in Tennessee based on the pavement management system (PMS) [8]	Chan, Chun Yip; Huang, Baoshan; Yan, Xuedong; Richards, Stephen	Journal of Advanced Transportation	2010	39
Sustainable Pavement Management System in Urban Areas Considering the Vehicle Operating Costs [1]	Loprencipe, Giuseppe; Pantuso, Antonio; Di Mascio, Paola	Sustainability	2017	18
Review of Louisiana's Pavement Management System Phase 1 [9]	Khattak, Mohammad Jamal; Baladi, Gilbert Y.; Zhang,	Transportation Research Record	2008	16

	Zhongjie; Ismail, Said			
Enhancement of Arizona pavement management system for construction and maintenance activities [10]	Li, Yongqi; Cheetham, Alan; Zaghloul, Sameh; Helali, Khaled; Bekheet, Wael	Pave Management; Monitoring, Evaluation, And Data Storage; And Acceleratyed Testing 2006	2006	15
Pavement management system for Lisbon [11]	Picado-Santos, L; Ferreira, A; Antunes, A; Carvalho, C; Santos, B; Bicho, M; Quadrado, I; Silvestre, S	Proceedings of the Institution of Civil Engineers-Municipal Engineer	2004	15
Pavement-management system for Oliveira do Hospital, Portugal [12]	Ferreira, A. J. L.; Meneses, S. C. N.; Vicente, F. A. A.	Proceedings of the Institution of Civil Engineers-Transport	2009	14
Robust Deflection Indices from Traffic-Speed Deflectometer Measurements to Predict Critical Pavement Responses for Network-Level Pavement Management System Application [13]	Nasimifar, Mahdi; Thyagarajan, Senthilmurugan; Siddharthan, Raj V.; Sivaneswaran, Nadarajah	Journal of Transportation Engineering	2016	13
A risk-based optimisation methodology for pavement management system of county roads [14]	Saha, Promothes; Ksaibati, Khaled	International Journal of Pavement Engineering	2016	13
Runway surface friction characteristics assessment for Lamezia Terme airfield pavement management system [15]	De Luca, Mario; Dell'Acqua, Gianluca	Journal of Air Transport Management	2014	12
PMSC - Pavement Management-System for Small Communities [16]	Tavakoli, A; Lapin, Ms; Figueroa, JI	Journal of Transportation Engineering-ASCE	1992	12

Table 2 highlights the key publications on PMS which have high citation score. “Integrated pavement management system with a Markovian prediction model” authored by Abaza, KA et al., has the highest citation score (65). This article was published in the Journal of Transportation Engineering by the American Society of Civil Engineering in 2004. Similarly, “Investigating

effects of asphalt pavement conditions on traffic accidents in Tennessee based on the pavement management system (PMS)” authored by Chan, Chun Yip et al., has the second-highest citation score (39). This article was published in the Journal of Advanced Transportation in 2010 followed by others shown in Table 2.

## Conclusion

Roads is the principal asset of every nation in the world. Efficient and well-maintained infrastructure networks are important for stability in society and for fostering economic development and sustainability in the climate. In an attempt to ensure that roads are still in good shape and fulfilling their purpose, PMS has been receiving growing publicity. Reasonable PMS needs to be placed in place to collect accurate and reliable pavement data. This paper concludes that a total 111 publications were published on the WoS in last 30 years with specific term PMS in their title. The total sum of the citations of all publications were 376 and a total of 12 h-index. It is observed that the publication trend is quite better in last one decade and PMS term is been the topic of research interest. Transportation Research Record, Pavement Management Implementation, International Journal of Pavement Engineering and Journal of Transportation Engineering by American Society of Civil Engineering are the key high-quality publishers and authors focus on the WoS. It is quite evident from the data that the trend of PMS related research is increasing which is a good sign for researches working in this area. This paper assists the authors to select the journal to publish their upcoming research article on PMS.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

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