

ABSTRACT

The Habilitation Thesis **STUDY OF ASPHALT MIX BEHAVIOUR – RESEARCH AND RESULTS** includes main scientific, professional and academic achievements of the candidate Carmen Răcănel after the public presentation of the PhD Thesis on the 29th of March, 2002, but also the future directions of the development of her professional career. The thesis, titled “Effects from creep and fatigue on the behaviour of asphalt mixes” was elaborated under the scientific leadership of Prof. Dr.H.C. Eng. Stelian DOROBANȚU at the Technical University of Civil Engineering of Bucharest.

The candidate began the academic activity at the Technical University of Civil Engineering of Bucharest, Faculty of Railways, Roads and Bridges, Department of Roads and Railways, just after the graduation, in 1993, going through all academic degrees, starting with junior lecturer, assistant professor, lecturer, and, associate professor, since 2004. At the moment, the candidate is an associate professor at the Department for Roads, Railways and Construction materials teaching courses such as “Highways Part II (Highways Infrastructure)”, “Highways Part III (Pavement Design)”, and “Composite materials for road layers”. The first book printed in a central publishing house was in 2003, and, at this moment, the candidate is the author of 9 specialized publications (books, lectures, design guides) and the editor of 4 books.

During her academic activity, after 2004, the candidate led over 60 students towards getting their diploma project and over 50 students with dissertation work, but also 3 PhD students in internship. She was an official referent for 6 PhD thesis and also a member in the Commission for the Graduation Exam at the Faculty for Railways, Roads and Bridges.

The research activity began with the participation in the first research contracts between 1991-1993, within the department research team, and continued until present day with the participation as team member for more than 100 research contracts and grants (of these, 6 grants and 4 technical standards). After finalizing the PhD thesis, the candidate was a director for more than 50 contracts and, of these, 3 were research grants.

The main activity of the candidate is research in the field of roads, with a special accent on the behavior of asphalt mixes based on laboratory studies. The most important and relevant research directions followed by the candidate are: study of the behaviour of asphalt mixes for permanent and fatigue strains, study of the behaviour of added asphalt mixes, study of the possibility of the use of non-conventional aggregates in asphalt mixes, study of the performances of asphalt mixes for airports. All these studies were performed in the context of the construction of sustainable roads, with accent on the reduction of materials, fuel, emission and costs, on the reuse of materials resulted from demolitions, waste recovery and recycling of the road layers. Thus, the focus is on preserving natural resources, reduction of storage space and environment protection.

The ”asphalt mix” produced as a natural aggregate mix, filler and bitumen, resulted from the distillation of petroleum (in contrast to the asphalt mix produced from asphalt rocks) was used for the first time as road layer on a street in New York, in U.S.A. 112 years ago, since that time it spread quickly, so that today more than 90% of roads surfaces in the entire world have layers based on asphalt mixes thanks to its quality.

The spectacular rise of traffic, but also of the axle loads, together with the change in axle geometry and superposed on climatic factors – temperature variations and humidity – led to the occurrence of damage (permanent deformations and strains, thermal and fatigue cracking). These types of damage are the research subjects for many researchers in the field of roads, in order to establish their causes and take the appropriate measures for elimination or reduction and for finding new solutions concerning material mixes. Thus, for the estimation of the behaviour and performance of asphalt mixes in flexible pavements, the knowledge and correct interpretation of stress and strain state under loads produced by vehicle axes and climate effects. Generally, with time, the researchers established that this damage occurs because of the quality of the bituminous binder and of the inappropriate granularity of the aggregates.

This is the context in which the habilitation thesis is written, presenting the laboratory research work for designing some asphalt mixes having higher strengths at permanent deformations, but meeting at the same

time the necessary properties for fatigue strength. For this purpose, in the thesis, the results obtained with the newest laboratory equipment, according to the European standards which are in use now in our country, are presented. These equipments were bought by the Roads Laboratory of the Technical University of Civil Engineering in Bucharest following the research grants and contracts in which the candidate participated actively.

Also, the advantages of using several types of additions in asphalt mixes as polymers, rubber, fibres but also additives for the modification of the work technology so that temperatures are reduced, an extension of the season for laying it and an increase of the transportation distance are obtained, together with the benefits for the environment, are presented in the thesis.

A special problem consists in establishing the composition and performances of asphalt mixes for airports, taking into account the fact that in our country the moving surfaces have had, since some years ago, a concrete coating, the valid normative still continue to offer information only for rigid road structures.

The problem of recycling is also an actual one taking into account their large quantity, but also the need for having storage space. In this regard, some solutions for ecologic asphalt mixes using the furnace slag are presented, this being the subject of the current grant, of which the candidate is the director.

The entire research presented through scientific achievements is based on several research grants and many contracts having subjects in the frame of laboratory testing. All these works were finalized in publishing ISI (14 papers) and BDI papers (14 papers), but also in 2 patents for: an optical measuring and recording device for deformations as a component of the equipment for rutting test and a method and mobile equipment for measuring the thickness of road layers.

The obtained results prove the vast experience in project management of both the candidate and her team in all performed research projects.

At the moment, the candidate is the Director of the Department for Roads, Railways and Construction Materials, Director of the Research Center “Roads and Airports”, Editor in chief of the on-line paper Romanian Journal of Transport Infrastructure, responsible with the quality for the Road Laboratory of T.U.C.E.B.. Also, she is the President of the Organizing Committee of the International Conference “Road Research and Administration (C.A.R.)” and the President of the Organizing Committee of the Scientific Session for the Students “Transport Infrastructure Engineering (I.I.T.)”.

The candidate obtained the 2016 “Ion Ionescu” award for excellence in the field of education and scientific research, offered by A.P.D.P. România.

The candidate is a reviewer for some papers and conferences, is member of several professional associations and of many commissions and councils. Also, she is certified as a project verifier and technical expert in the following domains: Road and runways for airfields (A4 – Mechanic strength and stability, B2 – Safety in service) and all D domains.

The main directions for future career development present the evolution and plans together with the research directions, teaching activity, practical applications in professional, academic and research plans such as: continuation of the editing of books in the field of roads, improvement of the teaching methods, development of the “Roads and Airports” Research Center with other new domains: “Pavement Design” and “Traffic safety”, extension of the competence field, but also the acquisition of new competences, continuation and extension of the research in the field, improvement of the Romanian method of designing of flexible pavement structures. All these are possible through grants awarded through competition, but also through the elaboration of norms and regulations, continuation of the dissemination of the research results, cooperation with other universities in Romania and abroad, and finally through the proposal launched for young peoples to sustain the education and research in the field of roads.

The references are included at the end of the habilitation thesis and include, beside the publications in the field with references in the text, the papers, patents and contracts of the candidate which were at the base of this habilitation thesis.