

Evaluation of the sustainability of road drainage systems

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Water is the most erosive agent that exists on the linear structures, because they are constantly subjected to outdoor condition like irregular infiltration, frosts and different rain intensities. Another variables that highly influence in the entire lifetime of a natural drainage system are the spatial and temporal variability of the rainfall, the soil, the vegetation cover and the design.

All this factors are affecting the vulnerability of the clearings and embankments, by wearing away the weakest materials which surround the roads or train rails, producing erosion and very bumpy surfaces. The result is that the original pattern, developed to diminish the lost of soil, is not properly working and it cannot eliminate water, with the consequence destruction of the linear structure after several rainfall periods, and the accumulation of material down slope.

The propose of this research focuses on analysing the drainage systems used in spanish roads and railways lines. For this purpose, a revision of the literature has been done, and the main drainage solutions have been recovered, carrying out an evaluation of them from an environmental point of view. This procedure has been requested by several authors in the past (Nwa, E.U. & Twocock, J.G., 1969; Goulter, I.C., 1992), together with the need of designing a more sustainable drainage system. The final objective of this complete revision is to compare objectively the designs to valuate them in order to develop a new drainage patter which minimize the erosion, increasing the durability and effectiveness of the drainage system.

For this purpose, it is necessary to assure that all the systems will be compare under similar parameters of flow rate, vegetation, substrate, lenght, slope and total section. Only the channels pattern and water distribution will change. The analysis has been done following Liu, H. & Zhu, X.B., (2012), who pointed out that the main parameters to take into account to select a road drainage system are the hydraulic functioning, structural strength, produced erosion, service life, initial invesment and maintenance costs of different drainage systems.

The followed methodology was to create a Leopold's matrix to compare among the alternatives of drainage design, asignating a puntuation from 1 to 5 to each factor that affects the functioning of the drainage. The process to decide the puntuation of every factor in each drainage design will be also explained. The alternative which obtains more puntuation represents the best available design to decrease erosion on the slopes and increase the service life. The validation of this results has been done in the field.

References

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