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Retrofitting the historical city of Oviedo, Spain: The potential role of SuDS in Santuyano's Boulevard and *"El Campo de San Francisco"*

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ABSTRACT

The city of Oviedo, in the Principality of Asturias, North-West Spain, is developing a plan to introduce Green Infrastructure (GI), following up from the European Union (EU) funding programmes. With this aim, two architectural and engineering ideas contests were organised by the City Council in order to retrofit the city by transforming the current A-66 highway which marks one of the main entries to the city into a Boulevard (Santuyano) and to empower greener spaces around the main park in the city centre (San Francisco). Pedestrians are the main protagonists, highlighting amenity above all targets. The University of Oviedo following its goal to develop SUDS within the Spanish-speaking community worldwide, organised a team of students, lecturers and researchers to contribute to these contests. The team was based on the students who formed the team which won the Innovation Contest in SUDS at the University of Oviedo, a pioneered experience in Spain and Latin-America at a University level. The team proposed a wide range of SUDS techniques including Permeable Pavement Systems (PPS) in incentive car parks to avoid traffic in the city centre, swales and bioretention cells in the boulevard and pedestrian streets, and ponds in parks, amongst others. Despite the fact that the ideas contests were looking for GI, both engineers and politicians conforming the City Council Panel demonstrated a lack of knowledge about SUDS and their global impact in biodiversity, amenity and water quantity and quality control. There is still a resistance in Northern Spain to apply SUDS but a brighter future can be spotted through the growing interest aroused by these two initiatives from the University of Oviedo which is pushing an agenda of change in urban drainage based upon SUDS. This paper shows the main findings from this design experience.

INTRODUCTION

- United Nations (2015) reported that 54% of the global population live in urban areas. Thus, there is an increase in human activities which have led into waterproofing of large areas in cities (Rushton, 2001). Climate change has developed a scenario of extreme flood and drought events (Willems et al. 2011).
- **Sustainable Urban Drainage Systems** (SUDS) have reached a high level of implementation across the globe, becoming a *reliable set of techniques to improve flood/drought resilience in urban environments* (Fletcher et al. 2015).
- This research aims to describe the results from a **pioneering experience** carried out at the University of Oviedo where *students from the Master in Civil Engineering participated in 2 international ideas contest to retrofit 2 areas of the historical city of Oviedo*, Northwest Spain (BOE 2017, 2018).

METHODOLOGY

❑ Location & Climatic Characteristics

- The study area comprehends the Santuyano's Boulevard (80.23 ha) and "El Campo de San Francisco" Park (7.38 ha) (figure 1).
- The city of Oviedo has a Cfb climate category based on the Köppen-Geiger classification (AEMET 2018) with an average temperature of 14˚C and 1,000 mm during the year.

Figure 1. Location of the city of Oviedo (left) and the study areas used in this work (right).

❑ Design parameters

- Q_{10} values (table 1).
- Daily precipitation: 55 mm.
- Storm duration: 60 minutes.

Table 1. Design value for 10 years return period.

Study Area	Q_{10} (m^3/s)
Santuyano's Boulevard	10.50
Campo San Francisco	0.94

❑ SUDS techniques proposed

- Permeable Pavements: to be implemented in "El Paseo del Bombé" (S. Francisco).
- Bioretention systems: Rain Gardens alongside the main road at the Boulevard and sidewalks in "Campo S. Francisco".

RESULTS - CONCLUSIONS

- A small retrofitting intervention on the urbanised area within the park based upon Permeable Pavements at "El Paseo del Bombé" would be able to *reduce up to 12.5% of the total runoff volume from the whole "Campo San Francisco" Area*, reducing risks of flooding and erosion in this steep area (Figure 2).

Figure 2. Location of "El Paseo del Bombé" in "Campo S. Francisco".

Figure 3. Proposed locations for the implementation of Bioretention Areas within the Boulevard.

- **Bioretention** areas in the Boulevard could take up to **21.9% of the total runoff volume** (Figure 3).
- **SUDS** implementation together with mobility measures can impact traffic volumes drastically, *moving away vehicles from the historical city centre* (Figure 4).

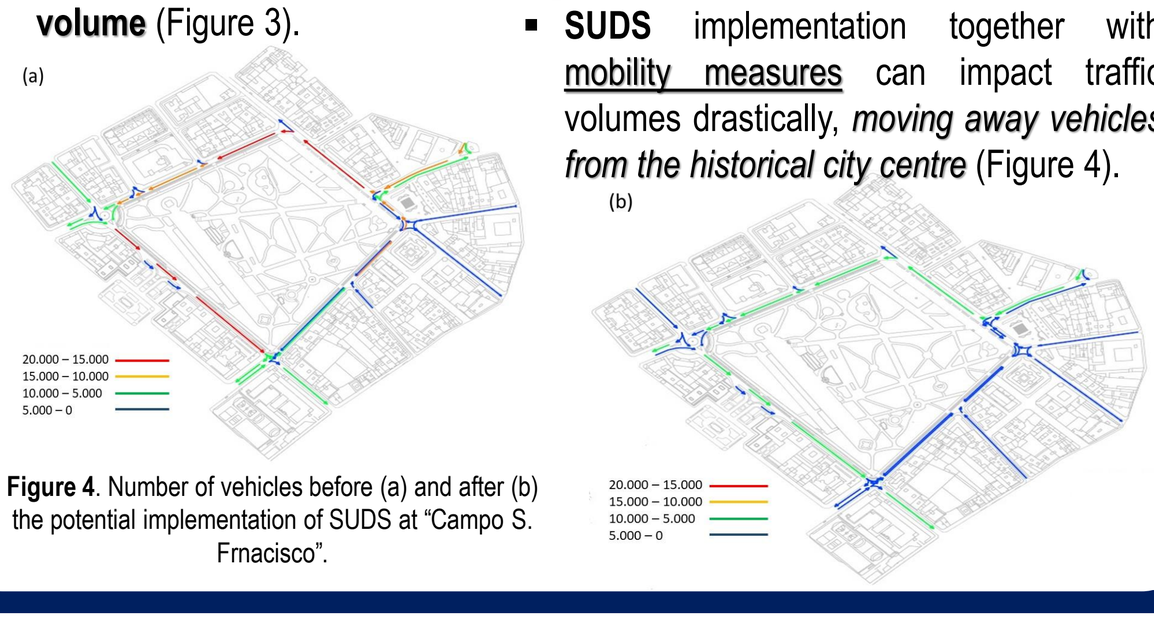

Figure 4. Number of vehicles before (a) and after (b) the potential implementation of SUDS at "Campo S. Frnacisco".

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