Study on the characteristic laws of urban road traffic flow under rainstorm and waterlogging

FORUM8
9th CPWC

Team : SMTH_2021

Overview

As a typical type of adverse weather, heavy rainfall can result in congestion and productivity loss in urban transportation system, which has been a severe problem for cities. Nowadays, little attention has been paid to the effects of the combination of rainfall and rain-induced waterlogging on urban road traffic. This study aims at thoroughly and quantitatively studying the effect of rainfall and waterlogging on traffic flow on urban road sections, based on a combination of methods including driving experiment and simulation. The results from this study can facilitate a deeper understanding of the rainfall and waterlogging on traffic flow.
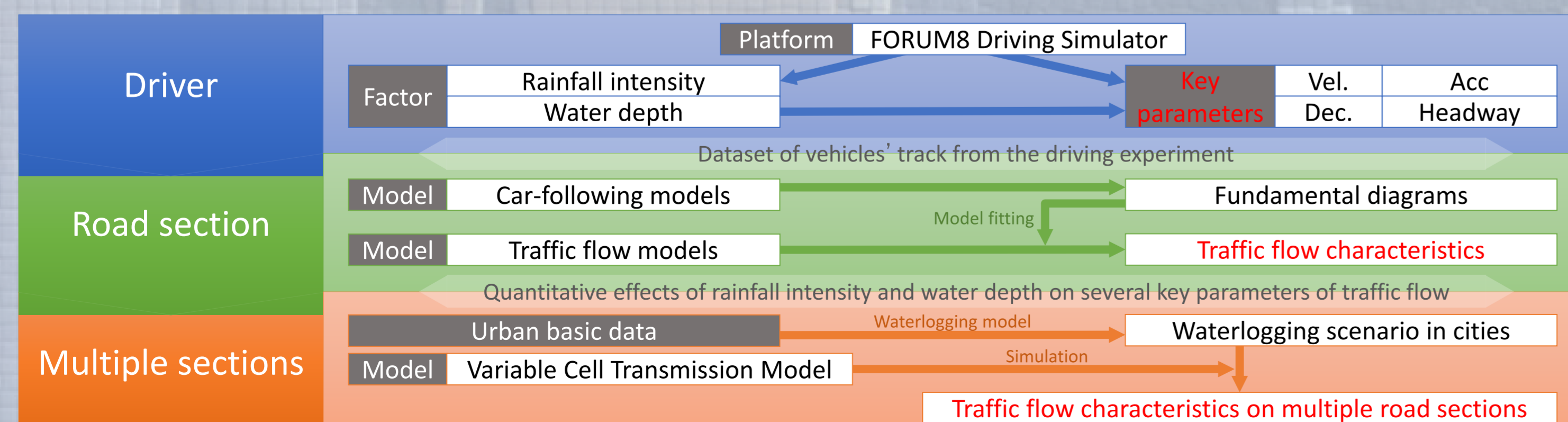
Background

The events of rainstorm and waterlogging are very common in cities, which have been a typical phenomenon of "urban disease".

How to figure out the characteristic laws of urban road traffic flow under rainstorm and waterlogging?
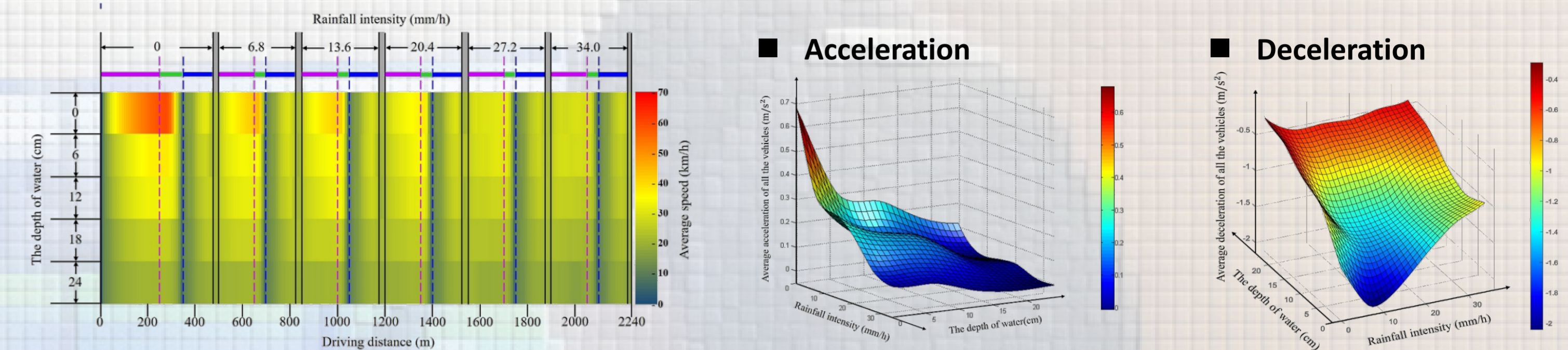What could we do with the support of FORUM8 driving simulator and UC-win/Road?
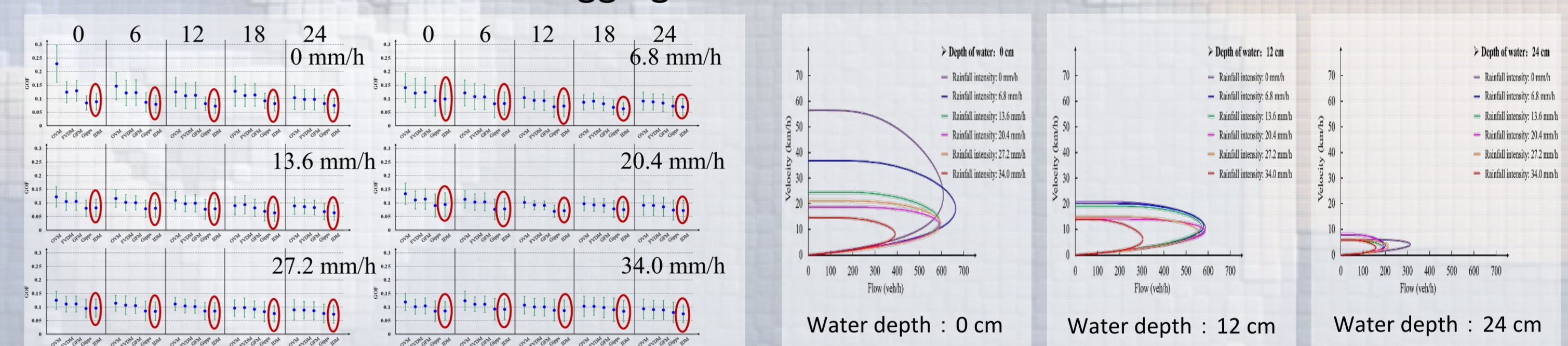
Framework and Methods

Driver	Factor	Rainfall intensity	Platform	FORUM8 Driving Simulator	Key parameters	Vel.	Acc
		Water depth				Dec.	Headway

Dataset of vehicles' track from the driving experiment

Road section	Model	Car-following models	Model fitting	Fundamental diagrams
	Model	Traffic flow models		Traffic flow characteristics

Quantitative effects of rainfall intensity and water depth on several key parameters of traffic flow

Multiple sections	Model	Urban basic data	Waterlogging model	Waterlogging scenario in cities
		Variable Cell Transmission Model	Simulation	

Traffic flow characteristics on multiple road sections

Results

1. A driving simulator study under rainstorm and waterlogging

■ Acceleration   ■ Deceleration

2. Traffic flow simulation and analysis of traffic characteristics on a single road section under rainstorm and waterlogging

0 mm/h   6.8 mm/h
13.6 mm/h   20.4 mm/h
27.2 mm/h   34.0 mm/h

Water depth : 0 cm   Water depth : 12 cm   Water depth : 24 cm

3. Traffic flow simulation and analysis of traffic characteristics on multiple road sections near the waterlogging prone points under rainstorm and waterlogging

Free flow speed v_f Capacity q_c Backward propagation speed W
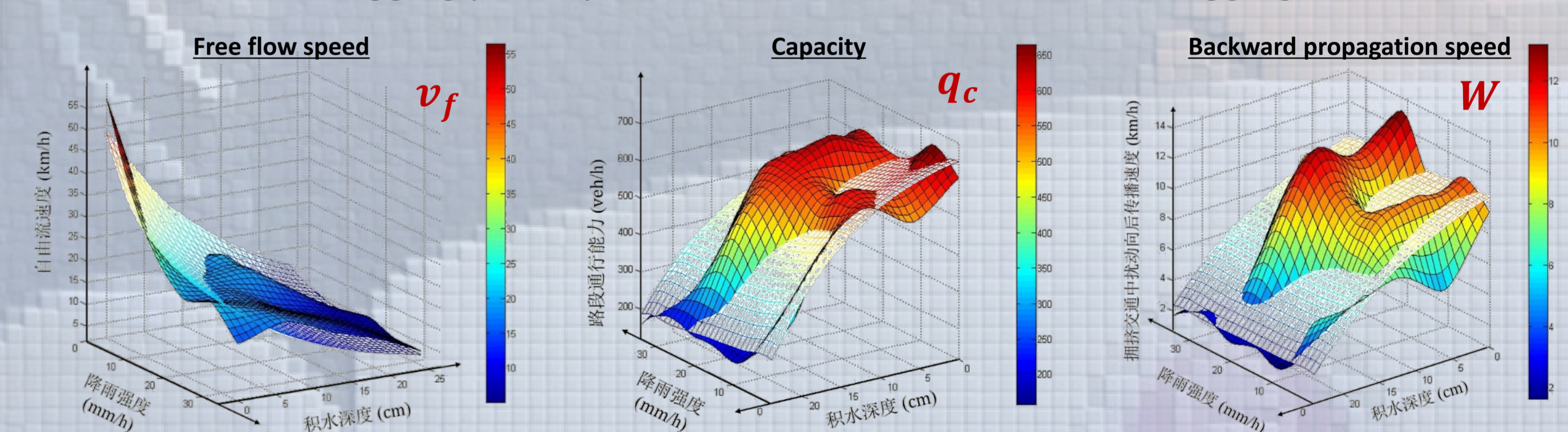
Summary and Prospect

Four relevant research papers have been finished in this project during the past year, with the support of FORUM8 driving simulator and UC-win/Road. It proves that FORUM8 driving simulator and UC-win/Road can not only be used as APP developing tools, but also are very powerful platforms to support scientific research.