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INFORMATION ON RESEARCH RESULTS

1. General information:

Project Title: **Developing and assessing traffic management measures under flooding conditions caused by heavy rains and high tide surge in Ho Chi Minh City**

Project code: **B2018-VGU-08**

Principal investigator: **Dr. Vũ Anh Tuấn**

Research institution: **Vietnamese-German University**

Duration: **18 months (June 2018 – December 2019)**

2. Objectives:

The ultimate objective of the research is to formulate a set of weather-responsive traffic management measures to minimize traffic impacts of heavy rains and urban floods. The research has three specific objectives as follows:

- 1) Collecting data (including surveys) and analyzing the levels of road flooding in HCMC due to heavy rains and high tidal rises.
- 2) Conducting travel behavior surveys and analysing the patterns of travel behavior changes due to adverse weather conditions (before, during and after the adverse wearther), and its impacts on traffic and mobility.
- 3) Formulating traffic management strategies to mitigate the negative traffic impacts of heavy rains and urban floods.

3. Creativity and innovation:

This research has contributed to the literature on the patterns of travel behavior changes under adverse weather conditions and urban flooding; the impacts of adverse weather and urban flooding on traffic and mobility, transport network capacity; the weather-responsive traffic management measures to minimize traffic impacts of heavy rains and urban floods.

This research has applied various techniques of analysis, for instances descriptive analysis, independence tests, binary logit models, and VISUM-based traffic simulation model, to: (1) capture possible changes of people's travel behavior under the adverse weather conditions; (2) quantify the impacts of adverse weather conditions, urban flooding and weather-responsive traffic management measures on traffic and mobility.

The value of research contribution is expressed by a methodology developed for assessing possible impacts of adverse weathers and urban flooding and weather-responsive traffic management measures. The methodology could be used for designing traffic management solutions and further improved in future researches.

4. Research results:

The research has been completed with respect to the goal of formulating a set of weather-responsive traffic management measures to minimize traffic impacts of heavy rains and urban floods. Specifically, three objectives have been achieved, including:

- 1) Collecting data of traffic volumes and flow speeds on 15 roads that floods have often occurred (i.e., surveys on normal and rainy days) and analyzing the levels of road flooding in HCMC due to heavy rains and/or high tidal rises and its impacts on traffic.
- 2) Conducting travel behavior surveys with 500 respondents and analyzing the patterns of travel behavior changes due to adverse weather conditions (before, during and after the adverse weather), and its impacts on traffic and mobility.
- 3) Formulating traffic management strategies to mitigate the negative traffic impacts of heavy rains and urban floods.

A transport model has been built on VISUM and used for traffic impact assessment of proposed measures. The results of this research shall be a scientific base for practical design of traffic management measures to efficiently respond to heavy rains and urban floods in HCMC, with a focus on potentially effective measures and specific road user groups (e.g., students, workers, and public transport users).

5. Products:

o	Expected products	Resulted products
1	Scientific products	
1.1	Publications in ISI/SCOPUS lists: 01 paper	<p>02 publications in SCOPUS list (Book Series “Lecture Notes in Civil Engineering” bởi NXB Springer (IF 0.13):</p> <p>Travel behavior change patterns under adverse weather conditions - A case study from Ho Chi Minh City (HCMC), Vietnam</p> <p>https://link.springer.com/chapter/10.1007%2F978-981-15-0802-8_147</p> <p>Analysis of Mode Choice Behavior under Adverse Weather Conditions Using RA and SA Surveys - A Case Study from Ho Chi Minh City (HCMC), Vietnam</p> <p>https://link.springer.com/chapter/10.1007%2F978-981-15-0802-8_153</p>
1.2	Publication in the list of The Vietnamese Council recognizing the title of Associate Professor and Professor: 02 papers	<p>02 papers published in Scientific Journal of Transport and Communications (Ministry of Transport) in the serial number T03/2020:</p> <p>Phân tích hành vi tham gia giao thông của người dân Thành phố Hồ Chí Minh làm cơ sở đề xuất các giải pháp quản lý giao thông đô thị ứng phó</p>

		<p>với mưa ngập đường</p> <p>Xây dựng bộ giải pháp quản lý giao thông đô thị ứng phó với mưa ngập đường và đánh giá tác động tiềm năng của một số giải pháp tại Thành phố Hồ Chí Minh</p> <p><i>(Drafted papers & Certifications is attached)</i></p>
2	Education product	
2.1	01 Master	<p>Supervising one master thesis “Nghiên cứu giải pháp quản lý giao thông ứng phó với điều kiện thời tiết bất lợi – Trường hợp nghiên cứu mạng lưới giao thông trên địa bàn phía Đông, Thành phố Hồ Chí Minh” at HCMC University of Transport. Final defense is expected in January 2020.</p> <p><i>(Master thesis outline is attached)</i></p>
3	Application products	
3.1	Traffic management measures to respond to road flooding.	Accomplished (Chapter 5)
3.2	Traffic simulation model (VISUM) to forecast traffic impacts of road flooding.	Accomplished (Chapter 6)
3.3	Parameters of road users’ behaviors and technical data of the modes of transport (headway, vision, speed...) in traffic congestion due to flooding.	Accomplished (Chapter 4)
3.4	Database of flooding and traffic situations.	Accomplished (Annex)
3.5	VISUM User Guideline	Accomplished (Annex)

6. Transfer method, beneficiary, and impacts of the research results:

The research results will be transferred to the Ministry of Education and Training for the purpose of education and research reference.

The research results will be also transferred to HCMC’s Department of Transport, Management Center of Saigon Tunnel (MCST), Center for Urban Road Infrastructure Management, Traffic Police, and District People's Committees to refer to and may conduct further studies to bring the proposals into practice.