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## Operational risks of Malaysia-Singapore high speed rail infrastructure to extreme climate conditions

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### ABSTRACT

Based on several decades of scientific observations, the world agrees that climate change is real and unequivocal. Around the world, atmospheric and oceanic temperature has been increasing, the amount of ice on the earth is decreasing, and then sea level has risen. In reality, the current railway network in Malaysia, over the last decade, has been significantly affected by severe weather conditions such as rainfall, lightning, wind and very high temperatures. These extreme climate conditions can result in asset system failure, quickly deteriorated operation and ultimately, delays to train services. Thus to avoid those disaster to happen, such infrastructure resilience is a vital for the new proposed High Speed Railway from Kuala Lumpur, Malaysia to Singapore. Identifying new and innovative way of improving infrastructure, which is resilience during periods of severe weather conditions, will reinforce the operational resilience of HSR once it is open. This study is therefore focused on the risks and pertinent effects of climate change on HSR infrastructure operation in Malaysia, including their operational requirements, local conditions including topographical and geological aspects, together with the operational requirements and local conditions to the design of infrastructure.

### INTRODUCTION

Globally, High Speed Rail (HSR) has become a catalyst for economic and societal growth, including in Malaysia. Its long-term economic repercussion has brought up strong interest amongst policy makers across the globe for in establishing the HSR for city and regional developments. In the development of this new form of transportation, Malaysia needs to ensure that the new HSR can cope with and adapt to the potential environmental changes. Also, railway operators generally face uncertainties from the complexities of climate change and the difficulties in predictions of climate model outputs (Remennikov et al., 2012; Remennikov and Kaewunruen, 2008). Extreme weather has affected railway operations and safety, including fatalities, injuries, property damage, delay and loss of opportunity. Little research has been conducted in Malaysia despite climate change posing serious challenges to infrastructure projects. As a result, no one knows exactly how vulnerable it will be especially with respect to transport infrastructure. It has been widely recognized that there is a need to integrate consideration of climate change and its impacts in design, development policies and projects (Kramer et al., 2010). 'Decisions

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