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# Climate adjustments to road design


Manila (2014)


London (2016)


Japan (2018)

Viet Nam and Cambodia (2020)

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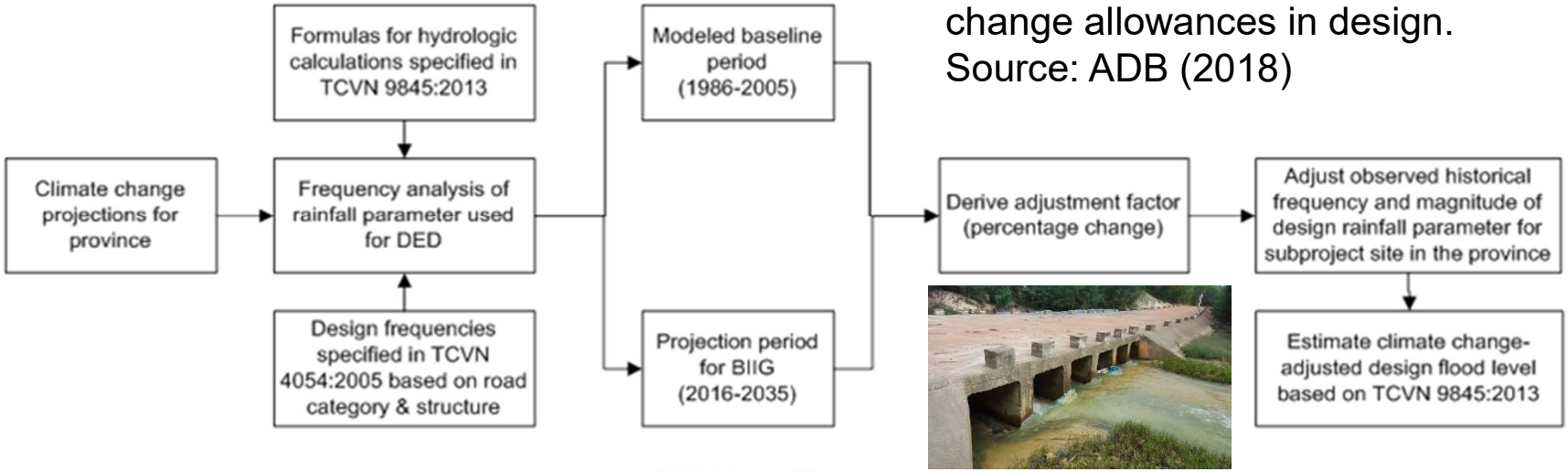
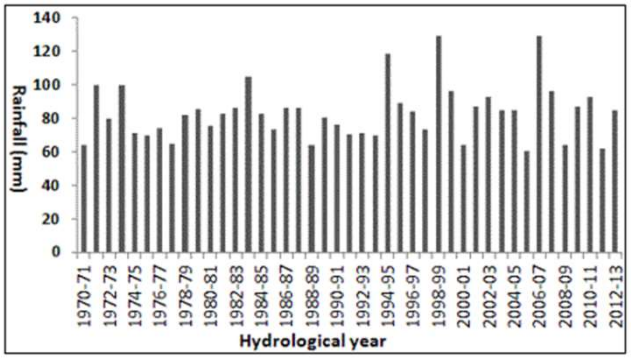
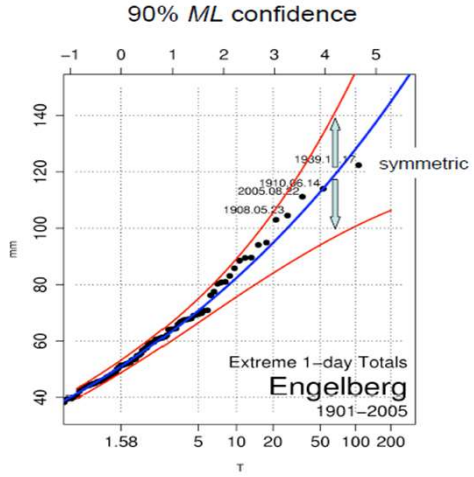
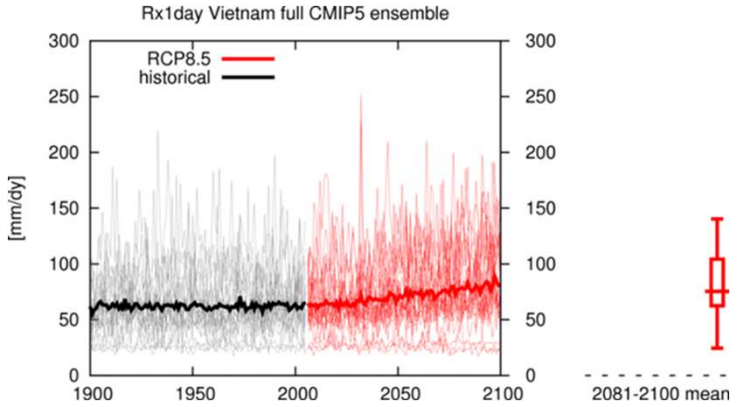
# Working with existing procedures

Procedure for incorporating climate change allowances in design.
Source: ADB (2018)



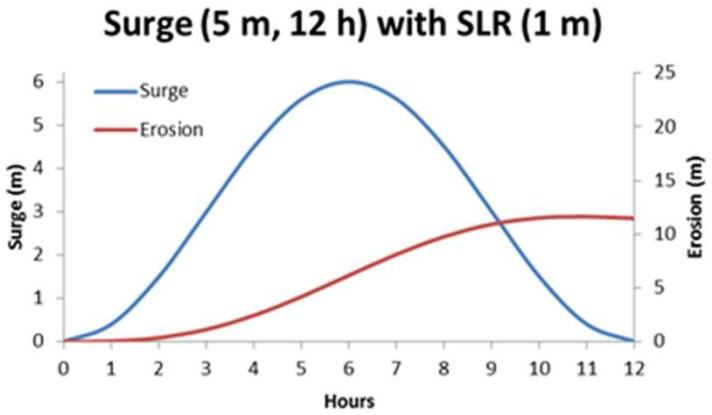
# Mainstreaming climate within design standards

| Scenario | Return Period (years) | | | | |
|---|---|---|---|---|---|
| | 2 | 5 | 10 | 20 | 25 |
| 2016-35 | 15 | 20 | 25 | 25 | 25 |
| 2036-55 | 35 | 25 | 30 | 30 | 35 |
| 2056-75 | 50 | 45 | 45 | 45 | 45 |
| 2076-95 | 80 | 75 | 75 | 70 | 70 |

National **adjustment factors** (%) for climate change in 1-day maximum rainfall based on CMIP5 RCP8.5 for Viet Nam. Source: ADB (2020)

# Managing contextual climate risks to roads

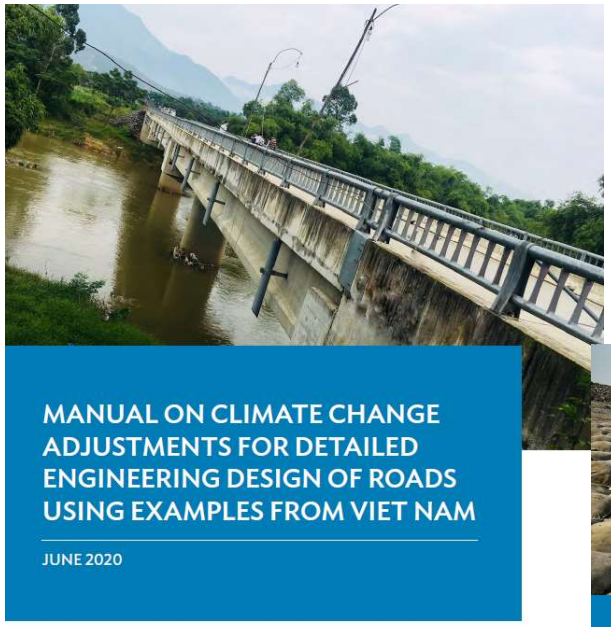






Sections of the Bao Ninh to Hai Ninh coastal road are between 4.1 to 9.9 m above mean seal level so are vulnerable to storm surges (plus sea level rise).

# Accessing resources and tools for practitioners





Source: [ADB (2020)]

Table 1: Steps in Estimating Design Values for Future Extreme Rainfall

| Step | Activity | Viet Nam Example |
|---|---|---|
| R1 | Specify project **objectives** | Upgrade culverts beneath a coastal road with expected operating life of 10 years.<br>Under Viet Nam Standards TCVN 4054:2005 (for road geometry), a culvert for a category 3, 4, or 5 rural road must be designed to convey discharge generated by an annual maximum 1-day rainfall event (Rx1day) with a 25-year return period. |
| R2 | Check for **contextual climate risks** at the project concept stage and adjust the site selection or design accordingly | Recognize that the most significant threat to the coastal road may not be from fluvial flooding but from storm surge and extreme waves—see the worked example for mean and extreme sea-level change (Table 2). |
| R3 | Obtain the **design value(s)** from historical rainfall data by<br>(a) collating and ensuring the quality of observed data for the site;<br>(b) extracting the annual maximum series;<br>(c) fitting an extreme-value distribution to (b); and<br>(d) calculating the rainfall amount for the required return period with standard error of the estimate. | For the nearest available station:<br>(a) Obtain daily rainfall series and ensure data quality through standard checks (of such items as unexpected outliers, or 5/10 or day-of-week biases);<br>(b) Extract the Rx1day value for each calendar year;<br>(c) Fit an extreme-value distribution (such as Gumbel or GEV) to the annual series in (b); and<br>(d) Use the extreme-value distribution parameters from (c) to estimate the 25-year return period Rx1day with confidence intervals.<br>Here the estimated 25-year Rx1day value is 338 mm. |
| R4 | Download **climate change scenarios** for the design variable(s) | Refer to the latest national climate change scenarios (if available) or the most recent IPCC scenarios.<br>Specify the level of uncertainty in climate projections that must be accommodated (level of risk aversion). This determines the emission scenario and the part(s) of the ensemble range to be evaluated—here the upper-bound 97.5 percentile of an RCP8.5 |

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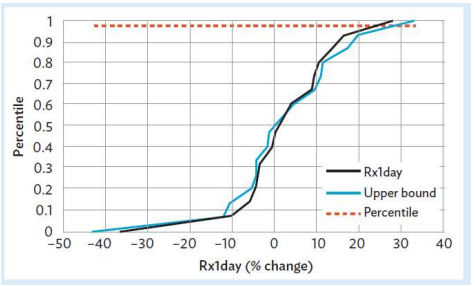


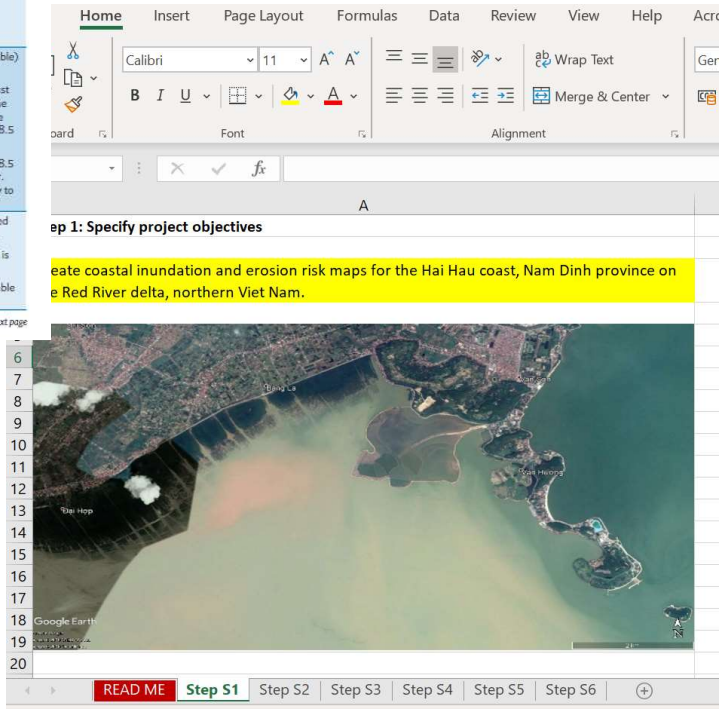


Source: [ADB (2018)]

# Thinking “tool kit”