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Vertical temperature gradients of concrete box girder caused by solar radiation in Sichuan-Tibet railway

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Research Purpose

- The trends in variation of vertical temperature gradient (VTG) values of concrete box girders in Sichuan-Tibet Railway are explored.
- The recommended VTG value of concrete box girders in Sichuan-Tibet Railway is proposed.

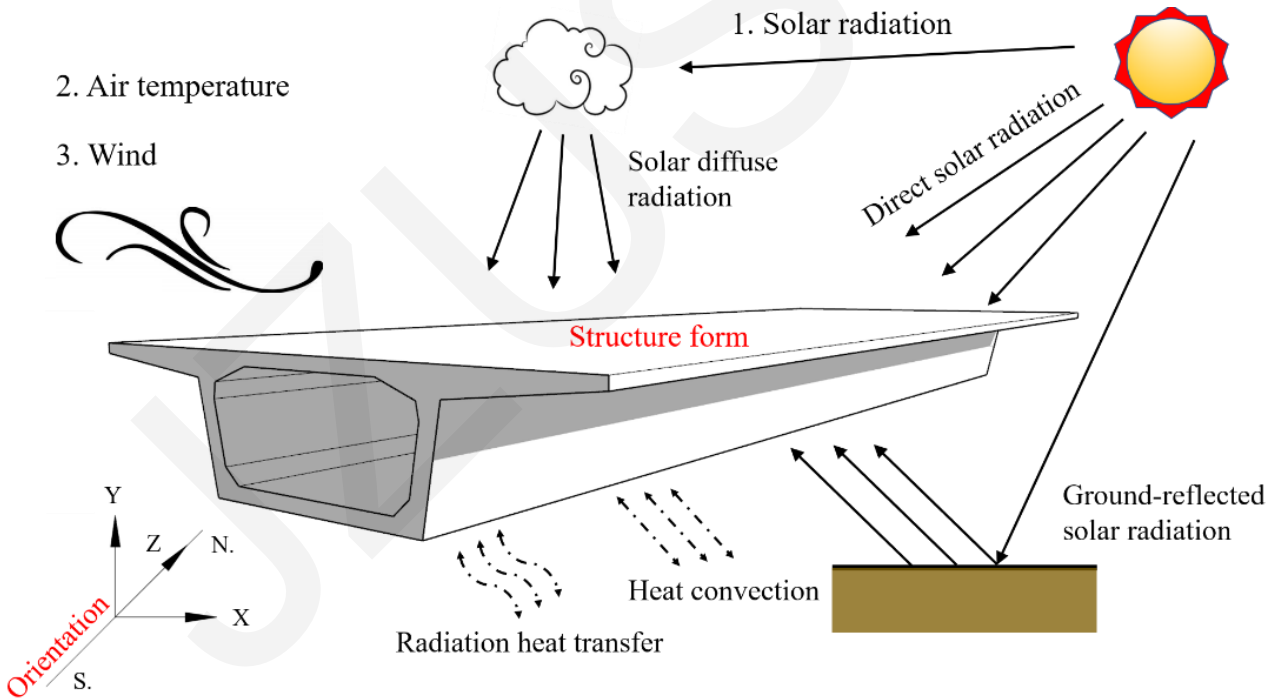

Fig. 1. Thermal environment of the structure

Research Method

- **Theoretical analysis, FE simulation, and experimental study are conducted in this work.**

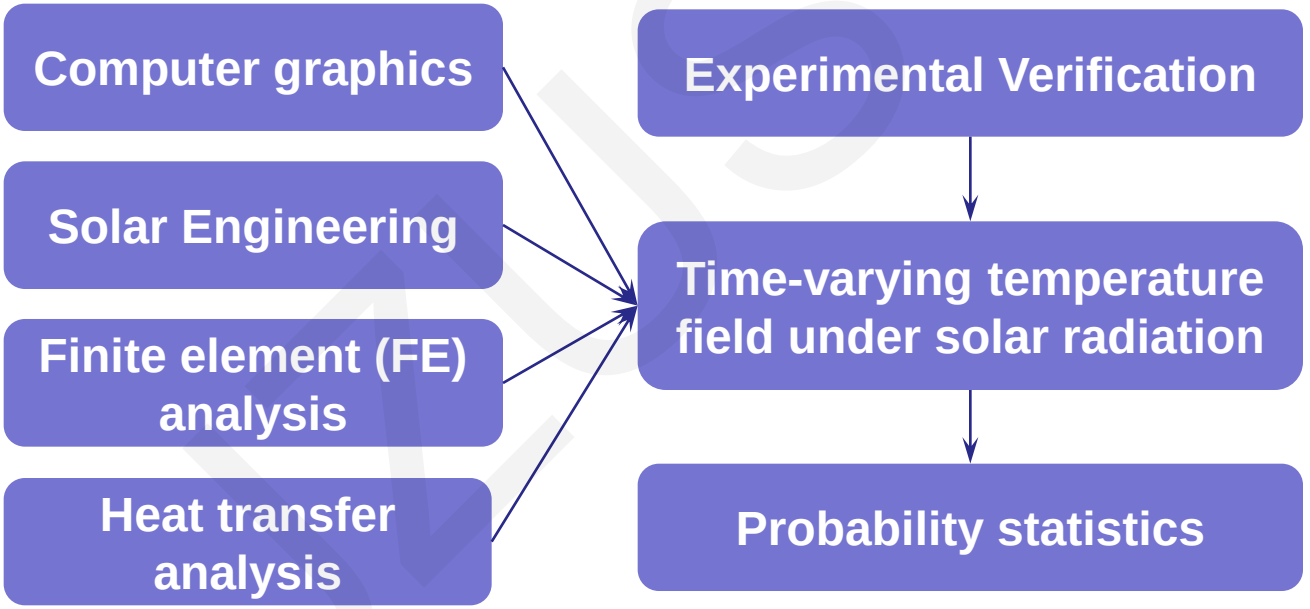

Fig. 2. Research method in this study.

The innovation points

- The solar radiation temperature distributions of box girder are analyzed, based on experimental and FE analysis.

- The trends in variation of VTG values of concrete box girders in Sichuan-Tibet Railway is explored.

- The recommended VTG value of concrete box girders in Sichuan-Tibet Railway is proposed.

Results

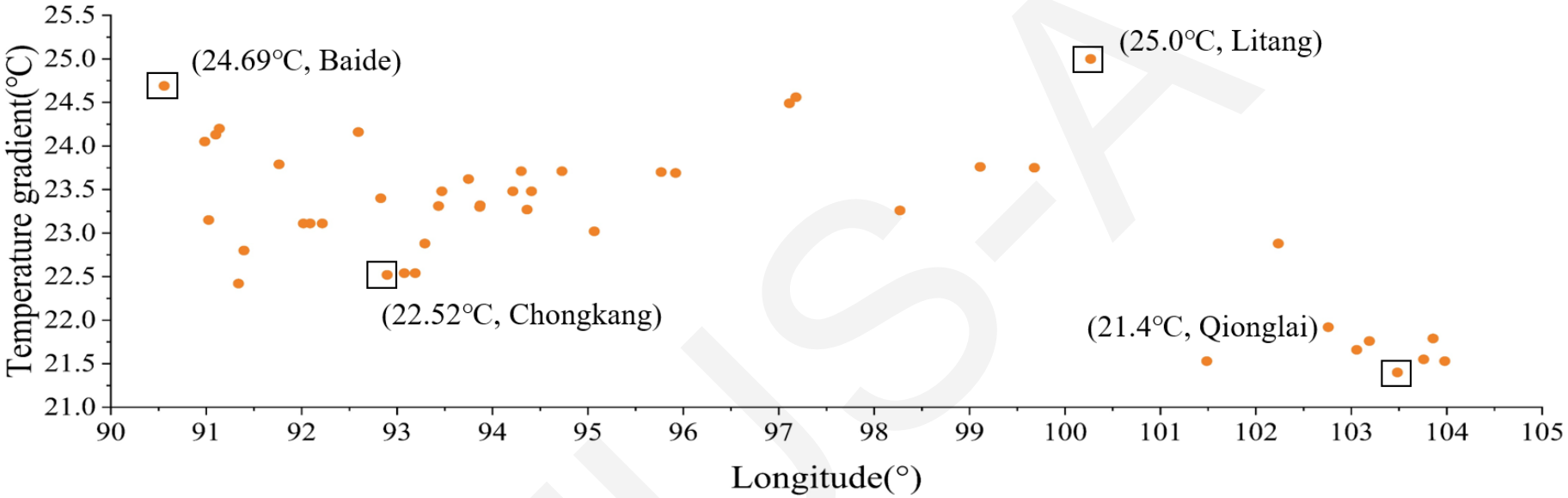

Fig. 3. VTG values of concrete box girders in the Sichuan-Tibet Railway.

Tab. 1. VTG values based on probability statistics.

VTG (°C)	Confidence interval (%)
24.97	98
24.72	95
24.45	90

Conclusions

- The developed FE model can predict the solar radiation temperature distributions of concete box girder accurately.
- The VTG values first rise, then decrease, and finally rise from Chengdu to Lhasa.
- The VTG samples ΔT come from a normal distribution, shown as ΔT~N(23.36,0.837).
- The recommended VTG value in the Sichuan-Tibet Railway is 25 ^{o}C with a confidence interval of 95%.