Bridge Corrosion

A Chloride Exposure Prediction Model for Bridges in Ontario

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Recap

- Build a database with climate and traffic data
- Allow user to input coordinate to return chloride exposure trend at that location by accessing data in database
- Divide map of Ontario into grids
- (for now) Coordinates within same grid is consider to have same output (i.e. Chloride exposure trend)

Risk: Accuracy - formula with assumed values

- V_{Speed}, V - speed limit of highway

$$\begin{cases} MR_{CA} = V_{speed} \times b \times K \times h_{film} \times \rho_{water} & \text{for } CA \\ MR_{TP} = V_{speed} \times b \times (1-K) \times h_{app} \times \rho_{water} & \text{for } TP \\ MR_{BW} = MR_{SW} = 0.5 \times V_{speed} \times b \times (h_{app} & \\ -K \times h_{film} - (1-K) \times h_{app}) \times \rho_{water} & \text{for } BW \text{ and } SW \end{cases}$$

$$\begin{cases} SD_{CA} = (-2.69 \times 10^{-5} \times V' + 2.43 \times 10^{-3}) \times MR_{CA} & \text{for } CA \\ SD_{TP} = (1.16 \times 10^{-5} \times V' - 5.25 \times 10^{-5}) \times MR_{TP} & \text{for } TP \\ SD_{BW} = (2.67 \times 10^{-5} \times V' - 4.71 \times 10^{-4}) \times MR_{BW} & \text{for } BW \\ SD_{SW} = (1.65 \times 10^{-5} \times V' - 3.99 \times 10^{-4}) \times MR_{SW} & \text{for } SW \end{cases}$$

Risk: Accuracy - formula with assumed values

- W_{lane} (lane width), d (distance between road edge and bridge substructure) - same for all the roads

$$M_{app} = \frac{V_{salt} \times h_{total}}{t_1 \times W_{lane}}$$

$$C_s = 0.015 \times C_{s_{air}} \times e^{-0.05d} + 0.985 \times C_{s_{air}} \times e^{-0.5d}$$

Risk: User Input

- Input coordinate that is not inside Ontario
- Input with negative longitude (eg. (-81, 44) and (279,44) is the same)
- Input close to Ontario boundary (still working on)

Code Demo

- Model verification in SRS by MATLAB
  - Generate the database once
    - Climate and traffic model are unlikely to change
  - Performance time
- Input checking in VnV by Python
  - GeoJSON - shape of Ontario
  - Geopandas - load the file

Model verification

- The models contain lots of data → start from testing individual one and compare with expected output (still working on)
- No need to use external database management system → all data are within one csv file, might do so if become a larger scale.

Input checking

- Check if the input coordinate is within Ontario
- Draw polygons in the shape of Ontario using vertex coordinates
- For now hard-coding, still looking for a better way

Questions?