Replacement of the Brooklyn Queens Expressway (BQE) Connector for the Kosciuszko Bridge in New York

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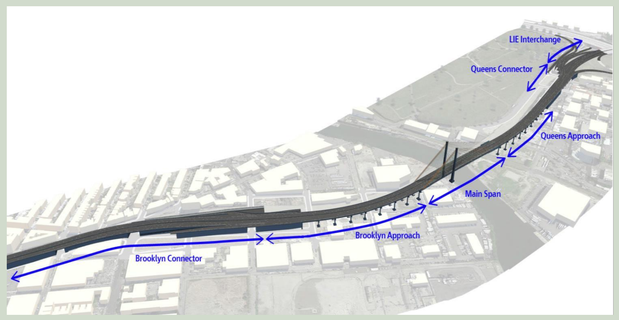
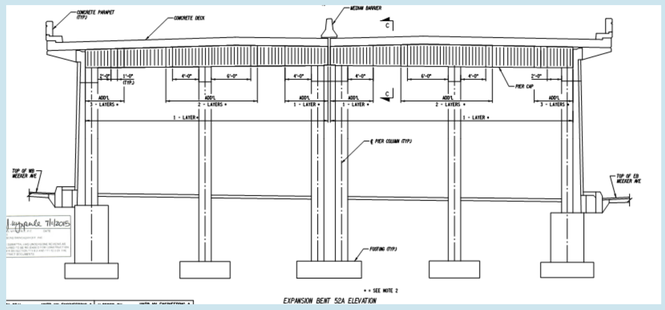
Engineering challenge

- As part of the Kosciuszko Bridge Replacement project, the Brooklyn Connector was a column-supported roadway to be replaced-in-place in stages by an earth-filled embankment while safely maintaining traffic.
- Differential settlement of the Connector's shallow footings leading to the shutdown of the vital NYC highway could not be tolerated.
- Fill heights ranging up to 40 feet were planned.
- The design-build contractor challenged the designers to demonstrate a constructible scheme to place normal weight fill without negative effect to the existing Connector.



Existing conditions



- 78 rigid concrete spans.
- Concrete piers on spread footings were founded on natural silty sand deposits.
- 3-span continuous rigid concrete frames in the longitudinal direction and two 2-span bents in the transverse direction.
- Miscellaneous urban fill over glacial sands and gravels. Stiff clay and bedrock were 100 ft or more below grade.

Engineering approach

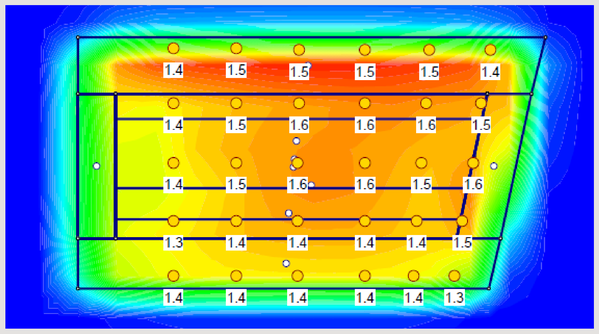
- Rigorous field and laboratory testing program included soil borings, cone penetrometer testing, shear wave velocity measurements, and a full scale ground settlement load test.
- Statistical analyses of soil property correlations were made to determine upper- and lower-bound estimated properties.
- 3-D settlement analyses considered statistical variations of ground conditions between adjacent footings to determine largest probable differential movements.

Full scale field load tests were performed to calibrate soil properties against field and laboratory measurements.

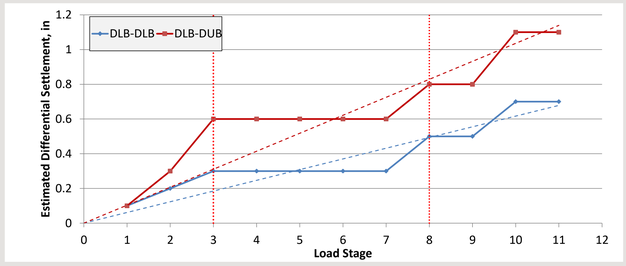
Fill was carefully placed underneath the existing Connector while it remained open to traffic.

An extensive, redundant instrumentation program was initiated to confirm predictions and protect the public.

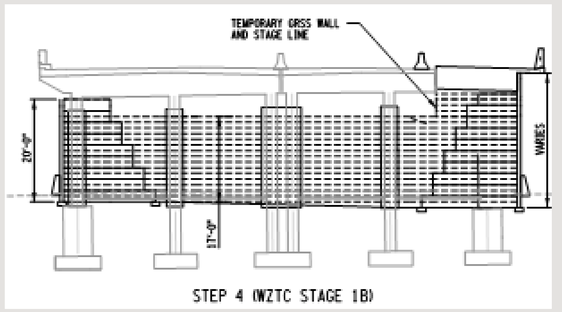
Engineering approach (cont'd)



- Plots of anticipated differential settlements based on construction load stages were developed for every column pair.



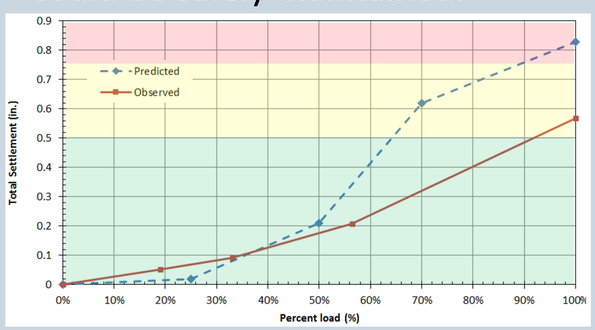
- Differential load stages were defined by the designers and predictive load-settlement curves developed.



- Designed and implemented structural monitoring system to measure differential movements between over 250 column pairs and confirm observed settlements were within predicted tolerance.

Results

- By observing actual deformations versus predicted settlements, we were able to demonstrate to the Owner that traffic could be safely maintained.



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