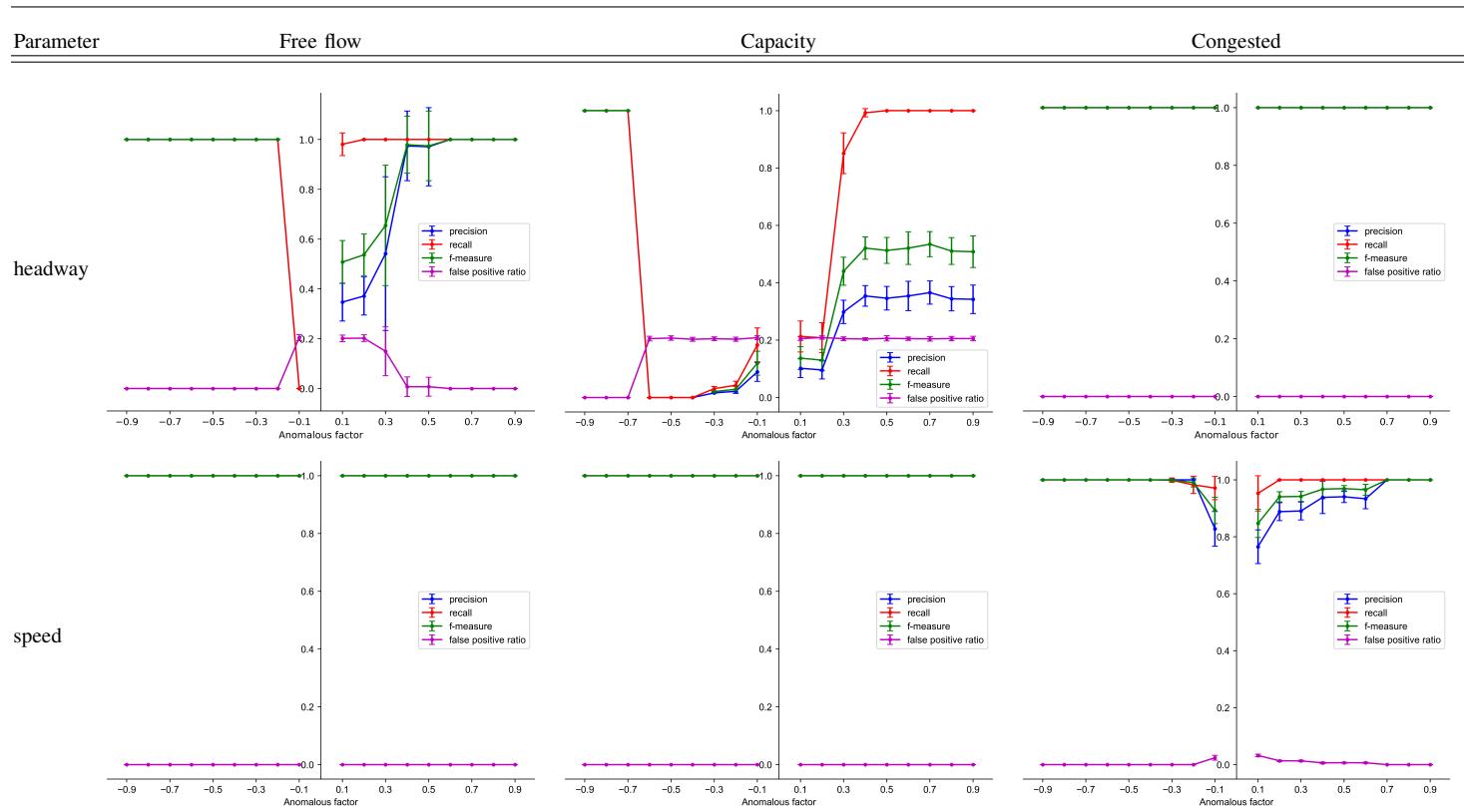


APPENDIX A SIMULATION RESULTS

Tables II, III, IV, V, VI and VII contain the numerical results generated using the global ground truth while Tables VIII, IX, X, XI, XII, XIII showing the numerical results generated using the local ground truth.

TABLE II. Evaluation metrics behavior when 10% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

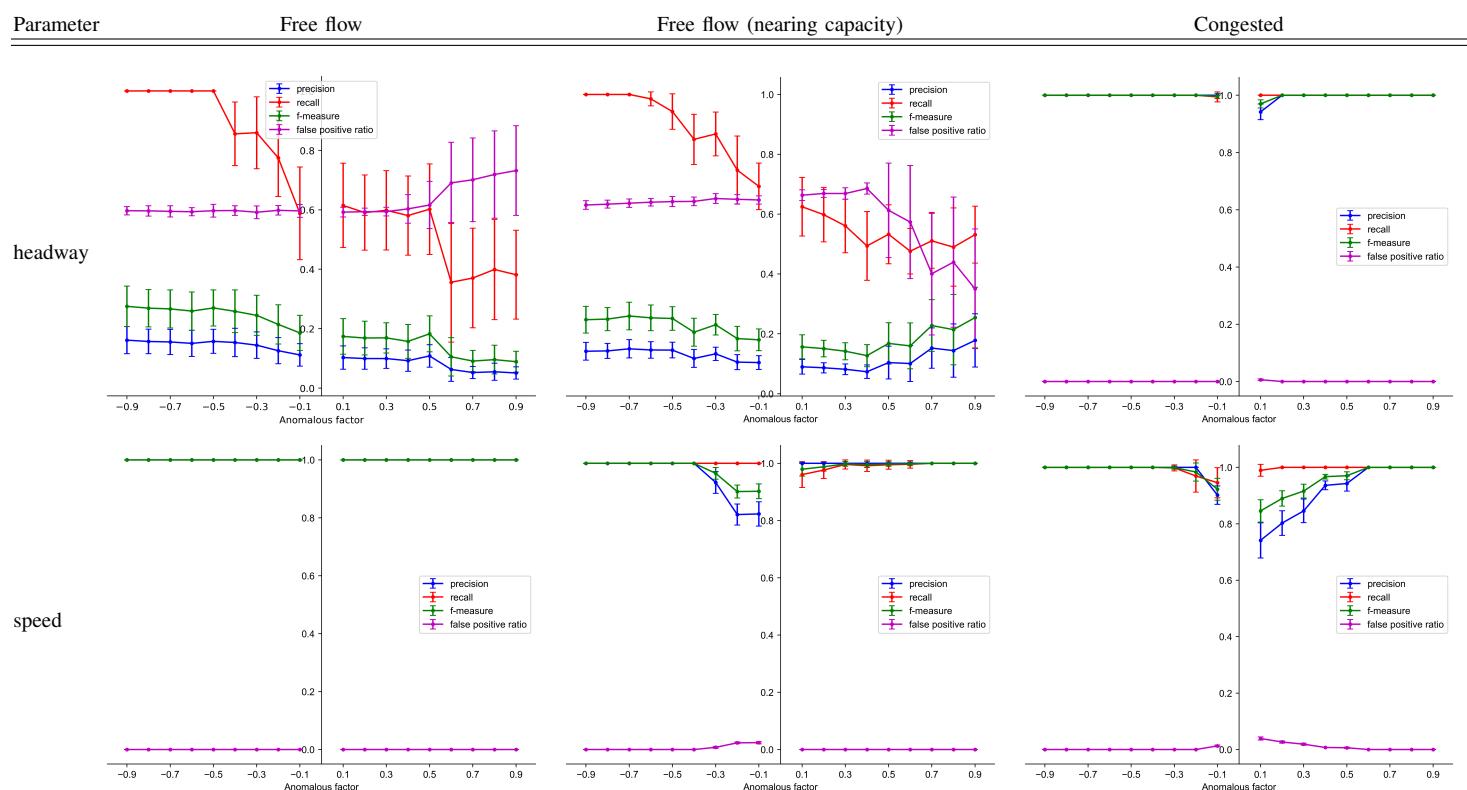
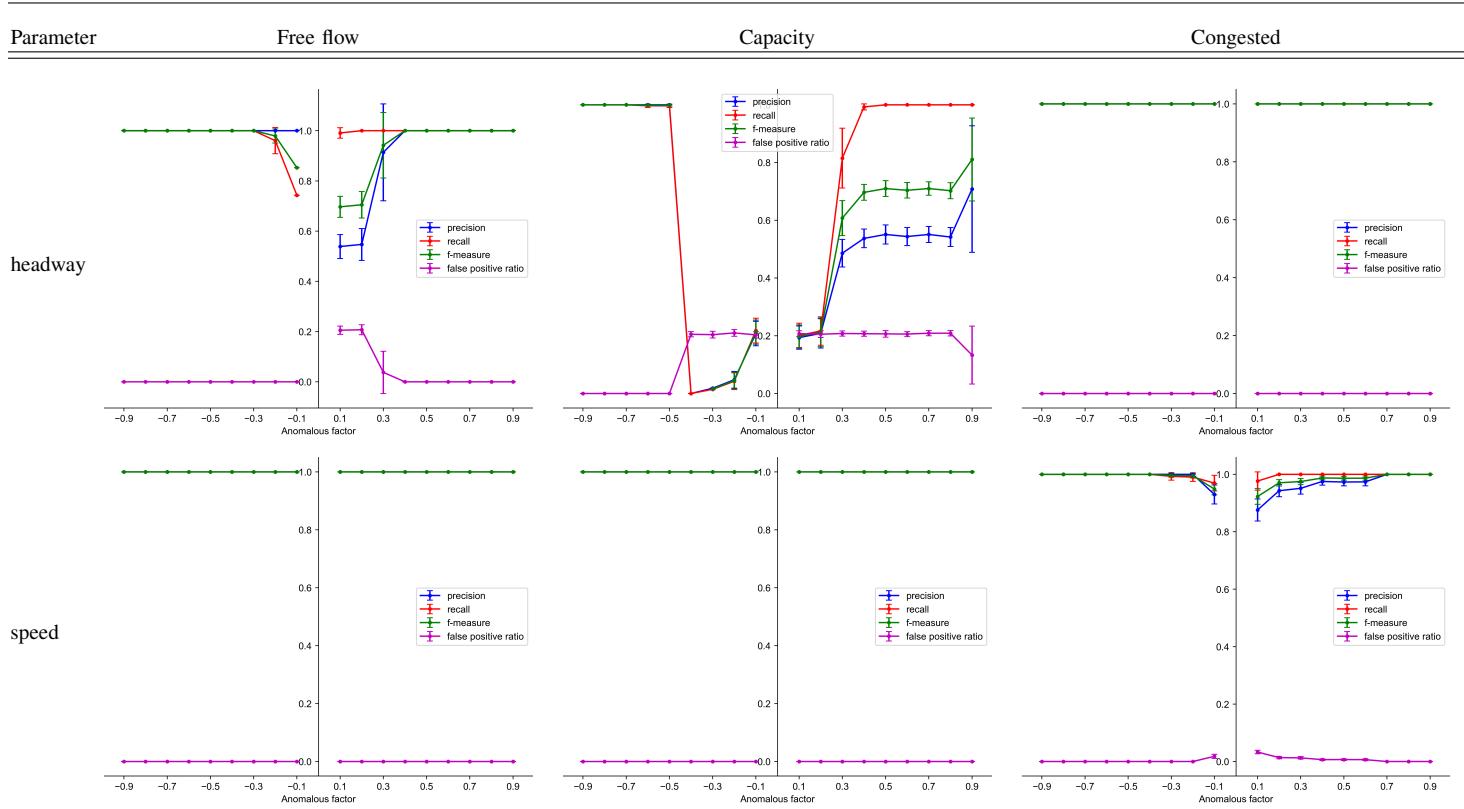


TABLE III. Evaluation metrics behavior when 20% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

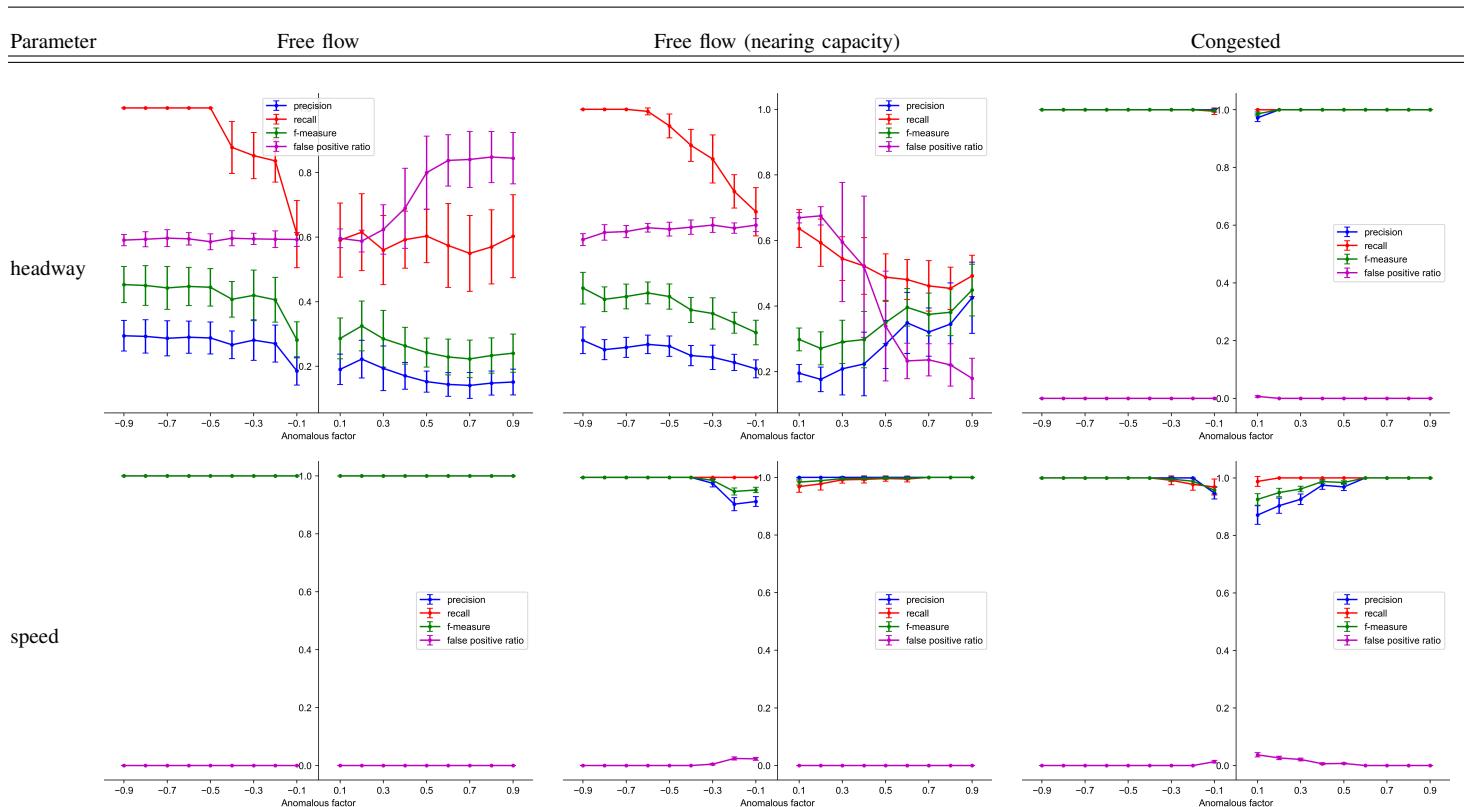
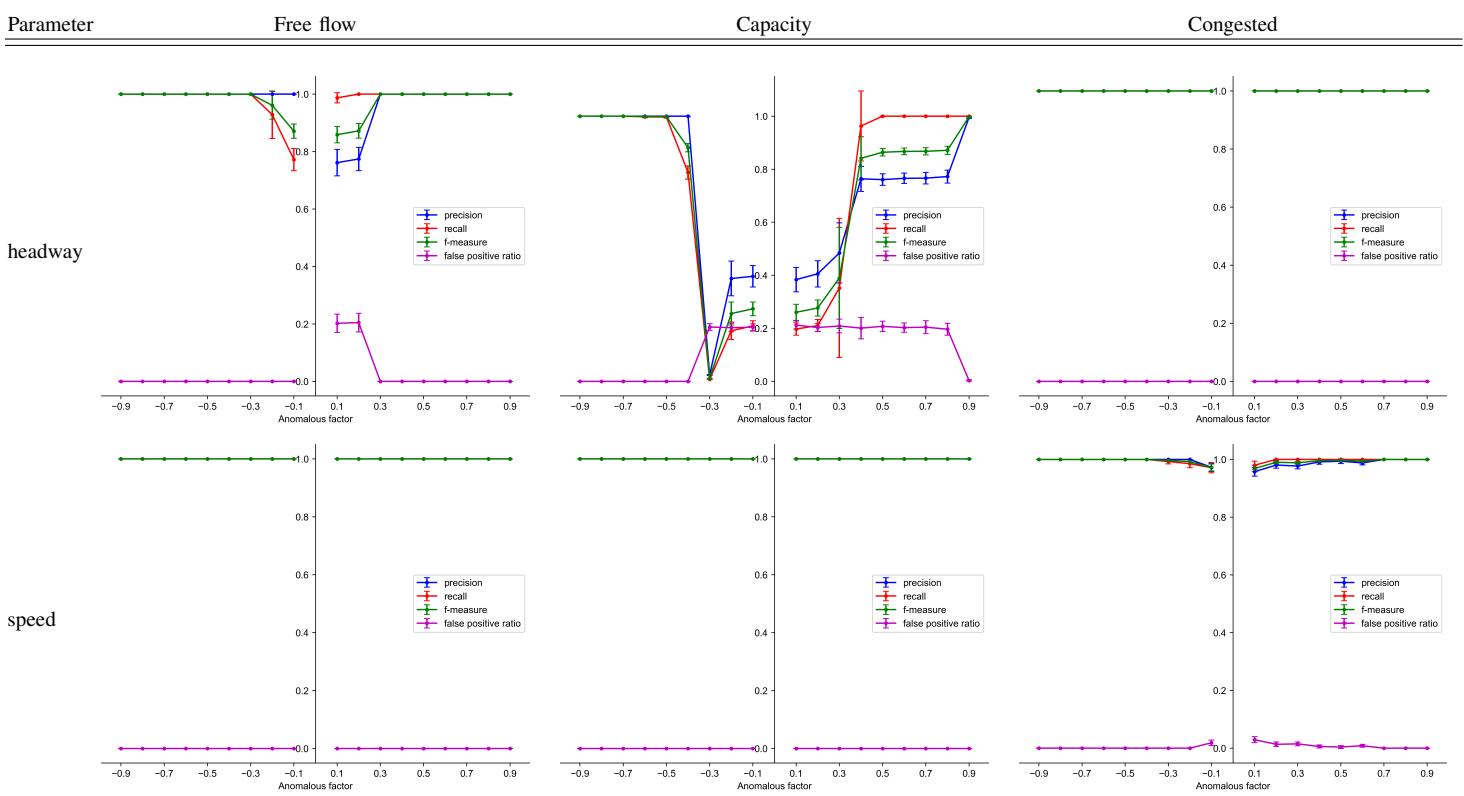
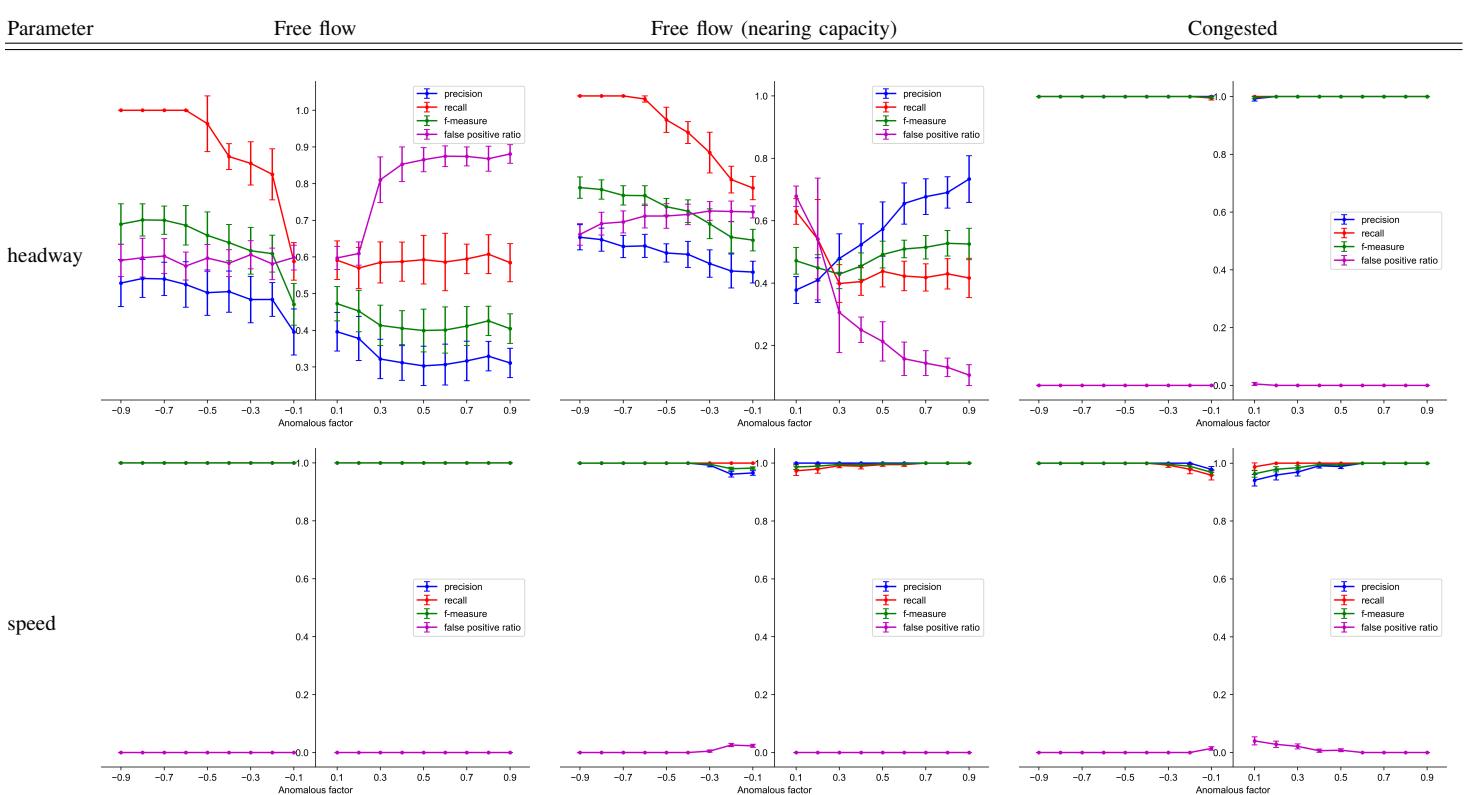


TABLE IV. Evaluation metrics behavior when 40% of the total population is anomalous on the schematic network

(a) Right lane



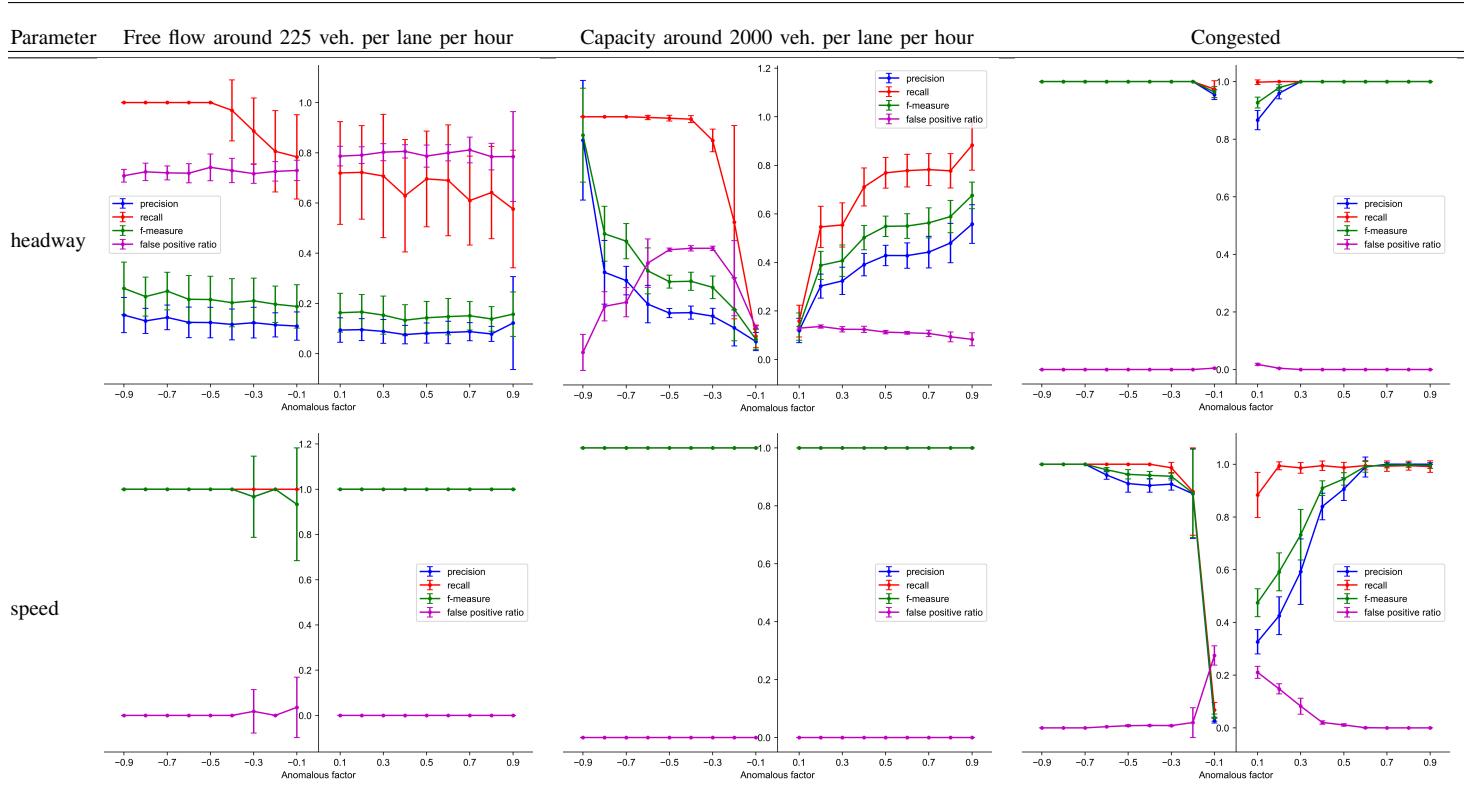
(b) Left lane



During free flow, the right lane does not experience a significant proportion of lane changes, but when the system reaches the capacity level the number of lane changes increases causing the accuracy of the anomalous headway detection going down. These dynamics do not have a significant effect on the speeds during these time windows. However the performance of the anomalous speeds detection hinders during the congested state because of the stop-start events. The left lane has a lesser occupancy compared to the right lane, and the proportion of lane changes is also significant during the free flow. Therfore the accuracy of the headway detection drops significantly. Further, when the percentage of anomalous population goes up the detections get better since it increases cluster densities.

TABLE V. Evaluation metrics behavior when 10% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

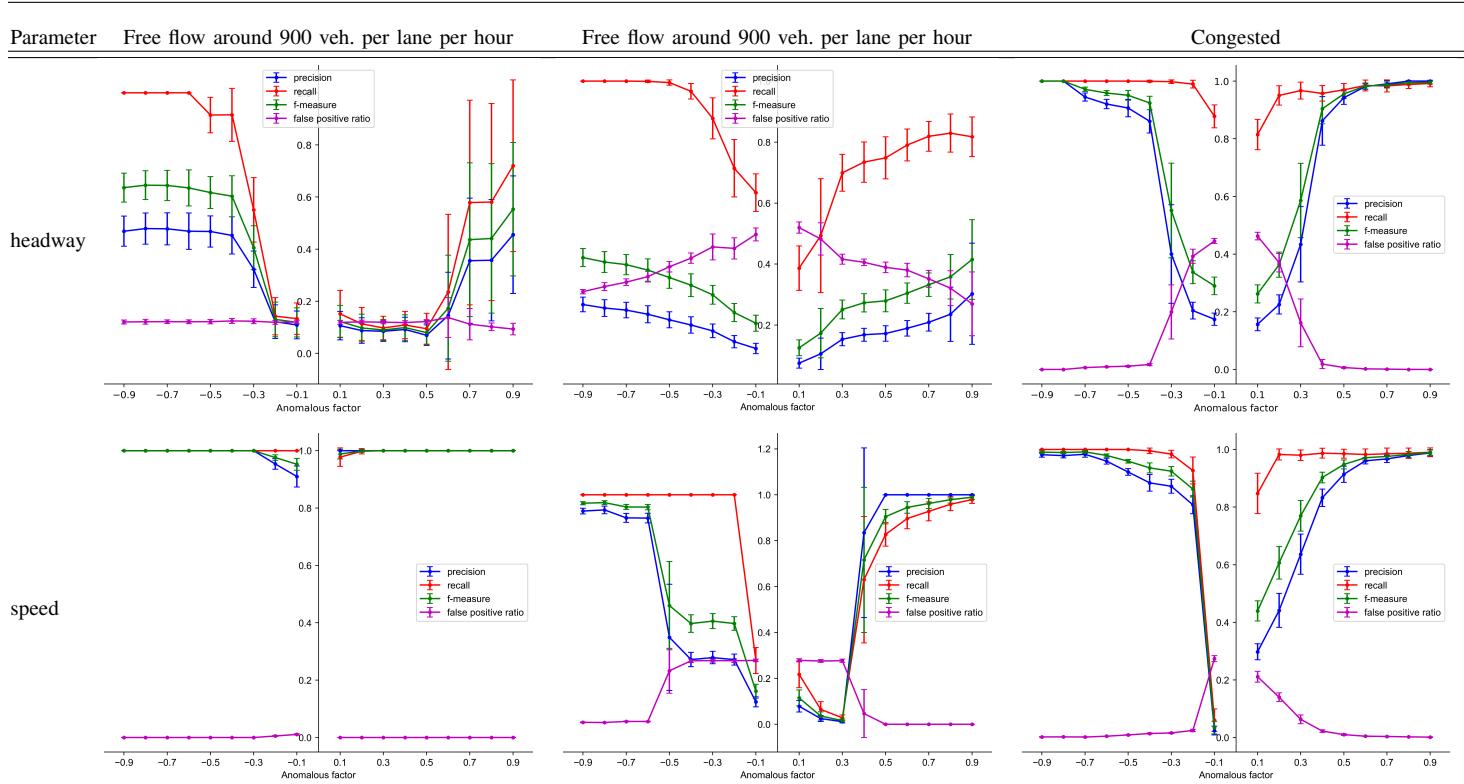
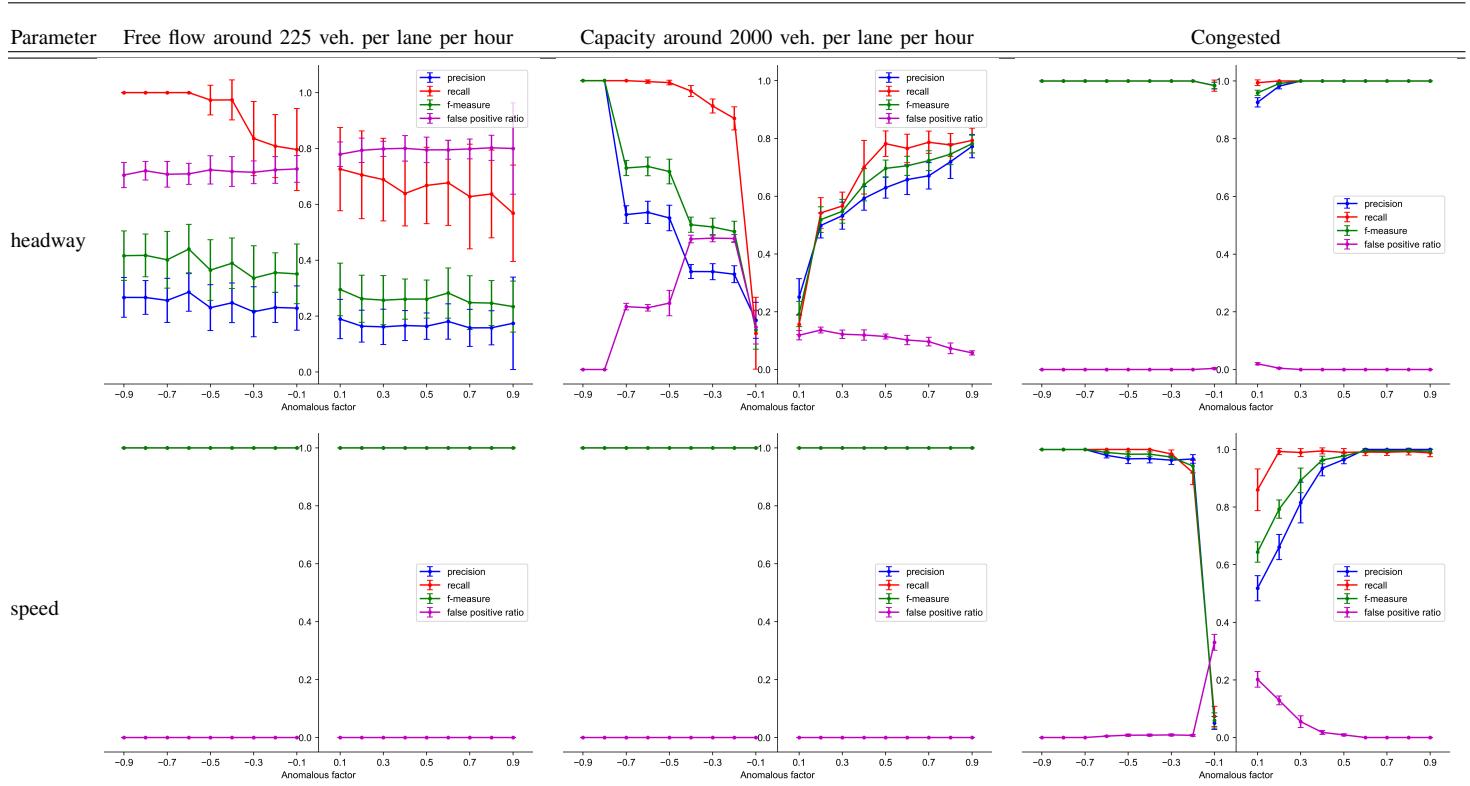


TABLE VI. Evaluation metrics behavior when 20% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

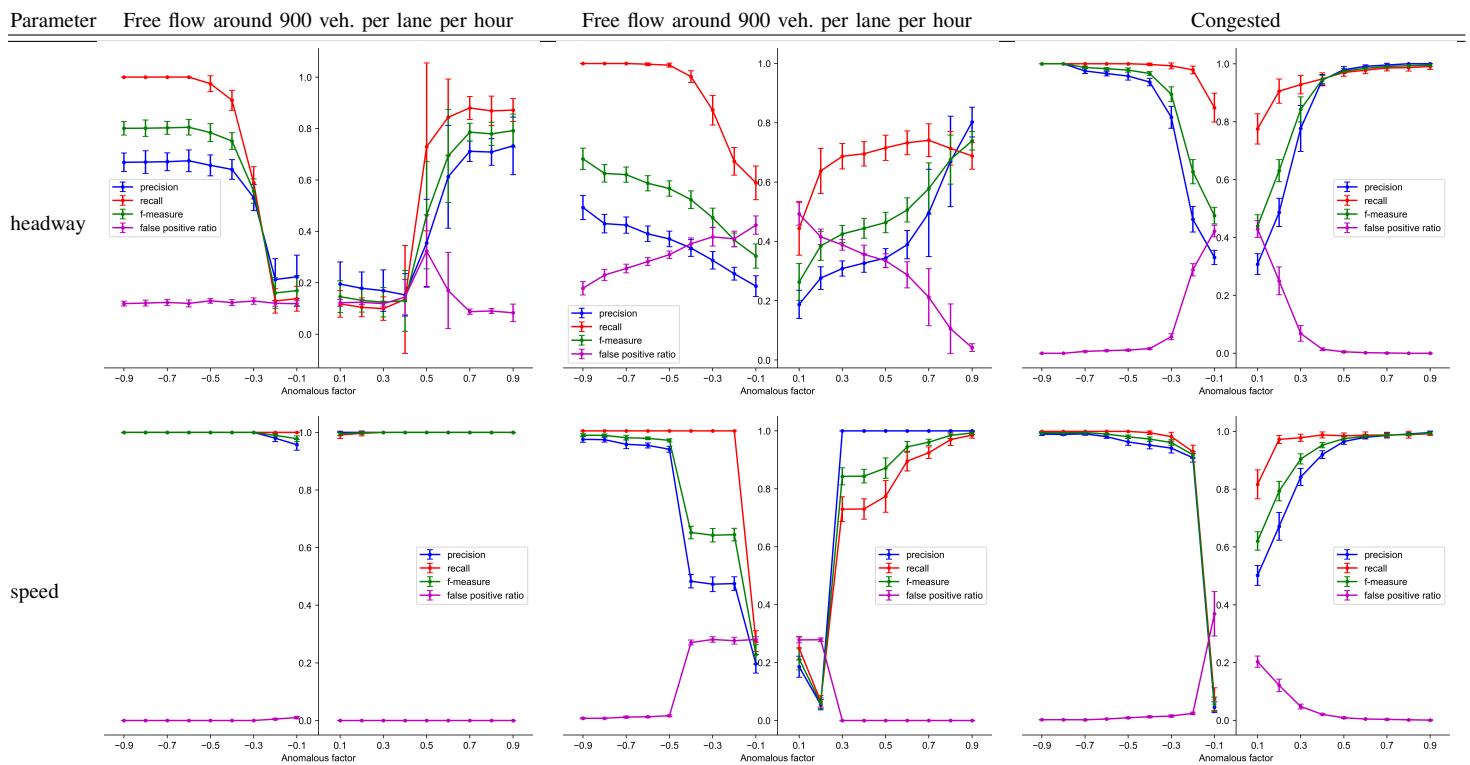
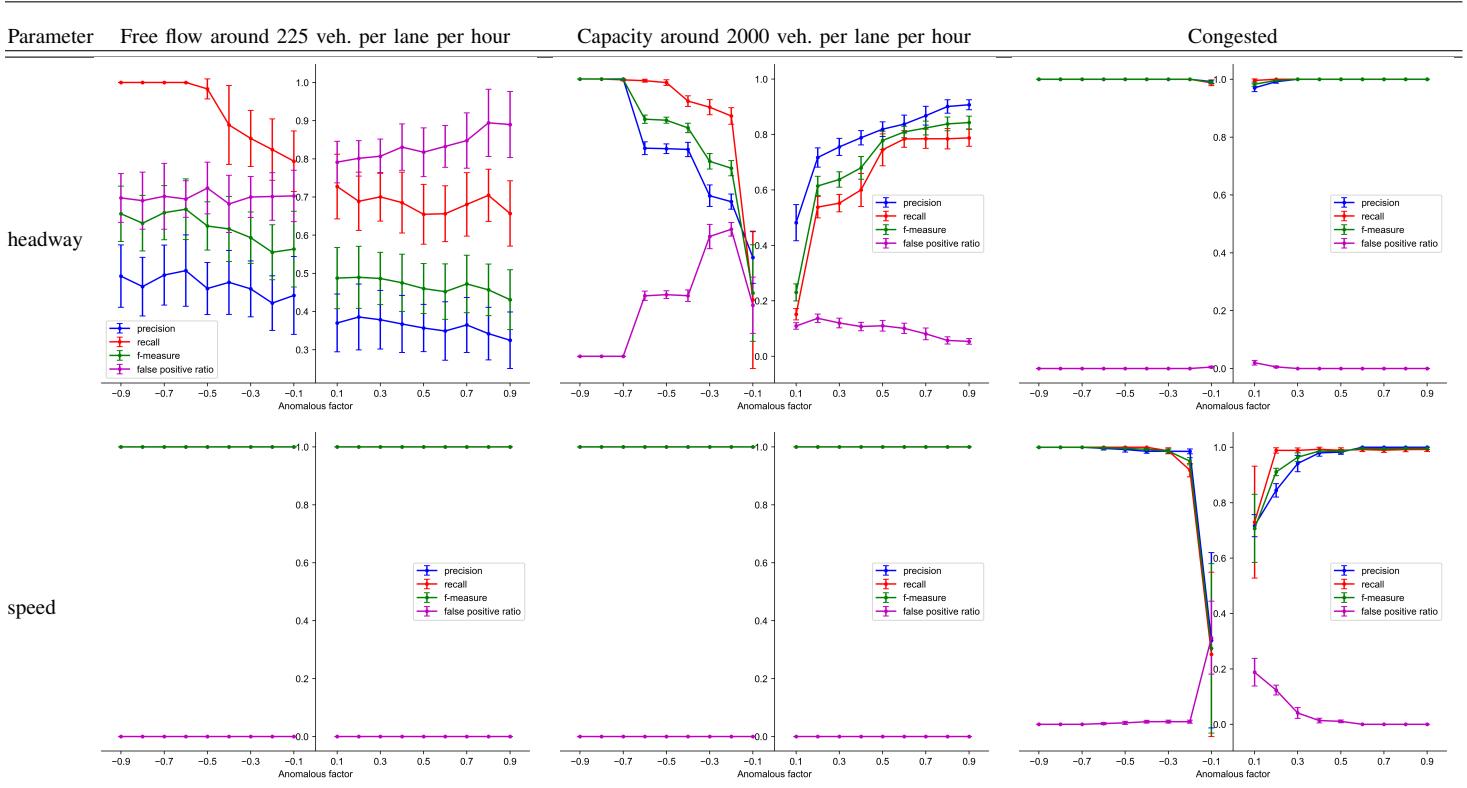
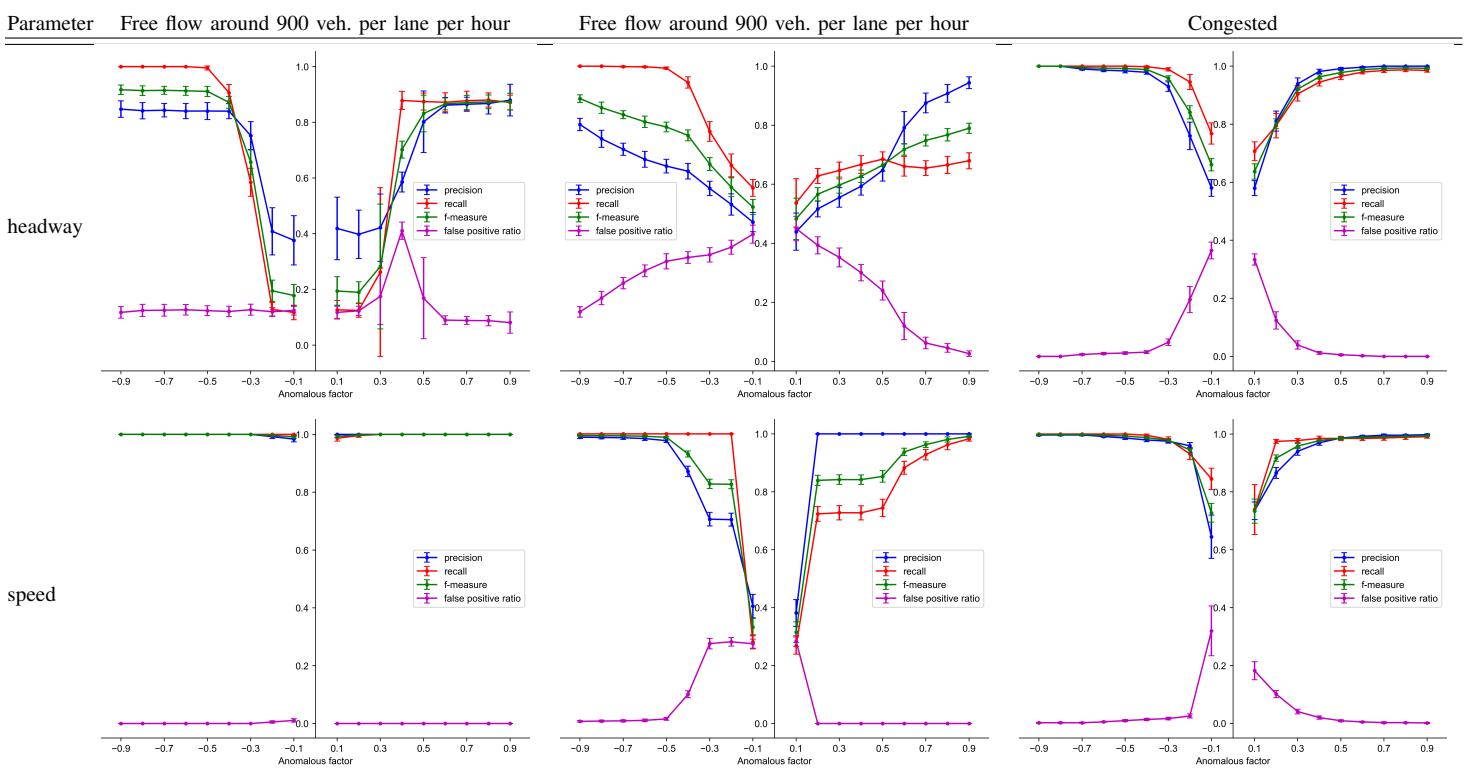


TABLE VII. Evaluation metrics behavior when 40% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

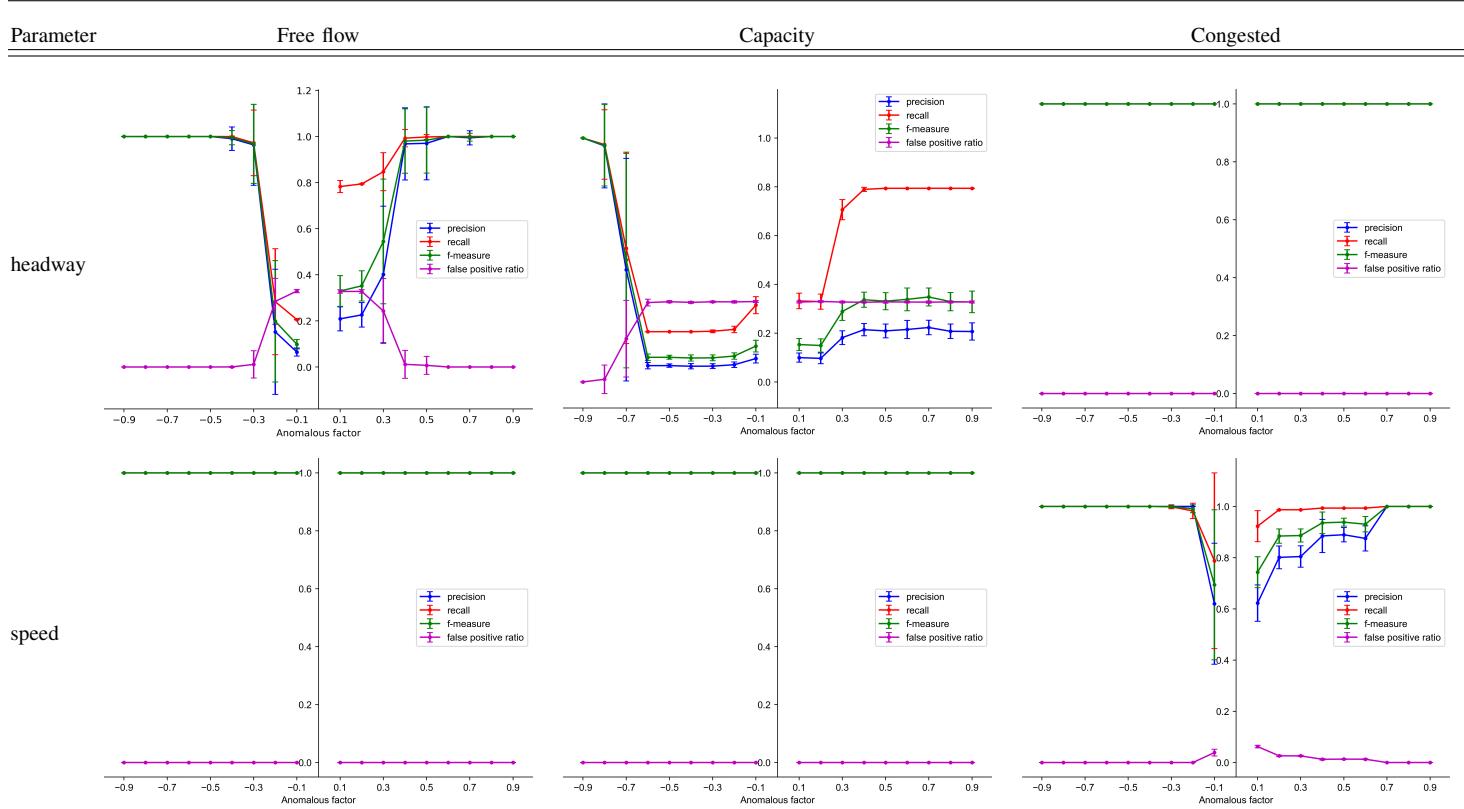


Due to a significant proportion of lane changes happens during free flow on the right lane (vehicles keeping left and leaving the freeway at the next ramp) under less density, the accuracy of the headway detection is poor. During the congested state stop-start events slightly hinder the performance of the anomalous speed detection.

When the right lane nearing capacity, both the anomalous headway and speed detections on the right lane performs better comparing to the detection on the left lane. Dynamics (e.g. lane changes and on ramp coming) at higher speed altering homogeneity of the flow hinders the performance. Further, when the percentage of malicious population goes up the detections get better since it increases cluster densities.

TABLE VIII. Evaluation metrics behavior when 10% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

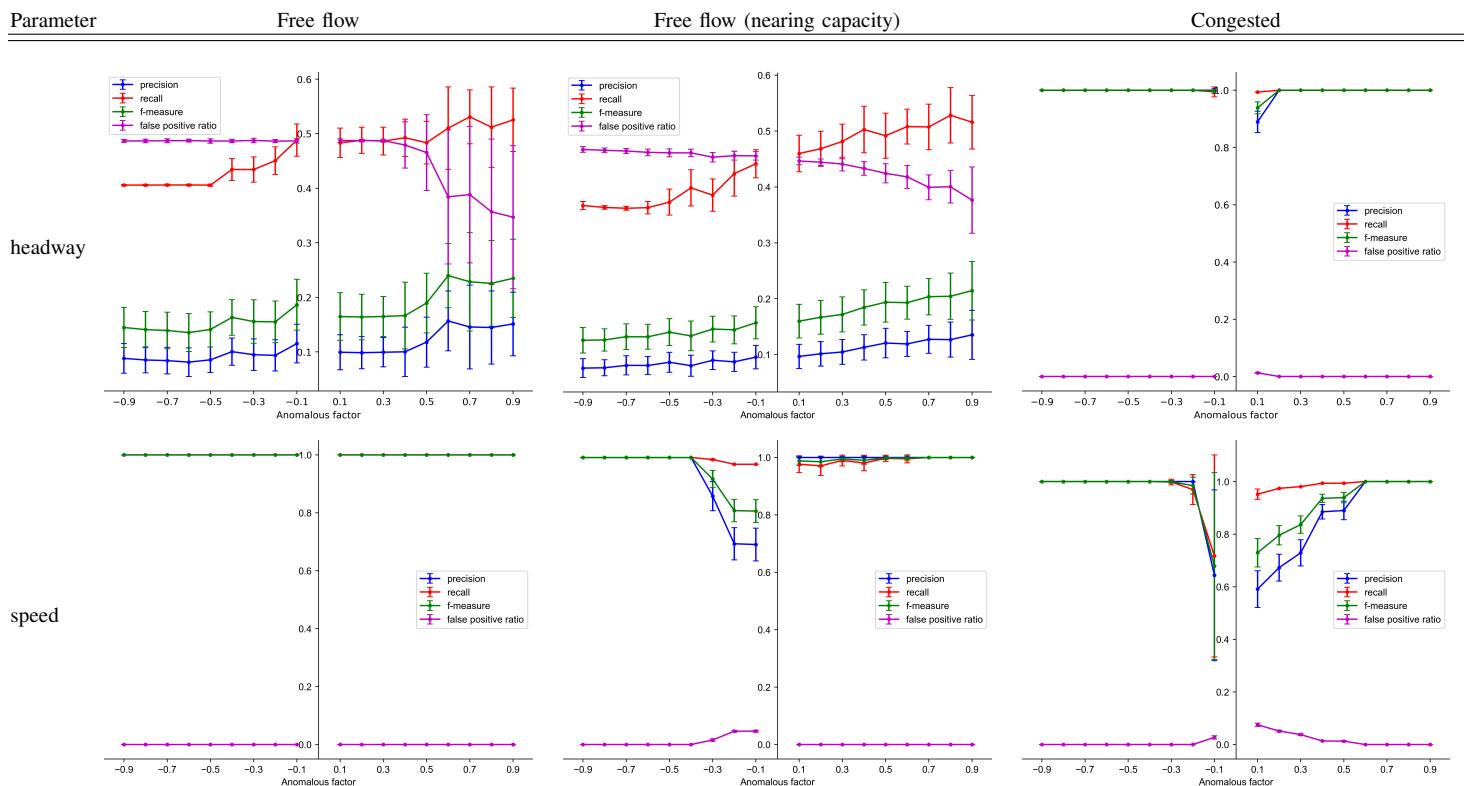
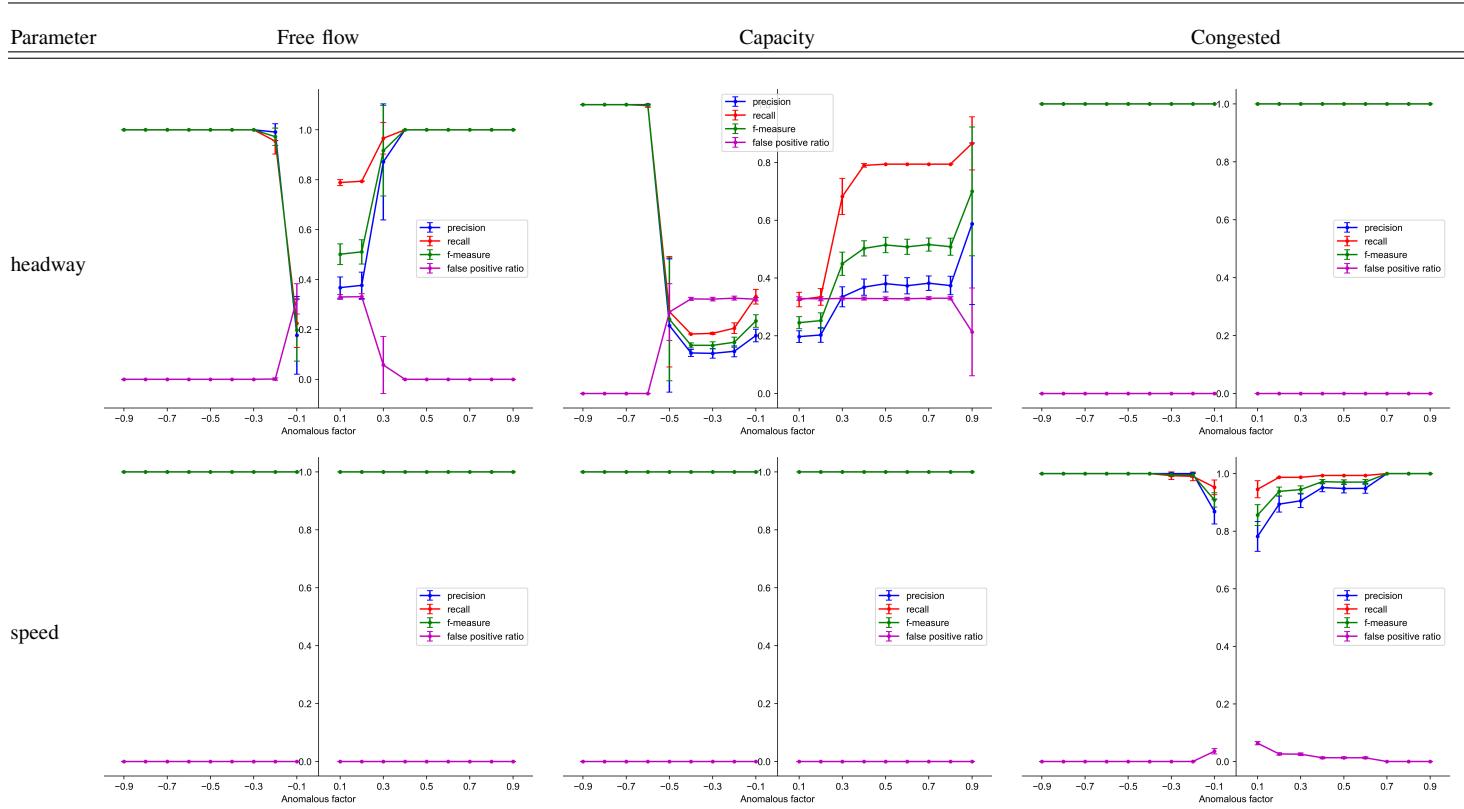


TABLE IX. Evaluation metrics behavior when 20% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

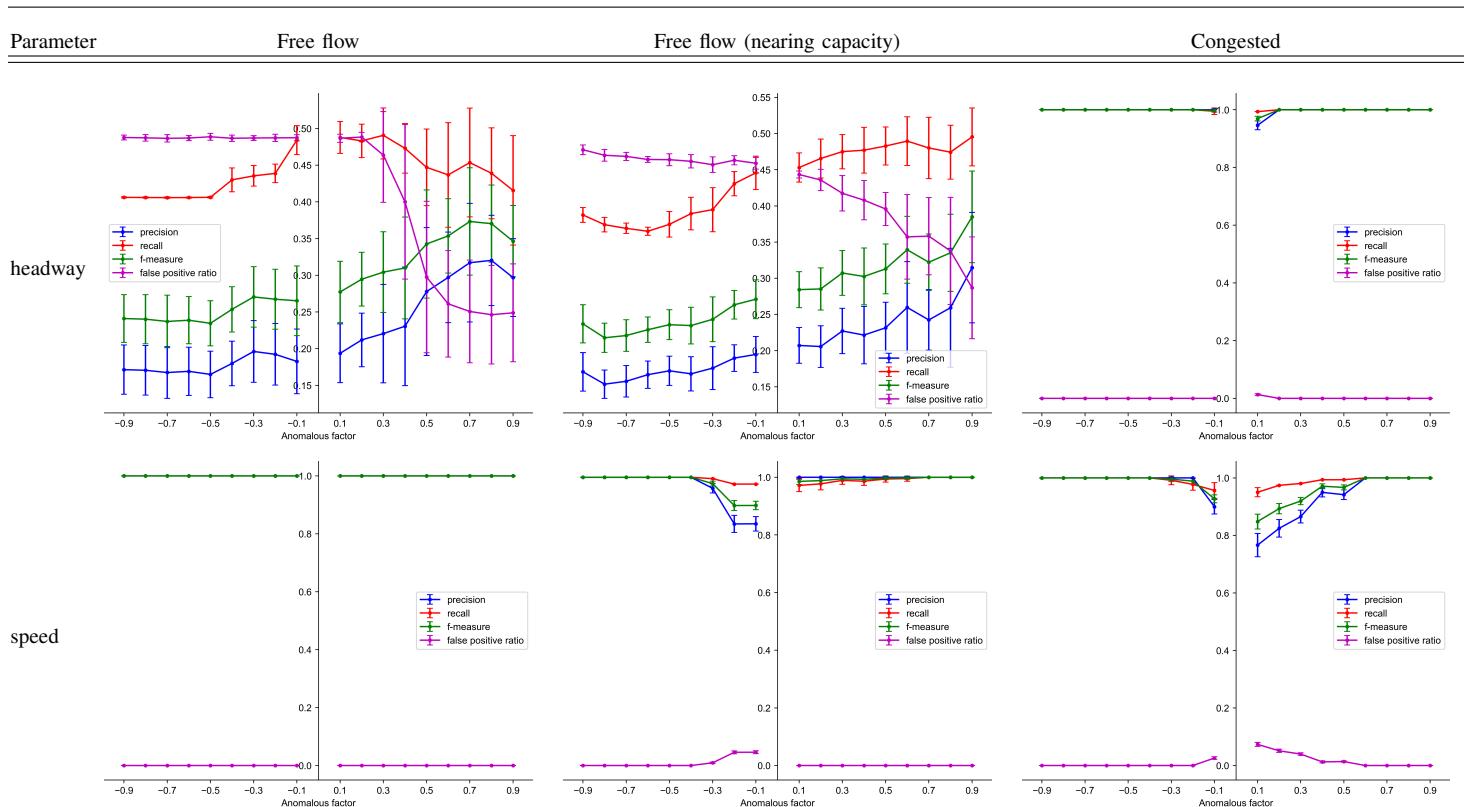
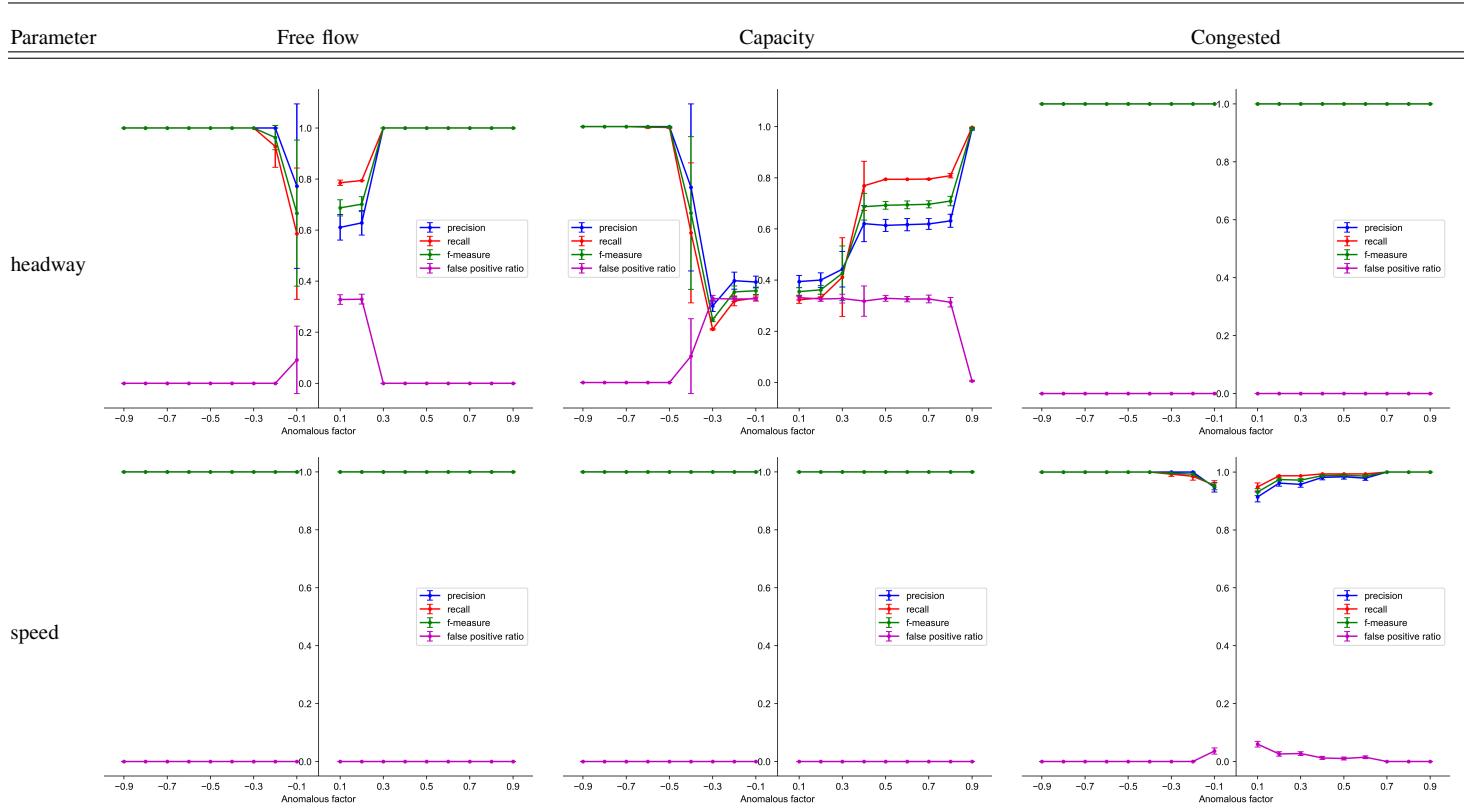


TABLE X. Evaluation metrics behavior when 40% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

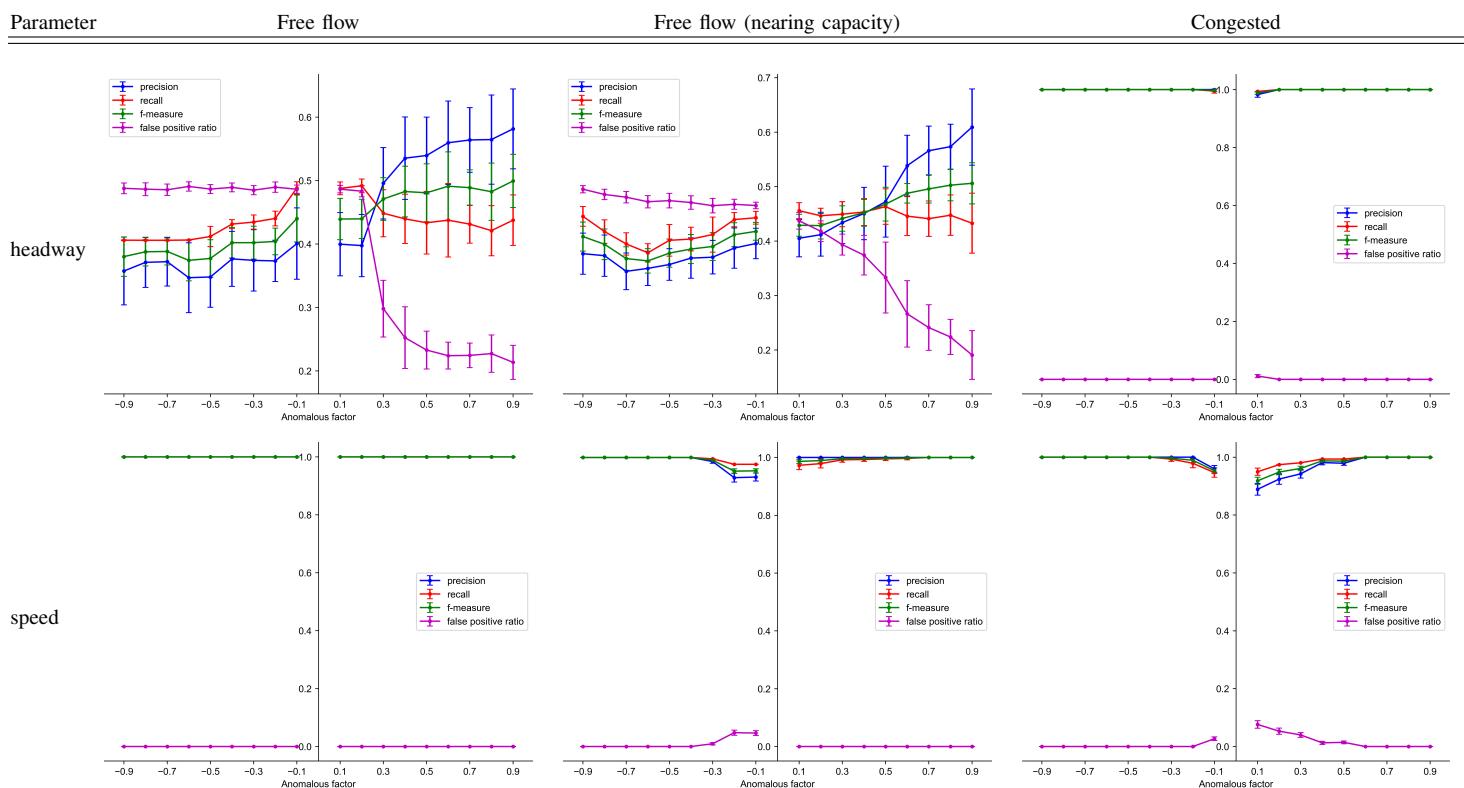
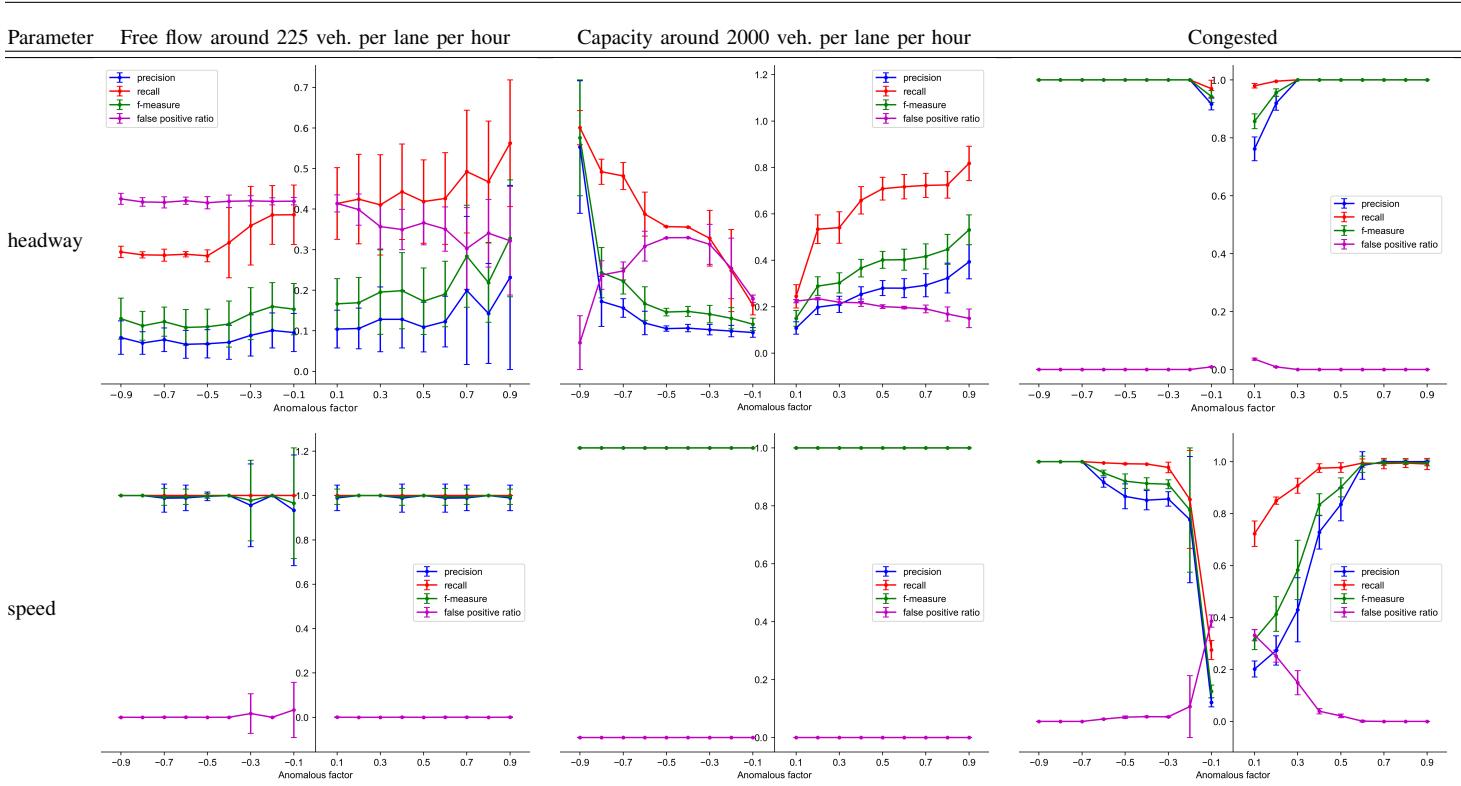


TABLE XI. Evaluation metrics behavior when 10% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

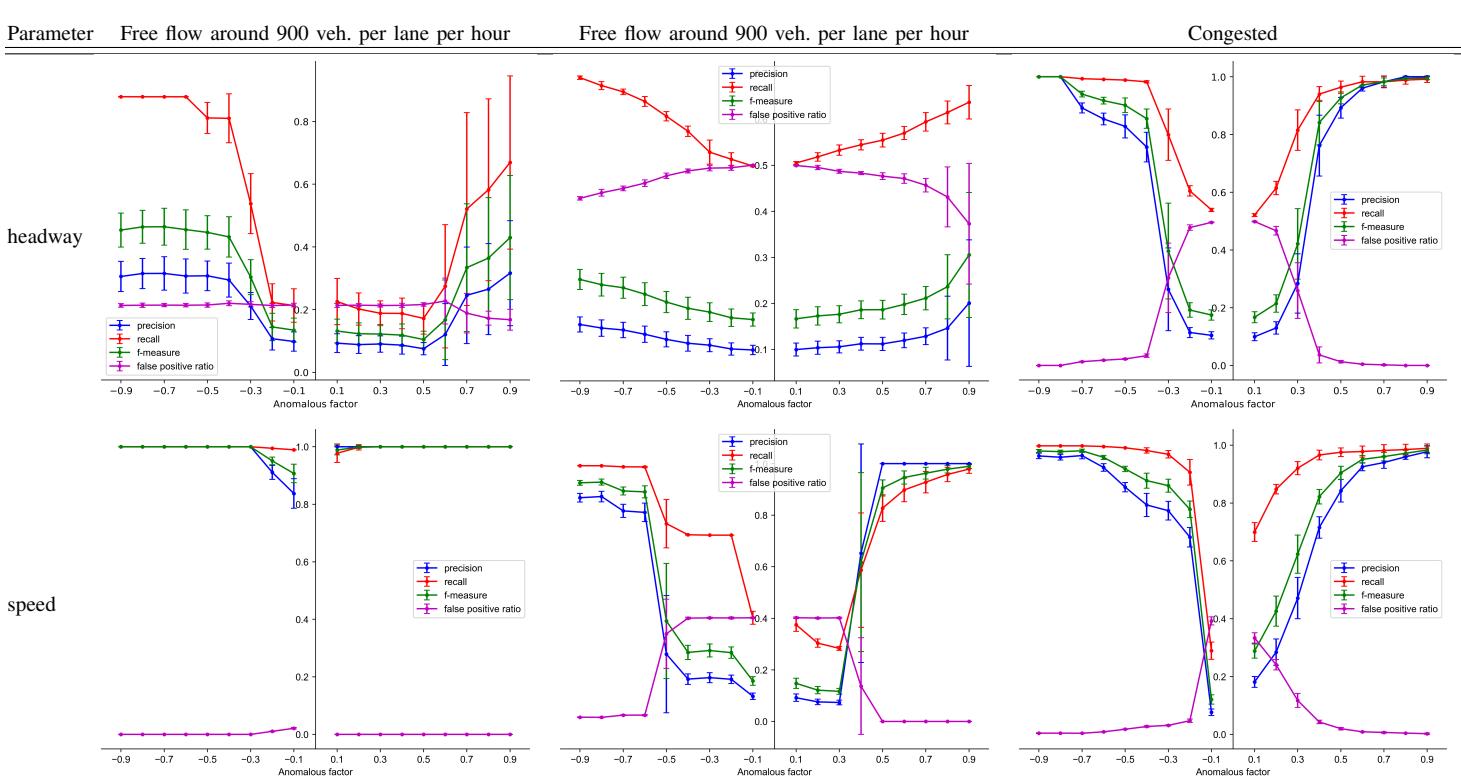
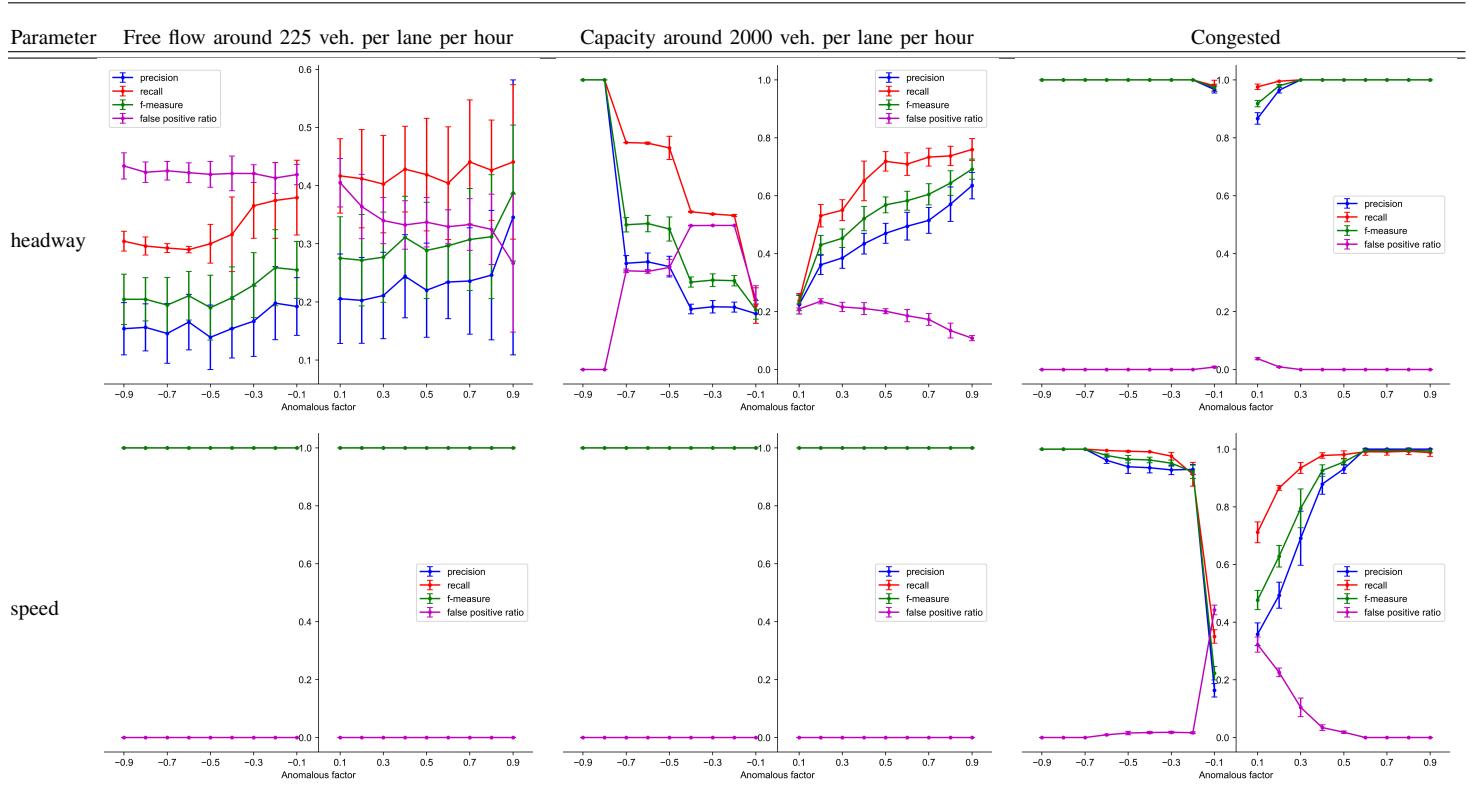


TABLE XII. Evaluation metrics behavior when 20% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

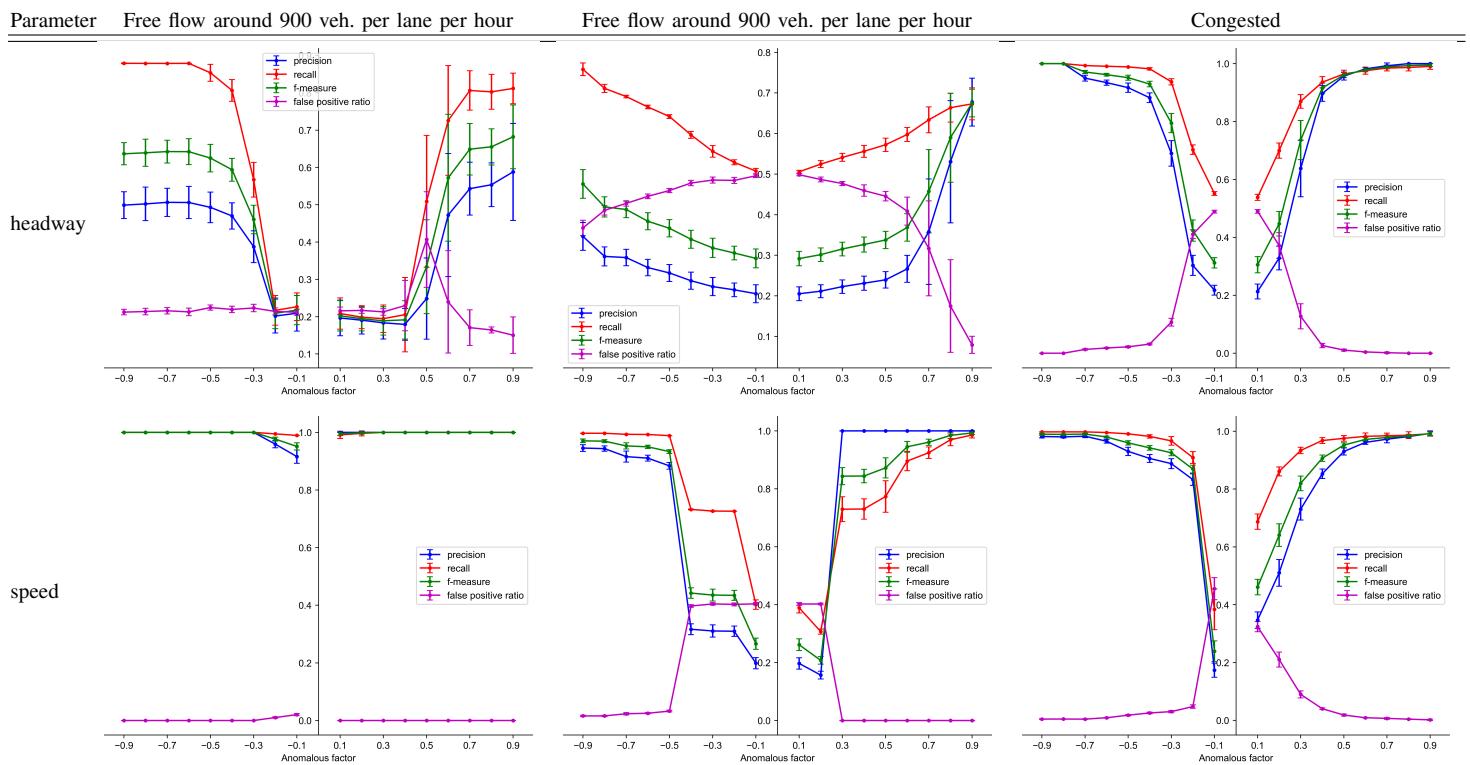
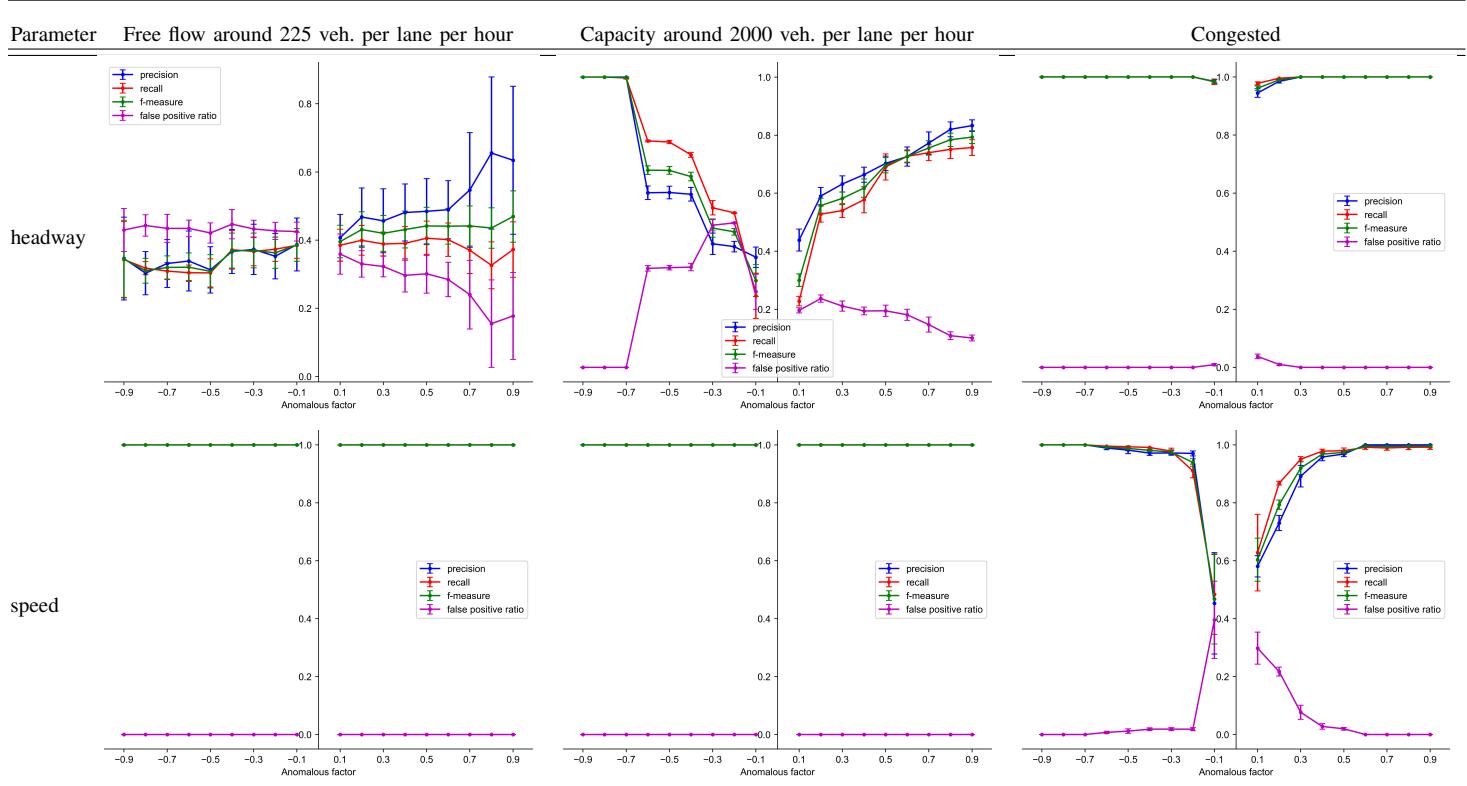


TABLE XIII. Evaluation metrics behavior when 40% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

