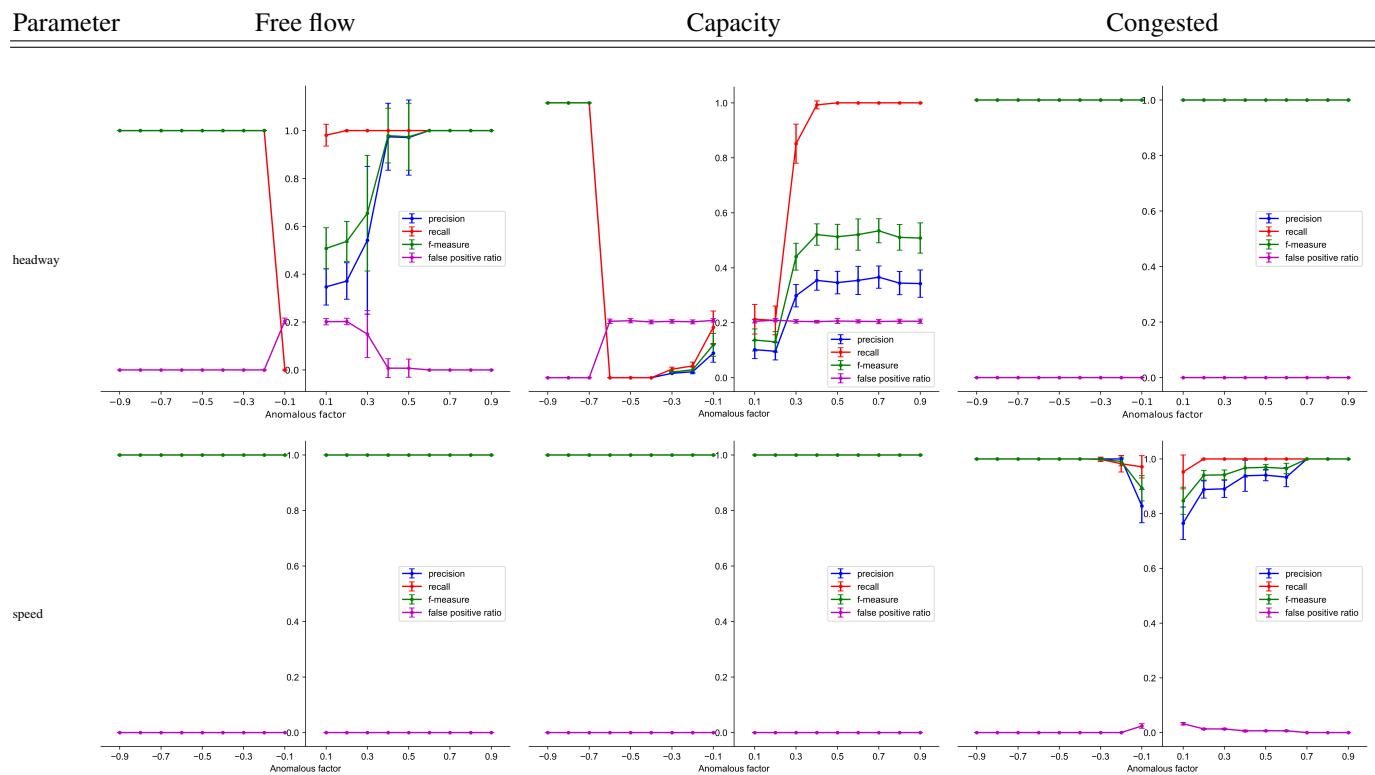

APPENDIX A SIMULATION RESULTS

Tables 1,2,3,4,5 and 6 contain the numerical results generated using the global ground truth while Tables 7,8,9,10,11,12 showing the numerical results were generated using the local ground truth.

TABLE 1: Evaluation metrics behavior when 10% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

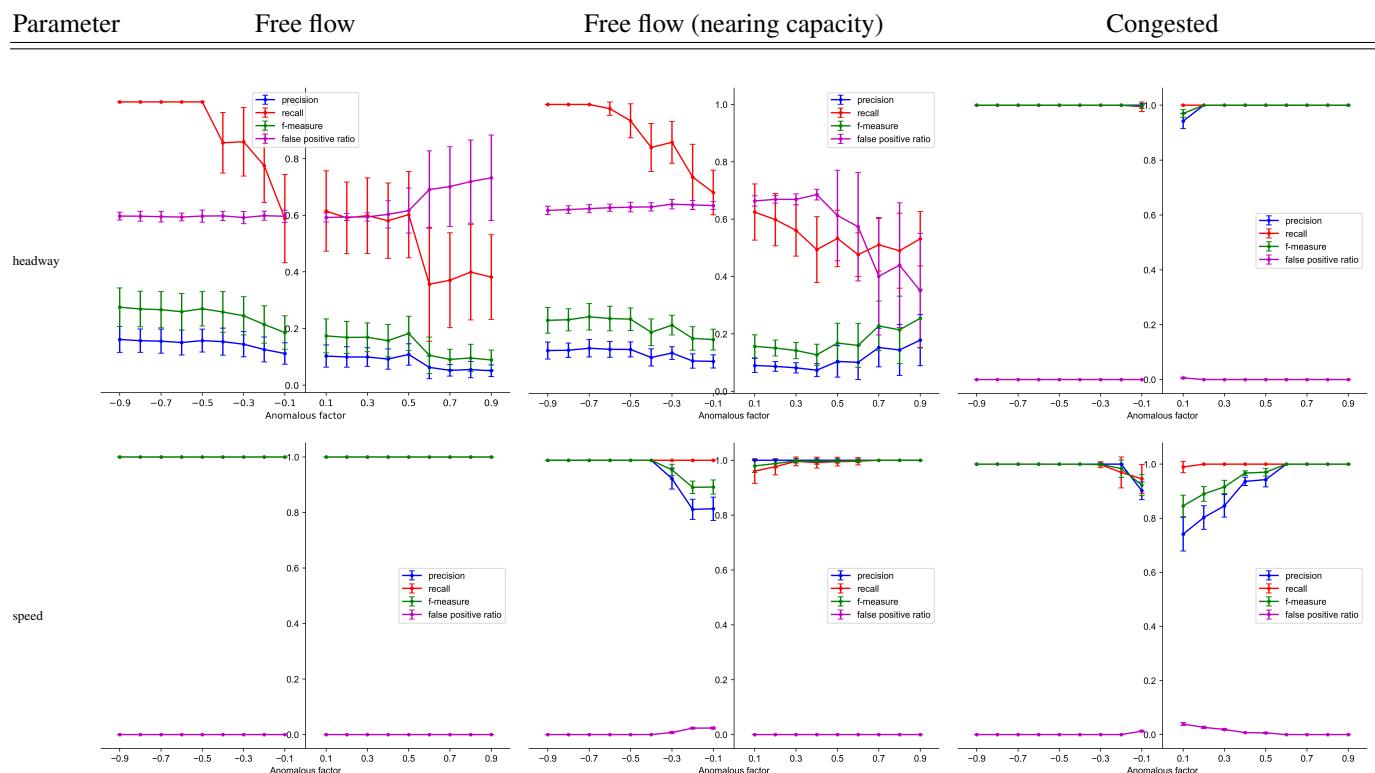


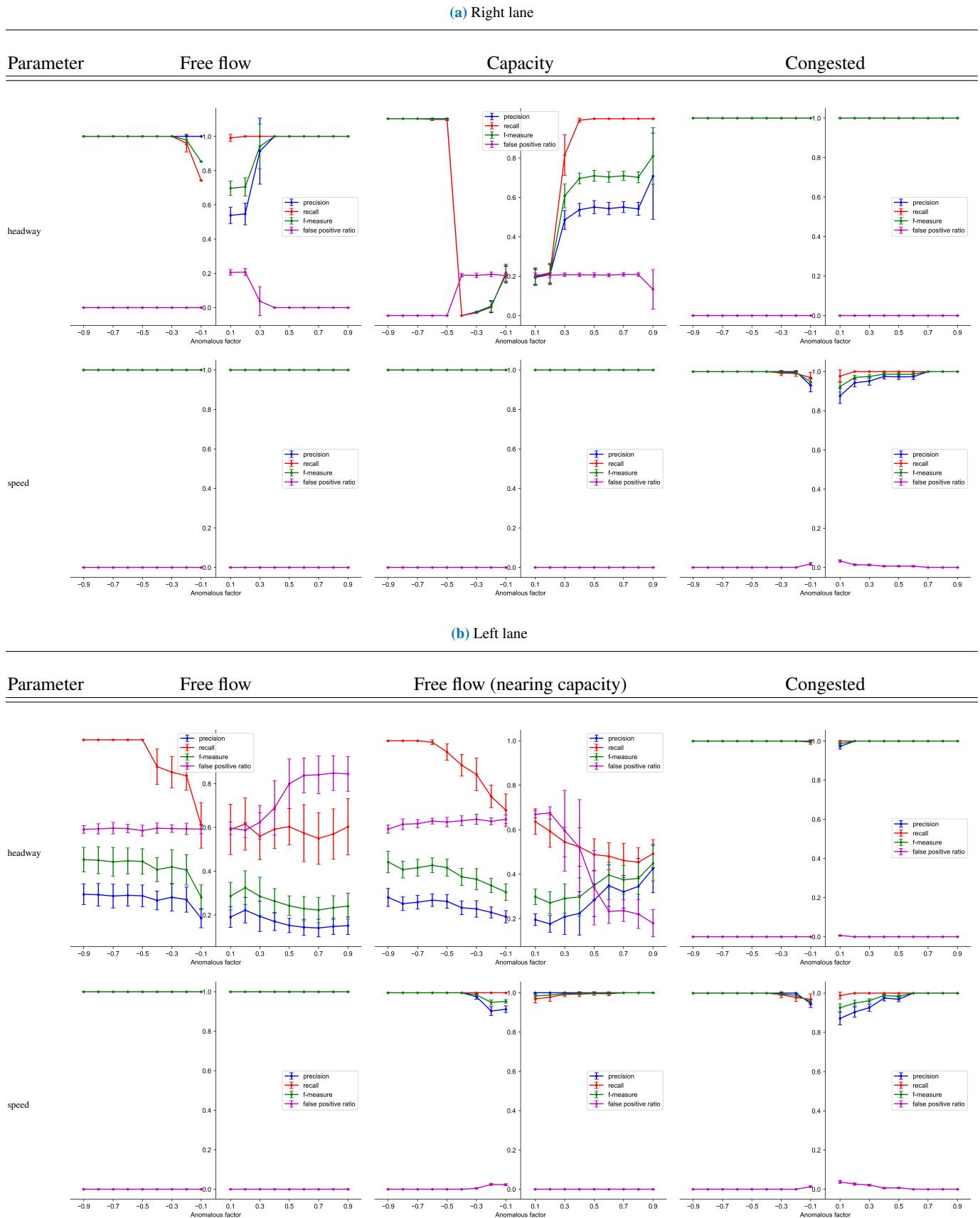
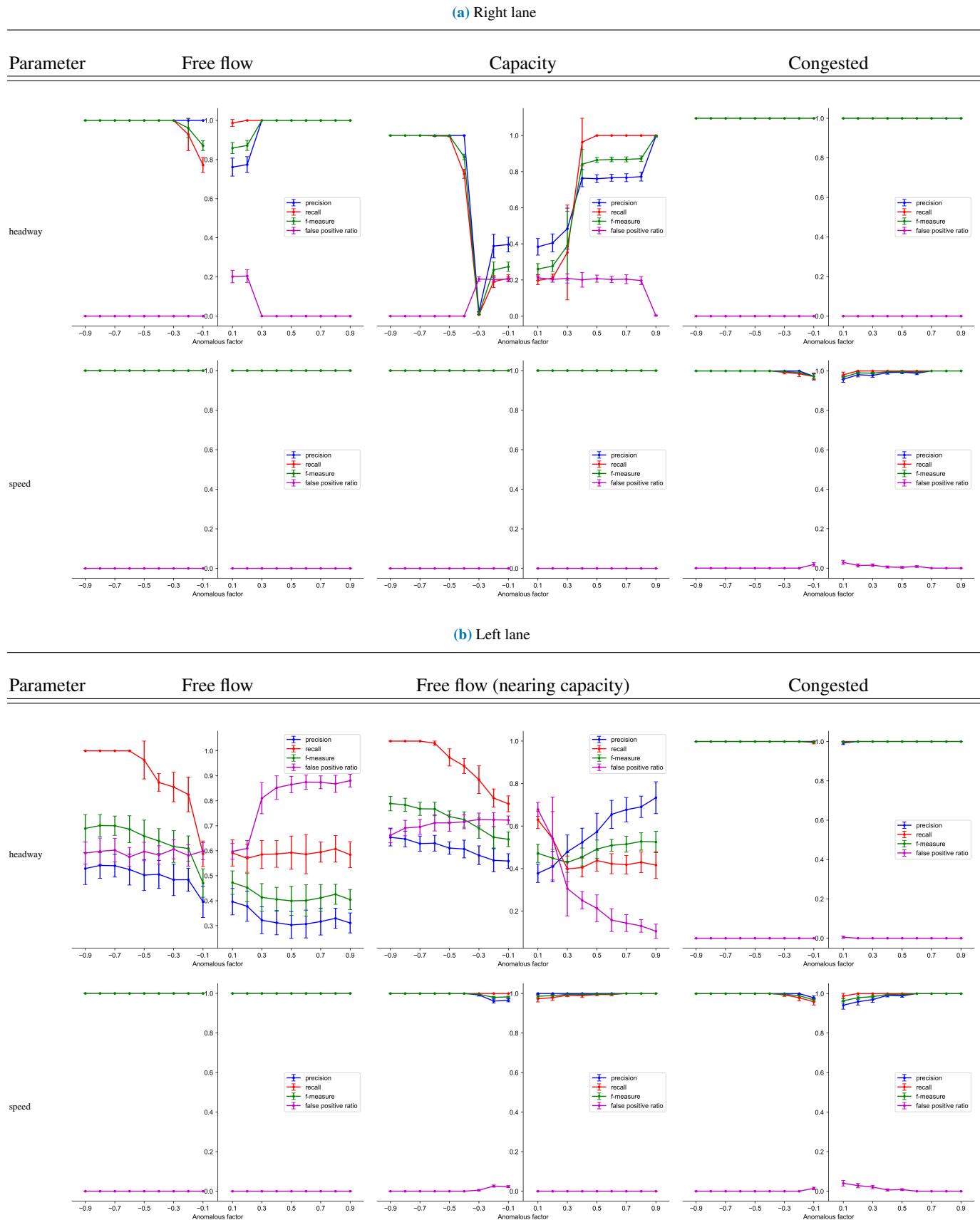
TABLE 2: Evaluation metrics behavior when 20% of the total population is anomalous on the schematic network

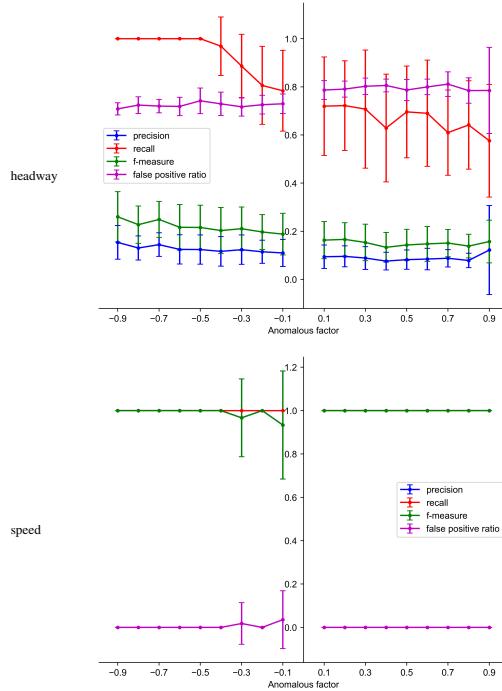
TABLE 3: Evaluation metrics behavior when 40% of the total population is anomalous on the schematic network

During the free flow, the right lane does not experience a significant proportion of lane changes. When the system reaches the capacity level the number of lane changes increases and decreases the accuracy of the headway detection. These dynamics do not have a significant effect on the speeds during these time windows. However the performance of the speed 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. Therefore the accuracy of the headway detection drops significantly.

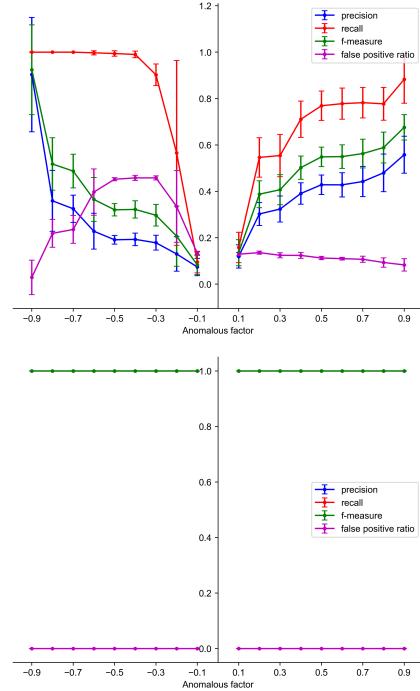
TABLE 4: Evaluation metrics behavior when 10% of the total population is anomalous on Sydney M4

(a) Right lane

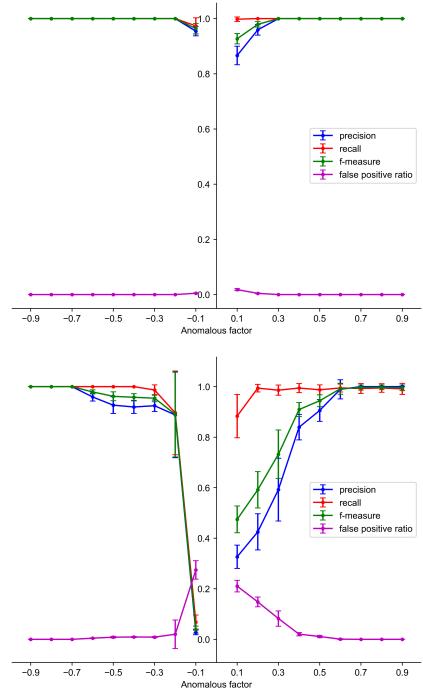
Parameter Free flow at 225 veh. /lane/hour



Capacity at 2000 veh. /lane/hour

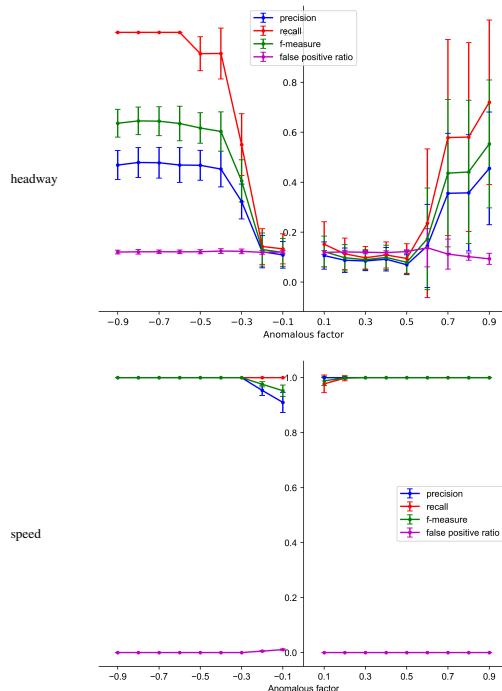


Congested

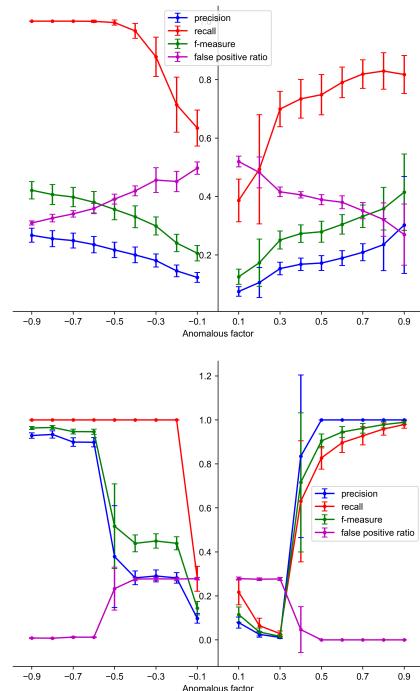


(b) Left lane

Parameter Free flow at 900 veh. /lane/hour



Free flow at 900 veh. /lane/hour



Congested

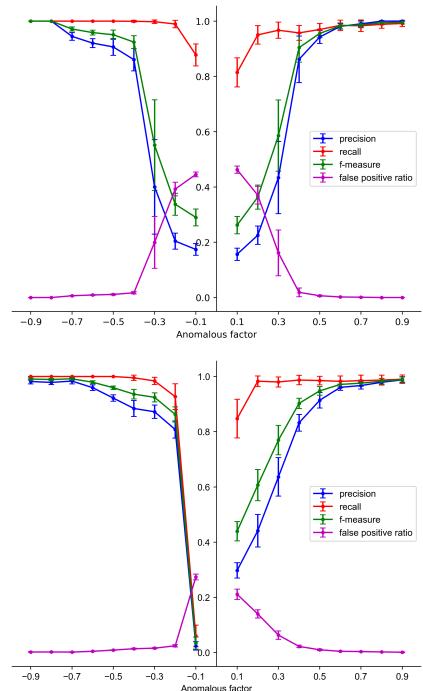


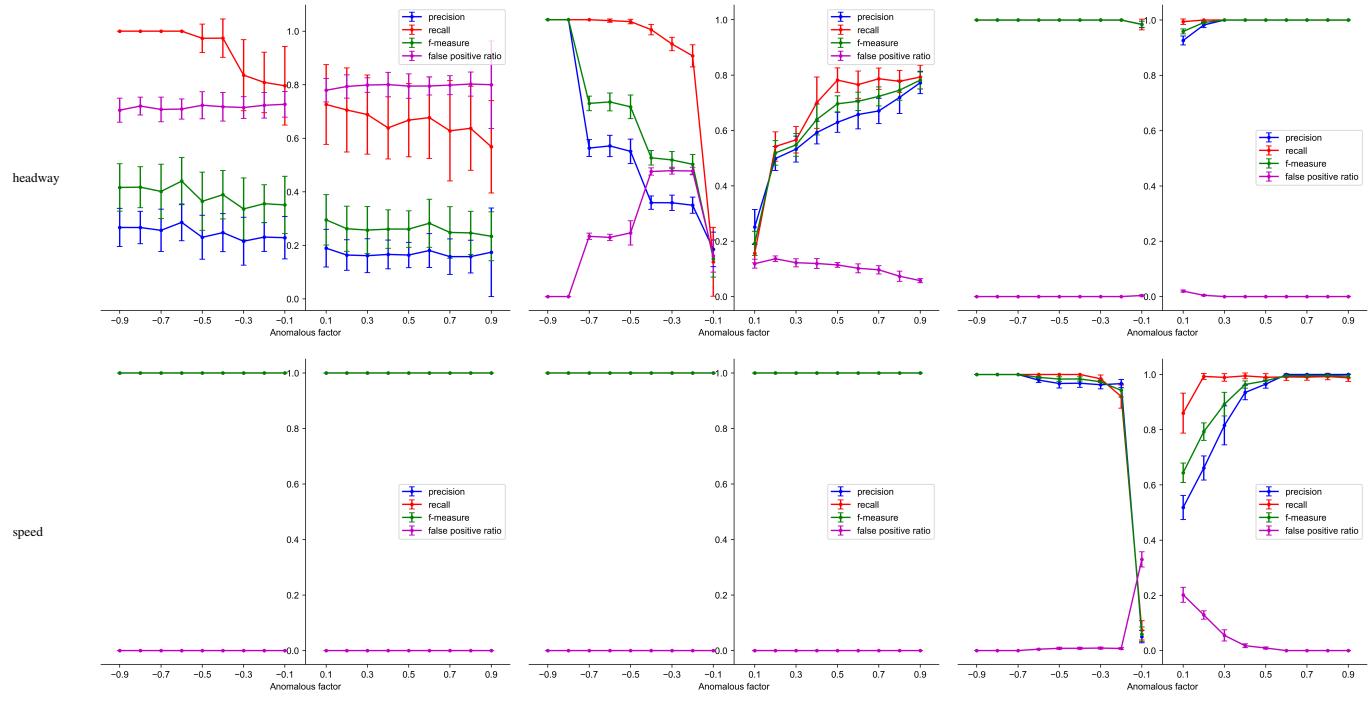
TABLE 5: Evaluation metrics behavior when 20% of the total population is anomalous on Sydney M4

(a) Right lane

Parameter Free flow at 225 veh. /lane/hour

Capacity at 2000 veh. /lane/hour

Congested



(b) Left lane

Parameter Free flow at 900 veh. /lane/hour

Free flow at 900 veh. /lane/hour

Congested

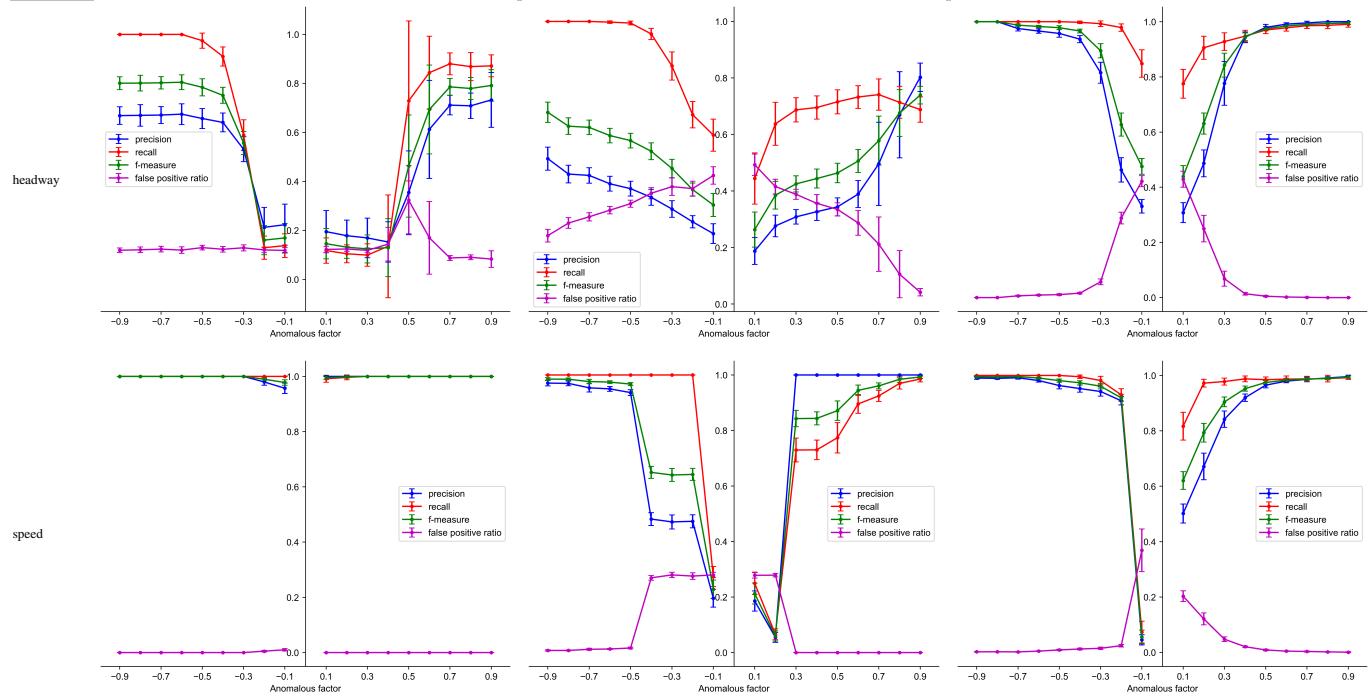
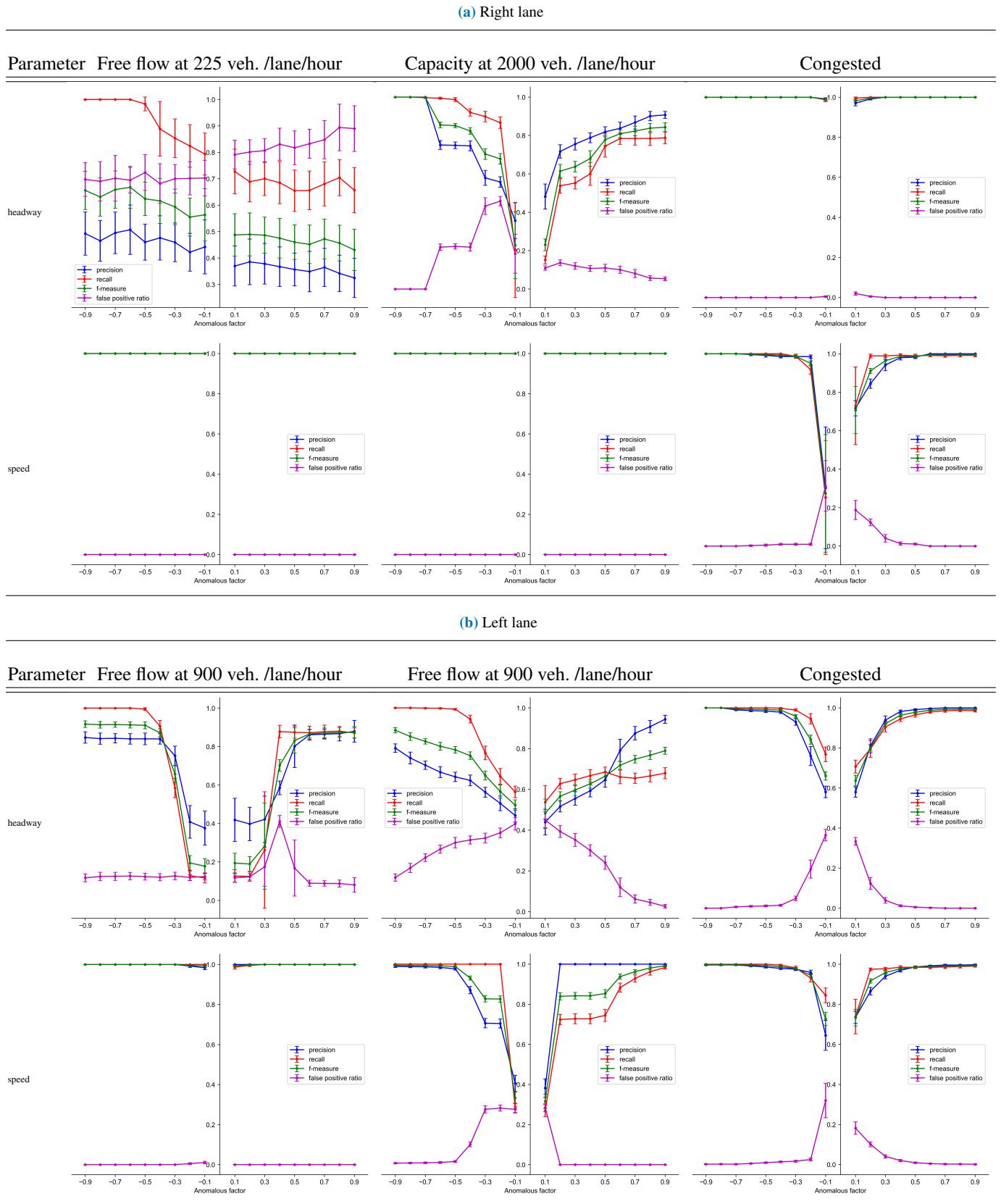


TABLE 6: Evaluation metrics behavior when 40% of the total population is anomalous on Sydney M4

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.

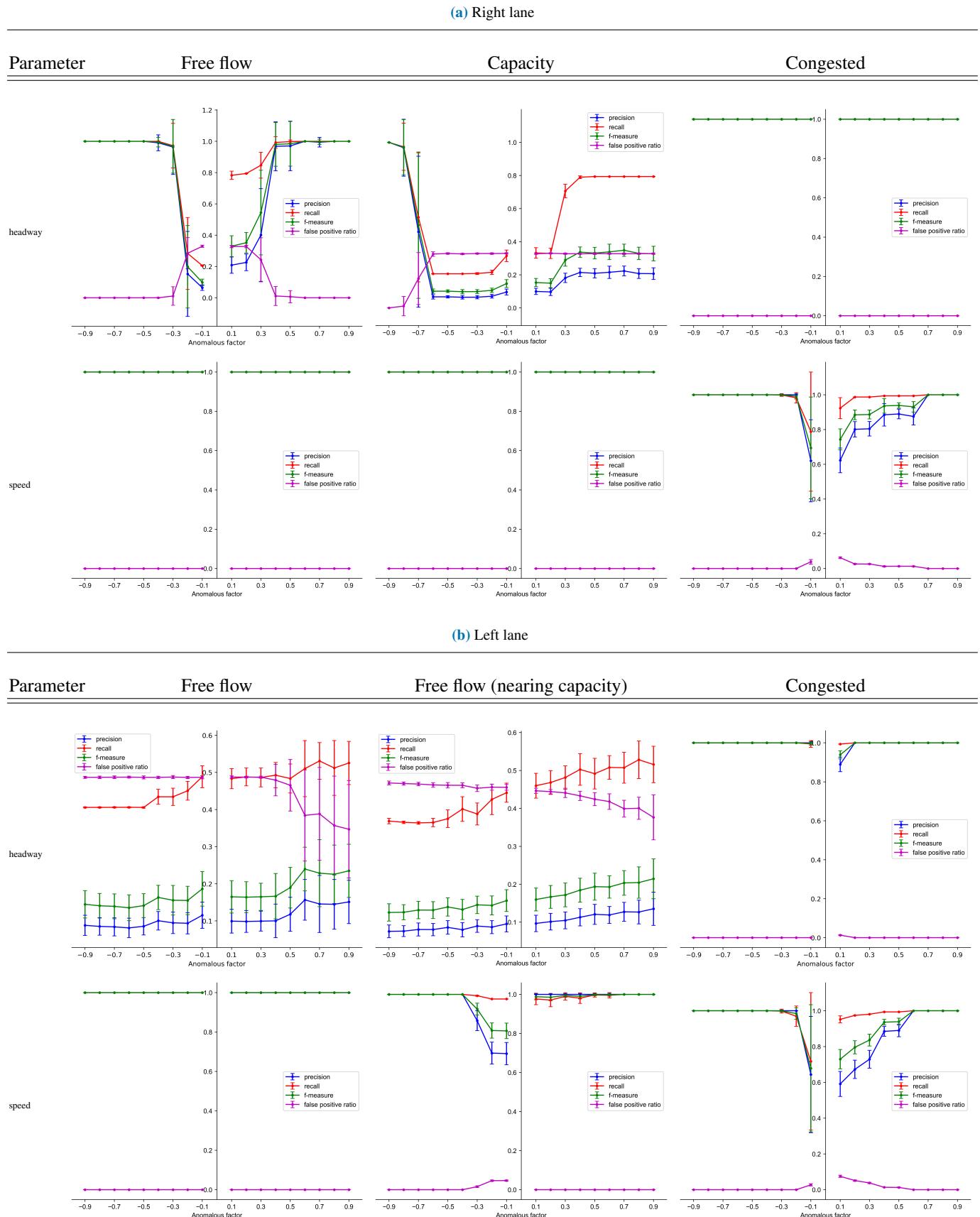
TABLE 7: Evaluation metrics behavior when 10% of the total population is anomalous on the schematic network

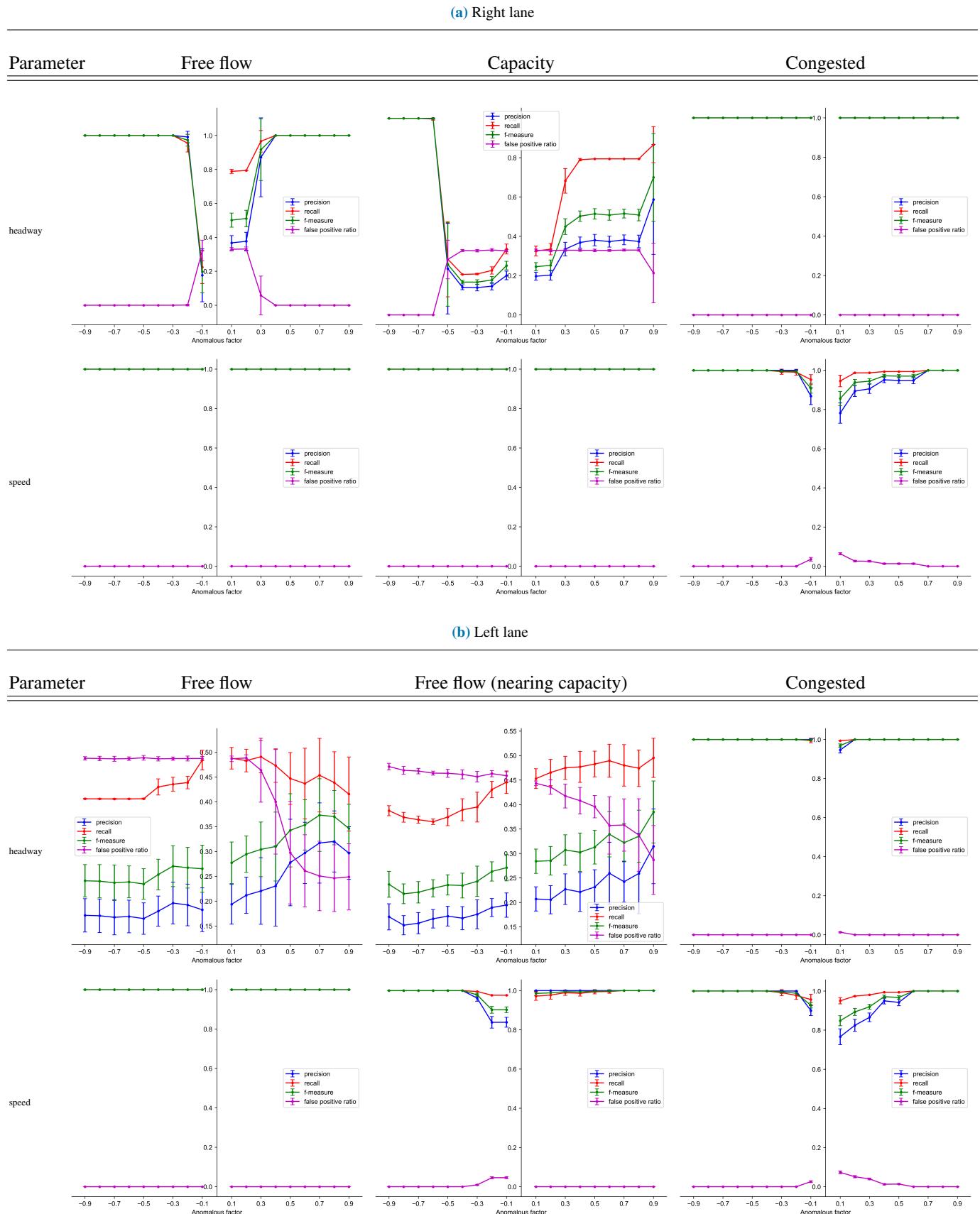
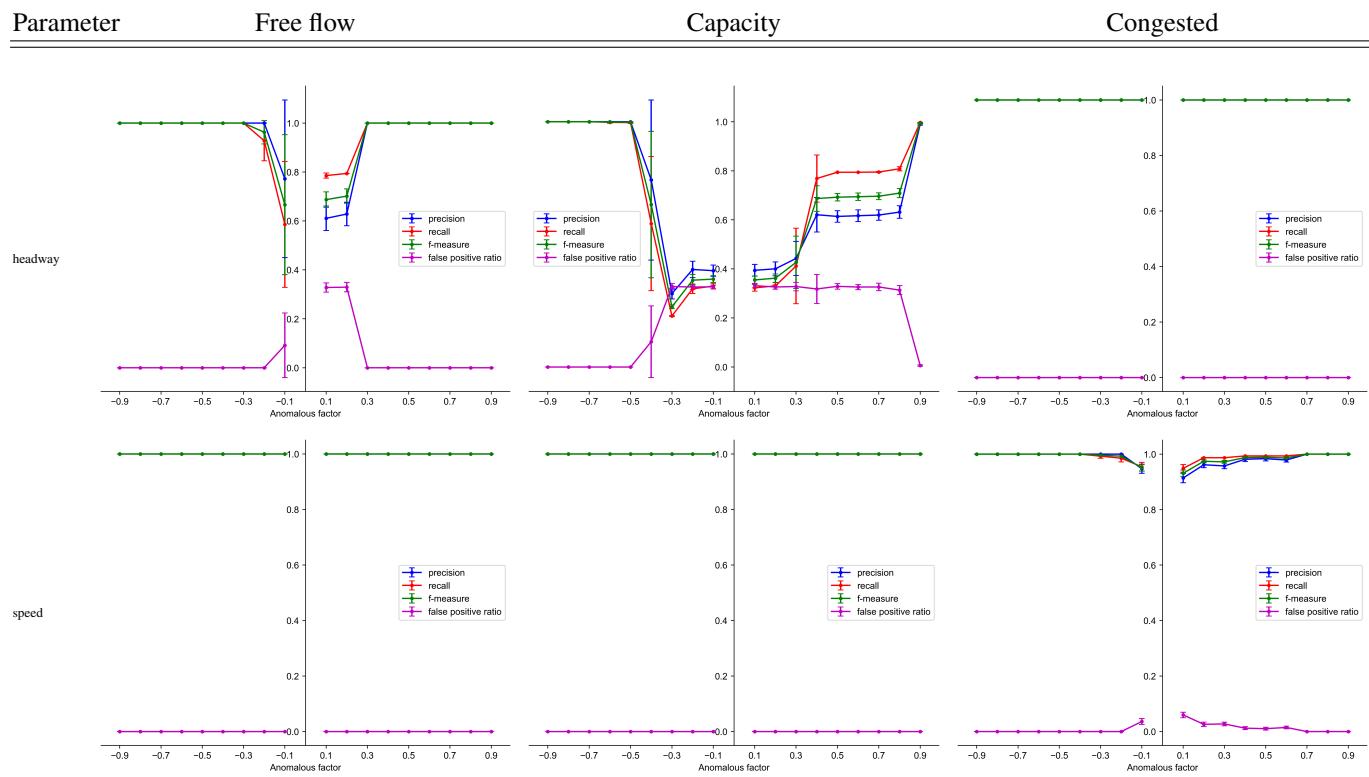
TABLE 8: Evaluation metrics behavior when 20% of the total population is anomalous on the schematic network

TABLE 9: Evaluation metrics behavior when 40% of the total population is anomalous on the schematic network

(a) Right lane



(b) Left lane

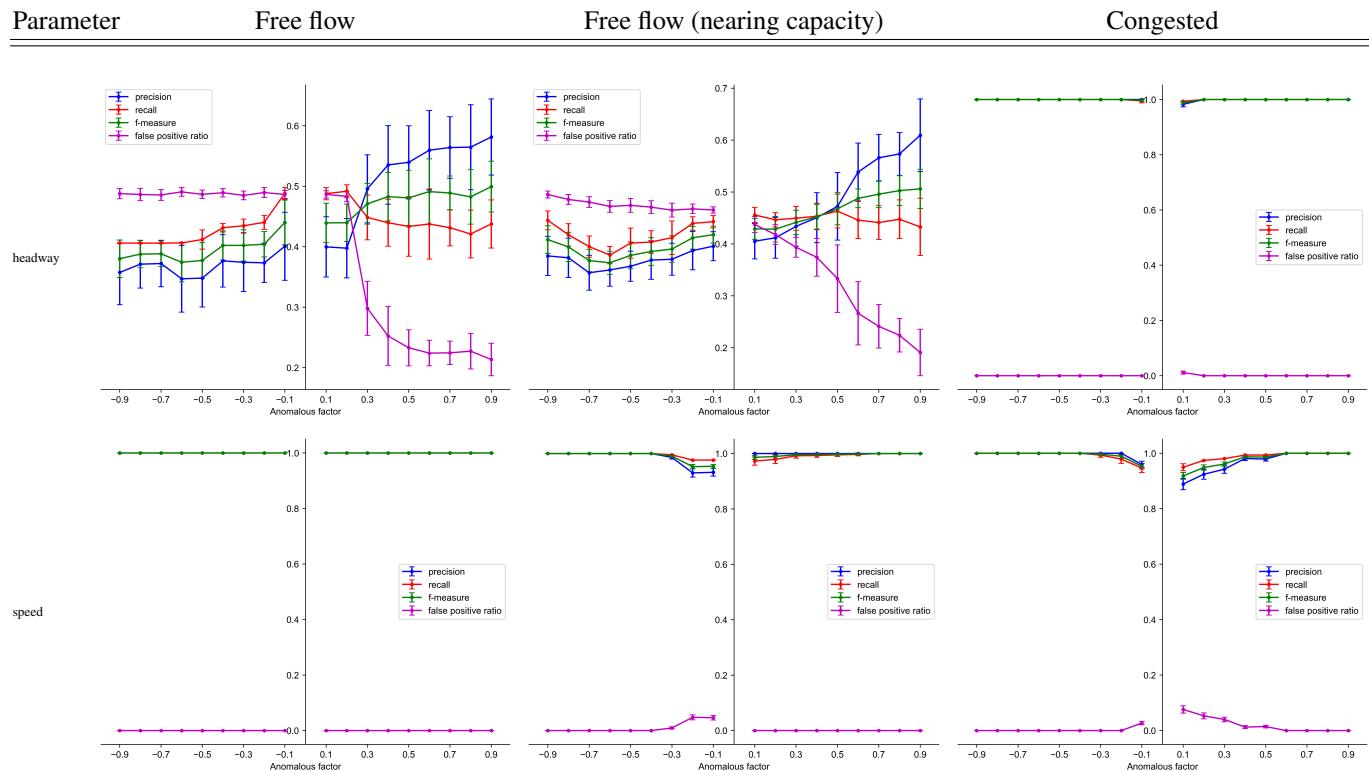
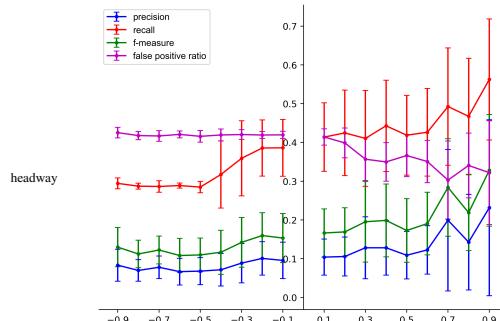


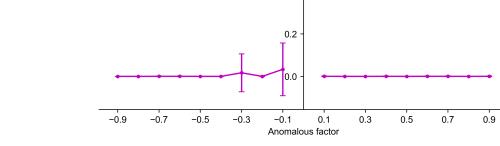
TABLE 10: Evaluation metrics behavior when 10% of the total population is anomalous on Sydney M4

(a) Right lane

Parameter Free flow at 225 veh. /lane/hour

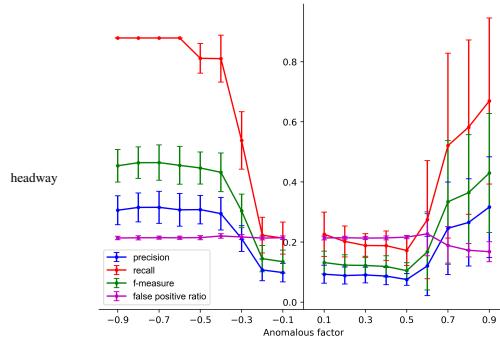


speed



(b) Left lane

Parameter Free flow at 900 veh. /lane/hour



speed

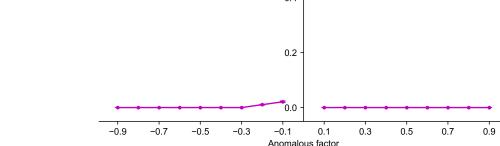


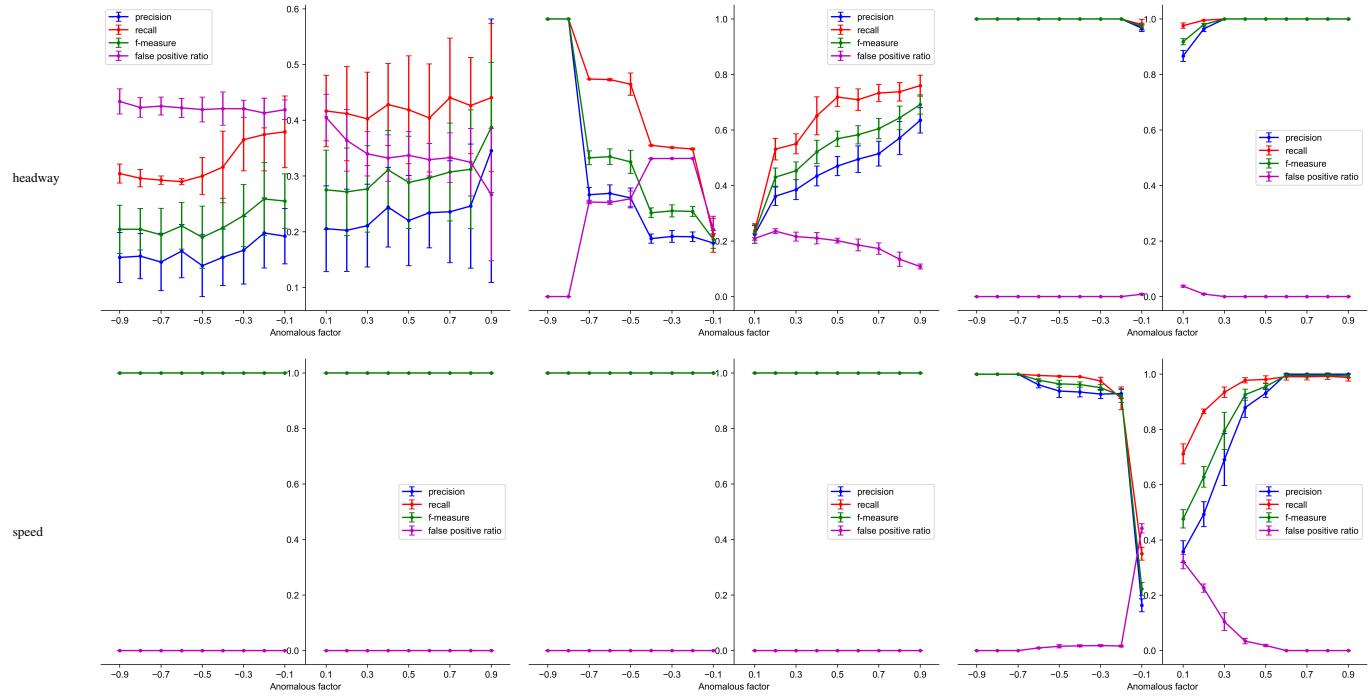
TABLE 11: Evaluation metrics behavior when 20% of the total population is anomalous on Sydney M4

(a) Right lane

Parameter Free flow at 225 veh. /lane/hour

Capacity at 2000 veh. /lane/hour

Congested



(b) Left lane

Parameter Free flow at 900 veh. /lane/hour

Free flow at 900 veh. /lane/hour

Congested

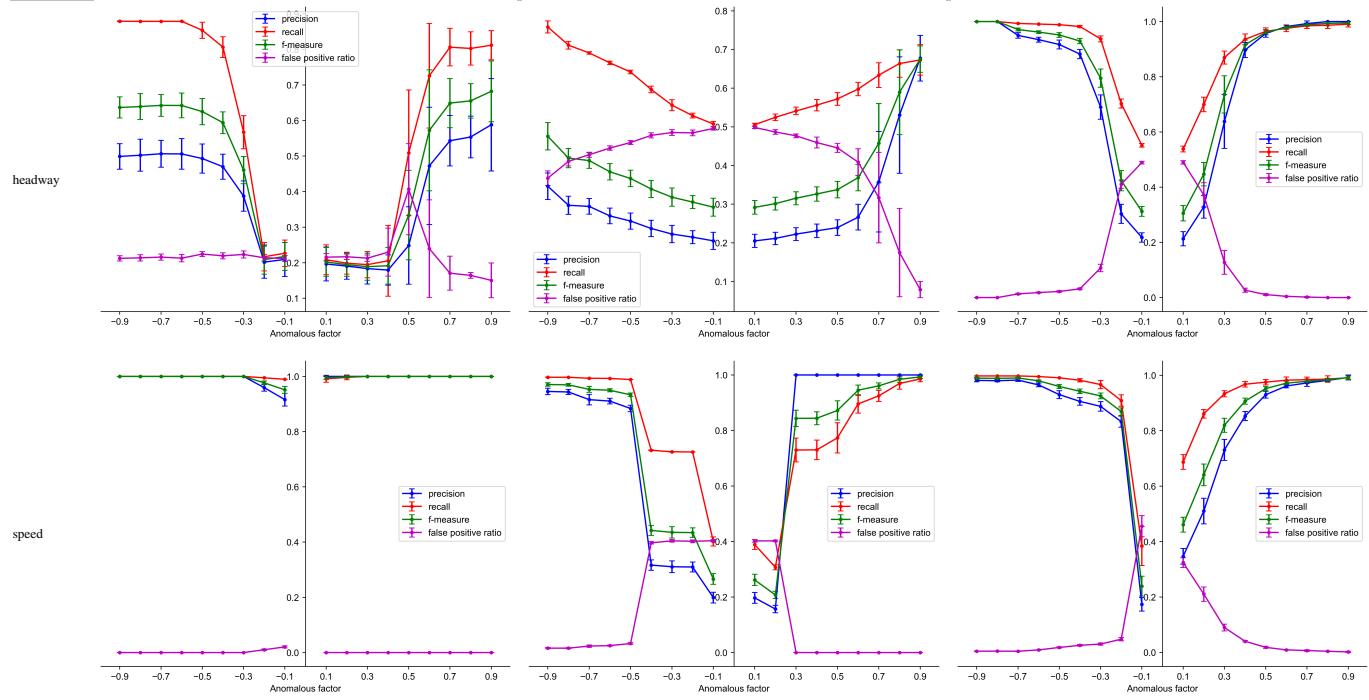
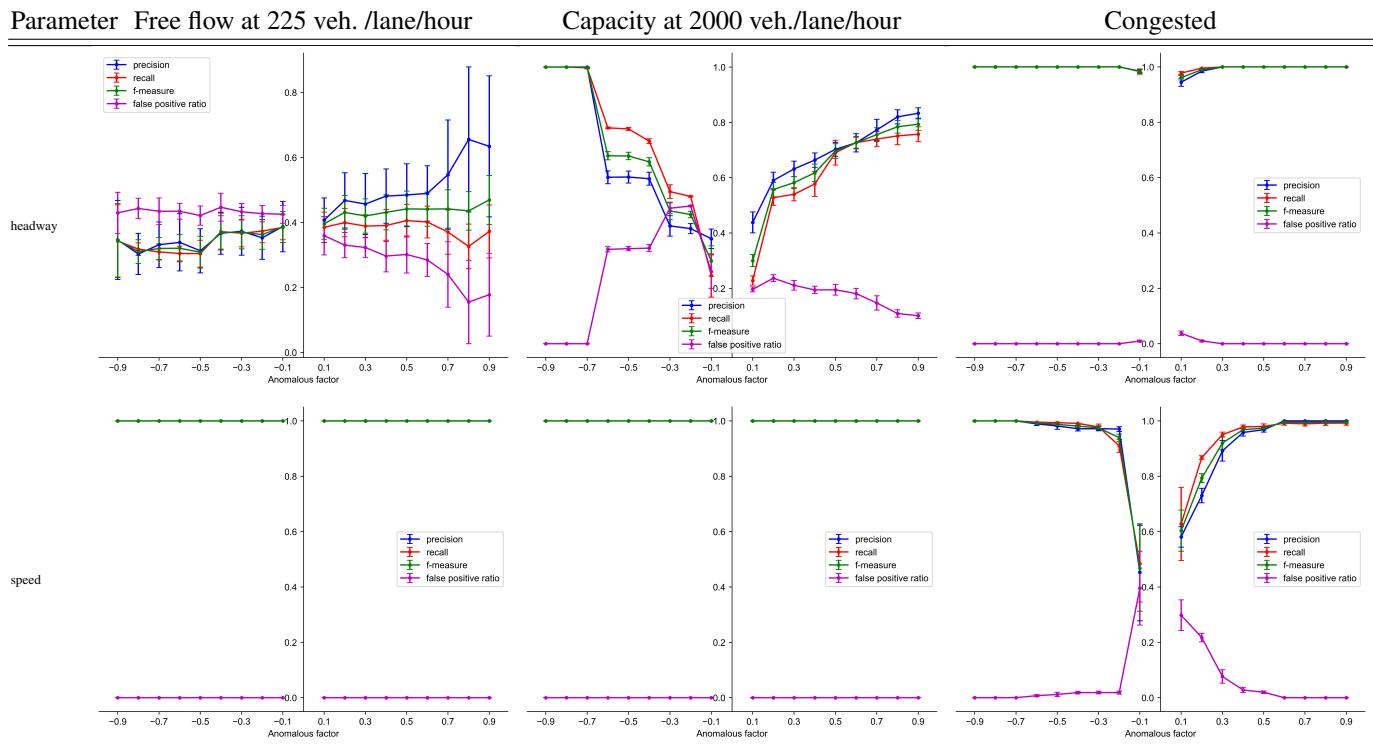


TABLE 12: Evaluation metrics behavior when 40% of the total population is anomalous on Sydney M4

(a) Right lane



(b) Left lane

