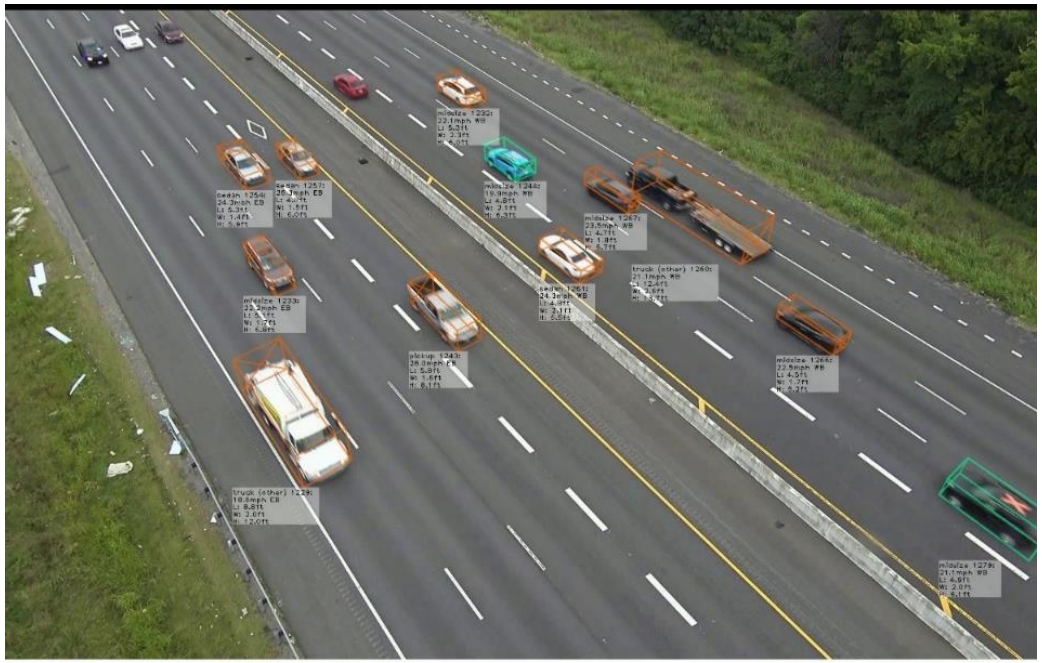
Overview and Data Sharing

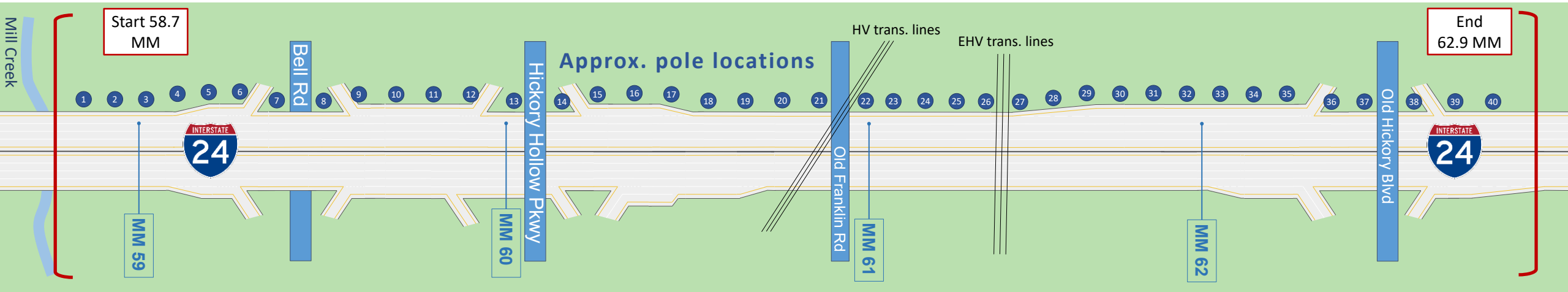
Junyi Ji
Ph.D. Candidate

Civil Engineering, Institute for Software Integrated Systems
Vanderbilt University

I-24 MOTION: The System

- **40 poles (110-135’ tall), 276 cameras.**
  (6 per pole)
- Overlapping fields of view for total coverage.
- 6x poles at interchanges with 12 cameras to collect data on highway and interchange ramps simultaneously.
- Every day generates 50TB+ of video, converted to 12GB+ of trajectory data.



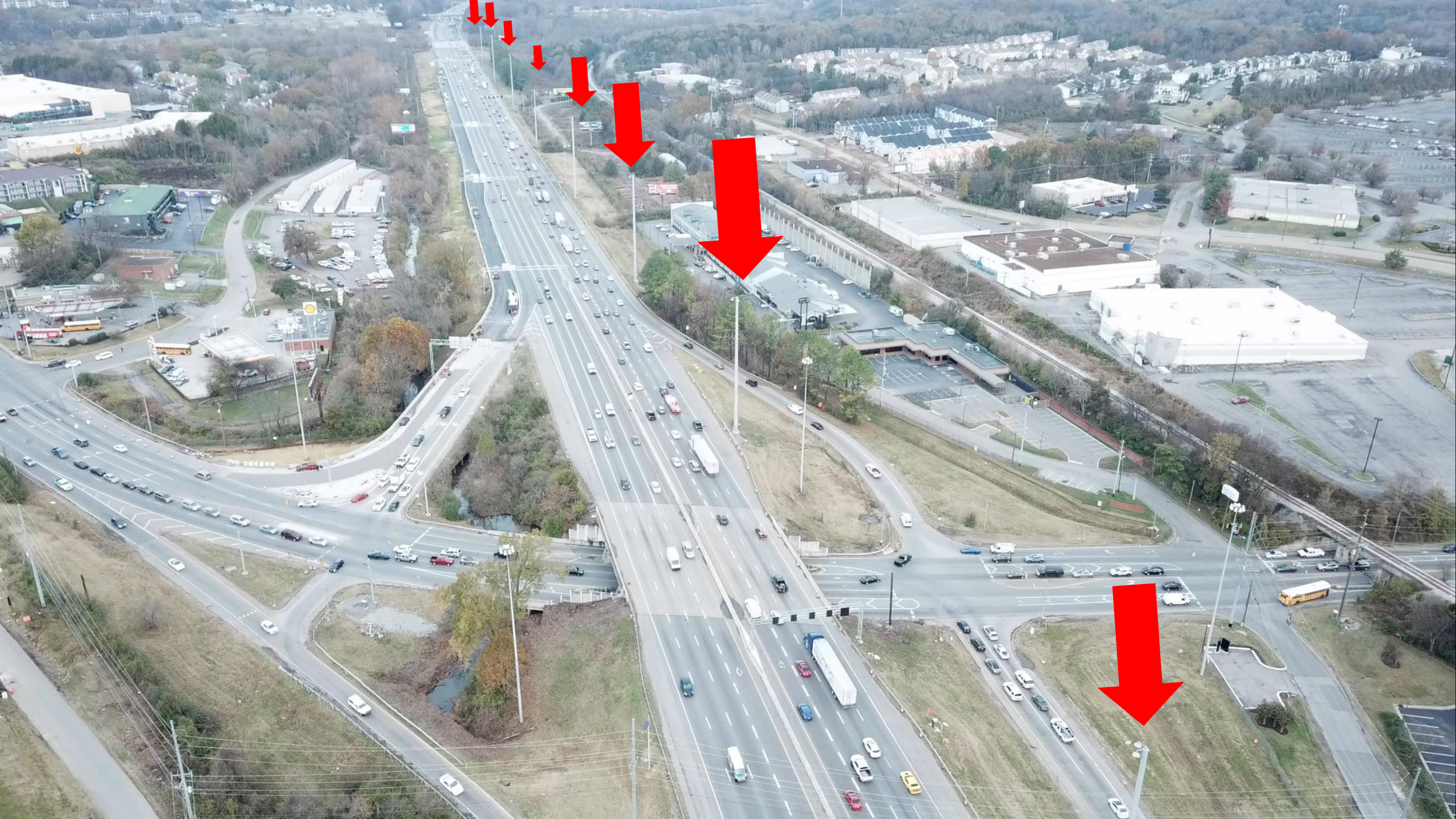


Construction timeline: February – November 2022

Construction completed

- Full system completed in Nov. 2022
  - 40 poles, 276 cameras across 4 miles
  - Essentially a 10-month construction timeline

- Some of the construction hurdles include:
  - Material procurement limitations/delays
  - Coordination with other projects
  - Night work due to roadway demand
  - High voltage power lines
  - External traffic accidents
  - Lawn mowers
  - Crane placement on steep hills



TDOT Department of Transportation

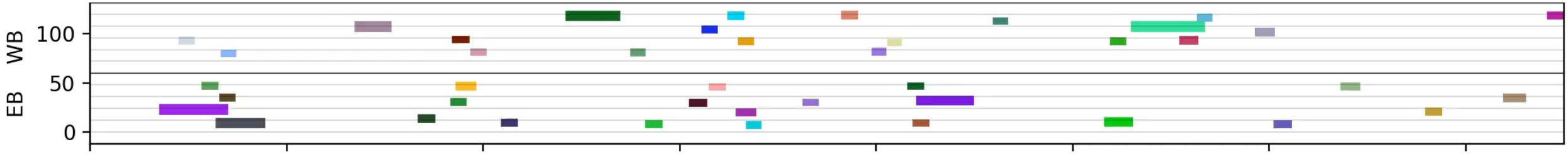
VANDERBILT UNIVERSITY

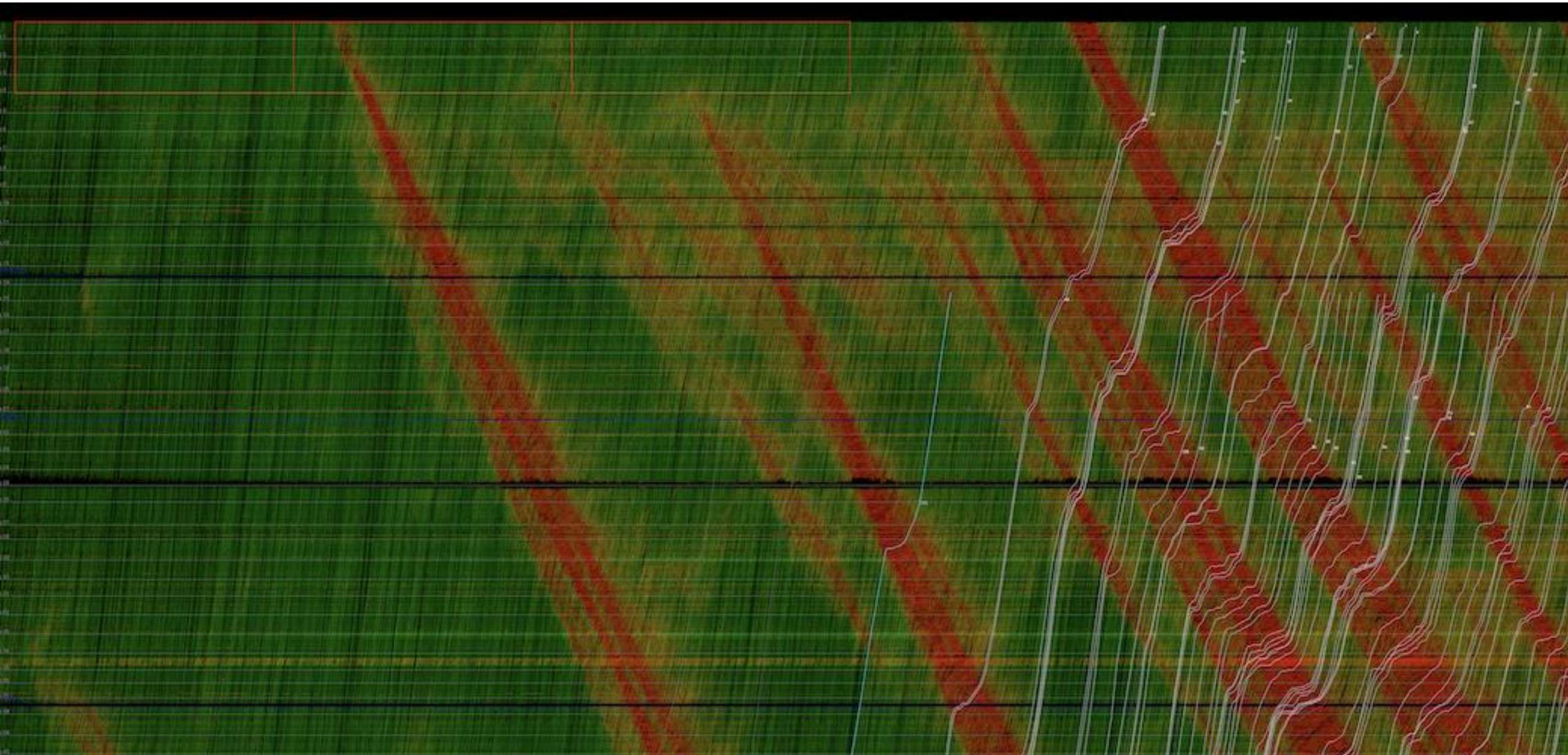
I-24 MOTION

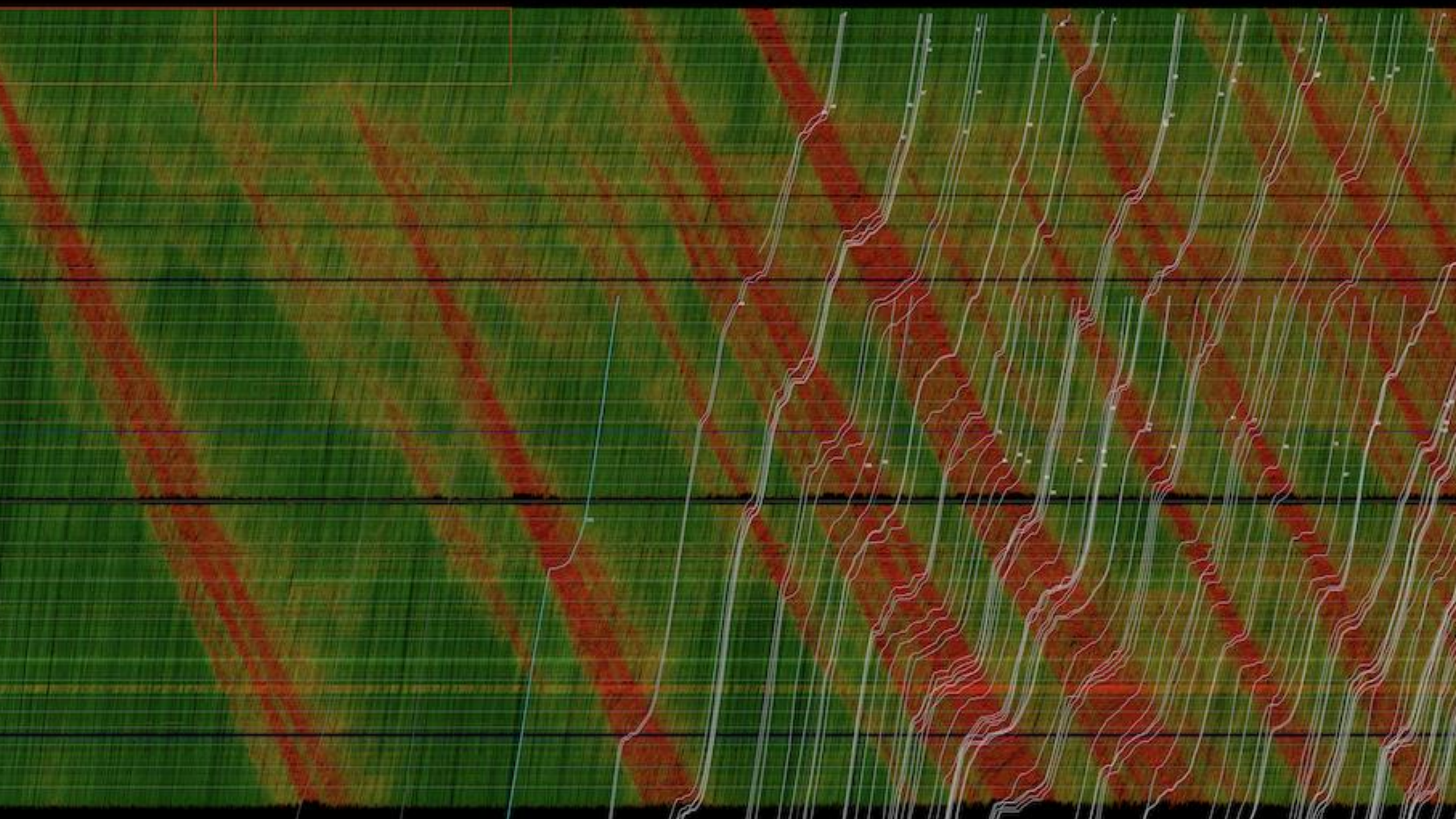
[Gloudemans et al. 2023; Zachár, 2023; Wang et al. 2023; Gloudemans et al. 2024; Wang et al. 2024; Ji et al. 2024]

Computer vision algorithms track vehicles with 3D bounding boxes for exact positioning.

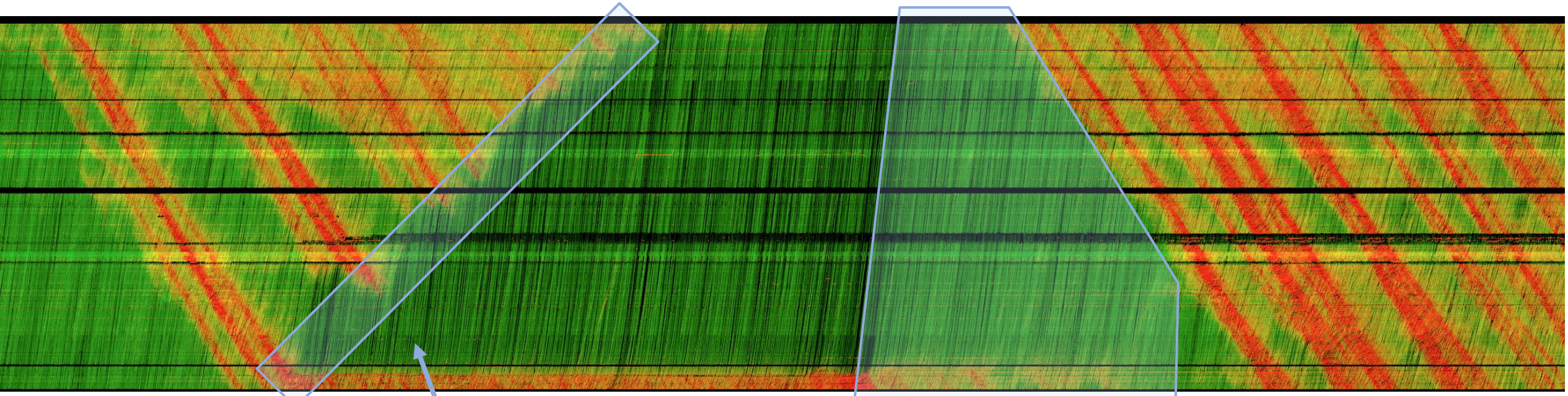
Image space positions are converted to roadway coordinates and stitched across cameras.



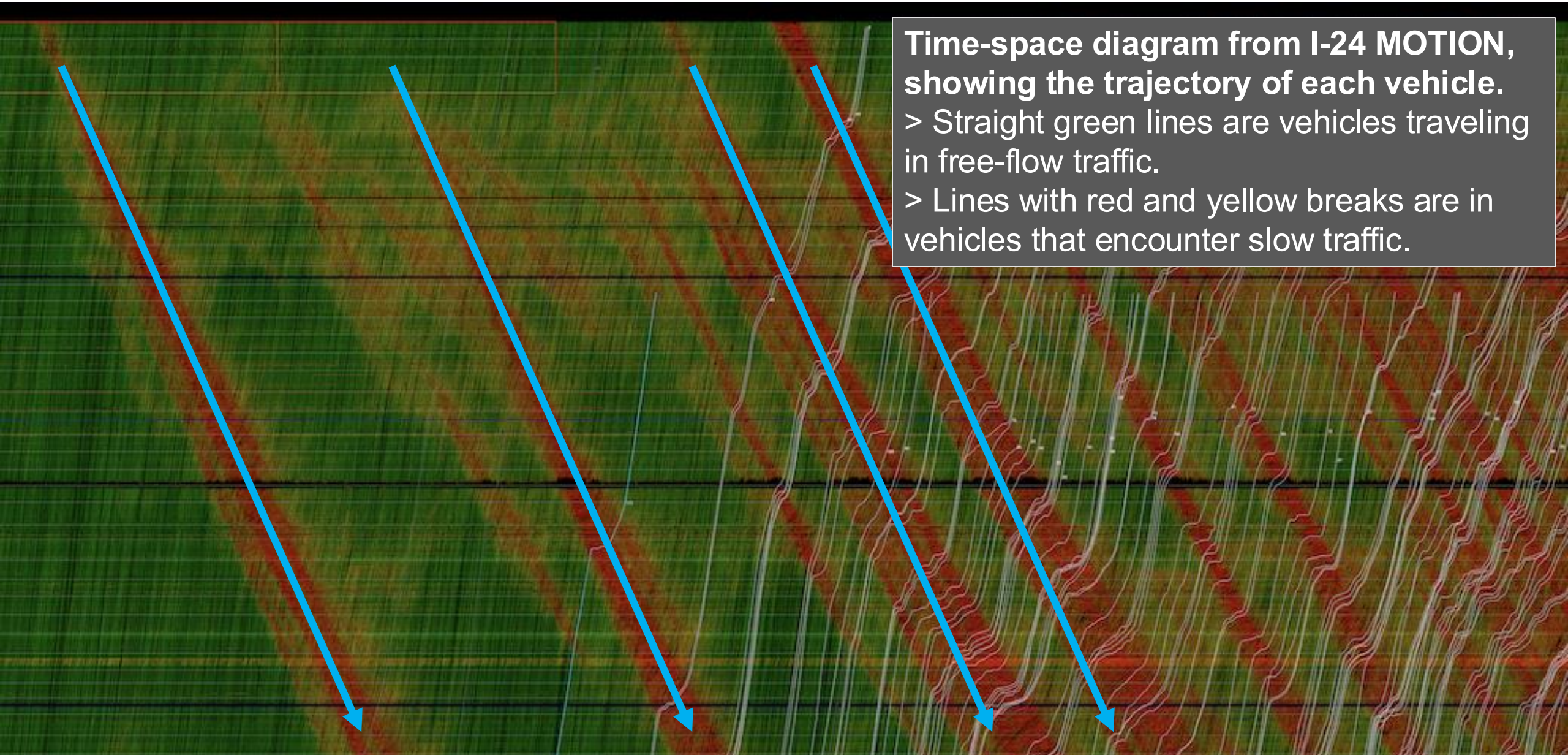




Waves persist in many conditions



Application: Smart Corridor optimization

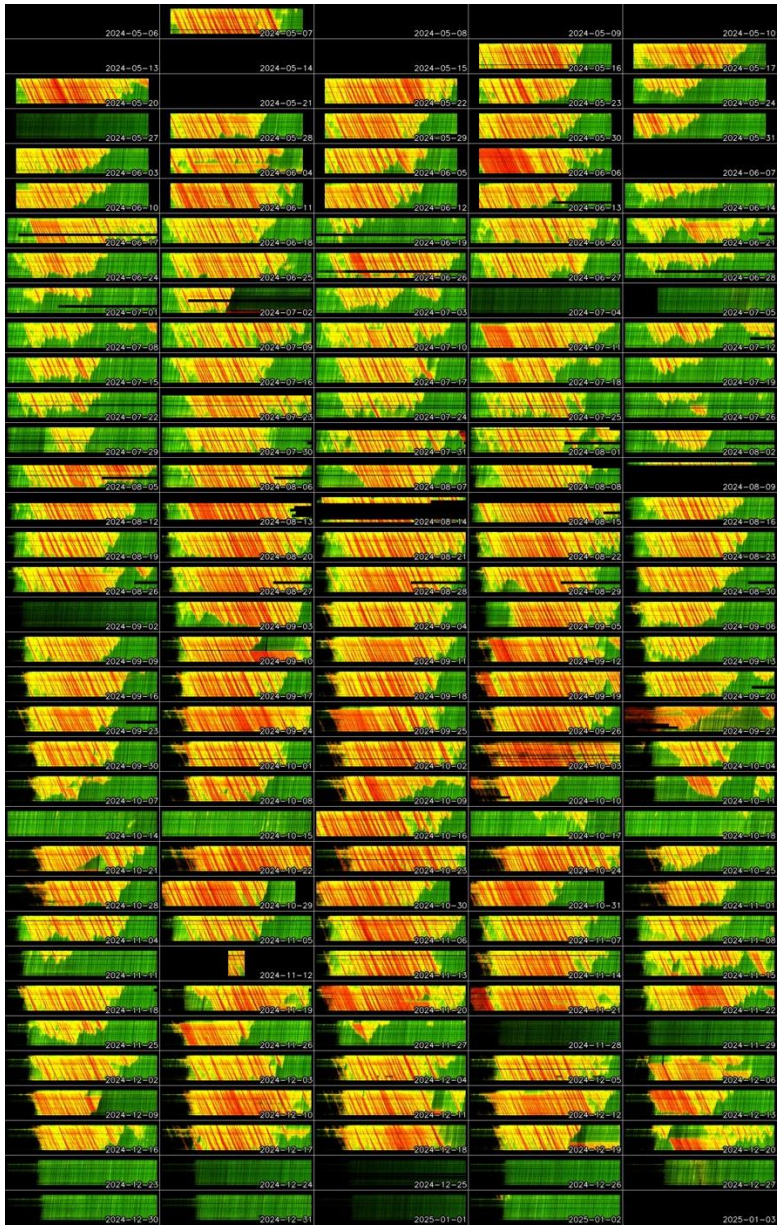


Time-space diagram from I-24 MOTION, showing the trajectory of each vehicle.

> Straight green lines are vehicles traveling in free-flow traffic.

> Lines with red and yellow breaks are in vehicles that encounter slow traffic.

Data release



- Most days will be released in various level of details (time-space diagrams in different resolutions, trajectory data)
- pending on paper acceptance
- derivative data will be available (mean speed field, wave analysis, selected events)
- Preview it here!

(must be a registered user at i24motion.org)

Data release

- **Inception trajectory dataset**: Gloudemans, D., Wang, Y., Ji, J., Zachar, G., Barbour, W., Hall, E., Cebelak, M., Smith, L. and Work, D.B., 2023. I-24 MOTION: An instrument for freeway traffic science. Transportation Research Part C: Emerging Technologies, 155, p.104311.
- **3D vehicle bounding box dataset:** Gloudemans, D., Work, D., Wang, Y., Gumm, G., and Barbour, W., 2023. The Interstate-24 3D Dataset: a new benchmark for 3D multi-camera vehicle tracking. In Proceedings of the 34th British Machine Vision Conference.
- **234 camera video dataset:** Gloudemans, D., Zachár, G., Wang, Y., Ji, J., Nice, M., Bunting, M., Barbour, W.W., Sprinkle, J., Piccoli, B., Monache, M.L.D. and Bayen, A., 2024. So you think you can track?. In Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (pp. 4528-4538).
- **Virtual trajectory & ASM tools** Ji, J., Wang, Y., Gloudemans, D., Zachár, G., Barbour, W. and Work, D.B., 2023. Virtual trajectories for I-24 MOTION: data and tools. arXiv preprint arXiv:2311.10888.
- **Radar / Crash dataset**: Coursey, A., Ji, J., Quinones-Grueiro, M., Barbour, W., Zhang, Y., Derr, T., Biswas, G. and Work, D.B., 2024. FT-AED: Benchmark Dataset for Early Freeway Traffic Anomalous Event Detection. arXiv preprint arXiv:2406.15283.
- **Superresolution tools & WaveX dataset**: Ji, J., Richardson, A., Gloudemans, D., Zachár, G., Nice, M., Barbour, W., Sprinkle, J., Piccoli, B. and Work, D.B., 2024. Stop-and-go waves reconstruction via iterative refinement. arXiv preprint arXiv:2408.00941.