Georgia Tech Traffic Flow

CSE6730/CX4230 - Modeling and Simulation

Team 11

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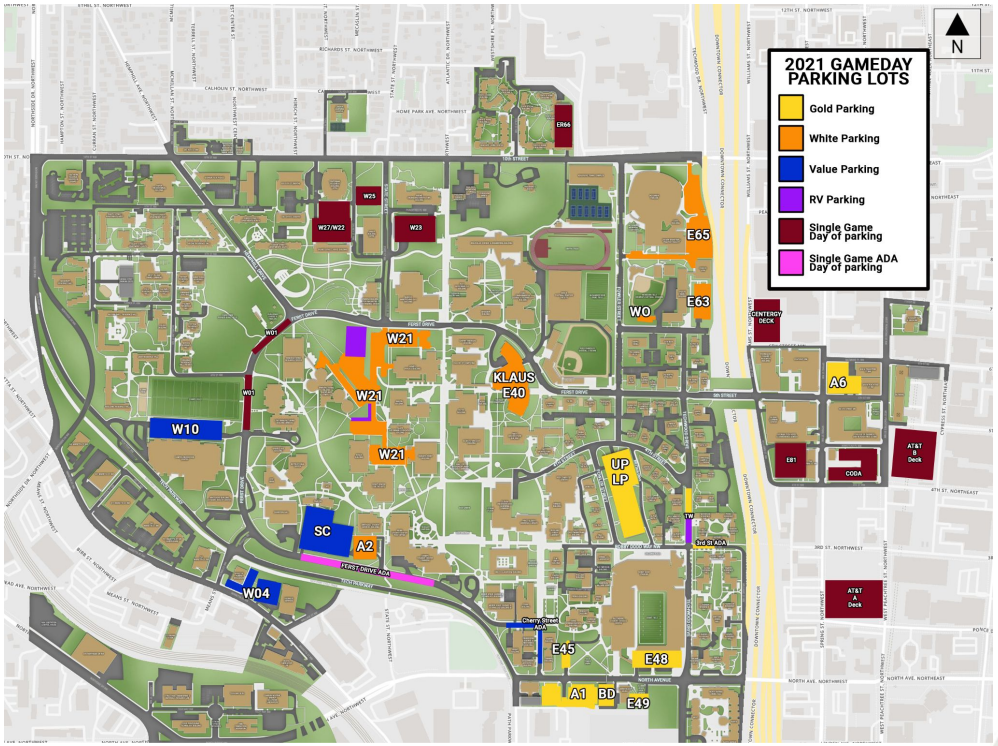
Introduction

- Model traffic flow on Georgia Tech using present campus road networks
- Introduce obstacles and blockades to analyze traffic rerouting



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Importance/Motivation

- Identify pain points in the campus road networks
- Provide statistical analysis to assist with city road planning
- Better planning of intersections, placement of stop signs, and traffic lights
- Develop re-routing strategies in situations of blockade or road closures (game days, special events, etc.)

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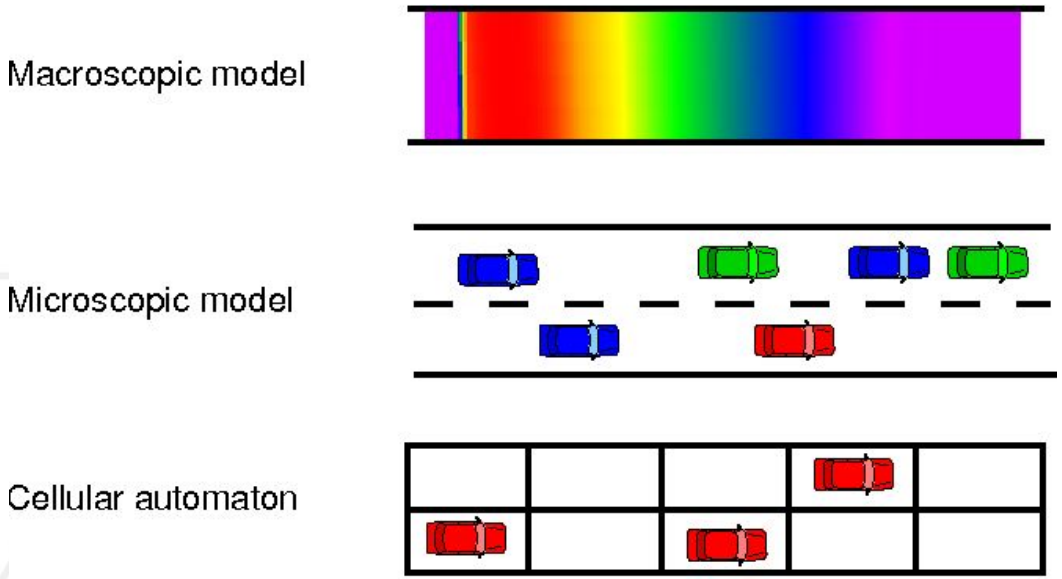
Conceptual Model

- Microscopic traffic model - multi-agent system with independently acting vehicles
- Every i-th vehicle follows the (i-1)-th vehicle
- Speed and position by the equations of motion



$$s_i = x_i - x_{i-1} - l_i$$

$$\Delta v_i = v_i - v_{i-1}$$

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Simulation Model

- We utilize the *Intelligent Driver Model (IDM)* developed by Treiber, Hennecke, and Helbing.
- Assumes a free road and free interactions
- The dynamics of the vehicle movements are described by the given equations:

$$\frac{dv_i}{dt} = a_{free\ road} + a_{interaction}$$

$$\begin{cases} a_{free\ road} = a_i \left(1 - \left(\frac{v_i}{v_{0,i}}\right)^{\delta}\right) \\ a_{interaction} = -a_i \left(\frac{s^*(v_i, \Delta v_i)}{s_i}\right)^2 \end{cases}$$

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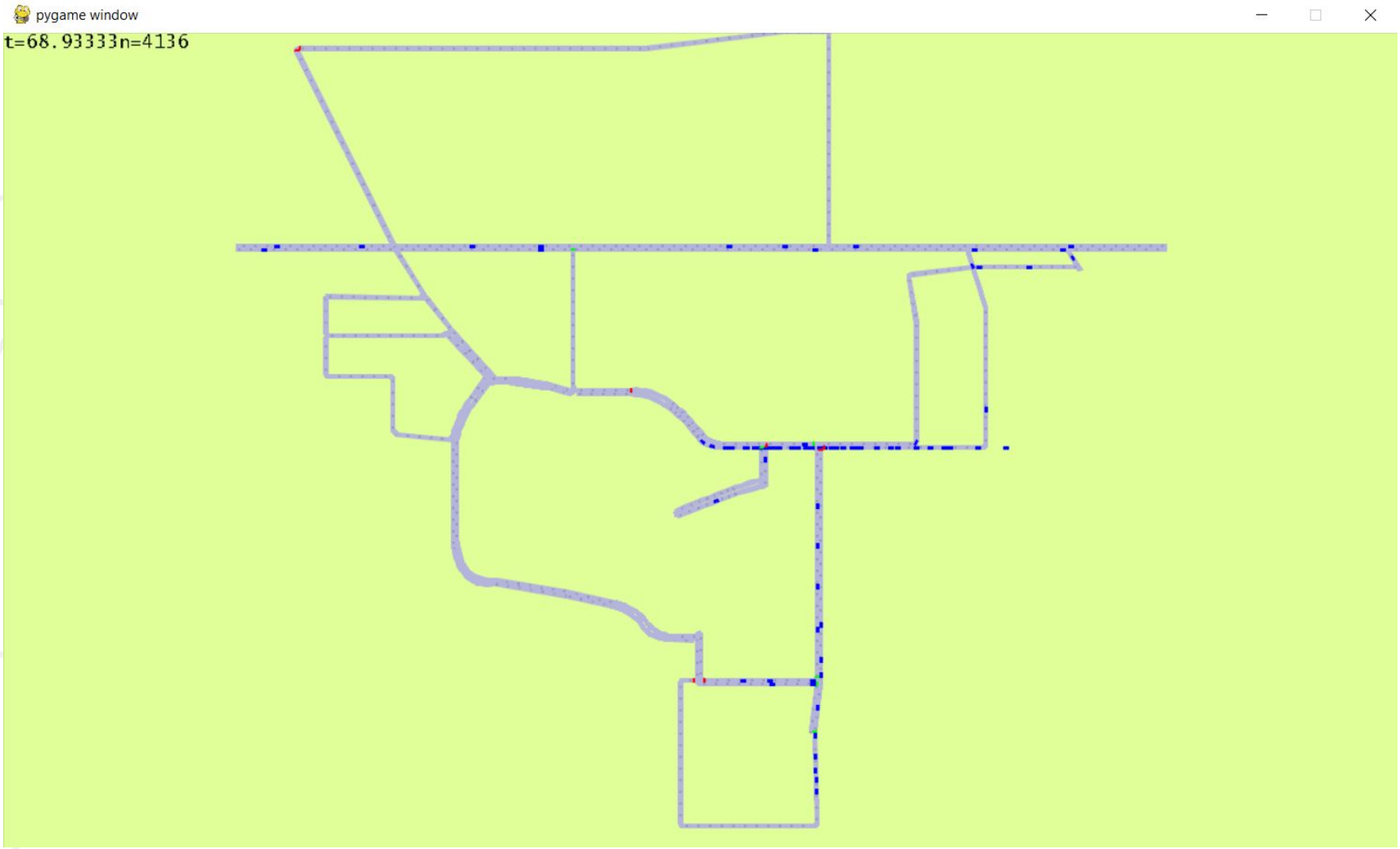
Replicated GT Road Map



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Demo

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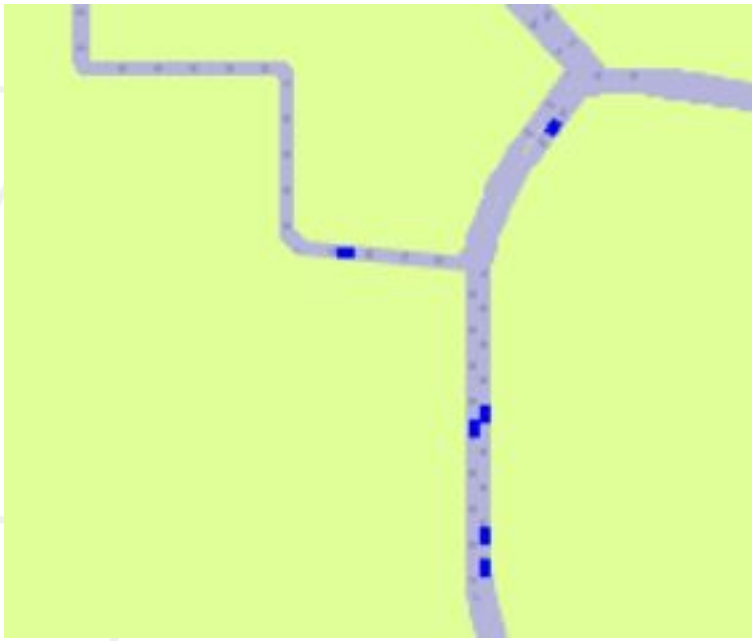
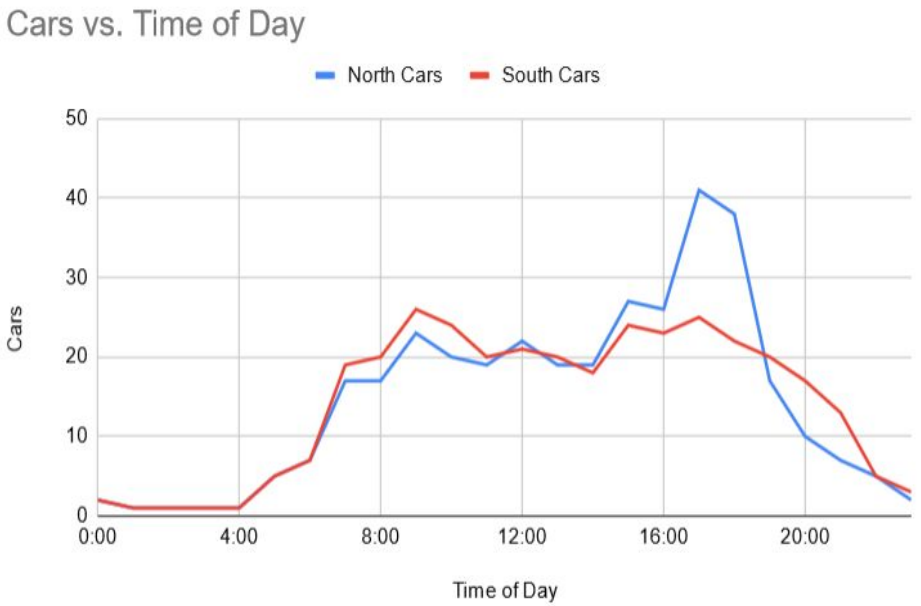
Results

Pain Point 1 - CRC Intersection





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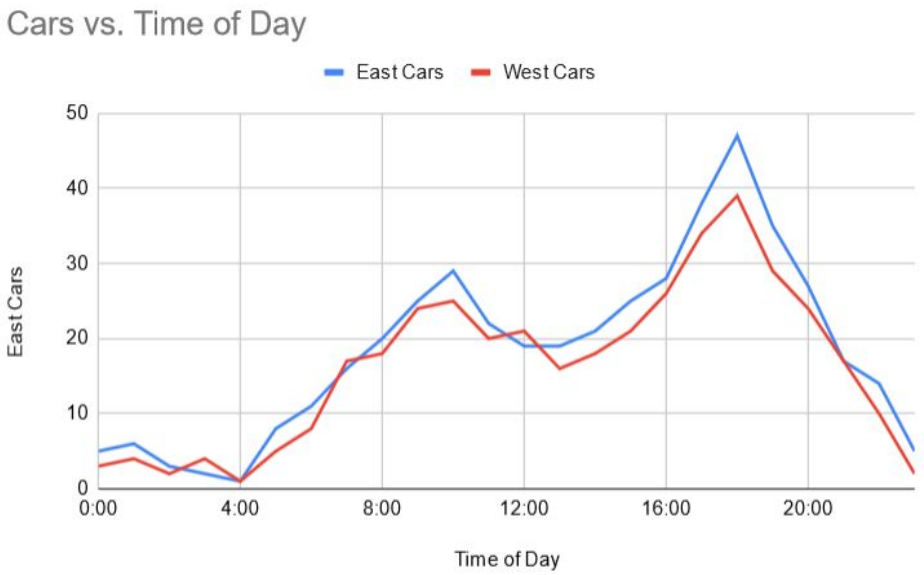
Results

Pain Point 2 - Ferst and Fowler Drive



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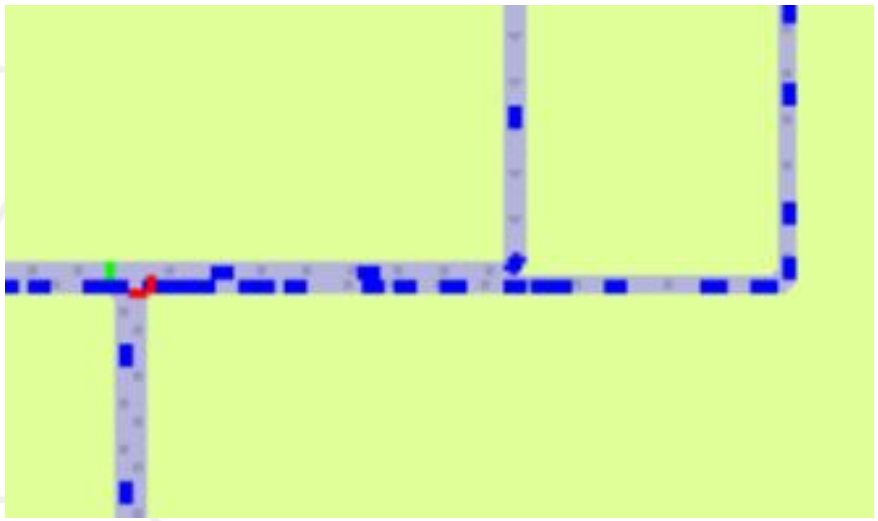
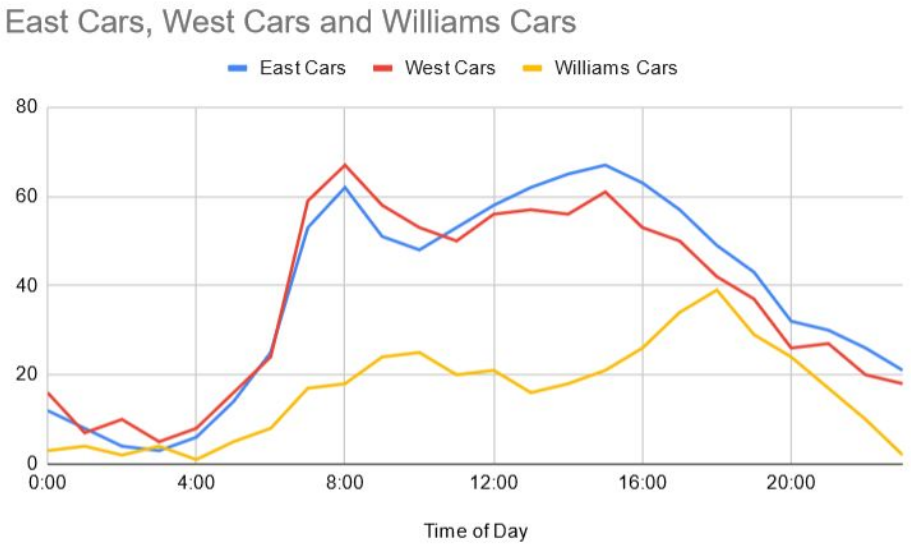
Results

Pain Point 3 - 5th and Williams





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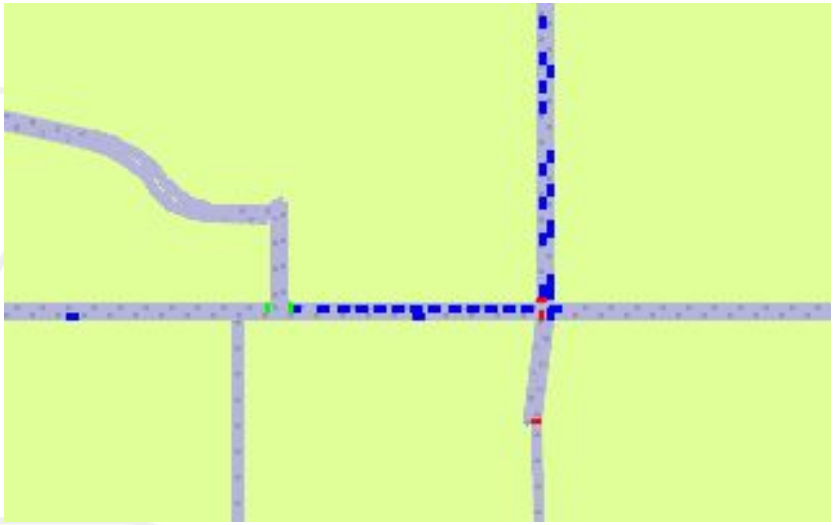
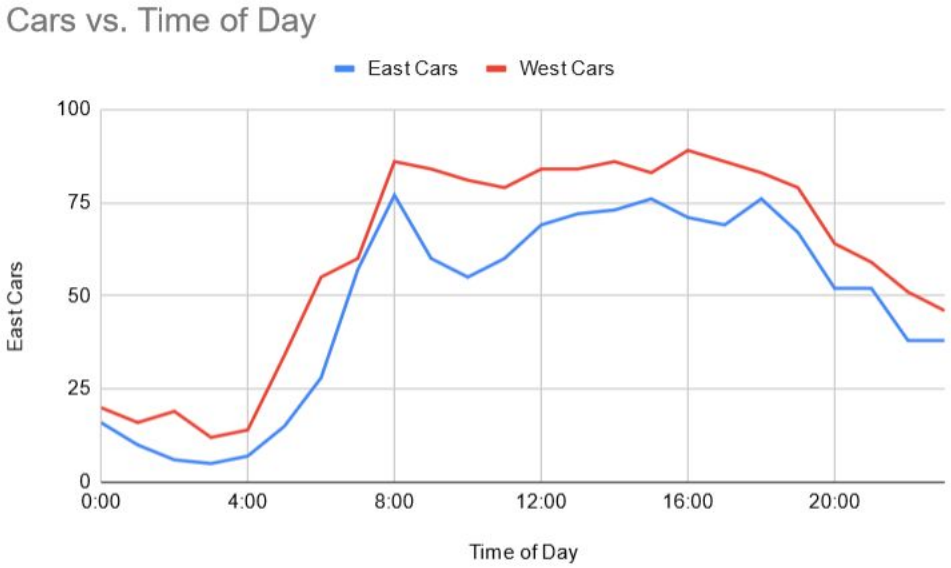
Results

Pain Point 4 - North Avenue





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Conclusion

- Successfully able to replicate traffic flow on the GT road system
- Able to identify pain points and busy/crowded intersections
- Provide data for better road planning, intersection management, and traffic flow
- Developed better re-routing strategies to aid in situations of obstructions and blockages

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Future Works

- Incorporate pedestrians and crosswalks to make the simulation even more accurate
- Add UI features to control traffic flow, vehicle speeds, road blockages, etc.
- Consider using a different simulation model like a logic-based model, cellular automata, machine learning approach, etc.

References

- Himite, B. (2021, September 7). Simulating traffic flow in Python. Medium. Retrieved April 28, 2022, from https://towardsdatascience.com/simulating-traffic-flow-in-python-ee1eab4dd20f
- Wikimedia Foundation. (2022, February 18). Intelligent driver model. Wikipedia. Retrieved April 29, 2022, from https://en.wikipedia.org/wiki/Intelligent_driver_model
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Thank you!

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