Metropolitan City Metro Simulation

Group 7

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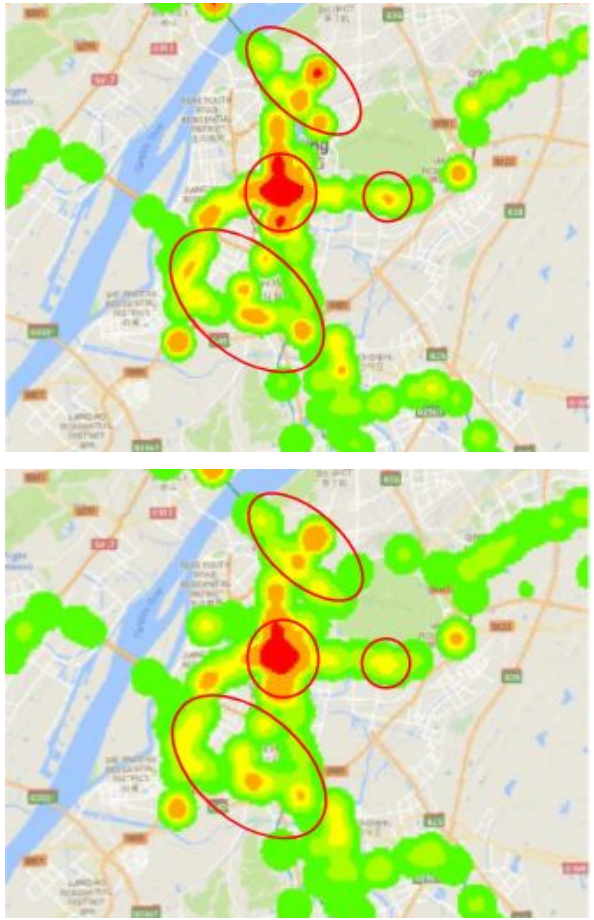
Introduction

- Modern metro networks are designed to be efficient
- More metros are deployed at peak hours
- New metros lines can be constructed if needed
- Need to reduce passenger delays and congestion, both on stations and in metros



Impact of New Metro Line

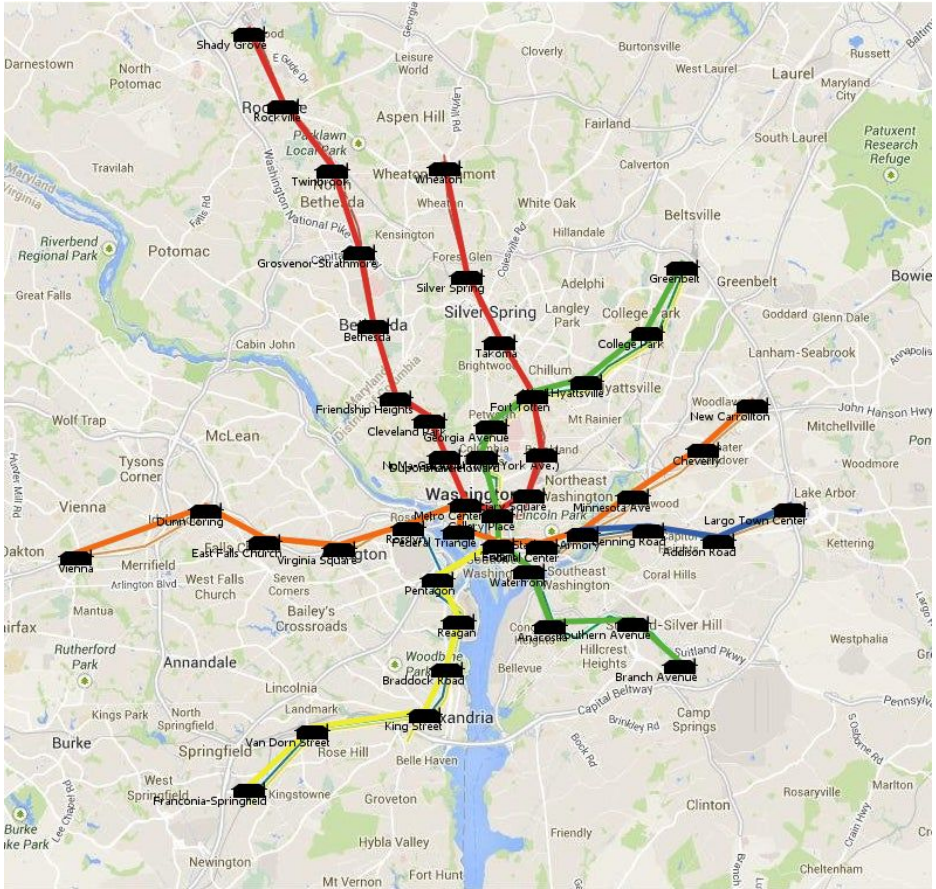
Introduction

ABM tool to simulate metro lines in order to:

- Measure passenger waiting and travel times
- Measure traffic and congestion in the metro
- Observe impact of different factors on these metrics

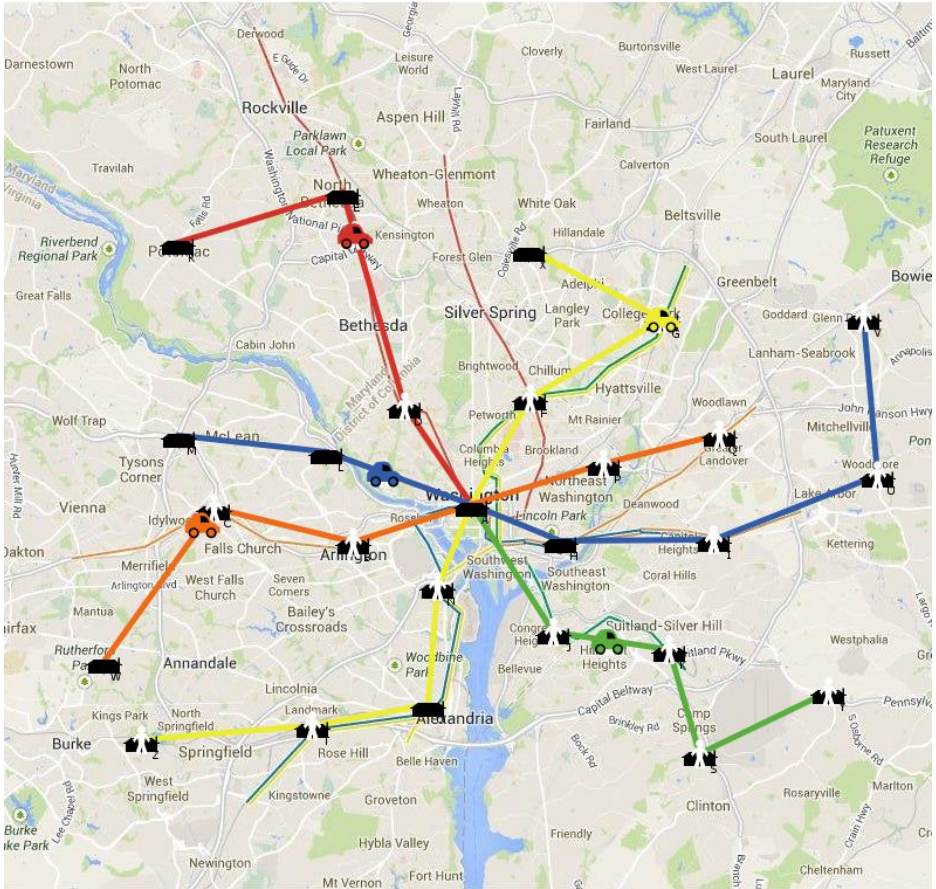
Model Overview

- Initialization
  - Day and Time set to 0
  - CSV data files loaded
  - Display city map,
    Stations,
    colored Metro Lines as links
    Eg. Washington Metro
  - Metros are spawned & hidden
  - Passengers are spawned (2hrs) and hidden.
  - Shortest path computed from src to dest



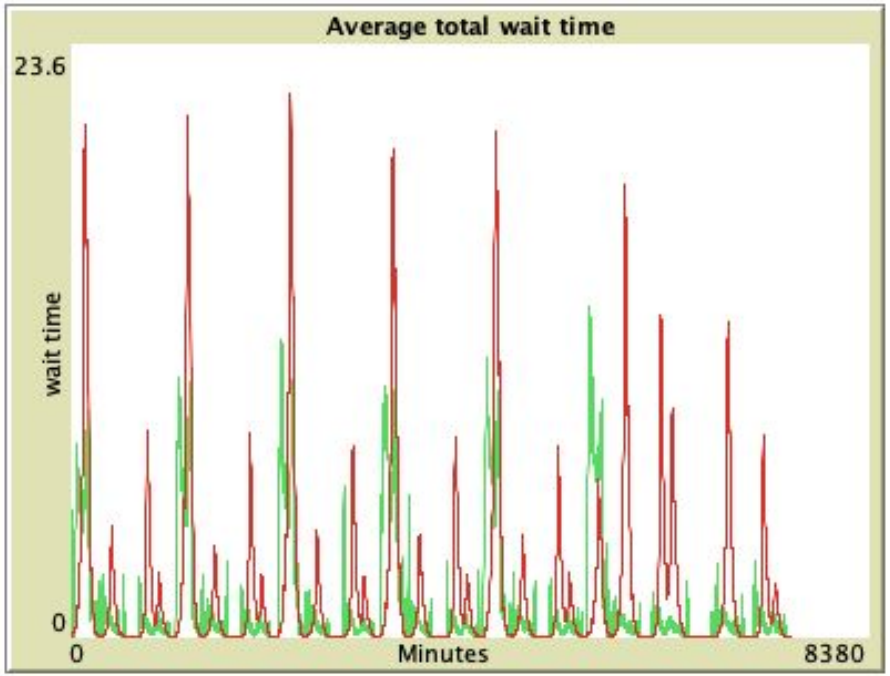
Model Overview

- Processes
  - Metro starts at given time.
    Moves along provided path in its respective metro line colour.
    Waits at each station for <user-input> minutes.
    Repeats route till its end time.
  - Passengers move to the station at the time given in the data.
    Waits for metro that matches its path and has capacity.
  - Checks current station for destination



Model Overview

- Output
  - Passengers
    - Average Wait Time
    - Average Travel Time
  - Station
    - Wait times at each station
    - Average Congestion
  - Metro
    - Average Congestion
    - Congestion for each metro line color



Experiments

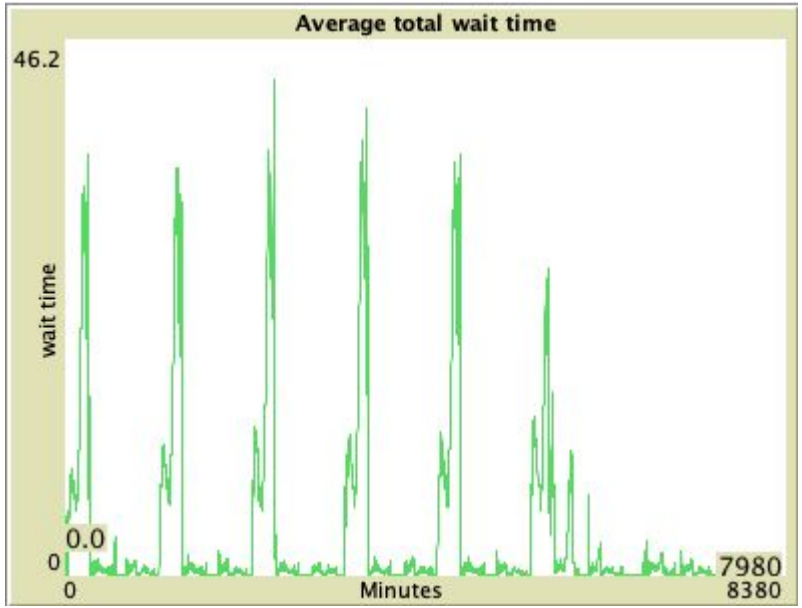
- 2012 Washington DC metro and passenger data.
- Average number of passengers daily travelling between all possible pairs of stations, divided into four bands depending on time - AM Peak, Afternoon, Evening and PM Peak. There was separate data for weekdays and weekends.
- There were stations for washington DC in 2012, which made the model computationally tough to run, we aggregated and merged some stations based on their proximity to each other.
- The daily data was normally distributed into their corresponding time periods (like AM peak corresponds to 5:30 AM to 9:30 AM), and ten passengers with same source, destination and time period were merged and counted as one.

Ent Station	Ext Station	Ent Time Period	Riders, Average Weekday, May 2012
Addison Road	Addison Road	AM Peak	7.8
Addison Road	Anacostia	AM Peak	10.4
Addison Road	Archives-Navy Memorial	AM Peak	35.2
Addison Road	Arlington Cemetery	AM Peak	0.4
Addison Road	Ballston	AM Peak	22.7
Addison Road	Benning Road	AM Peak	17.7
Addison Road	Bethesda	AM Peak	22.5
Addison Road	Braddock Road	AM Peak	2.6
Addison Road	Branch Avenue	AM Peak	2.2
Addison Road	Brookland	AM Peak	22.8
Addison Road	Capitol Heights	AM Peak	16.0
Addison Road	Capitol South	AM Peak	58.8

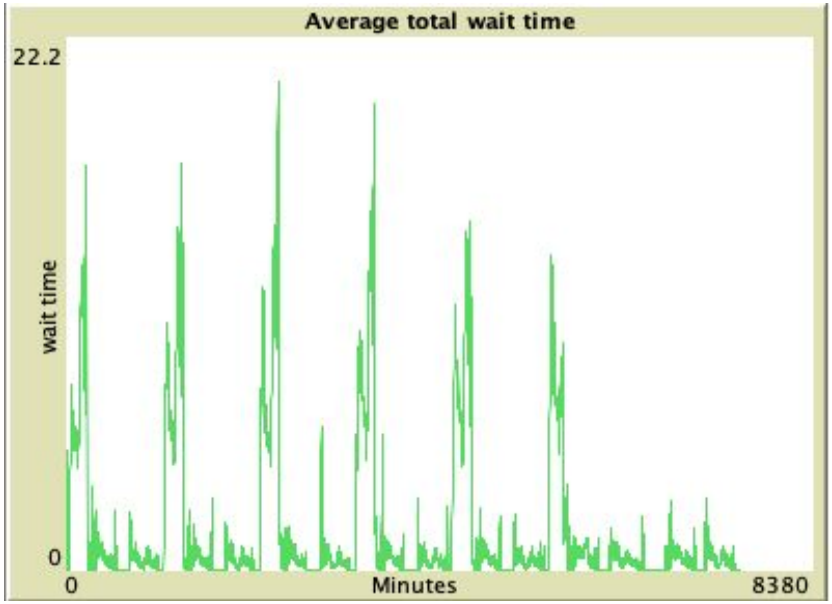
Source	Destination	Time	Day
Addison Road	Anacostia	07:13	4
Addison Road	L'Enfant	07:29	1
Addison Road	L'Enfant	07:31	1
Addison Road	L'Enfant	07:26	1
Addison Road	East Falls Church	07:31	3
Addison Road	East Falls Church	07:42	3
Addison Road	Benning Road	07:23	5
Addison Road	Bethesda	07:11	1
Addison Road	Bethesda	07:20	3

Working Demo

Observations

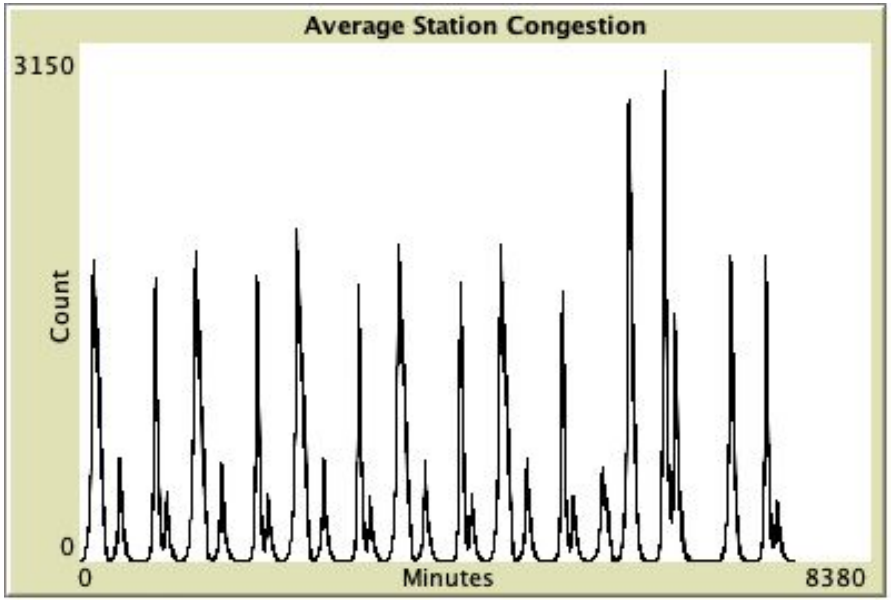


Metro Capacity = 72, Station Stop Time = 3 minutes



Metro Capacity = 78, Station Stop Time = 1 minute

Observations



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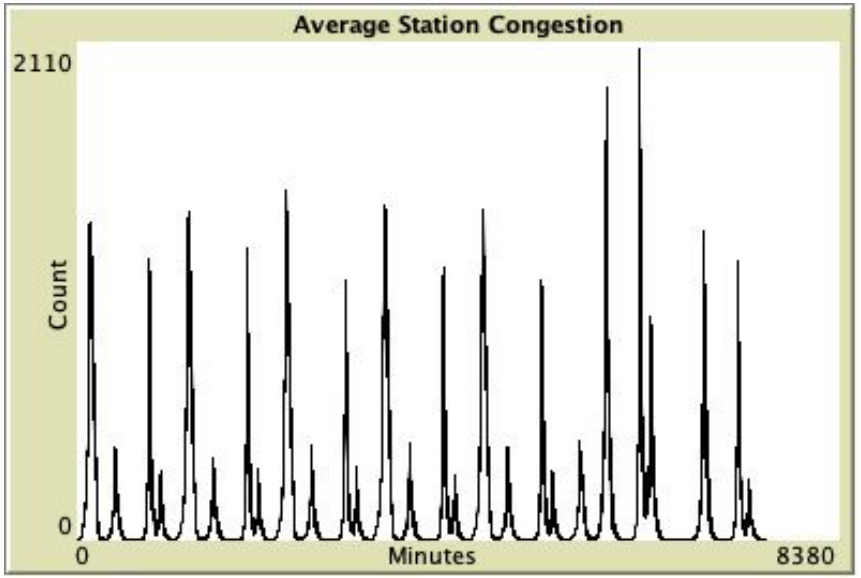

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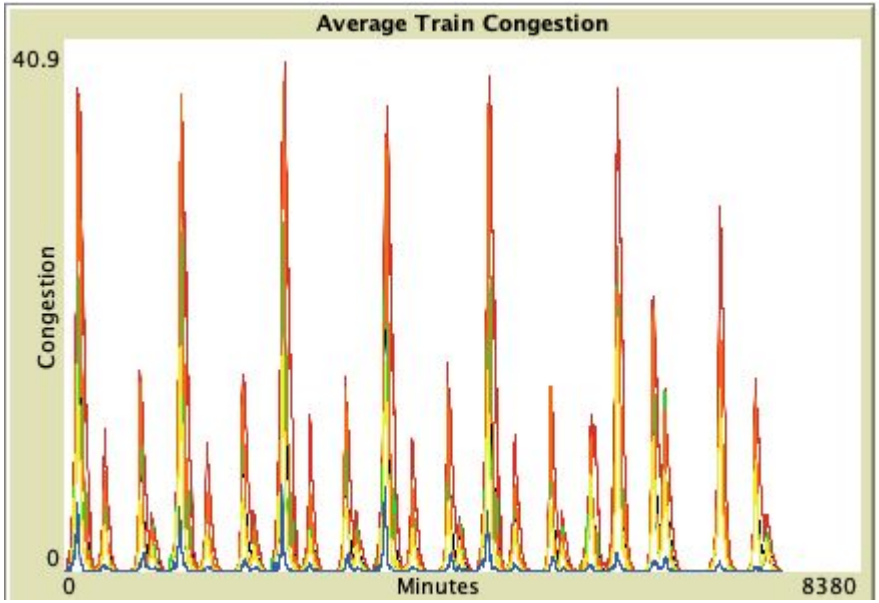

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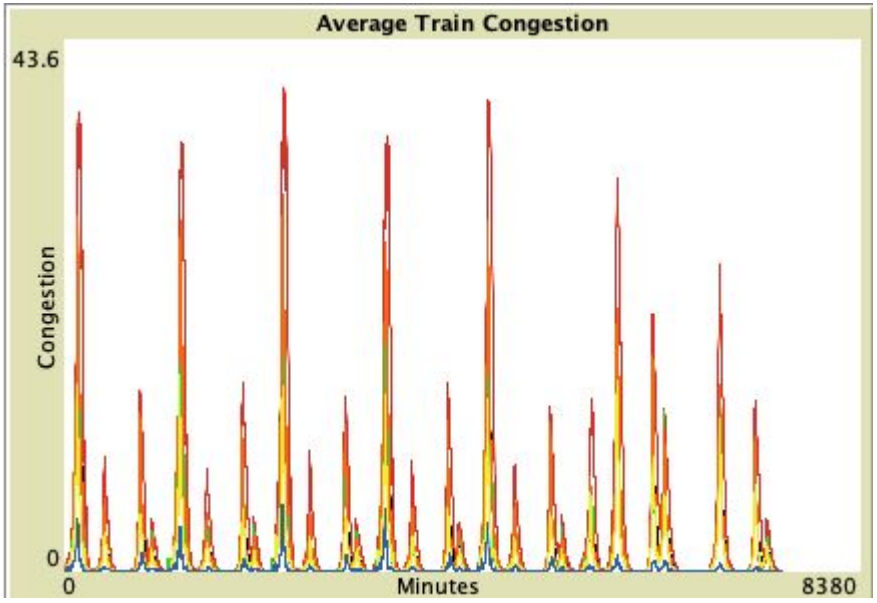

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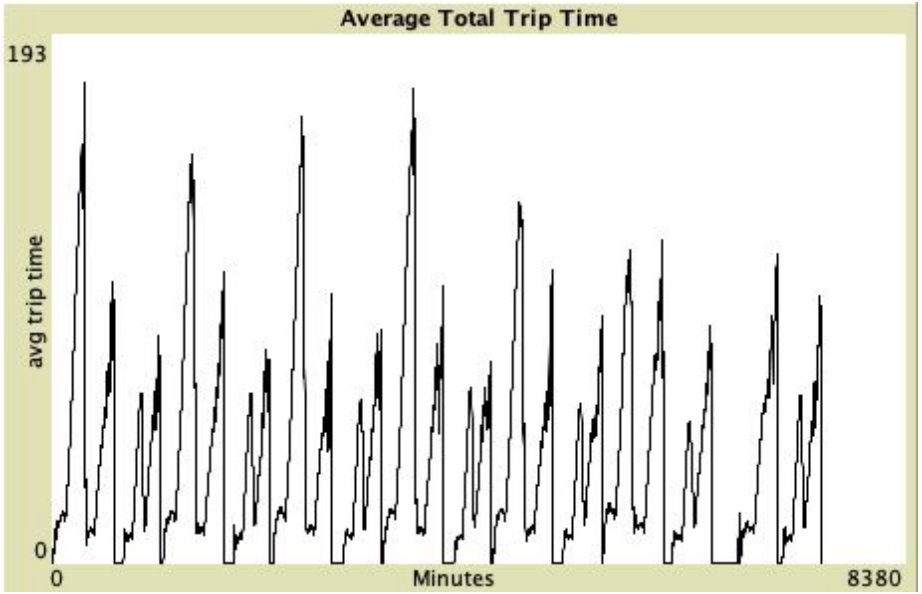

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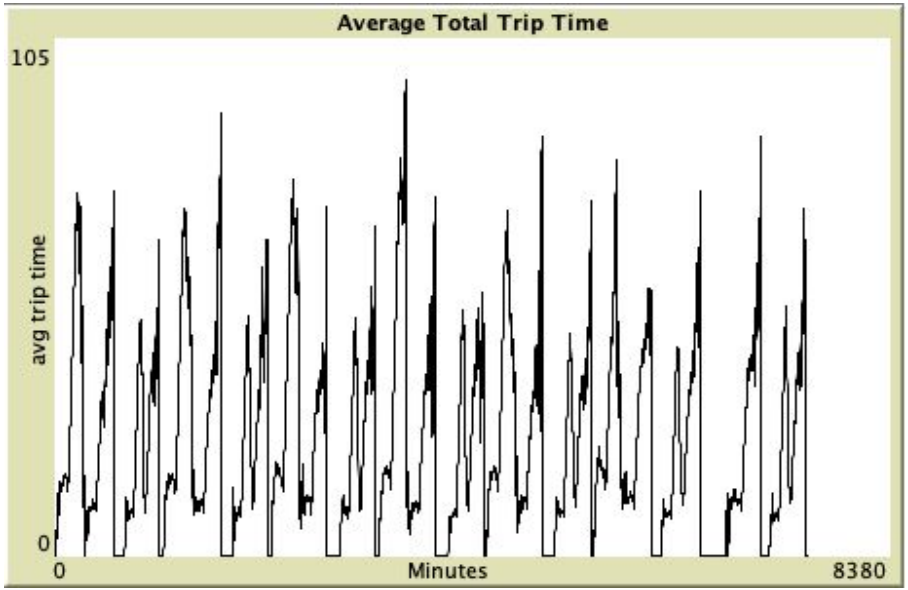

Metro Capacity = 78, Station Stop Time = 1 minute

Results (Peak)

	Average Total Wait Time	Average Per Station Wait Time (L'Enfant)	Average Total Trip Time	Average Station Congestion	Average Train Congestion
Metro Capacity = 72, Station Stop Time = 3 minutes	42.78	25.92	175.41	2985	23.24
Metro Capacity = 78, Station Stop Time = 1 minute	20.35	19	96.8	2083	20.55
Change (%)	52.43	26.70	44.82	30.22	11.57

Results (Average)

	Average Total Wait Time	Average Per Station Wait Time (L'Enfant)	Average Total Trip Time	Average Station Congestion	Average Train Congestion
Metro Capacity = 72, Station Stop Time = 3 minutes	3.59	1.16	37.41	279.69	2.44
Metro Capacity = 78, Station Stop Time = 1 minute	1.7	1.67	23.37	137.83	1.86
Change (%)	52.65	-43.97	37.53	50.72	23.77

Contributions

- **Suryavardan S**: spawn passengers, add metros, passengers to-fro, train stops at station, time and duration settings, DC data experiment, ODD
- **Shreyash Mishra**: floyd warshall algo, add stations, metro movement, train capacity, DC data experiment, Unit Tests, ODD
- **Shreyas M S**: add stations, add links, evaluation metrics & reporters (graphs and statistics), ODD
- **Yaduraj D**: time and duration settings, CSV Loading and saving, ODD

References

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Thank You