

# STEM Ambassadors

Christopher Davis



UNIVERSITY OF  
BIRMINGHAM

# Outline

1 Introduction

2 Railway Engineering

3 Activity

4 Discussion

5 Questions

# About me

- Christopher Davis
- STEM Ambassador
- Railway Systems Engineer
- PhD Student at the University of Birmingham
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- Member:
- Institution of Engineering and Technology (IET)
- Institution of Railway Signal Engineers (IRSE)
- Institute for Systems Engineering (IfSE)



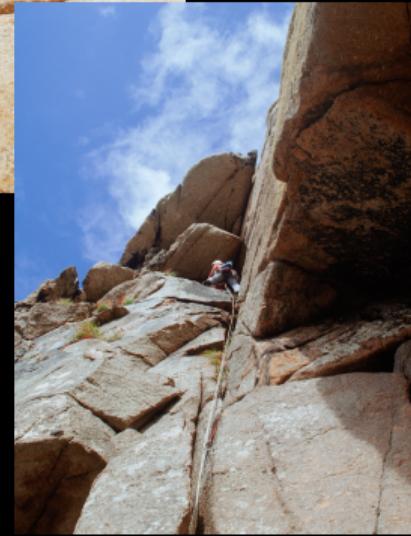
# History

- Bishop's Stortford: School
- Bristol: Electrical and Electronic Engineering MEng
- Bristol: Internal Software Developer
- London: Arup, Railway Systems Engineer
- Birmingham: PhD Student



<sup>1</sup>Image Source: OpenStreetMap.org

# Outside of Work



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# What is Engineering?

# Engineering Definitions

## Engineering Council

“Chartered Engineers (CEng) develop solutions to engineering problems using new or existing technologies, through innovation, creativity and change”

## Wikipedia

“Engineering is the practice of using natural science, mathematics, and the engineering design process to solve problems within technology, increase efficiency and productivity, and improve systems.”

## NASA

“Engineers solve problems.”

# What is Railway Engineering?

# Railway Engineering Disciplines

- Rolling Stock (Trains) (Mechanical / Electrical)
- Permanent Way (Track) (Mechanical / Civil)
- Bridges (Structural Engineers)
- Tunnels (Civil / Geotechnical Engineers)
- Stations (Structural Engineers)
- Signalling (Electrical)
- Timetabling / Transport Planning (Geography)



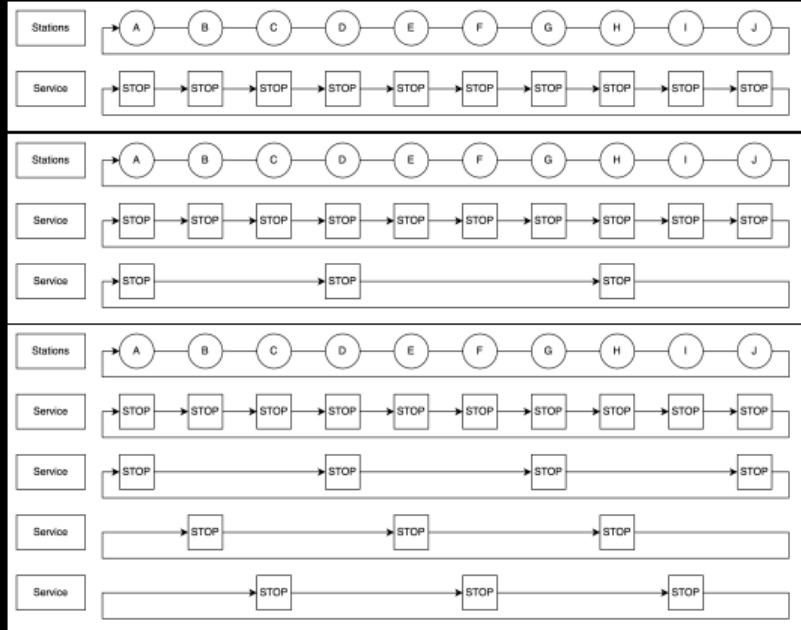
<sup>1</sup>Image Source: TheFrog001, Wikimedia Commons

# Different Views of a System

- Tube map
- Carto Metro
- undergrounddistances

# My Research

- Research into modelling and simulation of novel transport operating concepts
- Design a language to describe system architectures that is understandable by both humans and computers



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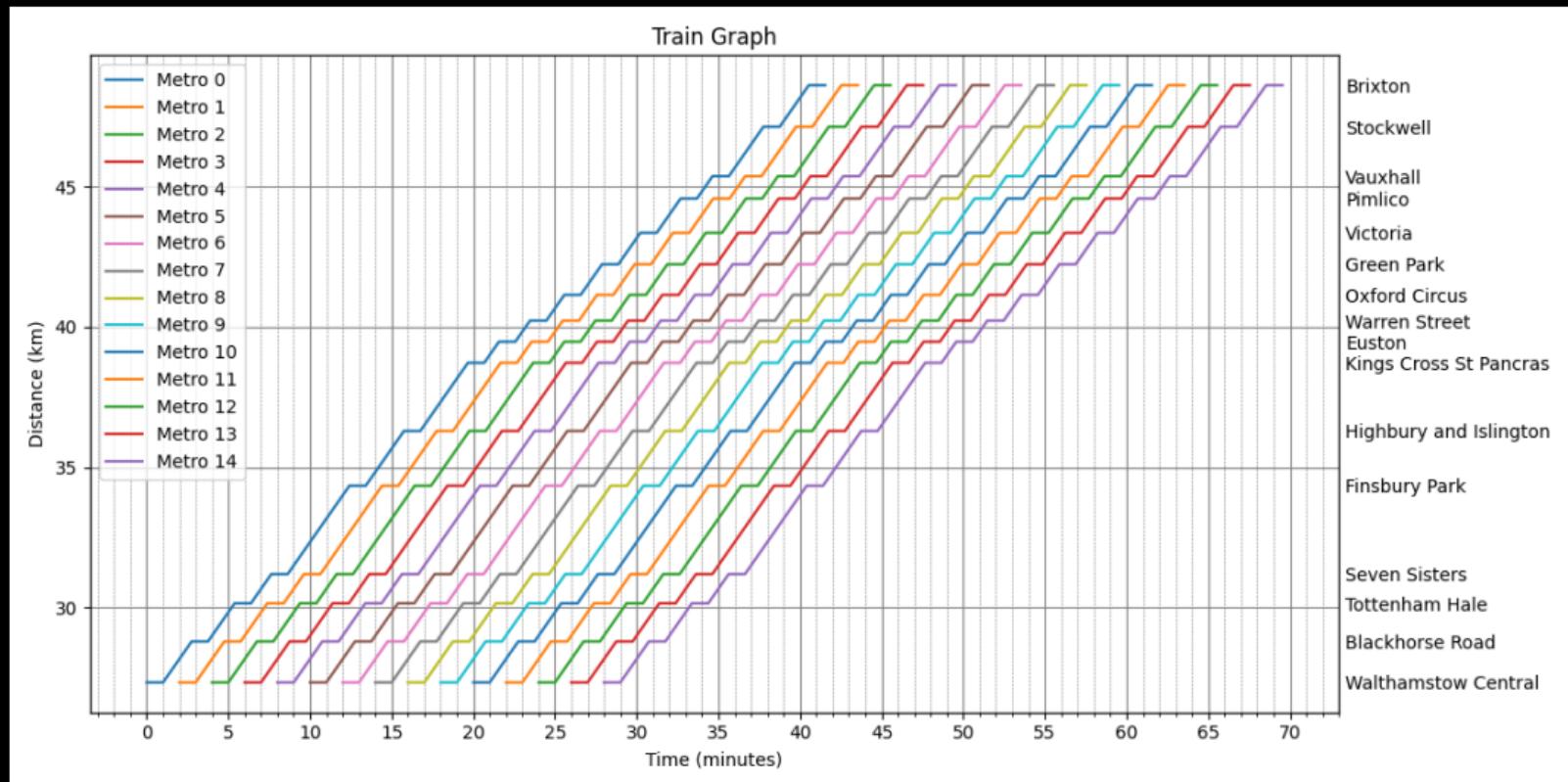
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# Activity: Introduction

- Railway networks rely on precise scheduling to ensure trains run safely, efficiently and on time
- A train graph is a type of time-distance diagram used to visualise how train move through a network
- It helps planners
  - Check for conflicts between services
  - Spot delays or inefficiencies
  - Ensure trains maintain safe spacing and arrive on time
- In this activity you'll take the role of a timetable planner
- Your goal is to design a conflict free schedule using a train graph

# Activity: Example Train Graph



# Activity: Your Task



- All service must depart within 60 min
- The schedule must be designed so that it can be repeated every hour without conflicts.
- A minimum Headway of 5 min must be maintained between any two trains at any point along the line.
- Dwell time must be applied at each scheduled stop.

Train Type	TPH	Max Velocity ( $\text{km h}^{-1}$ )	Stops	Dwell (min)
Express	2	120	D	7
Local	2	80	All	2.5
Freight	1	60	None	

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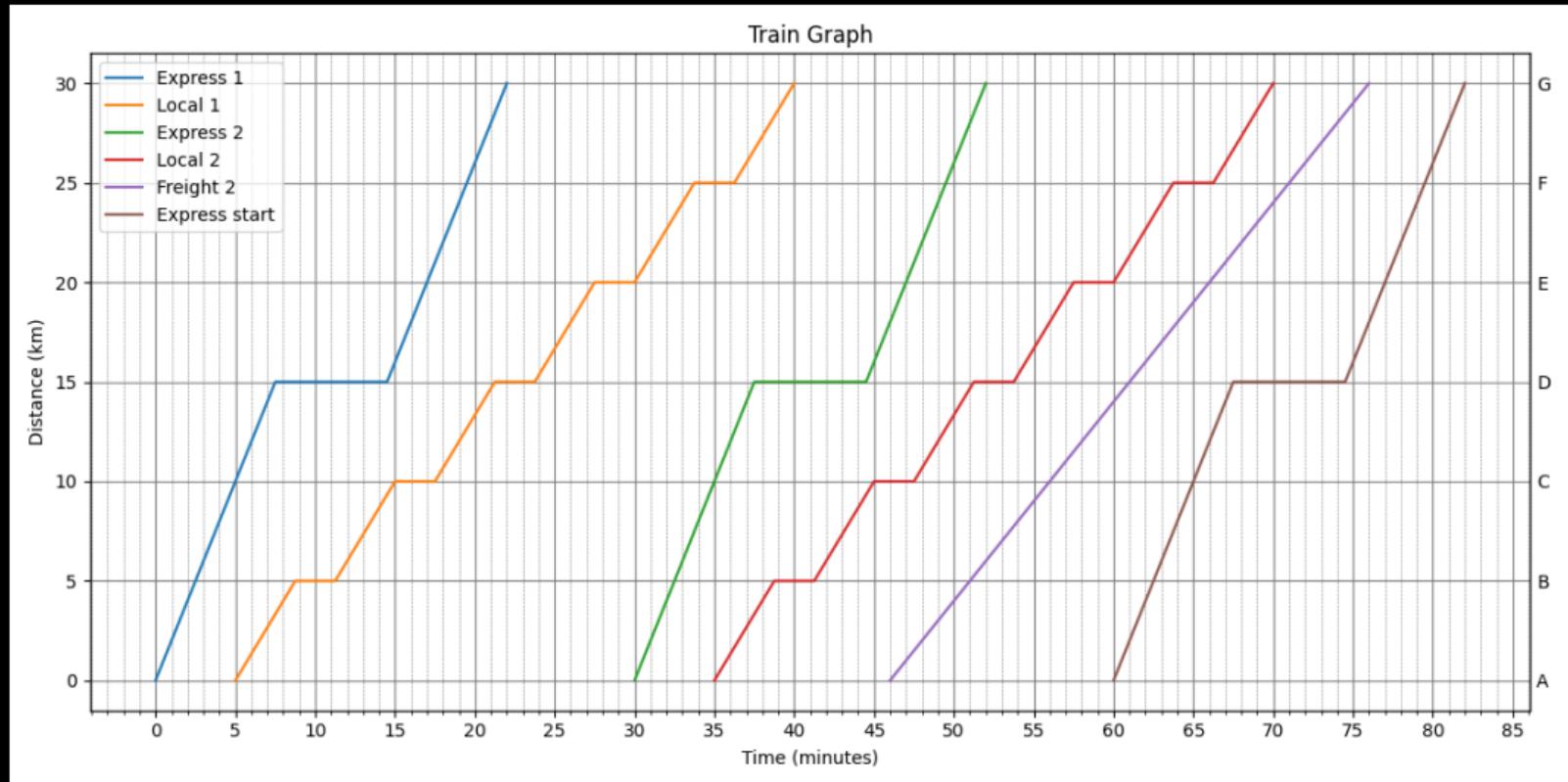
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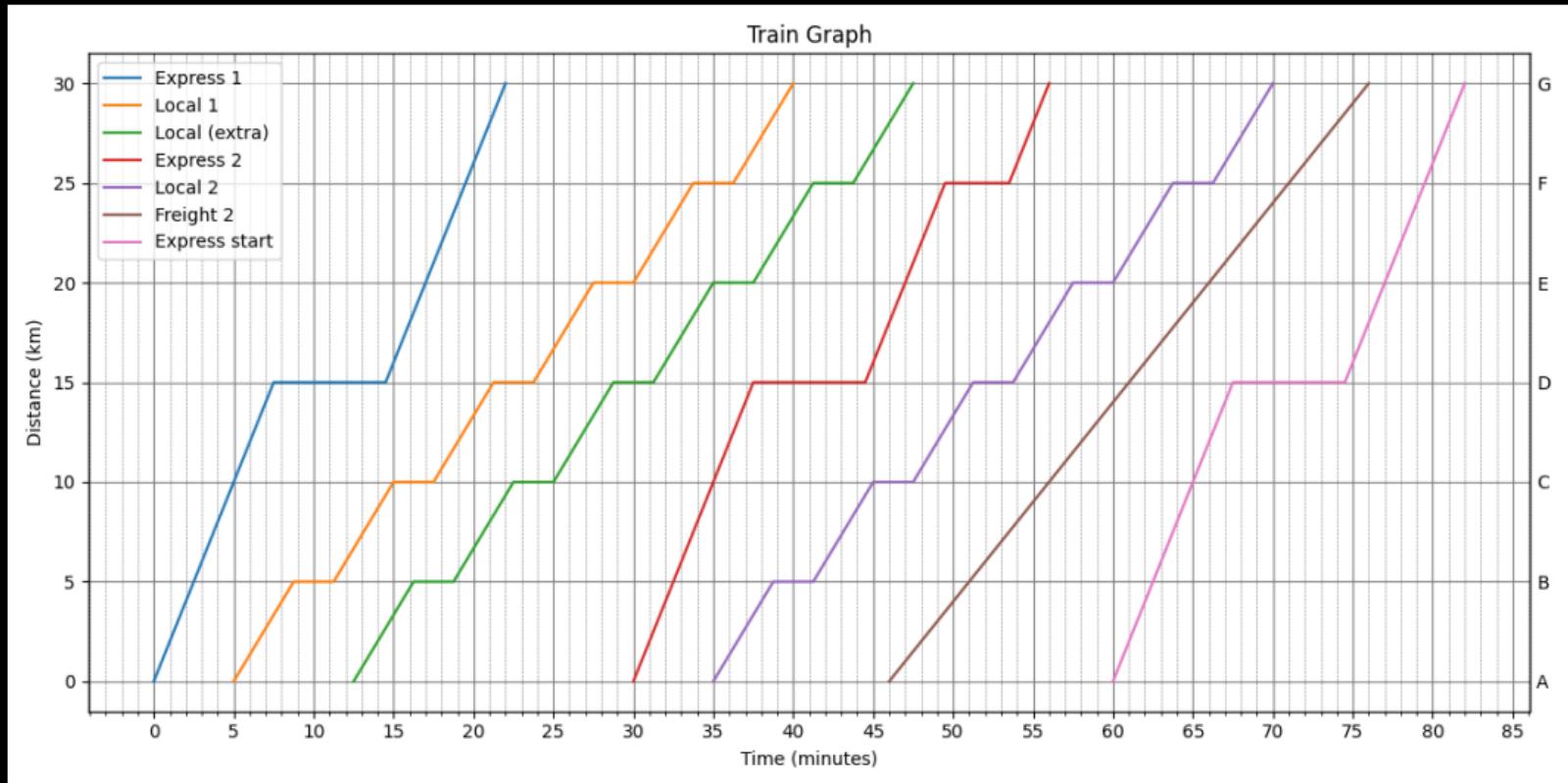
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## Activity: Discussion

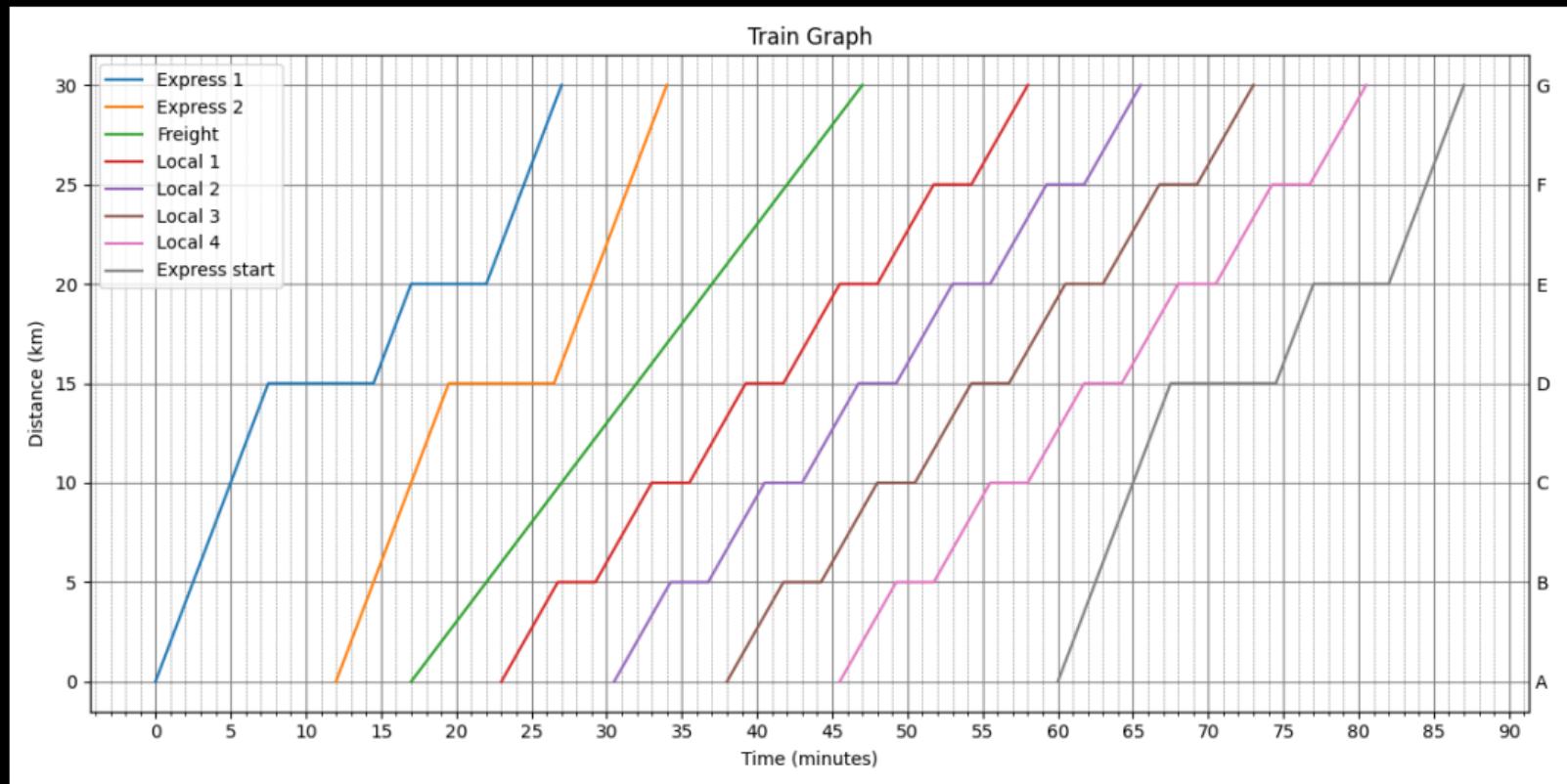
# Activity: My Train Graph - Standard



# Activity: My Train Graph - Extra Local



# Activity: My Train Graph - Grouped



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