ABMS Final Presentation

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Agenda

1. Introduction
2. Literature Review
3. Hypotheses
4. Model Description
5. Parameter Description
6. Results
7. Limitations
8. Conclusion

1.
Introduction

Shared Space

Shared Space

An urban design approach that minimises segregation between road users

Background

Idea is to remove reliance on traffic lights and have roundabouts instead.

The pedestrian walkway and roads are merged.

Rationale

This way, pedestrians and drivers are more cautious.

Saves time on waiting for traffic lights and it is actually more safe.

Stressed

Higher Accident Rate

Why ABMS?

1. Experiments done in real life are dangerous.

2. Allows planner to understand the effects of traffic in the shared space design from a bottom-up approach

Why ABMS?

3. Each agent has its own sensors and perceptors. This allows the planner to create an agent-model, where each agent can react according to their perceptions in the environment.

2.
Literature Review

Shared Space

Examples of past findings

1. High traffic flow discouraged pedestrians from using the carriageway (“roads”)

2. 56% of pedestrians chose to travel around the perimeter for the scheme

3. Pedestrians find it hard to cross the road and stay stuck on the side of the road

How our project contributes

Group 2

Regression

Video Tracking

Survey

ABMS

Despite the different methodologies, all of us hope to improve society's understanding of Shared Spaces

3.
Hypotheses

Shared Space

Hypotheses

A lower speed within shared spaces lead to lower accidents and stress levels.

4.
Model Description

Shared Space

Model Description

1. Initialise agents

2. Move agents

3. Calculate measurements

Model Description

1. **Initialise agents**

    a. Create x and y number of cars and pedestrians every 16 ticks

    b. Each agent will spawn at a random spawn point with a designated goal

Model Description

2. **Move agents (Both)** 

    a. Disappear once they reach their goal

    b. Die if involved in an accident

Model Description

2. **Move agents (Pedestrians)** 

    a. Stop moving / step back if cars are too close to themselves

    b. Move towards a patch that is closest to their goal within their walking distance

Model Description

2. **Move agents (Car)** 

    a. Move towards a patch that is closest to their goal within their current speed

    b. Slow down speed if another car is within their jam break radius

Model Description

3. **Calculate Measurements**

    a. Average stress level

    b. Total number of accidents (accident rate)

    c. Average time taken to reach destination

5.
Parameter Description

Shared Space

Parameter Description

1. The following definition defines our whole model:

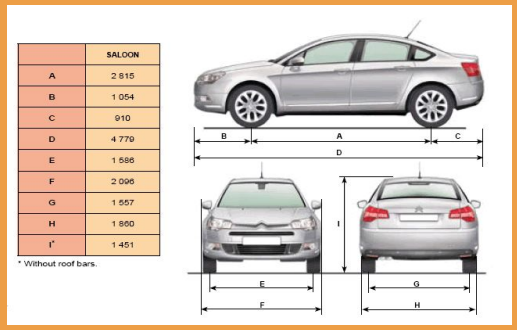
1 patch length = 1m

2. Parameters:
   a. Size
   b. Speed
   c. Visibility Range
   d. Accident avoidance
   e. Footfall / Throughput rate

Size

1 patch length = 1m

*p = patch

Size	Dimension	Supporting
World	80p x 80p	Similar to Elwick Square, UK
Car	4.5p x 2p	
Pedestrian	1.2p x 1.2p	Calculated in relation to size of car

	SALOON
A	2 815
B	1 054
C	910
D	4 779
E	1 586
F	2 096
G	1 557
H	1 860
I*	1 451

* Without roof bars.

Speed

1 patch length = 1m

*p = patch

Our model is quite small, so agents will exit too fast if we model 1 tick = 1s, so we scaled down our model:

1 tick = 0.25s

0.25s = human reaction time

Allows for easy future modelling:
Delay 1 tick = agents' reaction time

Speed	Dimension	Supporting
Car	8.9p/s 2.2p/ticks	
Pedestrian	1.3p/s 0.35p/tick	

Visibility

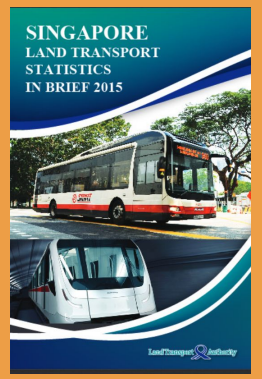
Visibility	Dimension	Supporting
Angle	114 deg (depth perception)	Binocular Vision and Stereopsis 

Range	Key Limitation Humans can actually faintly see a car 3km away (if unobstructed vision) It is hard to model ‘Vision Obstruction’ or ‘Line-of-Sight’ in Netlogo

Accident Avoidance

Action	Dimension	Supporting
Car Jam Break	⅓ Length of car * Cautiousness	**Length of Car** Values estimated from own driving experiences & our consideration that this is a low-speed driving environment (8.9 m/s = 32 km/hr) Sensitivity Analysis also done to ensure that the model runs smoothly at those values **Cautiousness** (default = 1) >1 : Drivers more cautious and react earlier <1 : Drivers less cautious and react later
Pedestrian Stop	Length of car * Cautiousness	
Pedestrian Step Back	⅓ Length of car * Cautiousness	

Footfall / throughput

Visibility	Dimension	Supporting
Cars	1 car / 4s 1 car / 16 ticks	LTA Statistics In Brief 2015 
Pedestrian	1 pedestrian / 4s 1 pedestrian / 16 ticks	Pedestrian flow in urban areas (Kaparias et al, 2015) (Nakamura, 2016)

6.
Results

Shared Space

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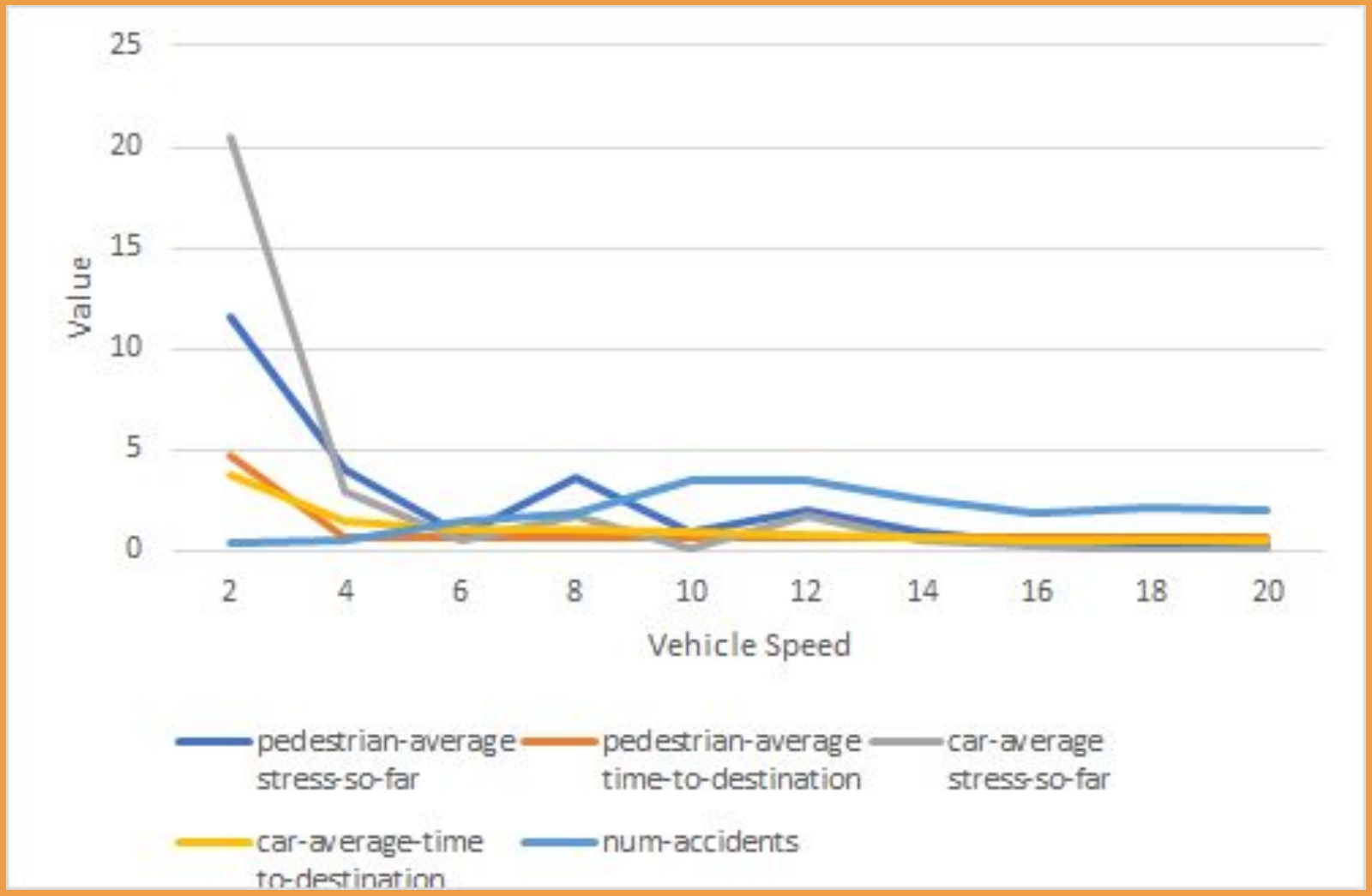
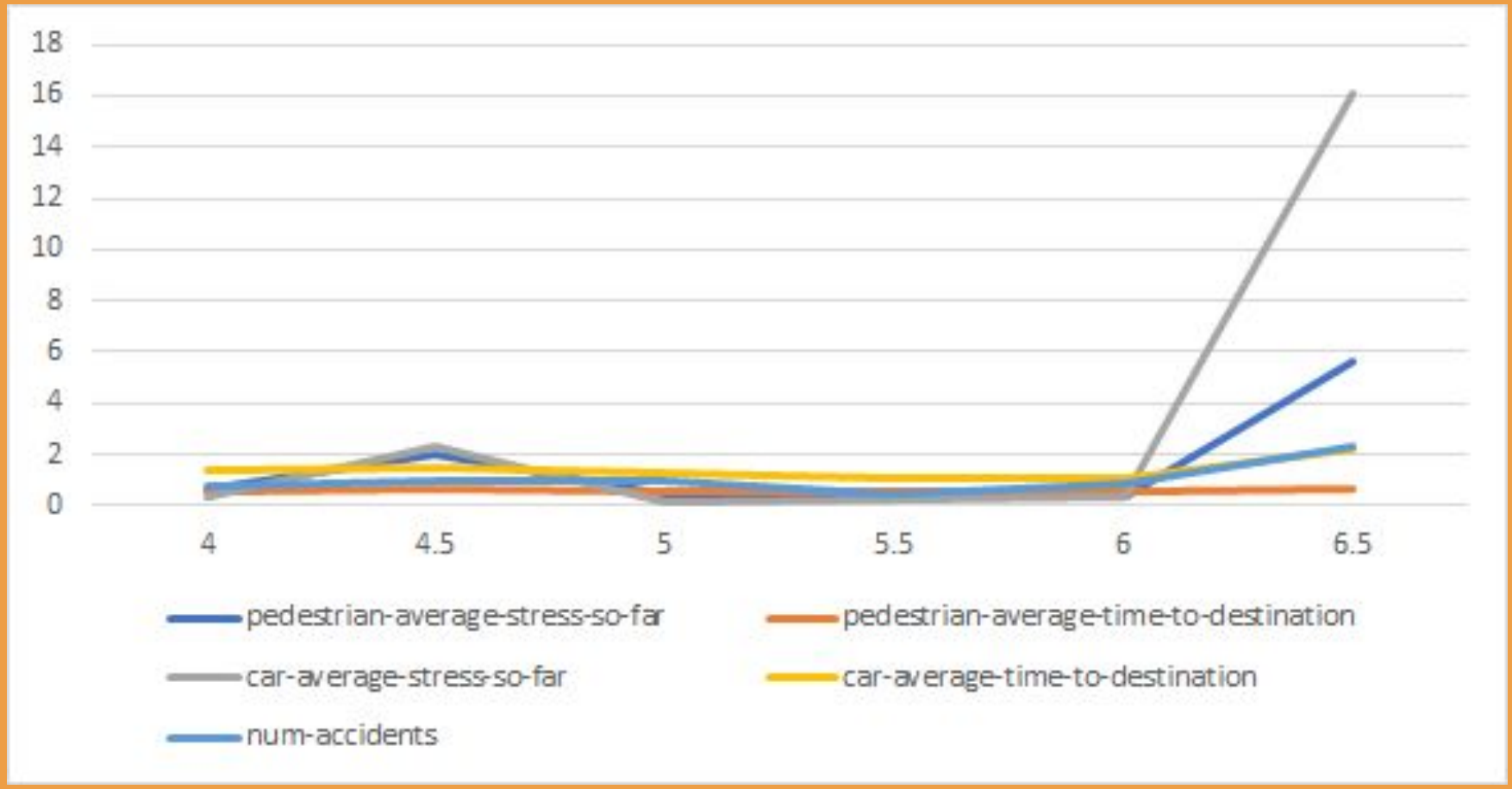
Vehicle Speed Comparison



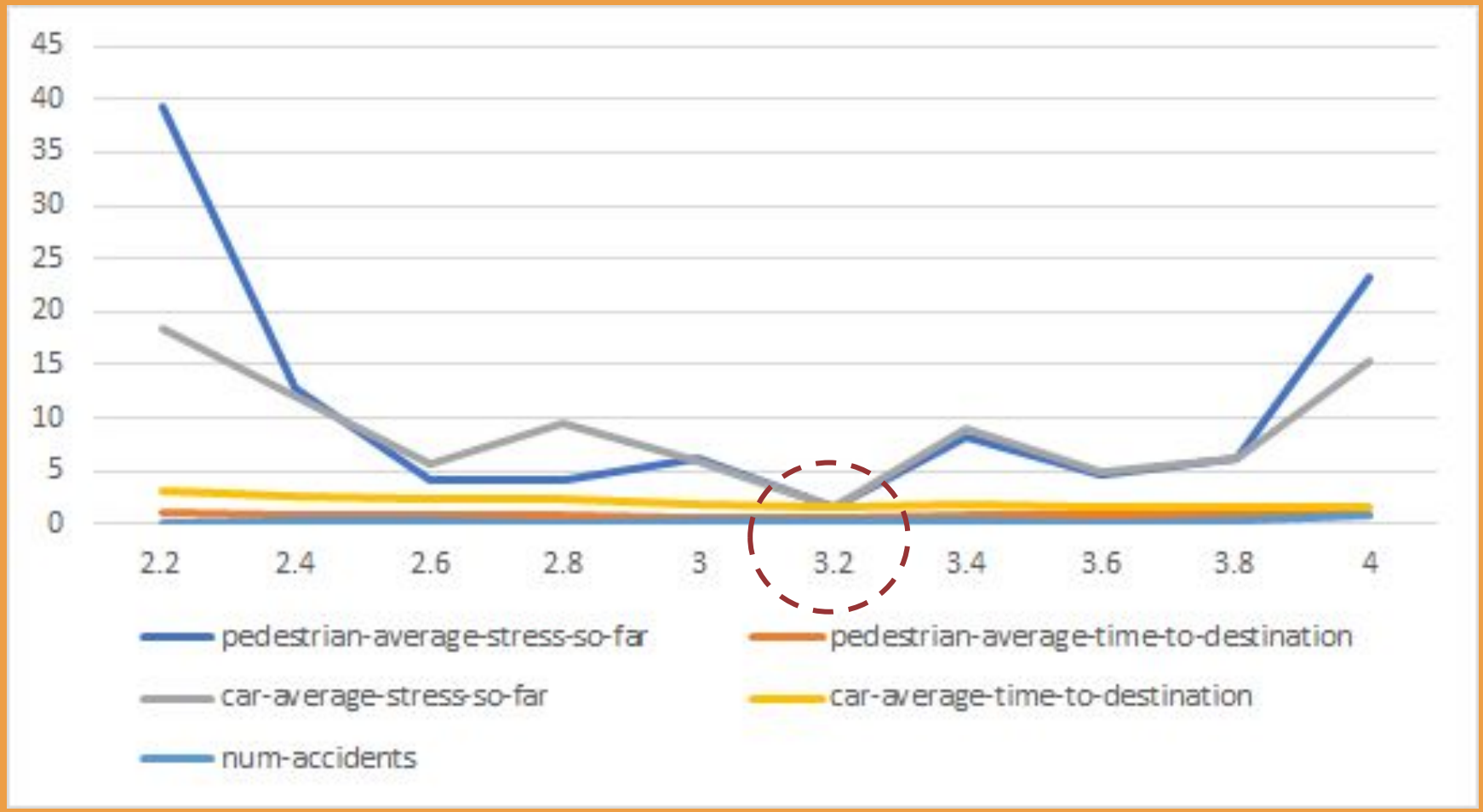
→ **Above 2 and below 8 patch/t:**

Low number of accidents



➔ **Below 6 patch/t :** Low stress level for pedestrian & cars

➔ **Spike at 6.5 p/t?** Stress level for car >> Pedestrain



➔ **Spike at 2.2 p/t?** Stress level for car < < Pedestrain

Conclusion: At **3.2 p/t** - lowest stress level

7. Limitations

Shared Space

Limitations (Modelling)

- Hard to quantify the visibility range of pedestrian
- Cautiousness of pedestrian is dependent on a variety of factors, like alertness, past accident history. It varies on individual's road knowledge

Limitations (Modelling)

- **Detection of collision limited by 4 times per “second”**
- **Unable to model the reality that fast cars are scary and stress-inducing**

Limitations (Shared Space)

- **Pedestrian users, like elderly and children, require supervision when using shared space**
  - **Children: Parent’s concern about safety**
  - **“Elderly and disabled are too scared to cross as they can't move fast enough” (Holmes, 2015)**

8.
Conclusion

Shared Space

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A lower speed within shared spaces
DOES NOT ALWAYS
lead to lower accidents and stress levels.
(i.e. 3.2 patch/tick)

However, implementation of shared space still **requires more survey on the ground**, since traffic condition and road users' behaviour varies across towns, cities and countries.

THANKS!

Any questions?

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References

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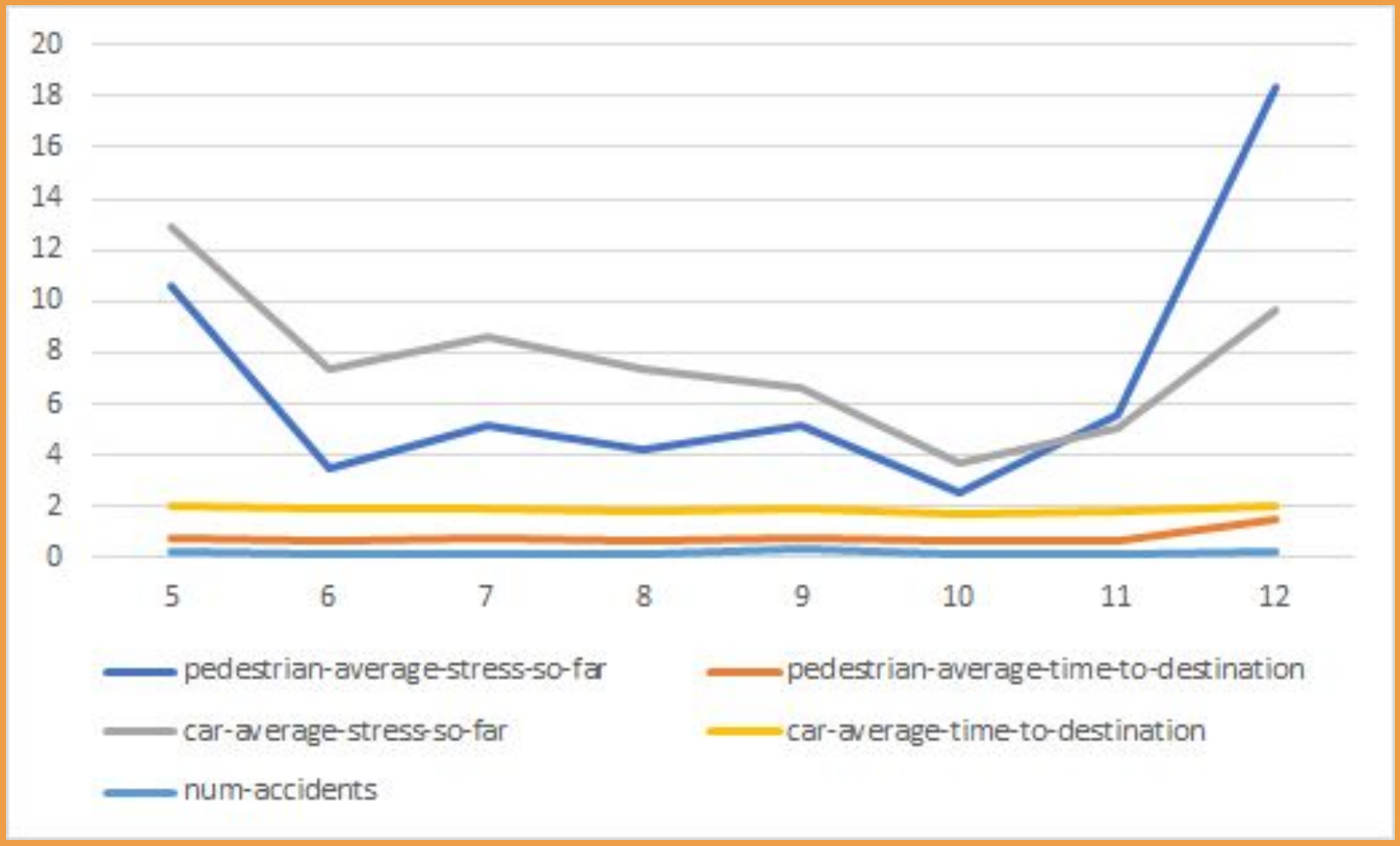
Appendix



Visibility Range (Sensitivity Analysis)