Assessment highlights 2021

General Mathematics

Internal assessment 1

Problem-solving and modelling task

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Assessment overview

Context

The context for this problem-solving and modelling task was based on the premise that speeding is one of the major contributing factors to injuries and fatalities on Queensland roads and that driving a vehicle within the speed limit reduces stopping distance.

Students were provided with access to statistical information about driving speed, reaction distance and braking distance. They were also given links to online simulators to collect extra test results.

The syllabus conditions require a written response of up to 10 pages (including tables, figures and diagrams) and a maximum of 2000 words. The appendixes can include raw data, repeated calculations, evidence of authentication and student notes. However, any information provided in the appendixes is not included in the word count and is not marked.

Task

Students were asked to investigate the relationship between driving speeds and stopping distances in two different locations.

In a written report, students were required to:

- verify and evaluate a model of the relationship between driving speeds and stopping distances in two locations
- make recommendations for safe following distances and speeds in the two identified locations
- demonstrate understanding of subject matter from Unit 3, Topic 1: Bivariate data analysis
- demonstrate the use of technology, analytic procedures and the syllabus problem-solving and mathematical modelling approach to develop their response.

Queensland Government

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Student response

Note: The following sample is an unedited authentic student response produced with permission. Any images or sources that do not have copyright approval have been redacted from the response. The response may contain errors and/or omissions that do not affect its overall match to the characteristics indicated in the top performance levels of the instrument-specific marking guide (ISMG).

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1. Introduction

Due to an increasing number of speeding and road incidents in Australia, the urgent need for quantitative recommendations for safe driving speeds and following distances has become significantly prevalent (Queensland Government, 2018). Therefore, utilising the Least Squares regression method and residual plot analysis, this PSMT will investigate the relationship between driving speed and stopping distance at various speeds in various conditions and driving areas. By developing a linear regression model for the data, a relevant recommendation for safe driving speeds and following distances in wet and dry driving conditions in built-up areas and motorways will be deduced and evaluated in this report.

1.1 Observations

- Insufficient sample space reduces the reliability of research and increases the margin of error (Deziel, 2018).
- An increase in stopping distance is directly related to an increase in Driving Speed (Road Safety Commission, 2020).
- External factors such as driver impairment, vehicle type, tires and the road type can additionally affect the stopping distance.
- Driving Speeds within 40-60km/h is considered to be the speed of a built-up area (Queensland Government, 2020).
- Speeds within 60-100km/h are considered to be the speeds of motorway areas (Queensland Government, 2020).
- Due to a decreased friction, stopping distance in wet weather is increased (Queensland Government, 2020)
- The safest stopping distance in dry conditions is 2 seconds (Queensland Government, 2020).
- The safest stopping distance in wet weather is 4 seconds to allow for appropriate reaction (Queensland Government, 2020).
-

1.2 Assumptions

- Excel will be utilised as the main graphing tool.
- Driving speed will be the Explanatory variable (x) while stopping distance is the response variable (y).
- 20 data points, as a representative sample of 1/5 of 100 for driving speed, reaction distance and braking distance for each roadway type and condition will be collected via the website 'It's a drag' to provide continuity in the statistics determined (Education Services Australia, 2016).
- Stopping distances for built-up areas will be calculated within the driving speed of 40-60km/h to represent driving in this area.
- Stopping distances for motorways will be calculated within the driving speed of 80-100km/h to represent driving in this area.
- Wet and dry road conditions will be used to constitute the bivariate relationship between driving speeds and stopping distances in a 'range of road or driving conditions'.
- Tires, road type and car type/weight will not be considered in calculations.
- The following assumptions of a linear regression model are relevant:
  - The relationship between the explanatory variable (X) and the response variable (Y) is linear.
  - No outliers present.
  - Homoscedasticity is present within the data.
  - Values are numerical.

2. Mathematical Concepts and Results

2.1 Raw data

The stopping distance will be determined via the following formula using the raw data:

$$Stopping\ distance\ (m) = Reaction\ distance\ (m) + Braking\ distance\ (m)$$

This calculation was conducted for each data set, view in the appendix.

2.2 Development of scatterplots and linear regression model

To determine if there is a linear relationship between driving speed and stopping distance, the data will be graphed as a scatterplot in Excel with a linear trendline. The formula of the linear regression, $y = a + bx$, will be calculated by determining the slope of the line (b) and the intercept point (a). These calculations, whilst being validified by Excel, will then be applied to the linear formula, whereby driving speed as the explanatory variable will be substituted into x, and then used calculate the predicted values. To evaluate the reliability of the model, the Correlation Coefficient (r), Coefficient of Determination (R^2) and residuals will be calculated, with the residuals displayed in a residual plot.

2.2.1 Built-up area – Dry conditions

Driving Speed (km/h)

Mean ($\bar{x}$):	$\bar{x} = \frac{\sum x}{n}$ $= \frac{1035}{20}$ = 51.75 km/h
Standard Deviation (S_x)	Calculated using STDEV function in excel: STDEV of $\bar{x} = 6.6481101391\ km/h$

Stopping Distance (m)

($\bar{y}$)	$\bar{y} = \frac{\sum x}{n}$ $= \frac{616}{20}$ = 30.80m
(S_y)	STDEV of $\bar{y} = 7.2227710093\ km/h$

Least Squares Regression

Correlation Coefficient (r)	Calculated using the CORREL function in excel: $r = 0.6105195033$
Coefficient of Determination (R^2)	$R^2 = r \times r$ $= 0.3727340639$

$y = a + bx \quad y = Response\ variable\ \ x = Explanatory\ variable$

Slope of the line (b)	$b = \frac{rs_y}{s_x}$ $b = \frac{0.6105195033\ x\ 7.2227710093}{6.6481101391}$ $= 0.6633$
Intercept point (a)	$a = \bar{y} - b\bar{x}$ $a = 30.80 - (0.6633 \times 51.75)$ = −3.5254

Therefore, the equation of the line is:

$$y = -3.5254 + 0.6633x$$

This is then graphed with a linear trendline, as a scatterplot in Excel.

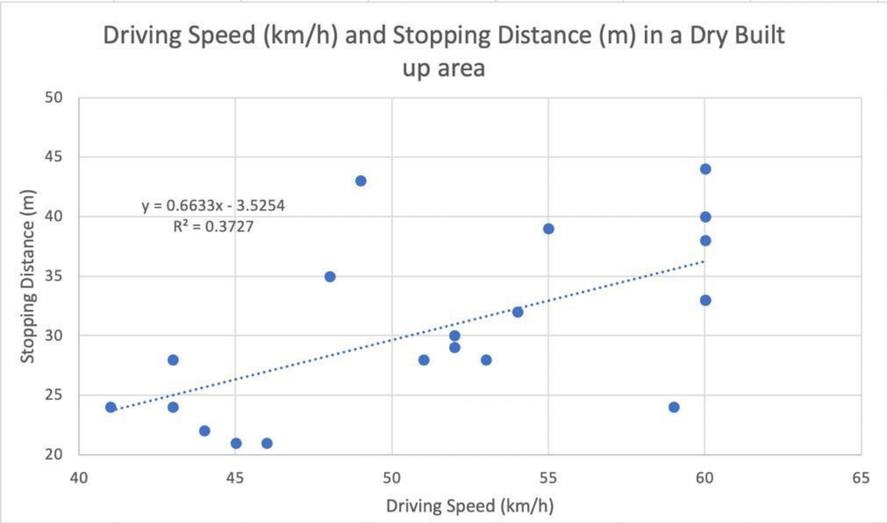

Figure 1 DS v. SD - Dry Built-up area

To determine the estimated values, and to evaluate the models' effectiveness, this formula will be reverse-engineered by substituting the driving speed values into x.

fx =-3.5254+(0.6633*53)

B	C	D
Driving Speed (in km/h)	**Stopping distance (in metres)**	**Estimated values**
53	28	31.63

These values will then be utilised to determine the residuals via the formula:

residual = observed – estimated

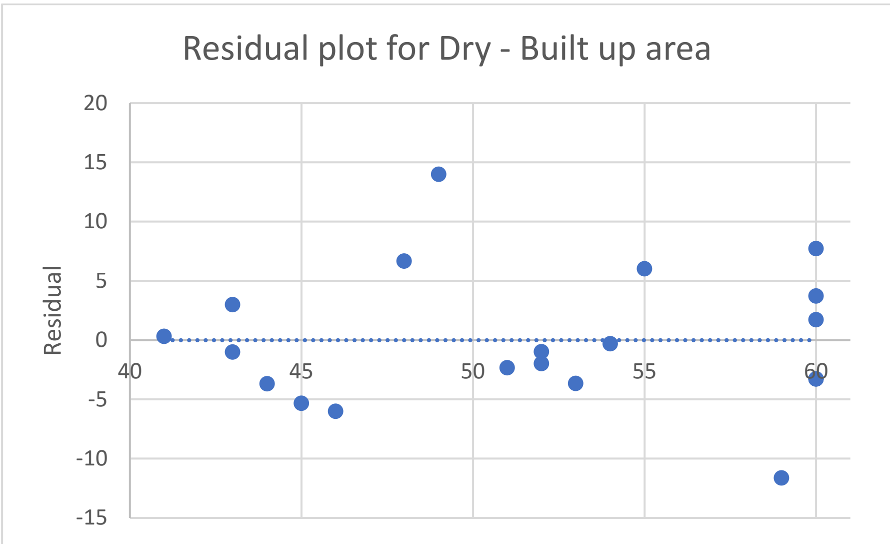

Figure 2 Residual plot - Dry Built-up area

C	D	E
Stopping distance (in metres)	Estimated values	Residuals
28	31.63	-3.63
29	30.97	-1.97
38	36.27	1.73
24	35.61	-11.61
21	26.32	-5.32
44	36.27	7.73
28	25.00	3.00
30	30.97	-0.97
22	25.66	-3.66
21	26.99	-5.99
33	36.27	-3.27
43	28.98	14.02
28	30.30	-2.30
35	28.31	6.69
33	36.27	-3.27
32	32.29	-0.29
24	25.00	-1.00
24	23.67	0.33
39	32.96	6.04
40	36.27	3.73

C	D	E
Stopping distance (in metres)	Estimated values	Residuals
28	=-3.5254+(0.6633*53)	=C2-D2
29	=$B$43+$B$44*B3	=C3-D3
38	=$B$43+$B$44*B4	=C4-D4
24	=$B$43+$B$44*B5	=C5-D5
21	=$B$43+$B$44*B6	=C6-D6
44	=$B$43+$B$44*B7	=C7-D7
28	=$B$43+$B$44*B8	=C8-D8
30	=$B$43+$B$44*B9	=C9-D9
22	=$B$43+$B$44*B10	=C10-D10
21	=$B$43+$B$44*B11	=C11-D11
33	=$B$43+$B$44*B12	=C12-D12
43	=$B$43+$B$44*B13	=C13-D13
28	=$B$43+$B$44*B14	=C14-D14
35	=$B$43+$B$44*B15	=C15-D15
33	=$B$43+$B$44*B16	=C16-D16
32	=$B$43+$B$44*B17	=C17-D17
24	=$B$43+$B$44*B18	=C18-D18
24	=$B$43+$B$44*B19	=C19-D19
39	=$B$43+$B$44*B20	=C20-D20
40	=$B$43+$B$44*B21	=C21-D21

Table 1 Residuals - Dry Built-up area

Following distance:

To provide a recommendable following distance, the average driving speed will first be converted into m/s, and then multiplied by two (representing the 2-second recommendation between vehicles) (Smart Drive Test Inc., 2020).

$$\bar{x} = 51.75\ km/h$$
$$= 51.75 \div 3.6$$
$$= 14.375 m/s$$
$$= 14.375 \times 2\ seconds$$
$$Safe\ following\ distance = 28.75m$$

Therefore, a safe following distance for vehicles in dry conditions in this area is 28.75m. This calculation is repeated to determine safe following distances on dry motorways. All calculations above will be conducted for each data set via excel.

2.2.2 Motorway – Dry conditions

	Driving Speed (in km/h)	Stopping distance (in metres)	Estimated values	Residuals
	82	73	54.81	18.19
	81	47	53.12	-6.12
	100	69	85.10	-16.10
	82	47	54.81	-7.81
	100	64	85.10	-21.10
	82	43	54.81	-11.81
	100	97	85.10	11.90
	94	78	75.00	3.00
	81	35	53.12	-18.12
	94	87	75.00	12.00
	90	54	68.27	-14.27
	86	63	61.54	1.46
	92	83	71.64	11.36
	88	76	64.90	11.10
	82	66	54.81	11.19
	100	94	85.10	8.90
	84	58	58.17	-0.17
	86	78	61.54	16.46
	100	90	85.10	4.90
	91	55	69.95	-14.95
	x	y		
Mean:	89.75	67.85		
STDEV:	7.3475738925	17.7446062969		
r	0.6968507315			
a	-83.1916158908			
b	1.6829149403			
r^2	0.4856009420			

A	B	C	D	E
	Driving Speed (in km/h)	Stopping distance (in metres)	Estimated values	Residuals
	82	73	=$B$31+$B$32*B2	=C2-D2
	81	47	=$B$31+$B$32*B3	=C3-D3
	100	69	=$B$31+$B$32*B4	=C4-D4
	82	47	=$B$31+$B$32*B5	=C5-D5
	100	64	=$B$31+$B$32*B6	=C6-D6
	82	43	=$B$31+$B$32*B7	=C7-D7
	100	97	=$B$31+$B$32*B8	=C8-D8
	94	78	=$B$31+$B$32*B9	=C9-D9
	81	35	=$B$31+$B$32*B10	=C10-D10
	94	87	=$B$31+$B$32*B11	=C11-D11
	90	54	=$B$31+$B$32*B12	=C12-D12
	86	63	=$B$31+$B$32*B13	=C13-D13
	92	83	=$B$31+$B$32*B14	=C14-D14
	88	76	=$B$31+$B$32*B15	=C15-D15
	82	66	=$B$31+$B$32*B16	=C16-D16
	100	94	=$B$31+$B$32*B17	=C17-D17
	84	58	=$B$31+$B$32*B18	=C18-D18
	86	78	=$B$31+$B$32*B19	=C19-D19
	100	90	=$B$31+$B$32*B20	=C20-D20
	91	55	=$B$31+$B$32*B21	=C21-D21
	x	y		
Mean:	=AVERAGE(B2:B36)	=AVERAGE(C2:C36)		
STDEV:	=STDEV(B2:B36)	=STDEV(C2:C36)		
r	=CORREL(B2:B36,C2:C3			
a	=C26-B32*B26			
b	=(B29*C27)/B27			
r^2	=B29*B29			

Table 2 Processed data - Dry Motorway

$$y = -83.192 + 1.6829x$$

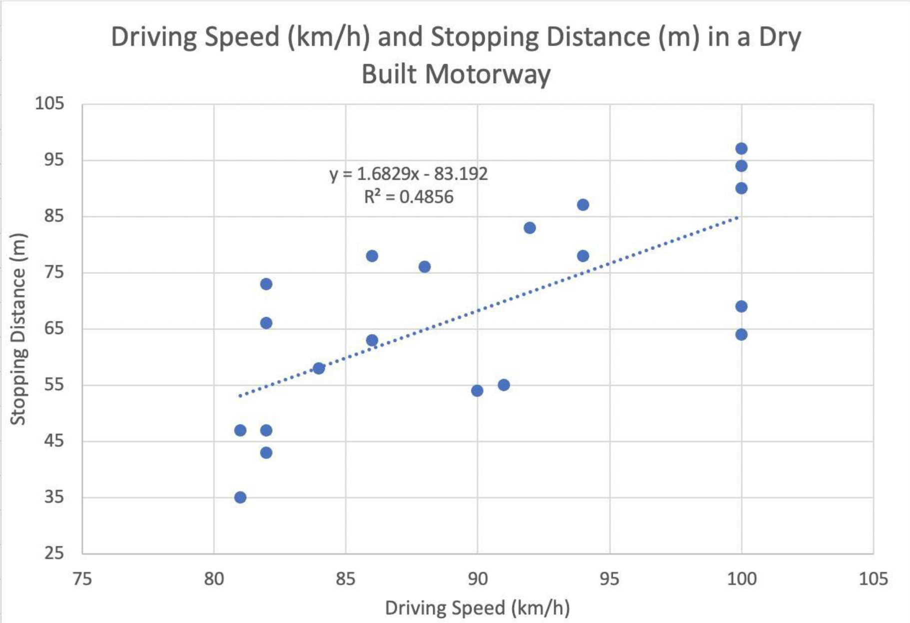

Figure 3 DS v. SD - Dry Motorway

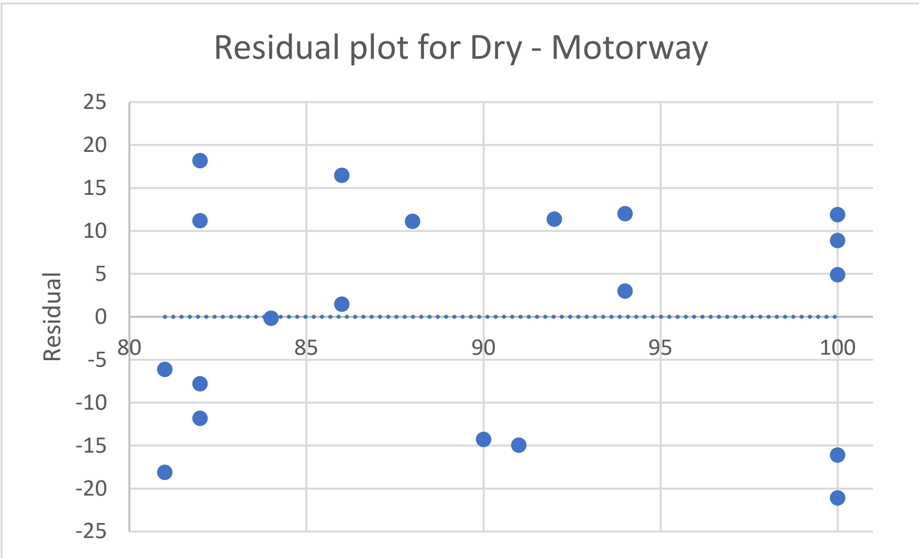

Figure 4 Residual plot - Dry Motorway

Following distance:

	x
Mean:	89.75
In m/s:	24.9305555556
Safe following distance (m):	49.8611111111

	x
Mean:	=AVERAGE(B2:B21)
In m/s:	=B43/3.6
Safe following distance (m):	=B44*2

2.2.3 Built-up area – Wet conditions

A	B	C	D	E
	Driving Speed (in km/h)	Stopping distance (in metres)	Estimated values	Residuals
	42	25	22.31	2.69
	51	32	30.40	1.60
	50	15	29.50	-14.50
	41	17	21.42	-4.42
	54	32	33.10	-1.10
	60	37	38.49	-1.49
	49	41	28.60	12.40
	56	49	34.89	14.11
	60	38	38.49	-0.49
	50	26	29.50	-3.50
	47	25	26.81	-1.81
	60	16	38.49	-22.49
	52	28	31.30	-3.30
	43	19	23.21	-4.21
	50	32	29.50	2.50
	44	30	24.11	5.89
	44	28	24.11	3.89
	59	49	37.59	11.41
	60	46	38.49	7.51
	48	23	27.70	-4.70
	x	y		
Mean:	51	30.40		
STDEV:	6.4807406984	10.3993926948		
r	0.5599289617			
a	-15.4233082707			
b	0.8984962406			
r^2	0.3135204421			

	Driving Speed (in km/h)	Stopping distance (in metres)	Estimated values	Residuals
	42	25	=$B$31+$B$32*B2	=C2-D2
	51	32	=$B$31+$B$32*B3	=C3-D3
	50	15	=$B$31+$B$32*B4	=C4-D4
	41	17	=$B$31+$B$32*B5	=C5-D5
	54	32	=$B$31+$B$32*B6	=C6-D6
	60	37	=$B$31+$B$32*B7	=C7-D7
	49	41	=$B$31+$B$32*B8	=C8-D8
	56	49	=$B$31+$B$32*B9	=C9-D9
	60	38	=$B$31+$B$32*B10	=C10-D10
	50	26	=$B$31+$B$32*B11	=C11-D11
	47	25	=$B$31+$B$32*B12	=C12-D12
	60	16	=$B$31+$B$32*B13	=C13-D13
	52	28	=$B$31+$B$32*B14	=C14-D14
	43	19	=$B$31+$B$32*B15	=C15-D15
	50	32	=$B$31+$B$32*B16	=C16-D16
	44	30	=$B$31+$B$32*B17	=C17-D17
	44	28	=$B$31+$B$32*B18	=C18-D18
	59	49	=$B$31+$B$32*B19	=C19-D19
	60	46	=$B$31+$B$32*B20	=C20-D20
	48	23	=$B$31+$B$32*B21	=C21-D21
	x	y		
Mean:	=AVERAGE(B2:B36)	=AVERAGE(C2:C36)		
STDEV:	=STDEV(B2:B36)	=STDEV(C2:C36)		
r	=CORREL(B2:B36,C2:C3			
a	=C26-B32*B26			
b	=(B29*C27)/B27			
r^2	=B29*B29			

Table 3 Processed data - Wet Built-up area

$$y = -15.4213 + 0.8985x$$

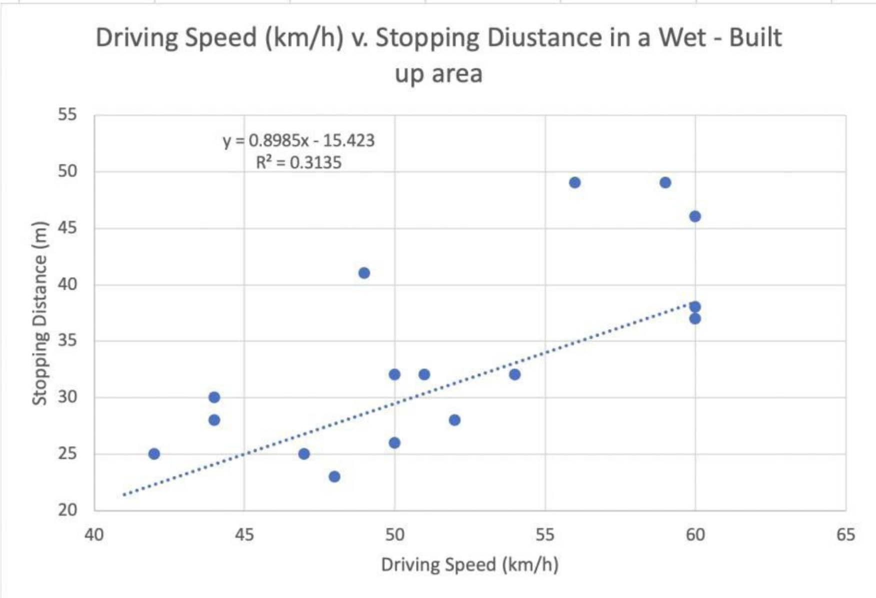

Figure 5 DS v. SD - Wet Built-up area

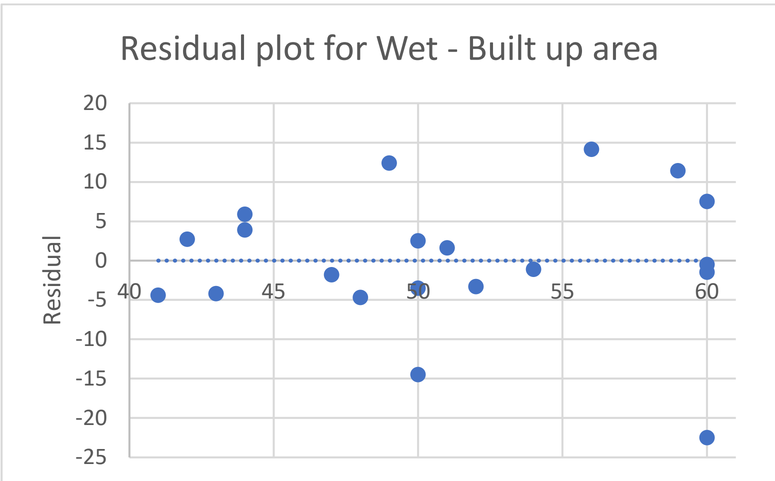

Figure 6 Residual plot - Wet Built-up area

Following Distance:
The calculations for following distances in wet conditions will be appropriately adjusted to coincide with government recommendations (Queensland Government, 2020). The average driving speed in m/s will now be multiplied by 4, representing the increased following distance in seconds recommended.

$$\bar{x} = 51m/h$$
$$= 51 \div 3.6$$
$$= 14.1667m/s$$
$$= 14.1667 \times 4\ seconds$$
$$Safe\ following\ distance = 56.6668m$$

This process is repeated for wet motorway.

2.2.4 Motorway – Wet conditions

	Driving Speed (in km/h)	Stopping distance (in metre	Estimated values	Residuals
	82	66	66.50	-0.50
	93	77	85.47	-8.47
	80	54	63.05	-9.05
	100	99	97.55	1.45
	94	87	87.20	-0.20
	82	79	66.50	12.50
	84	83	69.95	13.05
	100	99	97.55	1.45
	81	59	64.78	-5.78
	96	93	90.65	2.35
	85	68	71.68	-3.68
	100	96	97.55	-1.55
	87	64	75.13	-11.13
	100	98	97.55	0.45
	80	56	63.05	-7.05
	84	72	69.95	2.05
	93	82	85.47	-3.47
	90	85	80.30	4.70
	100	92	97.55	-5.55
	89	97	78.58	18.42
Mean:	90.0000000000	80.30		
STDEV:	7.5602840381	15.1348326021		
r	0.8615261069			
a	-74.9209944760			
b	1.7246777164			
r^2	0.7422272329			

	Driving Speed (in km/h)	Stopping distance (in metres)	Estimated values	Residuals
	82	66	=$B$30+$B$31*B2	=C2-D2
	93	77	=$B$30+$B$31*B3	=C3-D3
	80	54	=$B$30+$B$31*B4	=C4-D4
	100	99	=$B$30+$B$31*B5	=C5-D5
	94	87	=$B$30+$B$31*B6	=C6-D6
	82	79	=$B$30+$B$31*B7	=C7-D7
	84	83	=$B$30+$B$31*B8	=C8-D8
	100	99	=$B$30+$B$31*B9	=C9-D9
	81	59	=$B$30+$B$31*B10	=C10-D10
	96	93	=$B$30+$B$31*B11	=C11-D11
	85	68	=$B$30+$B$31*B12	=C12-D12
	100	96	=$B$30+$B$31*B13	=C13-D13
	87	64	=$B$30+$B$31*B14	=C14-D14
	100	98	=$B$30+$B$31*B15	=C15-D15
	80	56	=$B$30+$B$31*B16	=C16-D16
	84	72	=$B$30+$B$31*B17	=C17-D17
	93	82	=$B$30+$B$31*B18	=C18-D18
	90	85	=$B$30+$B$31*B19	=C19-D19
	100	92	=$B$30+$B$31*B20	=C20-D20
	x	y		
Mean:	=AVERAGE(B2:B24)	=AVERAGE(C2:C24)		
STDEV:	=STDEV(B2:B24)	=STDEV(C2:C24)		
r	=CORREL(B2:B24,C2:C2			
a	=C25-B31*B25			
b	=(B28*C26)/B26			
r^2	=B28*B28			

Table 4 Processed data - Wet Motorway

$$y = -74.921 + 1.7247x$$

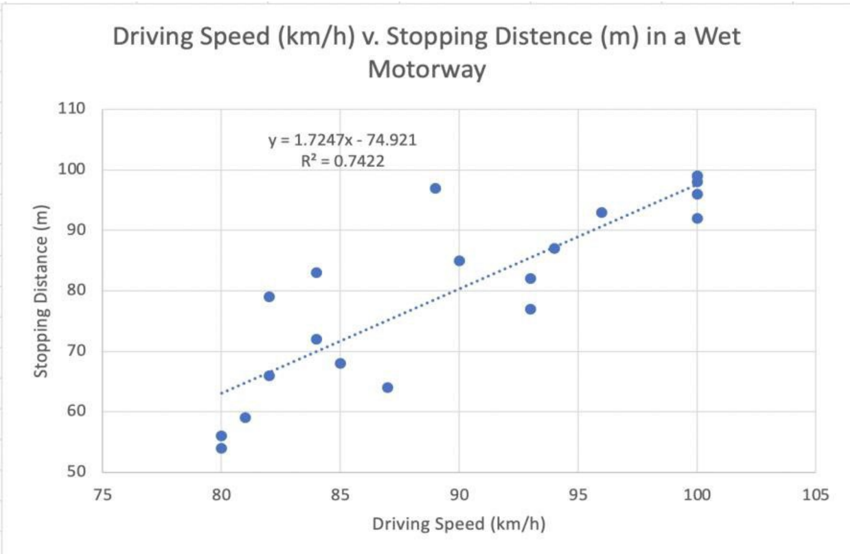

Figure 7 DS v. SD - Wet Motorway

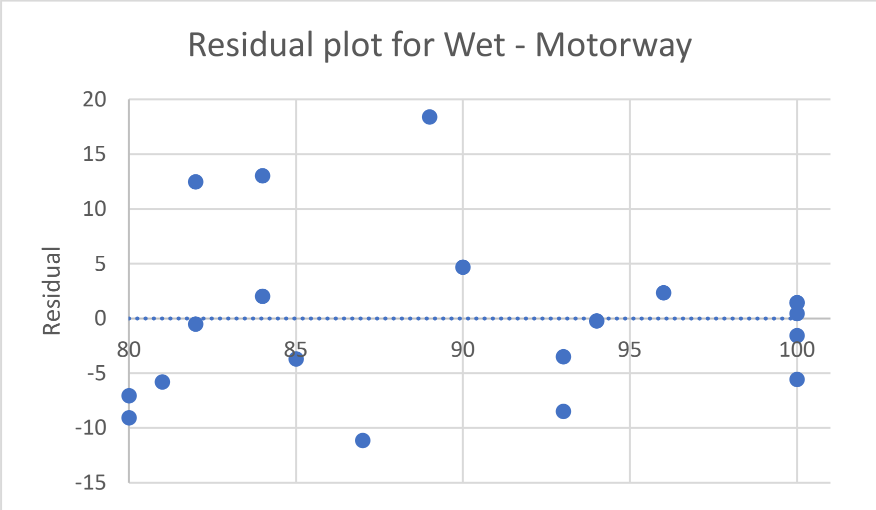

Figure 8 Residual plot - Wet Motorway

Following distance:

	x
Mean:	90.0526315789
In m/s:	25.0146198830
Safe following distance (m)	100.0584795322

	x
Mean:	=AVERAGE(B2:B20)
In m/s:	=B40/3.6
Safe following distance (m)	=B41*4

3. Discussion

For both road areas in dry conditions, a linear relationship was present between the variables. The built-up area scatterplot demonstrated a moderate, positive, linear association, deduced by the correlation coefficient 0.6105. The Coefficient of determination however identified only 37% of the variation in stopping distance is explained by the variation in driving speeds, indicating driving speed is not very explanatory of the variation in the stopping distance. The linear equation, developed as $y = -3.524 + 0.6633x$, indicated that, if the Driving speed of the vehicle was 0km/h, the stopping distance would be a predicted -3.524m. As the speed of the vehicle increased, however, the stopping distance will increase at a corresponding 0.6633m. This model allowed the calculation of a suitable following distance for a built-up area in dry conditions is an estimated 28.75m from the car in front. Similarly, the scatterplot for a motorway in dry conditions demonstrated another moderate, positive linear association between the two variables provided by the correlation coefficient of 0.6969. The coefficient of determination identified that only 48% of the variation in stopping distance is explained by the variation in driving speeds in a dry motorway. This relatively low R^2 for both roadways in dry conditions is indicative of the relationship of low explanation of driving speed in the variation of stopping distance in dry conditions (Frost, 2020). However, the linear relationship between the variables in dry conditions is reinforced by the residual plots, which both demonstrate a random pattern and distribution. The regression equation of $y = -83.192 + 1.6829x$ identified that, if the driving speed on a motorway during dry conditions was 0km/h, the stopping distance would be a predicted - 83.192m and would increase at a rate of 1.6829m as driving speed increased. Finally, the motorway model identified that the safe following distance on a dry motorway is an estimated 49m.

For wet road conditions, similar linear relationships were identified. The scatterplot for a built-up area demonstrated a moderate, positive, linear association with a correlation coefficient of 0.5599. The coefficient of determination identified that only 35% of the variation in stopping distance is explained by the variation in driving speeds in this area. The residual plot, however, demonstrated a randomly distributed pattern of residual values, indicating a strong linear relationship. The regression equation for the data, $y = -15.4213 + 0.8985x$, identified that, if the speed of the vehicle was 0km/h, the stopping distance would be -15.4213m, and would increase at a rate of 0.8985m as the speed increased. This predicted value is 0.2217m higher than the estimated slope of the line for the dry built- up area, coinciding with the observations that reduced friction contributes to a longer stopping distance (Queensland Government, 2020). The safe following distance was determined to be 56.69m. For a wet motorway, the scatterplot and relationship demonstrated an unprecedented strong, positive linear association with an extremely high correlation coefficient value of 0.8615. This contributes to the coefficient of determination of 74%, demonstrating that most of the variation in stopping distance is explained by the variation in driving speeds. This R^2 value is 39% higher than the variability in the wet built-up area, representing the strongest linear model in this investigation. Furthermore, the regression equation of $y = -74.921 + 1.7247x$ identified that, at a speed of 0km/h, the stopping distance would be a predicted 74.921m and would increase at a rate of 1.7247m as the driving speed increased. This relationship between the variables additionally indicated that stopping distance increases a rate of 0.058m higher than dry motorways. The linear relationship of both models is reinforced by the residual plots, which equally demonstrated a random residual pattern. Finally, the model identified that the safe following distance on a wet motorway is an estimated 49m.

While this mathematical model allows the identification of a suitable following distance for each roadway and driving condition, it does not provide a recommendation for safe driving speed. The most appropriate recommendation is to follow the signs provided by the state government. In Queensland, for built-up areas, the legal driving speed is 50km/h, and for motorways, 80-100km/h (Queensland Government, 2020). For wet weather conditions, the government recommends that the driver lower their speeds from these limits by at least 10km/h (Queensland Government, 2020).

4. Evaluation

Strengths:

A major strength of this model is the conformity of the data to the assumptions of linear regression. Due to the absence of outliers, a linear relationship between the variables, homoscedasticity of the data, and random residual plots, the linear regression model was the appropriate method to investigate the bivariate relationship between driving speed and stopping distance (Stat Trek, 2020).. Instead of sole reliance on R^2 to determine the statistical variability, these mathematical models employed the use of residual plots to interpolate the reliability and accuracy of the models determined. Additionally, by maintaining a consistent speed bracket for both road areas that represents the speeds of the state, the models' recommendations apply effectively (Queensland Government, 2020). Furthermore, as the recommendations of this model are founded upon reliable road safe sources, the model recommendations coincide with the governments' guidelines, validifying their suitability in a modern context. Additionally, the provision of reliable data from the website 'It's a Drag' allowed the investigation stopping distance at various speeds in various driving conditions (Education Services Australia, 2016).

Limitations:

The linear regression model has several limitations that impacts its use in the modern context. Because there is no statistical basis to assume that the linear regression model will apply to future driving speeds and subsequent stopping distances, the limitation to only current sample data limits the model's suitability for proving future relationships (Aivaz Kamer-Ainur, 2020). If speeds increased and organisations needed to apply this model to recommend safe driving speed and following distance, the model will be statistically unreliable (Aivaz Kamer-Ainur, 2020). The relationships identified by the two variables are also heavily hindered by this investigations' inadequate sample space. As the sample space for each roadway and condition is limited to 20 data points obtained from the one website and the same person, the margin of error and power of the study is reduced in determining the relationship between the variables (Deziel, 2018). This limitation is exacerbated by the potential unreliability of the simulator, which could potentially invalidate the mathematical relationships identified in this report (Deziel, 2018). Additionally, by limiting the investigation to only two external conditions, set speeds, and not assessing other conditions such as road type or vehicle, this solutions' practicality in a wide range of road conditions that can impact driving speed and stopping distance is very limited.

5. Conclusion

This PSMT aimed to investigate the bivariate relationship between driving speed and stopping distance in a range of driving conditions on built-up areas and motorways. By analysing this relationship, the solution aimed to provide a suitable recommendation for safe driving speed and following distances within the areas under the driving conditions. The calculations identified and developed by this model provided a mathematical solution to the relationship identified and appropriately addressed this relationship. However, as highlighted above, due to the limitations present within the model, the significance and future practicality of the model limits its use in future situations.

6. Appendix

Raw data:

Dry conditions

Driving Speed (in km/h)	Reaction distance (in metres)	Braking Distance (in metres)	Stopping distance (in metres)		Driving Speed (in km/h)	Reaction distance (in metres)	Braking Distance (in metres)	Stopping distance (in metres)
53	8	20	28		82	39	34	73
52	16	13	29		81	21	26	47
60	25	13	38		100	16	53	69
59	11	13	24		82	13	34	47
45	7	14	21		100	11	53	64
60	25	19	44		82	17	26	43
43	20	8	28		100	44	53	97
52	26	4	30		94	52	26	78
44	14	8	22		81	22	13	35
46	13	8	21		94	44	43	87
60	14	19	33		90	35	19	54
49	35	8	43		86	20	43	63
51	15	13	28		92	40	43	83
48	31	4	35		88	34	42	76
60	14	19	33		82	40	26	66
54	10	22	32		100	41	53	94
43	16	8	24		84	24	34	58
41	11	13	24		86	44	34	78
55	26	13	39		100	50	40	90
60	28	12	40		91	35	20	55
	BUILT UP AREA					MOTORWAY		

Wet conditions

Driving Speed (in km/h)	Reaction distance (in metres)	Braking Distance (in metres)	Stopping distance (in metres)		Driving Speed (in km	Reaction distance (in metres)	Braking Distance (in metres)	Stopping distance (in metres)
42	5	20	25		82	15	51	66
51	12	20	32		93	12	65	77
50	8	7	15		80	15	39	54
41	5	12	17		100	19	80	99
54	12	20	32		94	22	65	87
60	9	28	37		82	19	60	79
49	29	12	41		84	20	63	83
56	29	20	49		100	19	80	99
60	10	28	38		81	8	51	59
50	6	20	26		96	13	80	93
47	13	12	25		85	17	51	68
60	4	12	16		100	16	80	96
52	8	20	28		87	13	51	64
43	7	12	19		100	16	82	98
50	17	15	32		80	17	39	56
44	18	12	30		84	10	62	72
44	9	19	28		93	17	65	82
59	29	20	49		90	20	65	85
60	21	25	46		100	18	74	92
48	11	12	23		89	19	78	97
	BUILT UP AREA					MOTORWAY		

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