A

STATISTICAL REPORT

ON

THE IMPACT AND BENEFITS OF CAR FREE DAY ON THE RHONDDA CYNON TAF BOROUGH USING STATISTICAL EVIDENCE.

BY

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ABSTRACT

The high impact of road transport on the environment calls for both scientific and social policies to control carbon and greenhouse gas emissions. The goal of this research is to study cars and taxis as a top contributor to CO_2 emissions and reiterate the importance of putting policies in place to reduce car use. The CO, CO_2 and greenhouse gas emissions were assessed in relation to local, national and International emissions. This study investigated the contribution of road transport to the overall Carbon emissions in order to highlight the need for a different approach to reducing air pollution through individual and communal responsibility.

1. Introduction

Air pollution is of great threat to the planet and public health, on account of its impact on climate change and public health due to increased morbidity and mortality (Manisalidis et al., 2011). A car-free day has been proposed in a bid to tackle the issue of air pollution. According to Environmental Protection UK, UK road transport accounts for 22% of total UK emissions of CO_2 a major contributor to climate change (Hazel and David, 2019). Emissions from transport are rising faster than from other energy-using sectors and are predicted to increase by 80% between 2007 and 2030 (R Kahn, SS Kobayashi, M Beuthe, et al.,2007). The high impact of road transport on the environment calls for both scientific and social policies to control Carbon emissions. The goal of this research is to study cars as a high contributor to CO_2 emissions and reiterate the importance of putting policies in place to reduce car use. We aim to find statistical evidence supporting a car free day.

2. Methods and Methodology

To achieve the goal of this study, The Two-sample t-test a technique used to test for differences between two populations, was used to test differences in Carbon emissions from the different road types in Rhondda Cynon Taf. The one-way ANOVA is used to test the differences in the means of two or more datasets and was used to analyse the differences in the 5 major modes of road transport in the UK. G20 countries are considered the most technologically advanced countries, leading policies such as the Paris Agreement tackling greenhouse gas emissions. The World emission data was grouped into G20 countries and the other 119 countries captured in the dataset to see correlation between the G20 nations and rest of the world in terms of Carbon emissions from transport. A statistical software, SAS, was used to perform the statistical analysis.

3. Exploratory Data Analysis

Key Findings from datasets on CO_2 emissions from Rhondda Cynon Taf County Borough

Column name	Description
Year	The year the emission level was measured
Volume_Emissions	The volume of the CO_2 emissions measured for a particular year
Road_Type	The motor road type of measurement.

Table 3.1: Data description for CO2 emissions from Rhondda Cynon Taf County Borough

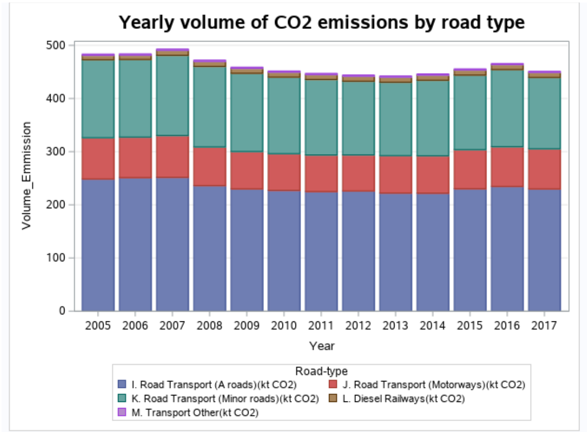


Fig 3.1

- CO_2 emissions by road type in Fig 3.1 showed that total emission from all road types in this dataset is approximately within the range of 400 – 500 Kilo Tonnes of CO_2 over the years captured.
- I.Road Transport (Major roads) contributes the largest amount of CO_2 yearly.
- K.Road(Minor roads) Transport is the next road type with the highest CO_2 emission with an average of 143.6 Kilo Tonnes yearly.
- M.Transport have the least CO_2 emissions with an average of 2 Kilo Tonnes yearly.
- I.Road Transport has values more spread out than the rest of the road type has shown by standard deviation values here, in the appendix.

Key Findings from the dataset on Yearly Carbon emissions from the different vehicle types in the U.K

Column name	Description
Year	The year the CO emission level was measured
Cars and Taxis (Thousand Tonnes)	The volume of the CO emissions measured for cars and taxis in a specific year. Measured in Thousand Tonnes of CO
LGVs(vans)(Thousand Tonnes)	The volume of the CO emissions measured for LGVs in a specific year. Measured in Thousand Tonnes of CO
HGVs (Thousand Tonnes)	The volume of the CO emissions measured for HGVs in a specific year. Measured in Thousand Tonnes of CO
Buses and Coaches (Thousand Tonnes)	The volume of the CO emissions measured for Buses and Coaches in a specific year. Measured in Thousand Tonnes of CO
Motorcycles & Mopeds (Thousand Tonnes)	The volume of the CO emissions measured for cars and taxis in a specific year. Measured in Thousand Tonnes of CO
Pollutants	The type of the pollutants measured.

Table 3.2 : Data description for yearly CO emissions in the United Kingdom

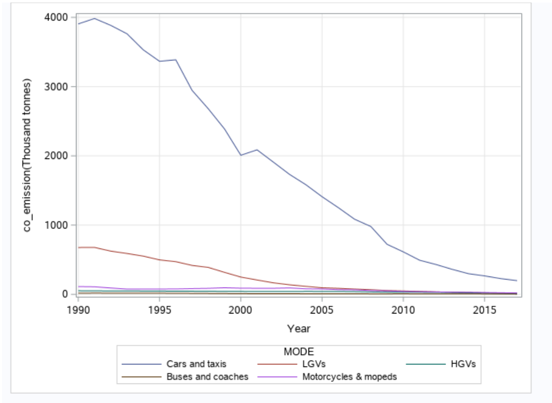


Fig 3.2: Time series plot for total emissions by transport type

- In Fig 3.2 Cars and Taxis are the largest contributors to the total CO emissions with an average yearly emission of around 1839 Thousand tonnes which is around 9 times the value of the second-highest which are Large Goods Vehicles with average yearly emission of approximately 240 Thousand tonnes. The values measured for Cars and Taxis along with that of LGVs has more variance than the other means of transport. This figure also shows that we have a downward trend in emissions from cars (and taxis) and LGVs.

- The result of a goodness-fit test Found here in the appendix, on the volume of yearly emissions reveals we have enough evidence to reject the null hypothesis on normality, and a pairwise scatterplot of the variables reveals that we have some correlation between the different variables in the sample.

Key Findings from dataset Yearly Greenhouse gas emissions by transport from G20 vs Rest of the world transport.

Column name	Description
Year	The year the emission level was measured
G20_GHG(MtCO)	The sum of the greenhouse gas emissions measured for all G20 nations. Measured in Million Tonnes of CO.
REST_GHG(MtCO)	The sum of the greenhouse gas emissions measured for the rest of the world. Measured in Million Tonnes of CO.

Table 3.3: Data description for year Yearly Greenhouse gas emissions by G20 countries and rest of the world

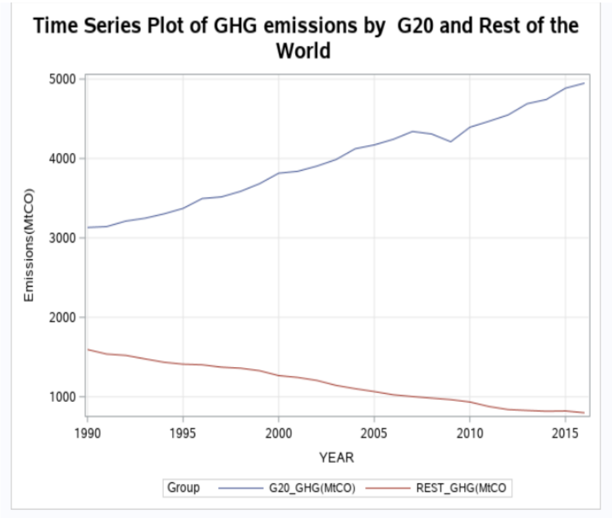


Fig 3.3

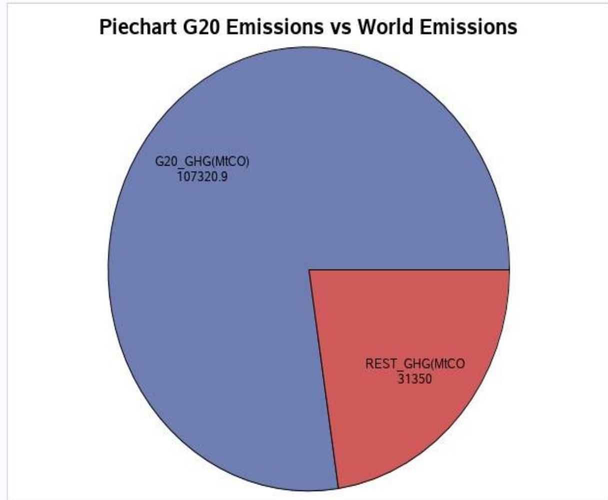


Fig 3.4

- Total G20 transport emissions in Fig 3.4 are higher than the rest of the world even though it has just 20 countries and the rest of the world has 119 countries. Total G20 transport emissions are around 3 times that of the rest of the world.
- Timeseries plot in Fig 3.3 shows that Greenhouse gas emissions by G20 have been increasing since 1990 although it took a small dip around 2007 while the emissions from the rest of the world have been on a steady decline.
- As shown here in the appendix, the data for both G20 countries and the rest of the world are normally Distributed.

4. Statistical Analysis and Findings

Research Question: Do we have a significant difference in the emissions from the top two road emission sources in RCT County Borough (I.Roads and K.Roads Transport)?

Do we have a significant difference in the CO_2 emissions from the I.Roads(Major roads) and K.Roads(Minor roads)?

Our Assumption here is that we have no difference between these two road types. We would be using a Two-sample T-test.

Hypothesis	**Assumption**
Null hypothesis H_0	No difference in the CO_2 emissions by the two road types
Alternative hypothesis: H_a	Difference in the CO_2 emissions exists between the two road types.

Table 4.0: Table for null hypothesis and alternative hypothesis for two-sample t-test

Normality Test

Hypothesis	Asumption
Null hypothesis H_0	Distribution of the dataset is normal
Alternative hypothesis: H_a	Distribution of the dataset is not normal

Table 4.1: Table for normality test

Variable: CO2_emissions (CO2_emissions)
Road_Type = I. Road

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.853073	Pr < W	0.0313
Kolmogorov-Smirnov	D	0.23309	Pr > D	0.0513
Cramer-von Mises	W-Sq	0.126188	Pr > W-Sq	0.0443
Anderson-Darling	A-Sq	0.776634	Pr > A-Sq	0.0335

Variable: CO2_emissions (CO2_emissions)
Road_Type = K.Road

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.979112	Pr < W	0.9749
Kolmogorov-Smirnov	D	0.085241	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.017997	Pr > W-Sq	>0.2500
Anderson-Darling	A-Sq	0.14118	Pr > A-Sq	>0.2500

Figure 4.0: Goodness-fit test for normality of CO_2 emissions by road type in RCT

Based on the p-value from the test for normality in Fig 4.0, we have enough evidence to reject the null hypothesis for K.Roads but not enough evidence to reject the null hypothesis for I.Roads. We would be performing a non-parametric test.

Wilcoxon Two-Sample Test					
				t Approximation	
Statistic	Z	Pr > Z	Pr > |Z|	Pr > Z	Pr > |Z|
260.0000	4.3077	<.0001	<.0001	0.0001	0.0002
Z includes a continuity correction of 0.5.					

Fig 4.1

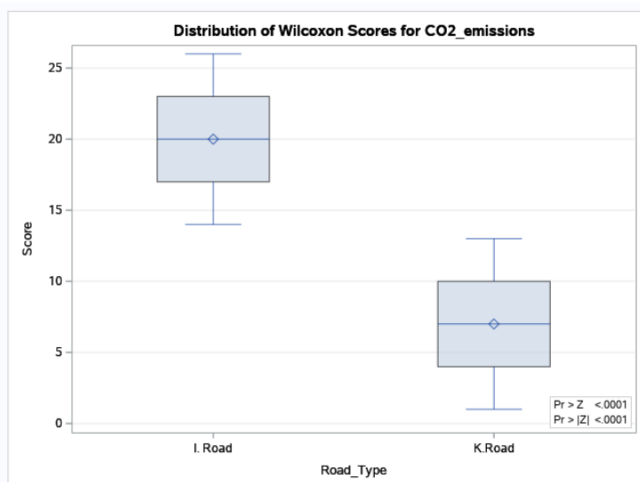


Fig 4.2

The output of the test in Fig 4.1 shows we have enough evidence to reject the null hypothesis at a 5% significance level. There is a difference in the CO_2 emissions with I.Roads(Major roads) having the highest value supported by the boxplot in Fig 4.2 This evidence shows that car free day within the county borough alone might not be enough because I.Roads links counties to one another. This might mean car free day needs to be a region wide activity and not limited to Rhondda Cynon Taf alone.

Road_Type	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
I. Road		233.6	227.2	240.0	10.6105	7.6086	17.5151
K.Road		143.6	140.5	146.6	5.0132	3.5949	8.2755
Diff (1-2)	Pooled	90.0240	83.3065	96.7415	8.2980	6.4793	11.5438
Diff (1-2)	Satterthwaite	90.0240	83.1602	96.8878			

Fig 4.3: summary statistics for the CO_2 emissions by road type in RCT

Confidence interval test above in Fig 4.3 shows that we have a 95% chance of not having the same CO_2 emissions.

Research question 2: Are there significant differences in CO emissions of different transport mode and how significantly different?

We perform this experiment using the One-Way Analysis of Variance to find differences in CO emissions.

Assumptions:

- The subjects are selected at random from the total groups.
- The dependent variable is normally distributed in each group.
- The dependent variable has the same variance in each group.

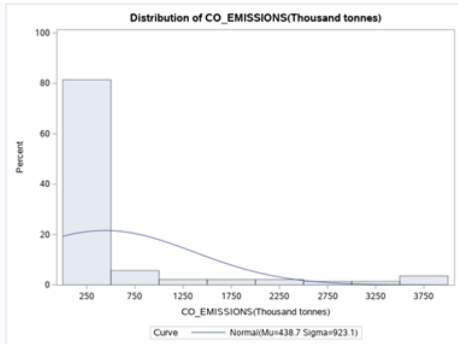
Hypothesis	**Assumption**
Null hypothesis H_0	NO significant difference between the distribution of CO emissions
Alternative hypothesis: H_a	Significant difference between the distribution of CO emissions exists

Table 4.2: Table for ANOVA test differences in CO emissions

Normality test

Hypothesis	**Asumption**
Null hypothesis H_0	Distribution of the dataset is normal
Alternative hypothesis: H_a	Distribution of the dataset is not normal

Table 4.3: Table for test of normality for CO emissions UK



Fitted Normal Distribution for CO_EMISSIONS(Thousand tonnes) (CO_EMISSIONS(Thousand tonnes))

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.3367423	Pr > D	<0.010
Cramer-von Mises	W-Sq	5.6335439	Pr > W-Sq	<0.005
Anderson-Darling	A-Sq	28.2461567	Pr > A-Sq	<0.005

Figure 4.4

Our output in Fig 4.4 provides enough evidence to reject the null hypothesis hence we would use a non-parametric test (Kruskal-Wallis test).

<u>Nonparametric One-Way ANOVA (NPAR1WAY)</u>

Kruskal-Wallis Test		
Chi-Square	DF	Pr > ChiSq
109.9763	4	<.0001

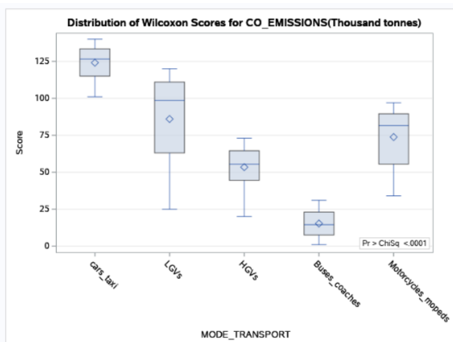


Fig 4.5

Fig 4.6

We have enough evidence to reject the null hypothesis at a 5% significance level from Fig 4.5, There is a difference between the distribution of CO emissions of the different mode of transport. Boxplot in Fig 4.6 also supports this with cars and taxis having the highest average emissions.

Post–hoc tests

Least Squares Means
Adjustment for Multiple Comparisons: Tukey

MODE_TRANSPORT	CO_EMISSIONS(Thousand tonnes) LSMEAN	LSMEAN Number
Buses_coaches	10.08273	1
HGVs	37.67880	2
LGVs	239.61280	3
Motorcycles_mopeds	67.14361	4
cars_taxi	1838.98726	5

Least Squares Means for effect MODE_TRANSPORT
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: CO_EMISSIONS(Thousand tonnes)

i/j	1	2	3	4	5
1		0.9998	0.6116	0.9966	<.0001
2	0.9998		0.7189	0.9997	<.0001
3	0.6116	0.7189		0.8206	<.0001
4	0.9966	0.9997	0.8206		<.0001
5	<.0001	<.0001	<.0001	<.0001	

Fig 4.7 pairwise comparison of CO emission by transport type UK

p-value is higher than 5% significance level in all pairwise comparison of cars (and taxis) in Fig 4.7 and other variables and lower in other pairwise comparisons which means cars (and taxis) differ significantly from other variables. We do not have enough evidence to reject the null hypothesis for pairwise comparison of other mode of transport and as such the distribution among all mode of transport is similar except for cars and taxis. This test suggests that reducing car usage through car free day and advocating adoption of alternatives to car transport in Rhondda Cynon Taf could help lower emissions.

Research Question: Determine the association between Greenhouse emissions by Technologically advanced countries (G20 countries) and the Rest of the world(119 countries captured)

Hypothesis	**Assumption**
Null hypothesis H_0	There is no correlation between G20 and the rest of the world
Alternative hypothesis: H_a	There is a correlation between G20 and the rest of the world

Table 4.4: Table for hypothesis assumption on Greenhouse emissions by G20 countries and the Rest of the world

Test for Normality

Fitted Normal Distribution for G20_GHG(MtCO) (G20_GHG(MtCO))

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.09022522	Pr > D	>0.150
Cramer-von Mises	W-Sq	0.04572035	Pr > W-Sq	>0.250
Anderson-Darling	A-Sq	0.32877842	Pr > A-Sq	>0.250

Fig 4.8a

Fitted Normal Distribution for REST_GHG(MtCO) (REST_GHG(MtCO))

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.11285765	Pr > D	>0.150
Cramer-von Mises	W-Sq	0.08839343	Pr > W-Sq	0.156
Anderson-Darling	A-Sq	0.58673118	Pr > A-Sq	0.119

Fig 4.8b

In Fig 4.8a and 4.8b Both groups (G20 and Rest of the world) have a normal distribution. We will use a parametric test

1 With Variables:	REST_GHG(MtCO)
1 Variables:	G20_GHG(MtCO)

Pearson Correlation Coefficients, N = 27 Prob > |r| under H0: Rho=0	
	G20_GHG(MtCO)
REST_GHG(MtCO) REST_GHG(MtCO)	-0.98887 <.0001

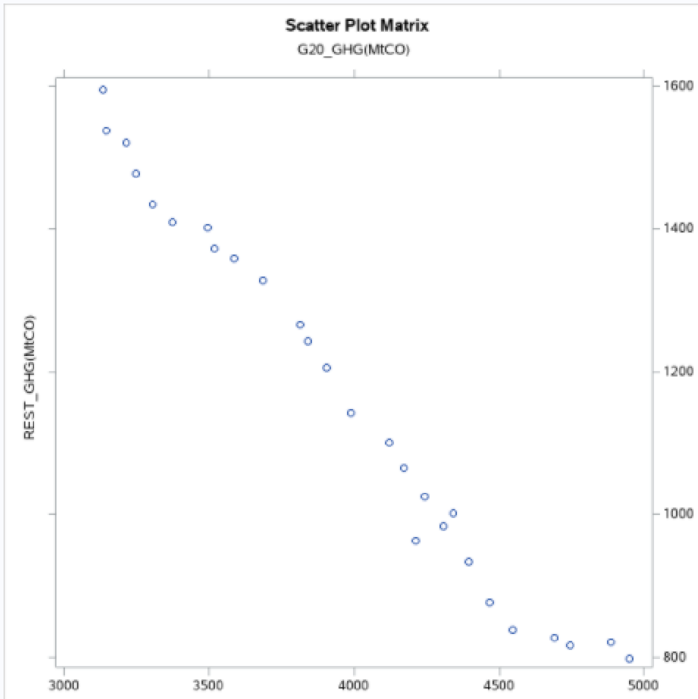


Fig 4.9 Scatterplot for G20 countries and Rest of the world

From the output in Fig 4.9 above we will notice that we have a strong negative correlation of -0.99 between G20 countries and the rest of the world and also a p-value lower than the 5% significance levels which means we have enough evidence to reject the null hypothesis at 5% significance level. Fig 3.3 shows that G20 transport greenhouse gas emissions is increasing. Which is expected due to their large industry and economic size.

5. Results and Discussion

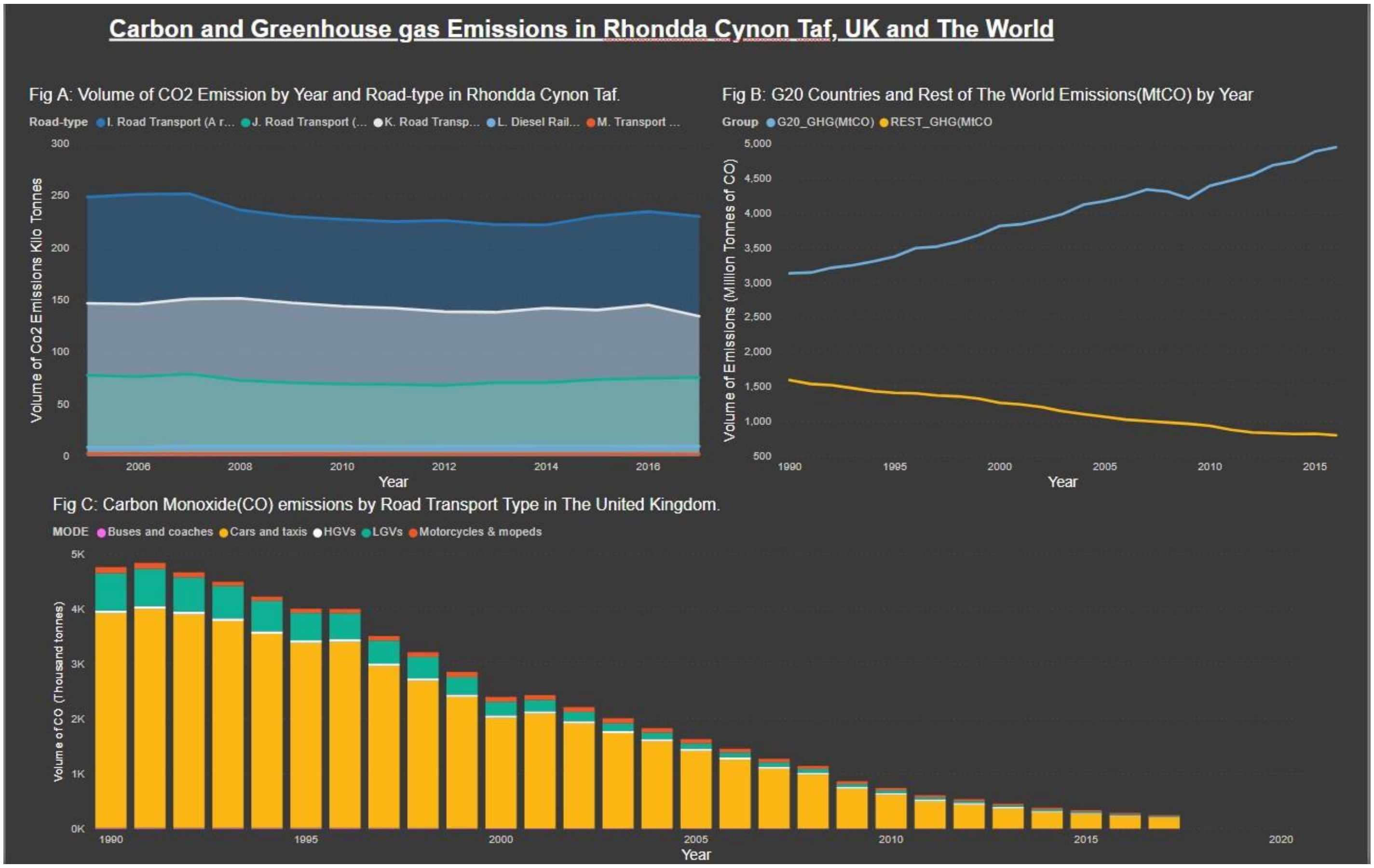


Figure 5.0 PowerBI Dashboard showing Carbon and Greenhouse gas emissions.

The data examined for the Rhondda Cynon Taf area was for the CO_2 emissions from the different road types in the borough, the exploratory analysis showed that I.Roads(Major roads) and K.Roads(Minor roads) have the highest CO_2 emissions. The statistical test performed using the two-sample T-test showed that we have a difference in the emissions from the I.Roads and K.Roads. The test showed that I.Roads are significantly higher in terms of CO_2 emissions than other road types, the boxplot in Fig 4.2 also confirms this with K.Roads having the highest CO_2 emissions. This means most of the road emissions by road type in RCT is due to the major roads within the county. This suggests a region wide (RCT and nearby counties) car free day might be more appropriate.

A one-way ANOVA test to determine the difference in CO emissions from the various mode of transport was performed. The test was done using a non-parametric test because we had non-normal data. The outcome of this test showed that we have differences between the modes of transport, on further analysis the study revealed that cars and taxis differ significantly from other modes of transport, while all the other modes of transport are similar. Encouraging the adoption of alternative to cars can help reduce the emissions from cars and taxis. A car free day would be a great starting point for this.

Correlation test performed for total GHG emissions from advanced(G20) countries and rest of the world (119 countries) revealed that we have a strong negative correlation between the G20 countries and the rest of the world. Fig 3.3 time series plot confirms this showing the trend over time. RCT being a county in a

G20 nation has the communal responsibility to improve the controls in place for reducing Carbon emissions from the county.

The outcome of this study shows that air pollution is still a problem faced in Rhondda Cynon Taff, UK and the rest of the world. A car free day would be a step in the right direction in creating social awareness on reducing the use of motorised travel. Research shows that combination of reduced reliance on motorised travel and substantial increases in active travel with vigorous implementation of low-emission technology offers the best outcomes in terms of climate change mitigation and public health (James Woodcock et al., 2009).

6. Conclusion

Important health and climate gains can be achieved by implementing policies focused on reducing cars and taxi usage. Social policies such as car free day if vigorously implemented can help reduce the CO_2 emissions in the Rhondda Cynon Taf Borough which would help improve the air quality and health of the residents in this region. Based on the findings of this study presented in this report, the implementation of a car free day would be recommended for the Rhondda Cynon Taf County Borough and nearby Counties.

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link

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Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport,

The Lancet,

Volume 374, Issue 9705,

2009,

Pages 1930-1943,

ISSN 0140-6736,

https://doi.org/10.1016/S0140-6736(09)61714-1.

(http://www.sciencedirect.com/science/article/pii/S0140673609617141)

GLOSSARY

G20 Countries - The members of the G20 are: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, United Kingdom, United States, and the European Union.

Rest of the World – The members in this dataset included 119 countries which were captured in the dataset found here.

RCT – This is a shorthand used for the Rhondda Cynon Taf County Borough

I.Roads – These are also known as A Roads which are major roads

K.Roads – These are minor roads

J.Roads – These are motorways

L. Diesel Railways – These are emissions from railway tracks.

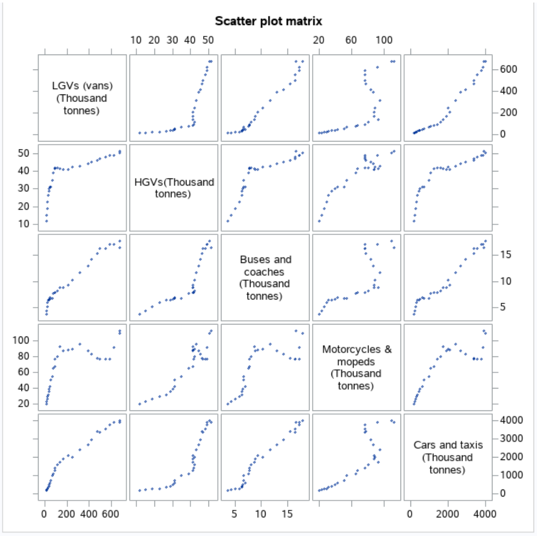
M. Transport Other – These are other modes of transport.

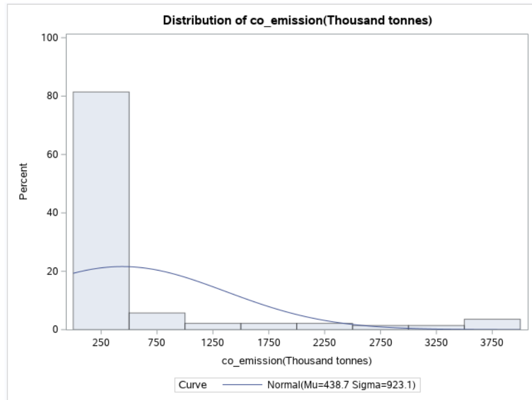
APPENDIX

Appendix 1: Exploratory plots

Analysis Variable : Volume_Emmission Volume_Emmission								
Road-type	**N Obs**	**Mean**	**Std Dev**	**Minimum**	**Maximum**	**Median**	**N**	**N Miss**
I. Road Transport (A roads)(kt CO2)	13	233.6023232	10.6104865	221.9939376	251.8969127	230.1681448	13	0
J. Road Transport (Motorways)(kt CO2)	13	72.7360739	3.5889437	67.7806112	78.7046938	72.6990032	13	0
K. Road Transport (Minor roads)(kt CO2)	13	143.5782941	5.0132337	134.2579387	151.4973755	143.9671619	13	0
L. Diesel Railways(kt CO2)	13	9.2981105	0.4184208	8.3079638	9.6717810	9.3942182	13	0
M. Transport Other(kt CO2)	13	2.1679417	0.1489284	1.9297046	2.4032362	2.1375312	13	0

Fig 1: Summary statistics for Rhondda Cynon taf



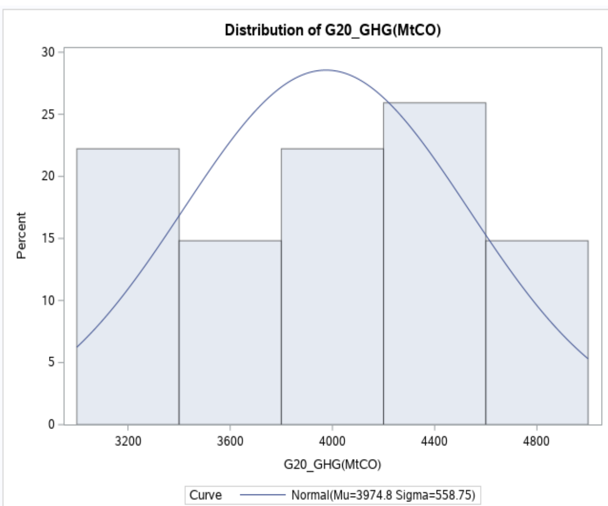


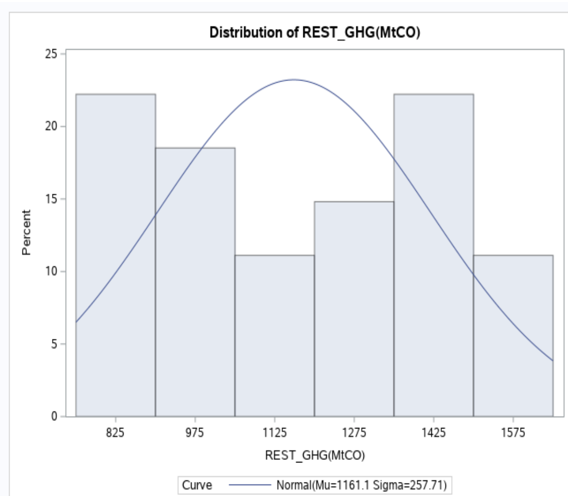
Fitted Normal Distribution for co_emission(Thousand tonnes) (co_emission(Thousand tonnes))

Goodness-of-Fit Tests for Normal Distribution				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.3367423	Pr > D	<0.010
Cramer-von Mises	W-Sq	5.6335439	Pr > W-Sq	<0.005
Anderson-Darling	A-Sq	28.2461567	Pr > A-Sq	<0.005

Variable	Label	Mean	Std Dev	Minimum	Maximum	N
Cars and taxis(Thousand tonnes)	Cars and taxis(Thousand tonnes)	1838.99	1325.60	197.9995176	3983.73	28
LGVs (vans)(Thousand tonnes)	LGVs (vans)(Thousand tonnes)	239.6127950	231.8316731	15.5866099	677.4762705	28
HGVs(Thousand tonnes)	HGVs(Thousand tonnes)	37.6787999	10.8700419	12.0932326	51.3521102	28
Buses and coaches(Thousand tonne	Buses and coaches(Thousand tonnes)	10.0827314	4.5143037	3.6449435	17.8063542	28
Motorcycles & mopeds(Thousand to	Motorcycles & mopeds(Thousand tonnes)	67.1436120	27.1385182	19.8433631	112.2548691	28

Fig2: Exploratory plots for Yearly Carbon emissions from the different vehicle types in the U.K





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Fitted Normal Distribution for REST_GHG(MtCO) (REST_GHG(MtCO))

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Cramer-von Mises	W-Sq	0.08839343	Pr > W-Sq	0.156
Anderson-Darling	A-Sq	0.58673118	Pr > A-Sq	0.119

Figure 1: Yearly Greenhouse gas emissions by transport from G20 vs Rest of the world vehicle

Appendix 3: Datasets used

Table 1 Yearly CO_2 emissions from motorways in Rhondda Cynon Taf County Borough. [source]

	Year	Volume_Emmission	Road-type
1	2013	9.53	L. Diesel Railways(kt CO2)
2	2005	8.48	L. Diesel Railways(kt CO2)
3	2015	73.54	J. Road Transport (Motorways)(kt CO2)
4	2008	2.40	M. Transport Other(kt CO2)
5	2014	142.12	K. Road Transport (Minor roads)(kt CO2)
6	2011	68.72	J. Road Transport (Motorways)(kt CO2)
7	2009	9.36	L. Diesel Railways(kt CO2)
8	2016	234.79	I. Road Transport (A roads)(kt CO2)
9	2017	9.48	L. Diesel Railways(kt CO2)
10	2006	145.87	K. Road Transport (Minor roads)(kt CO2)
11	2012	2.09	M. Transport Other(kt CO2)
12	2012	138.68	K. Road Transport (Minor roads)(kt CO2)
13	2009	70.27	J. Road Transport (Motorways)(kt CO2)
14	2016	145.06	K. Road Transport (Minor roads)(kt CO2)
15	2014	221.99	I. Road Transport (A roads)(kt CO2)
16	2007	9.39	L. Diesel Railways(kt CO2)
17	2013	70.44	J. Road Transport (Motorways)(kt CO2)
18	2011	9.29	L. Diesel Railways(kt CO2)
19	2010	227.35	I. Road Transport (A roads)(kt CO2)
20	2015	9.64	L. Diesel Railways(kt CO2)
21	2017	75.49	J. Road Transport (Motorways)(kt CO2)
22	2006	2.36	M. Transport Other(kt CO2)
23	2005	77.57	J. Road Transport (Motorways)(kt CO2)
24	2010	2.21	M. Transport Other(kt CO2)
25	2008	151.50	K. Road Transport (Minor roads)(kt CO2)
26	2014	2.09	M. Transport Other(kt CO2)
27	2011	142.06	K. Road Transport (Minor roads)(kt CO2)
28	2008	72.70	J. Road Transport (Motorways)(kt CO2)
29	2013	138.14	K. Road Transport (Minor roads)(kt CO2)
30	2013	222.26	I. Road Transport (A roads)(kt CO2)
31	2015	140.21	K. Road Transport (Minor roads)(kt CO2)
32	2010	69.01	J. Road Transport (Motorways)(kt CO2)
33	2017	134.26	K. Road Transport (Minor roads)(kt CO2)
34	2009	230.17	I. Road Transport (A roads)(kt CO2)
35	2006	8.31	L. Diesel Railways(kt CO2)
36	2012	67.78	J. Road Transport (Motorways)(kt CO2)
37	2008	9.35	L. Diesel Railways(kt CO2)
38	2015	230.42	I. Road Transport (A roads)(kt CO2)
39	2010	9.38	L. Diesel Railways(kt CO2)
40	2014	70.43	J. Road Transport (Motorways)(kt CO2)
41	2012	9.45	L. Diesel Railways(kt CO2)
42	2007	251.90	I. Road Transport (A roads)(kt CO2)
43	2014	9.67	L. Diesel Railways(kt CO2)
44	2016	74.68	J. Road Transport (Motorways)(kt CO2)
45	2016	9.53	L. Diesel Railways(kt CO2)
46	2017	230.08	I. Road Transport (A roads)(kt CO2)
47	2005	2.27	M. Transport Other(kt CO2)
48	2005	146.69	K. Road Transport (Minor roads)(kt CO2)
49	2007	2.33	M. Transport Other(kt CO2)
50	2011	225.14	I. Road Transport (A roads)(kt CO2)
51	2009	2.21	M. Transport Other(kt CO2)
52	2007	150.84	K. Road Transport (Minor roads)(kt CO2)
53	2011	2.14	M. Transport Other(kt CO2)
54	2006	76.23	J. Road Transport (Motorways)(kt CO2)
55	2013	2.13	M. Transport Other(kt CO2)
56	2009	147.13	K. Road Transport (Minor roads)(kt CO2)
57	2015	2.06	M. Transport Other(kt CO2)
58	2017	1.93	M. Transport Other(kt CO2)
59	2005	248.76	I. Road Transport (A roads)(kt CO2)
60	2006	251.37	I. Road Transport (A roads)(kt CO2)
61	2008	236.32	I. Road Transport (A roads)(kt CO2)
62	2012	226.28	I. Road Transport (A roads)(kt CO2)
63	2007	78.70	J. Road Transport (Motorways)(kt CO2)
64	2010	143.97	K. Road Transport (Minor roads)(kt CO2)
65	2016	1.95	M. Transport Other(kt CO2)

Table 2 Yearly CO emissions by the different vehicle types in the United Kingdom. [source]

	Year	Cars and taxis(Thousand tonnes)	LGVs (vans)(Thousand tonnes)	HGVs(Thousand tonnes)	Buses and coaches(Thousand tonne	Motorcycles & mopeds(Thousand to	Pollutants
1	1990	3905.1926658	676.33635679	51.35211017	16.482852077	112.25486911	co
2	1991	3983.7281315	677.47627049	50.45732205	17.806354221	108.89638123	co
3	1992	3884.110971	624.06783864	48.858661668	17.112658423	91.530514473	co
4	1993	3762.5563257	590.03379352	48.994486895	17.169081203	76.423877001	co
5	1994	3530.5677075	551.81931556	47.945445254	16.358182911	76.710366767	co
6	1995	3365.5451299	497.66419799	46.878724172	16.306115086	76.765683256	co
7	1996	3387.1030359	471.83437722	46.238066206	15.440849115	77.802196482	co
8	1997	2946.3248363	417.99186946	45.21283197	14.236530752	83.079550694	co
9	1998	2679.4741412	388.82307711	44.217884837	12.918415234	86.737111894	co
10	1999	2387.6702148	317.40181997	42.88715126	11.660532359	95.151524796	co
11	2000	2008.8030289	249.53657304	42.226198507	10.183306301	88.755225123	co
12	2001	2086.8928446	207.37364244	41.128376392	9.335110011	87.616244672	co
13	2002	1910.0691416	166.4928472	41.113492061	8.7933769685	87.355288921	co
14	2003	1732.0147855	137.73456842	41.247688031	8.7350164907	92.411747437	co
15	2004	1583.8001784	115.83323636	42.144061932	8.0823496387	79.934745715	co
16	2005	1409.8530556	94.421914661	41.879236622	7.8024682568	76.750610675	co
17	2006	1251.8829799	87.143680833	41.441916724	7.8179590284	67.292684056	co
18	2007	1084.8632423	76.623782579	39.132996494	7.6601956294	64.647661442	co
19	2008	979.92835844	66.835391392	34.705259646	6.6371628107	54.002546713	co
20	2009	722.37194387	54.44381875	31.279834938	6.7080127267	50.360425091	co
21	2010	613.13206309	48.972762312	31.099454801	6.9258478962	42.047330869	co
22	2011	492.88025095	41.677514414	30.01528457	6.5152493986	39.269236062	co
23	2012	431.49949319	35.800107921	28.948005035	6.3242884483	35.315035699	co
24	2013	361.50790078	30.301297083	26.657056779	6.3727893135	31.042637463	co
25	2014	298.64509107	25.829990915	22.849853885	5.8857540603	29.135753152	co
26	2015	266.30832443	22.296001355	18.854445303	5.0798385198	26.036875239	co
27	2016	226.91784059	18.805604203	15.147317564	4.321238133	22.851650161	co
28	2017	197.99951758	15.586609914	12.093232565	3.6449435379	19.843363063	co

Table 3 Yearly greenhouse gas emissions grouped by G20 countries and the rest of the world [source]

	YEAR	G20_GHG(MtCO)	REST_GHG(MtCO)
1	1990	3131.8	1594.7
2	1991	3143	1537.7
3	1992	3212.2	1521.1
4	1993	3248	1477.2
5	1994	3303.5	1434.5
6	1995	3372.4	1410.2
7	1996	3496.2	1402.3
8	1997	3516.6	1372.5
9	1998	3586.3	1359.7
10	1999	3683.4	1327.8
11	2000	3815.3	1266.5
12	2001	3839.2	1243.3
13	2002	3904.9	1205.3
14	2003	3987.5	1143.1
15	2004	4123.2	1101.5
16	2005	4171.6	1065.1
17	2006	4242.5	1024.5
18	2007	4340.8	1002.5
19	2008	4309.1	983
20	2009	4211.3	964
21	2010	4394.1	934.1
22	2011	4469.4	877
23	2012	4549.1	838.7
24	2013	4690.7	827.4
25	2014	4743.5	817.3
26	2015	4886	820.9
27	2016	4949.3	798.1