

Case Study 2 – Electric Vehicle Support Infrastructure

Due: Friday 29th April 2022, 8pm.

Peer Marking Deadline Friday 13th May 2022, 8pm.

Submission: Via Moodle + Panopto.

Marks: 30% of unit.

In this case study you will analyse a large dataset, the national average daily traffic count. Then using existing tools or software you develop; you will address a series of tasks. Some tasks will require you to locate and use additional data. The tasks include extracting vehicle mileage, estimating car growth in future, and estimating electricity requirement to meet electric vehicle demand at some future point. And finally, to decide how to meet any extra generation capability needed cost effectively. You will deliver your case study in the form of a video (oral) presentation of up to ten minutes and a one page executive summary.

Task 1: Basic Analysis

Traffic counts provides street-level traffic data for every junction-to-junction link on the 'A' road and motorway network in Great Britain. The historic data for 2000 to 2020 can be found here:

<https://roadtraffic.dft.gov.uk/downloads>

You should use the AADF Data major and minor roads. Your first task is to perform a basic clean up and summary analysis of the data. Your objective is to summarise the data in a way that simplifies the subsequent tasks. A region by region estimate of the annual millage of different classes of vehicles is a good starting point. Note, the data is missing from much of the minor roads and you should address this in a sensible way.

Task 2: Regression

In this task you should use the summary data to perform a regression analysis to estimate likely changes in traffic over the next **thirty** years. You should identify any potential risks associated with this analysis that may place limits on how it can be used.

Task 3: Research

As your objective is to assess the impact of the expected increase in the number and use of electric vehicles, you will need to research published estimates of how much of the UK vehicle fleet will be electric over time. This is unlikely to be a simple regression using historic data, there will be a number of other factors involved. It is these factors and their impact that you need to identify.

Your goal is to estimate the number of electric miles driven each year over the time period and estimate how much power generation will be needed to achieve this. You will need to identify how much additional generation capacity this will require. You should also attempt to locate at least one other independent estimate of this for comparison to your own estimate.

Task 4: Recommendation

Different generation technologies have different £/MWh figures. The Department for business, energy and strategy (BEIS) maintains a regularly updated overview of generation technologies.

<https://www.gov.uk/government/collections/energy-generation-cost-projections>

Using this and other sources, you should make a recommendation of the amount and type of new generation capacity that will be needed to meet demand at the lowest overall cost. This is in part an optimisation problem. For example, you might need to take into account the impact that the time of day at which charging occurs will have on the mix of generation technologies that are appropriate.

Task 5: Executive summary

You should summarise the key points of your case study presentation in a one page executive summary. Key points include important results, assumptions and conclusions. This document should also contain your bibliography. The bibliography will not count towards the one page limit.

A word of advice on units. Experience from past cohorts has shown that it is easy to get units of measurement confused and this can have a significant impact on the tasks above. In particular students have often confused GWs and GWhr. Gigawatts is the rate at which electricity is being consumed. A Gigawatt-hour is an amount of electricity, the rate times the duration. An electric vehicle battery capacity is measured in KWhrs. This is the number hours the battery could supply the given KW rate of electricity. The car will use a specified number of KWhrs/mile. Power plant capacity is often given in GWs. This is the rate at which it produces electricity, to determine the number of GWhrs it produces per year you need to multiply this figure by 365*24.

Submission

You must submit three things by the deadline.

1. An .mp4 to Panopto, by following the link on moodle.
2. A .pdf of the one page executive summary and bibliography to the moodle assignment.
3. A zip file containing any code you developed for the task. You should not include any data that you downloaded from elsewhere, or large data sets that can be re-created from the code.

The .pdf must be uploaded separately and not compressed in any way. It must not be included in the .zip file. A marking penalty will be applied if you fail to keep the .pdf separate.

Assessment

Assessment will be based on the video (oral) presentation and executive summary. Your goal is to deliver a critical and informative submission. The video must be no longer than 10 minutes. It must be submitted as an mp4 that will be playable on the University PanOpto platform. The executive summary should be no longer than a page and be in pdf format.

The video should not exceed 10 minutes as markers will not be expected to include content beyond this in their assessment. You are free to use less time if you do not need it.

Similarly, only the first page of the executive summary and the appendix will be assessed.

Assessment Criteria		
Question	Criteria	Marks
Task 1	Has the raw data been summarised?	3
	The data has been observed and cleaned as necessary, 1 mark.	
	If basic total mileage per region is given, 1 mark.	
	Or, if the mileage per region and vehicle type is given 2 marks.	
Task 2	Has an analysis of annual trends been clearly presented?	2
	If the presentation is purely descriptive, 1 mark.	
	Or, if it provides insights into what may have caused the trends noted, 2 marks.	
Task 3	Has an appropriate choice of regression model been made?	2
	Has the choice of regression model been properly justified?	1
	Has the regression model chosen been correctly applied?	1
	Have any potential risks in using the model predictions been identified.	1
Task 3	Has a realistic estimate of the number of electric miles driven each year over the time period been provided based on the model used?	2
	Has a consistent estimate of how much power generation will be needed to achieve this been provided?	2
	Have one or more independent estimates of the likely generation required been found?	1

Task 4	Is a recommendation consistent with the previous tasks and any additional information gathered been made?	1
	Has the recommendation be justified using the evidence presented?	2
Task 5	Has a effective executive summary been provided? If it contains a summary of some of the key points of the video presentation, 1 mark. Or, contains a summary of most of the key points of the video presentation, 2 marks. Or, if it provides a concise summary of the key points of the video presentation, 3 marks.	3
Presentation	Is the content delivered using a mix of audio and visual approaches?	1
	If the correct terminology used when discussing the content? If less that 1/3, no marks, if 1/3-2/3 then 1 mark, if more than 2/3 then 2 marks.	2
	Do the majority of graphs, charts and tables contain the appropriate level of detail?	1
	Are all graphs, charts and tables clearly labelled? If less than 1/3, no marks, if 1/3-2/3 then 1 mark, if more than 2/3 then 2 marks.	2
References	Have appropriate references been provided where appropriate? If a few assertions or assumptions are underpinned by appropriate references, 1 mark. Or, if an appropriate set of references are included for most assumptions or assertions but it is not always clear where they apply, 2 marks. Or, an appropriate set of references are included for most assumptions or assertions and it is clear where they apply, 3 marks.	3

Additional assessment advice and several marked examples will be provided after the deadline to assist with peer marking.

Peer Assessment

This unit will make use of peer assessment. This means that after the initial deadline for a piece of coursework you will be allocated the work of three other students to examine and assign a mark. This will allow you to see how others have tackled the same problem. The purpose of this is to expose you to issues you may not have identified for yourself and improve your understanding of the problem being tackled.

You will be provided details of how to download the three submissions. You are expected to examine these and compare them to the assessment specification given in this document. Each of the criteria is designed to be a simple pass/fail assessment where the submission either meets the requirement or it does not. Where any criteria are not met, you must indicate why you have reached this conclusion.

You will be given a link to an online form where you can submit an entry for each submission you examine. You must also submit an entry for your own work. You are strongly recommended to assess your own work after you have reviewed the work of the other students. You must submit all the forms by the peer assessment deadline.

There are no additional marks for completing the peer assessment. However, a penalty of up to 50% will be applied to your lab mark should you fail to complete the peer assessment satisfactorily.

A satisfactory assessment entry means you will have completed a form for each submission allocated to you and provided a valid justification for each of the criteria you have labelled as not met.

The work you submit should be anonymous and not include your name or userid. You should remove any reference to your username in any pathname in your code. Replace it with 'username'. You must not engage in discussion of your mark or the marks you will allocate to your peers with your peers. You should report any attempt by others to influence the marking process.

Mark Calculation

Your mark will be calculated in the following way:

1. The two closest peer marks given will be used. If the three marks are equally spaced, the pair closest to your own estimate will be used.
2. If your own mark estimate lies above the peer marks you will receive the mean of the peer marks.

3. Otherwise, you will receive the mean of the two highest marks. (The two peer marks and your own estimate.)

Your mark will be returned to you once this processing has been done. You will also receive the details of the marks allocated by your peers. This will include their reasoning. This is a provisional mark. If you do not consider the mark to be fair, you can contact the lecturer and ask for it to be reviewed. Your work will be re-marked and where the lecturer determines a different mark, the peer marking will be checked and any unsatisfactory marking will have the penalty applied. Should your request for a review not be justified, a penalty may be applied to your mark as you will have further demonstrated that you have not properly understood the material or the feedback you have received.

After the review period the coursework mark will be finalised. To maximise your marks, you should attempt to be as accurate in the marking of both the peer work and your own.

Extensions

If any student is granted an extension, they will still have to undertake peer marking of others work after their updated deadline, with appropriate extensions. Their own work may be peer marked or assessed by the lecturers/tutors depending on the availability of peer markers at that time.

Plagiarism

Plagiarism is a serious offence - please check: <http://www.bath.ac.uk/library/help/infoguides/plagiarism.html> and <http://www.bath.ac.uk/students/support/academic/academic-integrity/>