

'ACHIEVING CARBON REDUCTION AND IMPROVING THE AIR QUALITY IN CUPAR'

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1. INTRODUCTION

1.1 Introduction

The purpose of this paper is to describe an innovative approach, to providing carbon reduction and improving air quality, within a small rural market town, where car can often be described as king. Cupar, has one of the highest car ownership levels in Scotland at 75%.

The project has required multiple council services and general public participation, to achieve two outcomes;

- 1. Provide carbon reduction**
- 2. Improve the air quality in Cupar**

via a range of transport interventions,

However first of all a brief background about Cupar, and how the Cupar Air Quality Management Area (AQMA) came to be declared, and its subsequent actions.

1.2 Background

Cupar is the traditional market/county town in Fife, with a population of approximately 8,800. The town has a long history dating back to the 13th Century, but has not really seen significant growth over the past 150 years. This has meant that most of its design and infrastructure were developed prior to the inception of the motor car.

Cupar's streets and building architecture has lead to a number of narrow 'canyon style' streets, including the A91 through St Catherine's Street and the Bonnygate. However due to traffic volumes associated with the A91, This has led to congestion and poor air quality problems in Cupar. The road is the most heavily used road in North Fife with approximately **55,000 to 60,000** motor vehicles passing through Cupar each day, linking up St Andrews with Perth & Kinross and Stirling.

Street canyon style streets such as the Bonnygate have long been associated with exceedences of air quality strategy objectives in relatively urban locations, particularly where such streets run perpendicular to prevalent wind direction. In such situations, restricted and turbulent airflow can reduce the dispersion of air pollutants and result in elevated concentrations at certain locations

1.3 Cupar AQMA Declaration

In October 2008 Fife Council declared the A91 Cupar Bonnygate area, as an Air Quality Management Area (AQMA), due to exceedence in levels of Nitrogen Dioxide (NOx) and Particulate Matter (PM10). Both of which are hazardous to human health¹.

At the time of declaration:

- NOx levels were at **52** µg/m³. (The acceptable level is 40 µg/m³)
- PM10 was at **23** µg/m³ (The acceptable level is 18 µg/m³).

Research carried out in 2008², identified that road vehicle traffic had made the largest contribution (80%), to creating the elevated concentrations of Nitrogen Dioxide (NOx) and Particulate Matter (PM10), within the AQMA.

When this is broken down further analysis shows that;

- Moving traffic contributed approximately 62% of NOx emissions
- Stationary vehicles estimated to contribute approximately 18% NOx emissions.

A map of the declared AQMA is shown as Figure 1 below.

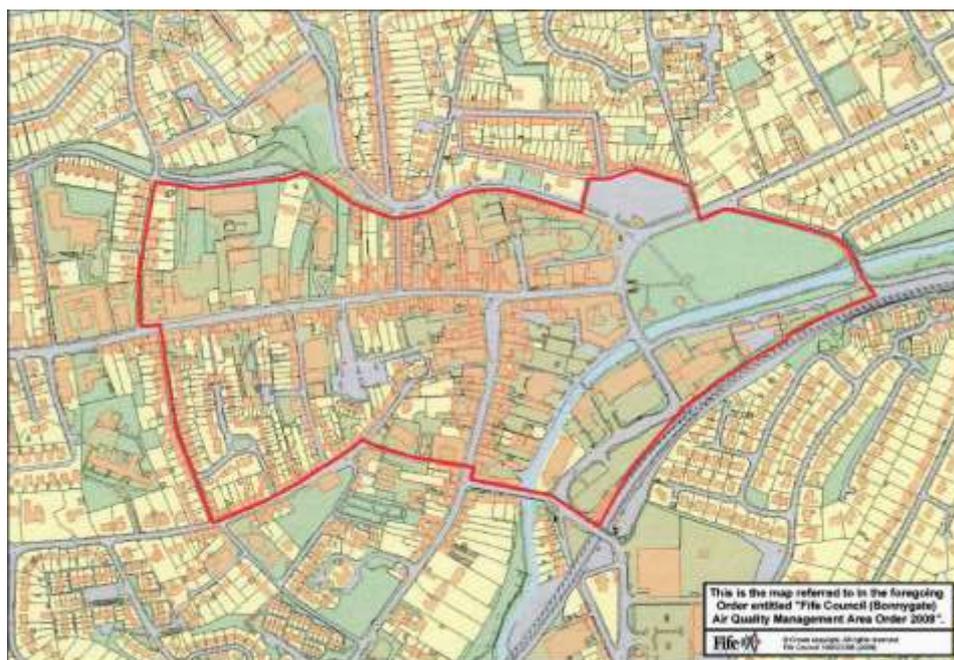


Figure 1 Map Indicating the Location of Cupar AQMA

1.4 Cupar AQMA Action Plan

In September 2010 Fife Council produced the **Fife Council Bonny gate Air Quality Action Plan September 2010.**

¹ If the person is generally healthy, the levels of air pollution seen in the Cupar AQMA are unlikely to have any serious short-term ill effects. However people with lung diseases or heart conditions are at greater risk, especially the elderly.

² http://publications.1fife.org.uk/uploadfiles/publications/c64_2007-8DetailedAssessment,Bonnygate,Cuapr.pdf

The plan aims to work towards reducing transport emissions of NOx and PM10 in the AQMA by approximately 53% and 33% respectively. The required improvements do appear to be quite onerous, however these represent the ambient concentrations required to meet the objectives, of meeting the Scottish Government thresholds.

To achieve these reductions, Transportation & Environmental services have or are proposing to undertake the following transport interventions.

- Installation of Permanent Traffic/Cycling, Walking and Air Quality monitoring equipment
- Implementation of new Urban Traffic Management and Control system
- Personalised Travel Planning for all Residents/ Promotion of Sustainable Travel Options in Cupar ('TRY IT' Cupar)
- Introduction of a Car Club
- Introduction of Electric Vehicle Infrastructure for Cupar

To deliver these transport interventions the following teams from within Transportation Services have been involved:

- Transport Planning
- Transport Policy & Strategy
- Travel Planning
- Traffic Management
- Passenger Transport
- Fleet Services
- Design and Construction

A full transport audit was undertaken in the Cupar, in order to provide a baseline of existing travel behaviour in the town, to identify what had led to these exceedences in both NOx and PM10, and allow the service to identify what initiatives would be feasible and have the most benefit. It also decided what was required as part of the first intervention listed. Installation of Permanent Traffic/Cycling, Walking and Air Quality monitoring equipment

The results of the transport audit are described in chapter 2.

2. DATA GATHERING & TRANSPORT AUDIT

2.1 Introduction

The transport audit was undertaken in March 2011 and included:

- Junction Turning Counts
- Bus Stop Survey (0700 - 1800 hours)
- Rail Station user Questionnaire (am peak)
- Town Centre Occupancy/Duration Parking Survey (0800 - 1700 hours) & On/Off Street Parking Questionnaire (0800 - 1600 hours)
- Road Cordon Survey monitoring traffic movements by noting registration numbers in and out of the Town Centre

As part of data monitoring it is proposed to undertake these surveys on an annual basis.

2.1 Junction Turning Counts

Manual counts were undertaken at four junctions within the Town Centre in order to get a baseline of current traffic conditions which have led to the elevated levels of NO_x and PM₁₀. See Figure 2. The purpose of undertaking this survey was to observe which directions traffic were entering the AQMA from, and where they were travelling too. The counts were recorded by vehicle classification and undertaken for am, pm and off peak periods. The results showed a combined peak hourly flow of:

- St. Catherine Wynd (East end of Bonnygate Corridor) - 821 vehicles (included 87%)
- West end of Bonnygate - 994 vehicles (78% cars).



Figure 2 Locations of the Junction Turning Counts

The full vehicle classification breakdown for vehicles passing through each junction is shown below in Figure 3.

	Car	LGV	OGV1	OGV2	Bus	Bicycle
Site 1 Daily Average	78.13%	16.02%	1.76%	2.24%	1.61%	0.23%
Site 2 Daily Average	82.81%	12.68%	1.45%	1.22%	0.84%	0.99%
Site 3 Daily Average	82.35%	11.44%	3.10%	1.00%	1.96%	0.14%
Site 4 Daily Average	76.38%	14.51%	2.84%	2.66%	2.76%	0.84%

Figure 3 Full Vehicle Classification of the Junction Turning Counts

2.2 Bus Stop Survey & Questionnaires

The bus stop survey was undertaken to see what the current public transport behaviour was in town, its potential frequency and how much of an affect bus usage and travel was having on the AQMA, and if there was any scope to help promote bus travel as a form of carbon reduction within the town.

The survey was undertaken at the Crossgate bus stances between 0700 & 1800 hours and all passengers boarding alighting were recorded.

- On average there are fifteen buses using these stops every hour with an average of 104 passengers using the services hourly.
- There is on average an Express bus service every 10 minutes at Crossgate.
- On average seven passengers are getting on each of the 64 express buses stopping at Crossgate with on average four passengers getting off each bus.
- There were a total of 1142 people using the bus stops between 0700 and 1800 hours with 695 passengers getting on the buses and 447 people getting off.

An issue which became evident while undertaking the bus stop survey was that a number of buses sit idle with the engines running for several minutes at the Crossgate; this data has been passed onto Stagecoach East Scotland.

As part of this survey, bus users were asked two questions about how satisfied they were with the service in Cupar and North East Fife in general, in total 238 people responded. The results are shown below.

Q1. How satisfied are you with Bus Services in the Cupar and North East Fife area?

Very satisfied	28%
Fairly satisfied	45%
Fairly dissatisfied	13%
Very dissatisfied	14%

Q2. How satisfied are you with the frequency of Bus Services in the Cupar and North East Fife area?

Very satisfied	29%
Fairly satisfied	43%
Fairly dissatisfied	13%
Very dissatisfied	15%

2.3 Rail Station User Questionnaire

Similar to the Bus Stop Survey & Questionnaires described above, a rail station survey was also undertaken between 06:00 and 10:00 am peak period , where 116 (69% of rail users) were interviewed

- A total of 116 (69%) of all travellers between 06:00 & 10:00 were interviewed at Cupar Railway Station.
- 76% of all travellers began their journey from Cupar.
- 50% of all trips were to Edinburgh with 17% of all travellers going to Dundee.
- 69% of all journeys were work related.
- 53% of all travellers walk to Cupar Railway Station, while 29% drove, 10% were dropped off, 3% arrived by bicycle with the remaining travellers arriving by other modes of transport as illustrated in Figure 4.

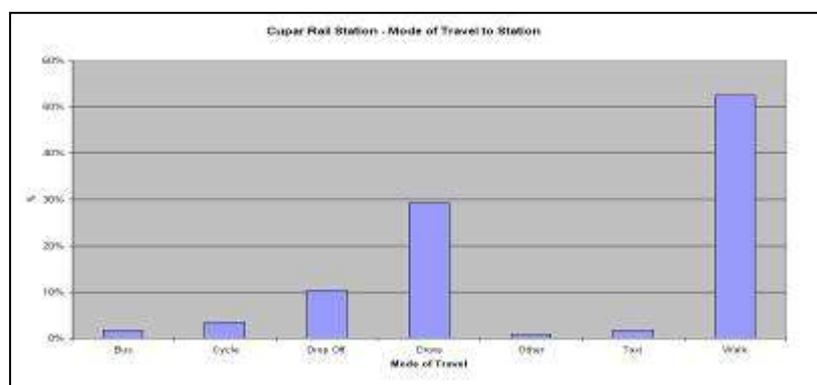


Figure 4 Mode of travel used to arrive at Cupar Rail Station

2.4 Town Centre Occupancy/Duration Parking Survey & Questionnaires

Parking management and control was also looked at; a parking survey was undertaken covering all cars parked on and off street within the Cupar AQMA between 0800 and 1700 hours. In total over the course of the day 2360 cars were parked within the Cupar AQMA, with an average duration time of 107 minutes per car, and occupancy of 60%.

In addition Questionnaires were asked to all car drivers parking within the AQMA between 0800 - 1700 hours, to ascertain where people come from who park within Cupar AQMA, the reason why they park there and how often they did it. A total of 290 (21%) of all car drivers parking between 08:00 & 17:00 were interviewed, of which:-

- 30% of the car occupants began their journey in Cupar.
- 71% of all driver journeys originate within 10 miles from Cupar.
- Over 40% of all drivers park in the Town Centre for work
- A third of all drivers frequently made this trip between 5 and 7 days a week. With over 75% making the trip at least once a week.
- 32% of drivers did use other modes of transport to make the trip and of those, 75% were made up with walkers and bus users.
- 20% of those who solely use their car are interested in exploring different modes of transport.
- 32% of those originating out with the town are concerned by the Air Quality while 56% who start their journey in Cupar are concerned.

2.5 Road Cordon Survey

A Road Cordon Survey was undertaken, to identify what percentage of trips travelling through the AQMA were through trips e.g. using the A91 or A914, and which trips were local trips into Cupar itself. The road cordon survey was undertaken over three time periods:-

- Morning 0700 - 0930
- Afternoon 1130 - 1330
- Evening 1530 - 1800

All vehicle registrations were noted when they passed through the points in either direction on the points shown, see Figure 5.

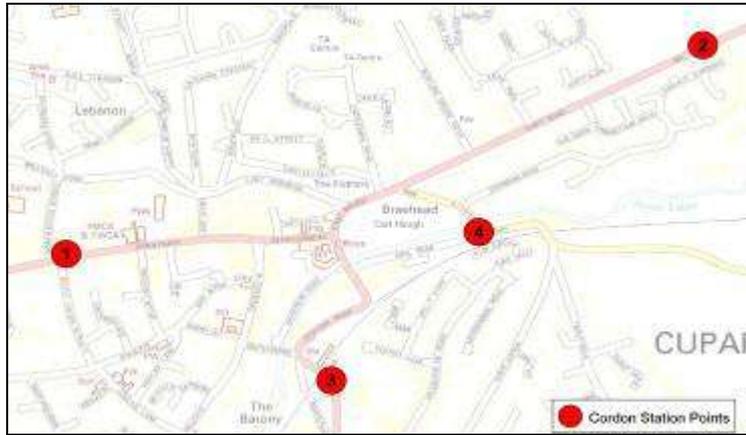


Figure 5 Locations of where the Road Cordon Survey Station Points

The results showed that on average between the 4 sites, 42% of all trips in the time periods are through trips, i.e. just passing through the AQMA, and 58% of trips are too destinations within the AQMA.

Figures 6A.6B.6C. & 6D show the breakdown of trip percentile for each site

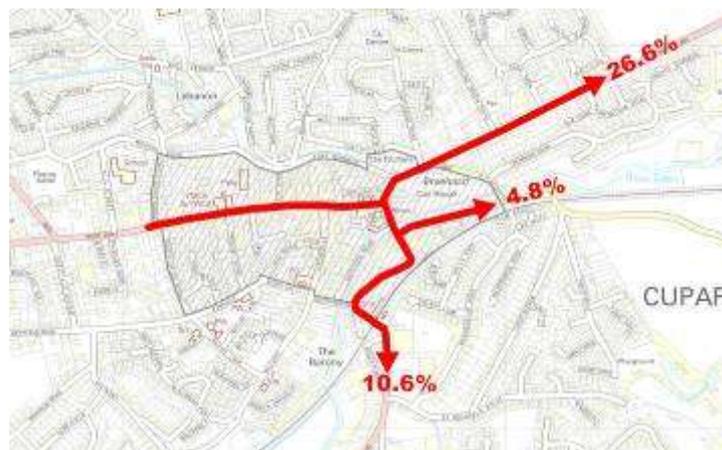


Figure 6.A. % of all trips travelling through AQMA from Site 1 (A91)

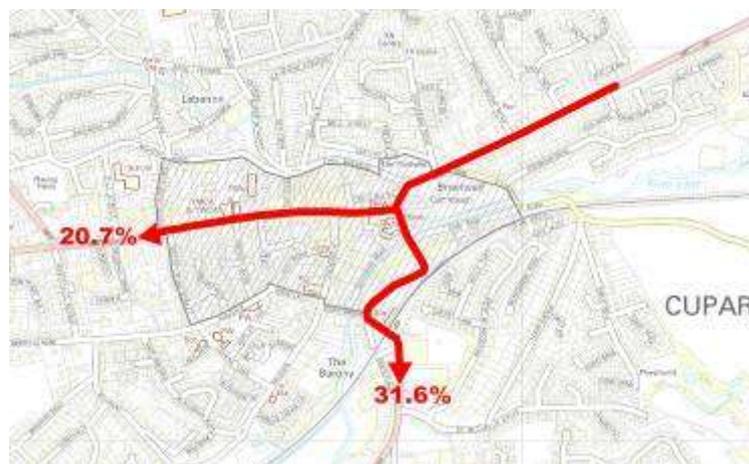


Figure 6.B. % of all trips travelling through AQMA from Site 2 (A91)

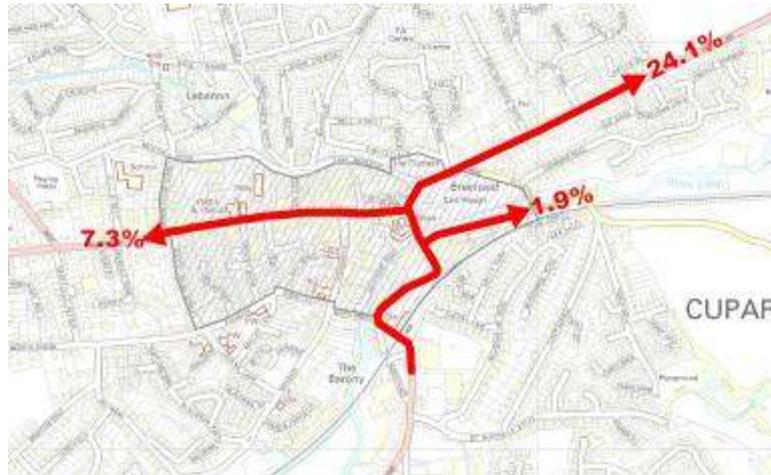


Figure 6.C. % of all trips travelling through AQMA from Site 3 (South Road)

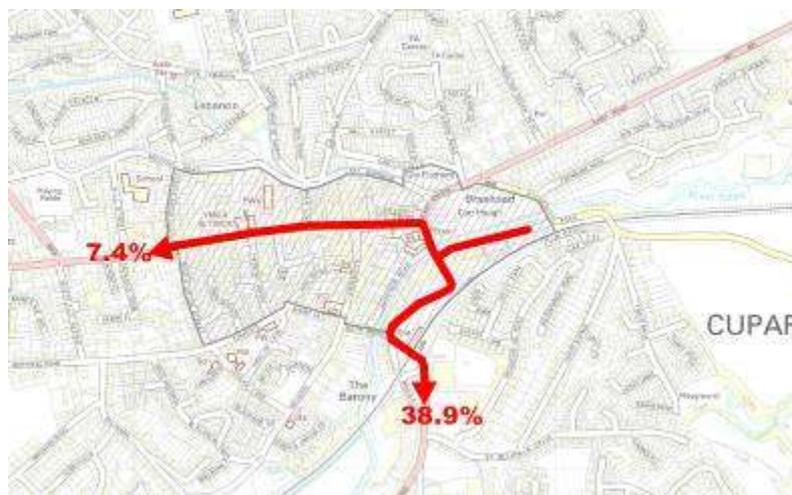


Figure 6.D. % of all trips travelling through AQMA from Site 4 (Coal Road)

2.6 Transport Audit Issues, Summary & Recommendations

After undertaking the transport audit, it was decided that some of the surveys had proven to be a useful exercise in order, to see what issues may have caused the exceedences in NO_x and PM₁₀, and what could be targeted for improvement.

- 42% of all vehicle trips are through trips, so have no connection to Cupar but are responsible for 34% of all emissions within the AQMA.
- 30% of vehicles parking within the AQMA, given the size of Cupar as a town these trips should be targeted to be undertaken by a more sustainable travel mode.
- The bus stops and local bus services are generally under utilised and satisfaction levels could be improved, with 25% of respondents stating they weren't satisfied with the standard of services.

Following these issues raised from undertaking the transport audit, the following permanent data monitoring equipment is installed, and surveys to be undertaken on an annual basis.

- Permanent monitoring counters to be installed at the entrance/exit at Fluthers Car Park and Bonnygate Car Park
- A yearly monitor of the bus stops in the Crossgate will show a continued snapshot of daily bus usage figures in the Town for both local and regional express services.
- A yearly questionnaire of those parked with the Town Centre
- A Rail Station (am) Peak Questionnaire Survey will allow us to monitor any change in Travel habits.

3. IMPLEMENTATION OF ACTIONS

3.1 Introduction

This chapter describes the transport interventions, which have either have implemented or planning to implement over the past or coming years, to achieve:

- 1. Provide carbon reduction**
- 2. Improve air the quality in Cupar**

3.2 Implementation of a new Urban Traffic Management and Control system (UTMC)

The traffic signalised junctions on the A91 in Cupar had exceeded their design capacity for a number of years, which had raised local concerns about the traffic problems and delays at peak times.

Traffic in Cupar had increased by an average of 1.5% per annum since 1989 and is predicted to increase in future years as a result of further development, anticipated in the St Andrew's and North East Fife local plan, and natural growth.

The over capacity problems and subsequent delays, were causing a detrimental impact within the Cupar AQMA, because stationary vehicles were sitting with their engines running idle as the queues and delays built up. It is estimated that this had caused around 25% of the road traffic conditions alone

Prior to 2009 the Cupar town centre traffic signals had been operated via a basic MOVA system. Where the existing pedestrian crossing located immediately to the west of Lady Wynd, had previously stopped traffic before it entered the narrowest section of the Bonnygate, causing queues/delays, and stationary vehicles with their engines idling, as they approached the Crossgate junction signals, causing queues/delays, and stationary vehicles with their engines idling.

The new scheme is a SCOOT (Split Cycle Offset Optimisation Technique) set of traffic signals, which have been re-timed and coordinated with the Crossgate signals so that eastbound traffic is stopped at the Lady Wynd crossing on every cycle and presented with a green light when progressing through the Crossgate junction.

This set of signals has been set up to be compatible with the proposed overall Urban Traffic Management and Control (UTMC) system in Cupar which involves synchronised fixed time signals in order to address peak hour congestion and queuing at key junctions.

The UTMC is due for completion in the summer 2012 and includes:

- Widening the junction at the east end of St Catherine Street following the demolition of the ATS and Paterson Bell buildings.
- Giving priority to east/west traffic flow along the A91, with side roads giving way.
- Removing the traffic lights at the Mercat Cross, War Memorial and East Burnside.

- Removing the Mercat Cross

The projected cost of the scheme is £1.6 M.

3.3 Personalised Travel Planning for all Residents/ Promotion of Sustainable Travel Options in Cupar

It had been identified in the Fife Local Transport Strategy that over half of all trips in Cupar are local (less than 2 miles), distances that can often be made more quickly, safely and easily by walking, cycling and public transport.

So in order to help to achieve carbon reduction and improve the air quality, a marketing and information campaign was undertaken in order to make a more sustainable and travel conscience town. A personalised travel planning scheme was set up and undertaken in late 2010 and early 2011 under the banner of “TRY IT Cupar”.

The aim of the scheme was to engage with residents and local community groups to make Cupar a more sustainable community. Increase public transport usage and encourage people to cycle and walk where possible.

The scheme employed 6 young people through the Scottish Government Future Jobs Fund for 6 months, to undertake doorstep engagement throughout February, March and April 2011, and a feedback telephone monitoring in September 2011.

In total 383 households in Cupar answered their doors to the Personalised Travel Planning public engagement, 352 (9.2%) of the households participated and 31 chose not to take part when engaged at the door.

In addition information resources were also produced for households to refer too, such as the Cupar Community Guide. The guide was developed to encourage residents to source goods locally, cutting down the need to travel. Walking and cycling maps were also produced and sent out to all residents who requested them, and made available from a number of shops and public buildings in Cupar.

Finally a promotion and marketing event was organised organised into promoting “TRY IT Cupar” on the 31st March 2012. Every household in Cupar was mailed a postcard inviting them to attend, as well as articles in the local press, sustainable transport events held on the included

- Dr Bike (Free bike checks and repairs)
- Cycle Start Cupar launch
- Bums off Seat walks (Fife Wide walking Initiative)
- Bike Try Outs (Try out a range of different bikes, all different shapes and sizes)
- Cycling assault course

In total 500 people attended the day, with a further 200 requesting more information on the project.

3.4 Creation of Cupar Car Club

Another intervention undertaken is to reduce, car dependency and car ownership levels In Cupar, is the creation of a Car Club which will offer a viable and attractive alternative to the private car.

Research undertaken by the Transport Research Laboratory (TRL) research shows that, on average, members of car clubs report substantially lower levels of household car use than the average household with at least one full car license holder, and in some cases deferred purchase of a vehicle as a result of car club membership. In addition, car club vehicles tend to be considerably newer and cleaner than the average private car. Consequently, average estimations of emissions of CO₂, NO_x and PM₁₀ from car use by households with established car club members are less than half of the equivalent emissions estimations for non-car club households. In addition research undertaken by Edinburgh City Car club indicates that for each Car Club vehicle being introduced reduces the number of privately owned vehicles by 8.³

It is proposed that the scheme will operate using the Council's pool car fleet within Cupar. Four cars will be available to the public at evenings and weekends, where most of the demand is anticipated, during office hours it will be used by Fife Council, and one vehicle will be available to use 24/7 for the public. The scheme will provide local businesses and the residents of Cupar with an additional travel mode, without having to purchase a vehicle.

3.5 Electric Vehicle Infrastructure

Electric Vehicle Infrastructure is planned to be implemented in Cupar in 2012. The scheme has been developed in the backdrop of the Scottish Government, 'Plugged in Places' initiative of providing an Electric Vehicle Charging network across the Scottish Central belt.

The scheme is hoped to be a 'carrot and stick' incentive for introducing electric vehicles over the next 10 years, the scheme will be used by Fife Council, its community planning partners and the general public, to use. This year will see the introduction of 1 Electric Car has being as a used as a Pool Car at the Fife Council Offices at County Buildings on St Catherine Street, the car club described above is also to make use of an Electric Vehicle, and finally 2 Mini Electric Vans located at Prestonhall Depot at the trading estate.

It is proposed to make charging infrastructure available for the public to use, with locations planned at Fluthers Car Park, located at the western end of the AQMA, and at Cupar Railway station, which is consistent with the 'Plugged In Places' idea of public locations, being at long stay car parks and public transport interchanges.

The vehicles and charging points were purchased and ordered by Transportation services at the end of March 2012, and is forecasted to be fully installed and operational by the end of Summer 2012.

³ <http://www.eltis.org/studies/77e.htm>

4. CONCLUSION & RESULTS

The purpose of this chapter is to highlight if the exceedences of NO_x and PM₁₀ have either increased or decreased since the Cupar AQMA was declared in 2008. As reported in the introduction section NO_x, had annual mean concentrations at a high of 52 µg/m³ in 2008, which exceeded the recommended level, set by the Scottish Government of 40 µg/m³ by 25%. For PM₁₀ this level was 23 µg/m³, the recommended level set by Scottish Government of 18 µg/m³, 22% higher.

Fife Council currently reports the results of the Cupar AQMA for NO_x and PM₁₀ annually as part of the **Air Quality Progress Report**, which is produced in August every year. The reports provide a monitoring data on a number of sites within Fife where air quality levels are suspected to be close to the Scottish Government thresholds.

The results show that since the declaration the results have improved, and by late 2010 in the most part the levels of exceedence are in the past part no longer there. The yearly results are shown in Figures 7 & 8 below.

Year	2008	2009	2010	2011
NO _x Level	52	46	33	32

Figure 7 NO_x Levels in the Cupar AQMA 2008-2011

Year	2008	2009	2010	2011
PM ₁₀ Level	23	19	16	19**

Figure 8 PM₁₀ Levels in the Cupar AQMA 2008-2011

It is worth noting that concentrations have increased since late 2010; however this can be viewed as an anomaly and the 2010 records should not be treated to be as accurate as the other year's records, because no monitoring was carried out between February and July which may have distorted the annual mean for 2010. So a period mean adjustment (1.04) had to be applied to compensate for this missing period in 2010. Also the increase in 2011 could be attributed to the calm weather conditions throughout the year, (93.1% across Scotland) especially during the abnormally cold winter months of late 2010 and early 2011, which can lead to increases in PM₁₀⁴.

The reconfiguring of the traffic signals from MOVA to SCOOT has had the largest impact in reducing the levels of NO_x and PM₁₀. The introduction of this measure coincided with the largest decline in concentrations of NO_x and PM₁₀. With the other measures planned as part of the UTMC project is thought that the levels of NO_x and PM₁₀ will eventually be below the Scottish Government thresholds and stay there permanently.

It is more difficult to quantify the impact that the "TRY IT Cupar" scheme, in terms of making a difference to the air quality, it will probably have a more minor impact than the UTMC scheme, but the council and service view is that it was still worthwhile

⁴ 2011 Air Quality Progress Report for Fife Council

undertaking, as it has involved a significant amount of community engagement and education for residents, about how they make their travel choices, the intervention will lead to more general carbon reduction, and will help keep the air quality in the AQMA down in the future, as there will be fewer localised trips being made by private car.

Finally the other two interventions have yet to be deployed, but it is expected that they are only going to have a very minor impact on the air quality or delivering carbon reduction, but still a positive one.

In addition as both the car club and the Electric Vehicle infrastructure, are going to be used by Fife Council services, it is going to send out a positive message to the public that Fife Council is setting the standard with its own carbon reduction measures, and delivering one of its 8 key priorities of being the greenest council in Scotland.

The purpose of this paper has been to describe how a Local Authority has managed to improve Air Quality within a local area, and promote carbon reduction. This scheme has managed to do this as the monitoring results show.

It is accepted that a Transport Planning/Traffic management intervention (Cupar UTMC) has had the largest impact on achieving the air quality goal, however it does very little for the general carbon reduction objective as vehicle numbers on the A91 remain the same, and the number of local trips remain the same. It is just very difficult to quantify "TRY IT Cupar" with a set of statistical results, but it is generally believed within the Fife Council Travel Planning team that the scheme has been a success, and the results from the annual monitoring surveys in future years will be able to prove this.

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