



Air Quality Investigation in Walkinstown, Dublin 12: Monitoring NO₂ Levels and Reducing the Impact

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Abstract

Air quality levels at Dublin 12 were monitored by Transition Year students at Drimnagh Castle Secondary School from October-November 2020. The investigation was presented to us by The Globe Program. Schools around Ireland were asked to come forward and participate in an interesting module to boost our scientific knowledge about the changing world around us. Through discussion, observation, research and analysis, pupils worked together to determine nitrogen dioxide concentration in our local atmosphere.

We were given nitrogen dioxide diffusion tubes to record data. Our group placed these at preferred locations and at hotspots we believed would generate great amounts of information. Traffic counts of the Walkinstown area were recorded to support our hypothesis and helped us gain a general understanding of the cause and effect variables. By using different methods and reflecting on data results, conclusions were made on what we have learned from this experience. Suggestions to improve our research and further ideas on what we would do differently were considered.

We should accept responsibility as a community, raise awareness about pollution and take initiative for a better world.

Research Question(s)

- What is the concentration of nitrogen dioxide pollutants in our local area?
- What factors influence these results?
- How can we reduce air pollution in Walkinstown?

These questions help us discuss the causes and effects of air pollution in our community. We should be able to understand our sample results, analyse and interpret them. We should be able to learn how to reduce the impact of pollution.

Introduction

Transition Year students of Drimnagh Castle Secondary participated in an air quality investigation conducted by The GLOBE Program. The monitoring took place for four weeks between Friday 16th October and Friday 13th November. This campaign addressed the concentration levels of nitrogen dioxide (NO₂) in the area around our school. The students in our class all have a keen interest in learning more about air pollution.

Air quality is a measure of how clean or polluted the air is. By taking part in this campaign, we can understand the causes and effects air pollution brings to our communities. Our school is located beside the Long Mile Road in Walkinstown, Dublin 12. The road is usually very busy as many shops, schools and industrial estates are located here. During rush hours, vehicles idle on the Long Mile Road for many minutes. This increases greenhouse gas emission near schools and other places which affect human health. Therefore, our local area proved to be an ideal location to monitor and test air quality.



Figure I: Aerial satellite image of Dublin 12 (via Google Maps, 2021)



Figure II: 3D View of the Long Mile Road (via Google Earth, 2021)

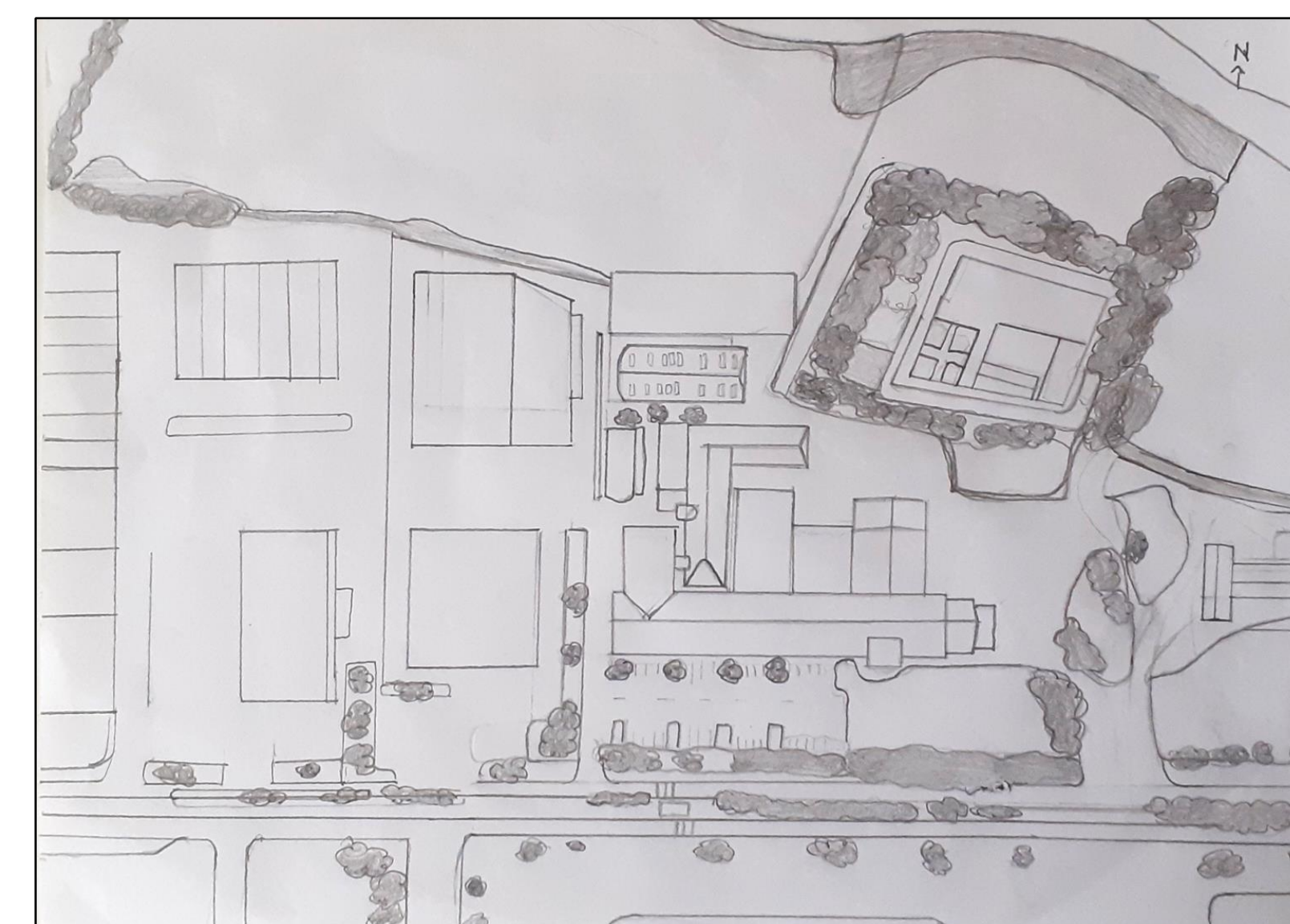


Figure III: Hand-drawn map of our local area (A)

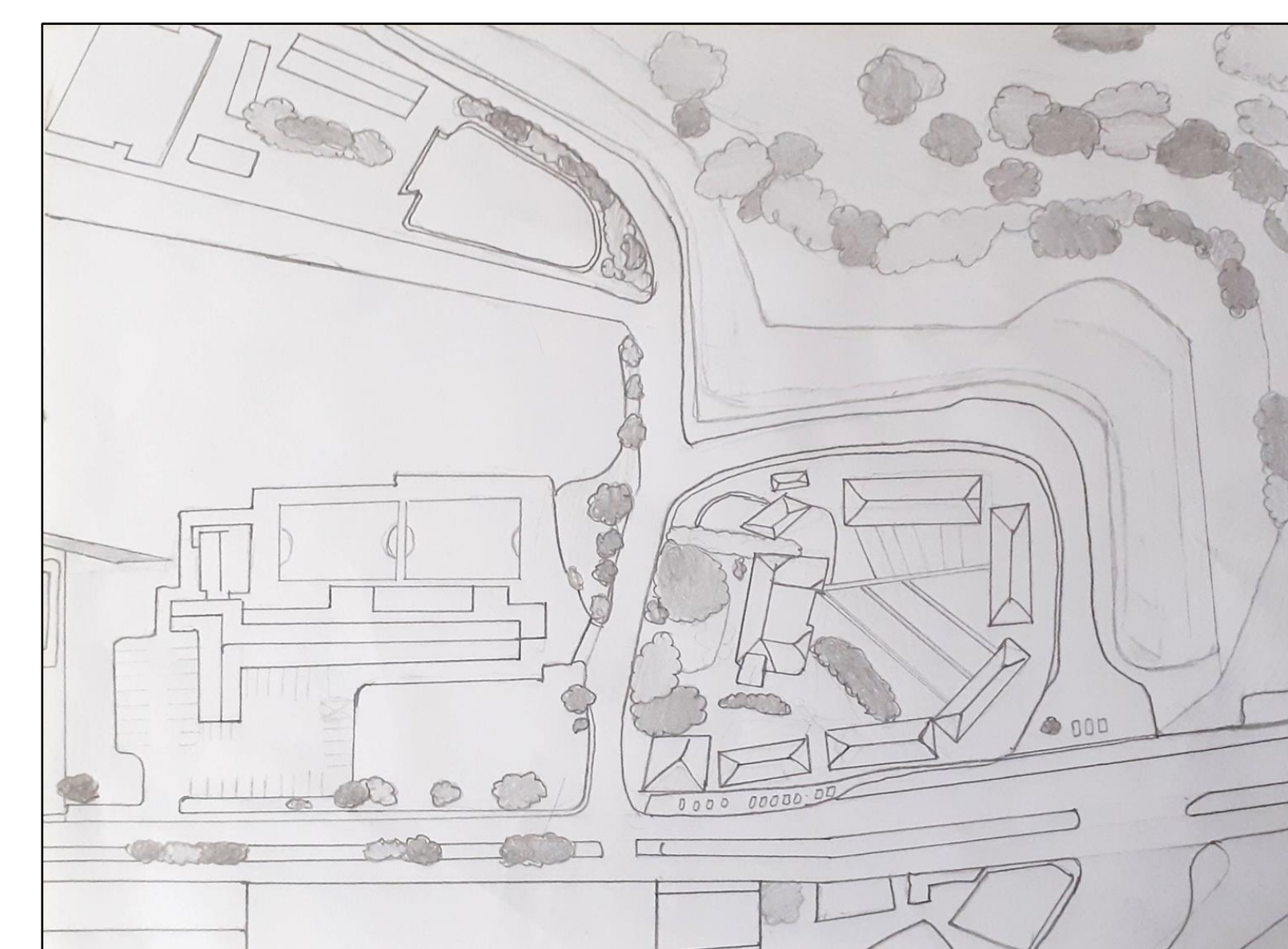


Figure IV: Hand-drawn map of our local area (B)

Overview

Air pollution is a significant issue that is rapidly increasing across the world. It poses a great threat to both health and climate. Many densely populated cities of the developing world suffer from the effects of air pollution. According to the World Health Organization, roughly seven million people die from the crisis every year. Studies have shown that 91% of the world's population live in places where air quality exceeds the WHO's guideline limits.

The most evident air pollutants in Ireland are Particulate Matter 10 and 2.5. Air quality in Ireland is linked to human activities and is caused by everyday routines. The pollution results from industry, power generation, residential energy, the burning of fossil fuels and agricultural/waste incineration. Air pollution is responsible for numerous health issues for all ages in urban regions. Almost 2 million people die each year from air pollution. Respiratory disease, cardiovascular disease, skin/eye irritation and cancer can develop from living in areas with high pollutant concentration.

This investigation is of great value as it improves the current knowledge of our school and the local community about air quality. It helps raise awareness about pollution and teaches people to reduce their carbon footprint. Climate change is a relevant topic in our education, hence we figured that the best way to learn is by doing. Drimnagh Castle's involvement in the air quality survey will prove to be beneficial.

Methods

Our school is adjacent to the Long Mile Road in the residential suburb. High volumes of traffic flow throughout the area as a result of its proximity to the city centre and several bus routes. Light industry, warehousing, car dealerships and commercial outlet stores are concentrated alongside the Long Mile Road in the western sector of the relatively flat terrain suburb.

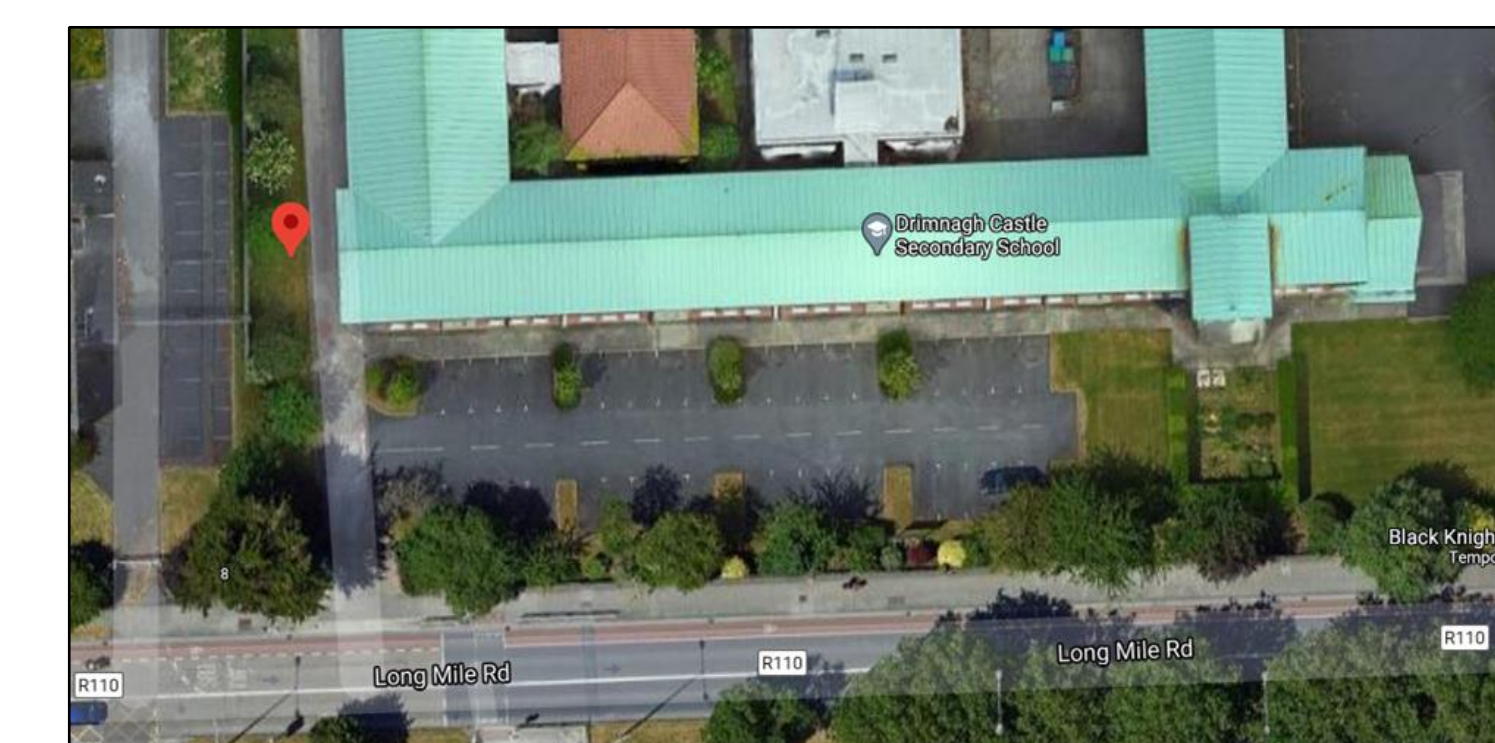


Figure V: Location of Sample 1. (via Google Maps)
Co-ordinates: 53.32421, -6.33442



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1. The students chose specific areas to place the NO₂ tubes.
1. The tubes were placed in areas that we identified as places affected by greenhouse gas emissions.
1. We took traffic counts in our local area to compare them with the NO₂ results to see if the volume of traffic affects the number of greenhouse gases emitted.
1. After a period of time (between Friday 16th October and Friday 13th November) the NO₂ tubes were retrieved.
1. The concentration of NO₂ captured in our diffusion tubes was sent to a laboratory to be analysed. The laboratory then applied a correction to express this concentration in terms of a cubic metre. Each result represented an average NO₂ concentration, expressed in micrograms (µg) per cubic metre of air (m³), that was captured over the four week period at our school.
1. We removed the white cap and used a passive sampler to record the locations.
1. With the results we received from the lab, we were able to improve our current knowledge of our school and the local community about air quality and helped us answer our research question.



It is extremely important to remember that NO₂ is just one part of determining overall air quality. There are other air pollutants that can seriously affect our health, such as particulate matter, ozone and sulphur dioxide.



Transition Year students decided to carry out a traffic survey. NO₂ is a traffic-related pollutant and our school's proximity to the local road Long Mile Road and high levels of traffic in the area contributes to the level of NO₂ concentrations around our school.

Traffic can have a pivotal impact on our recordings. Heavy traffic on the Long Mile Road only occurs during peak rush hours and this causes much air pollution. The survey will determine if the number of vehicles influences the sample results.

Results

Sample Results

The results of our NO₂ investigation arrived on the 20th of January 2021.

From our sample results, we can conclude that our average level of nitrogen dioxide is in the 'medium' category according to the concentration scale given in Figure VI. The lowest reading was from Sample 6 and it recorded an average of 15.50 µg/m³. Our highest concentration level was from Sample 3 and it reported 32.41 µg/m³. These results were among the highest levels of the schools listed in the program.

| µg/m ³ | Colour Code | NO ₂ Level Description |
|-------------------|-------------|-----------------------------------|
| 50+ | Black | Very High |
| 40-50 | Red | High |
| 30-40 | Orange | Medium to High |
| 20-30 | Yellow | Medium |
| 10-20 | Green | Low to Medium |
| 0-10 | Blue | Low |

Scale approval is pending.

Figure VI: (via The GLOBE Program, 2021)

Sample Results Table:

| Sample | Concentration of NO ₂ | Latitude | Longitude |
|----------|----------------------------------|----------|-----------|
| Sample 1 | 27.39 µg/m ³ | 53.32421 | -6.33442 |
| Sample 2 | 20.75 µg/m ³ | 53.32063 | -6.33382 |
| Sample 3 | 32.41 µg/m ³ | - | - |
| Sample 4 | 27.41 µg/m ³ | - | - |
| Sample 5 | 17.22 µg/m ³ | - | - |
| Sample 6 | 15.50 µg/m ³ | 53.32598 | -6.33203 |

The group researched the Environmental Protection Agency's website for further information on the air quality in our local area. The website provided statistical graphs and statements relating to the concentration of toxic particles. The air quality index observed by the EPA from the area is in the 'good' category. The nearest monitoring station to our school is at Walkinstown Library. Overall, our results portrayed higher levels compared to their monitoring station readings.

Traffic Survey Results

The survey was conducted in local areas such as in front of the Assumption, at the top of Long Mile Road and outside the EuroCycles store. We also reported by Walkinstown playground, the main gate of our school, the nearby Aldi and at a bus stop next to the school. We split into groups and counted the number of vehicles that drove by over time. The weather was calm and bright with a gentle breeze.



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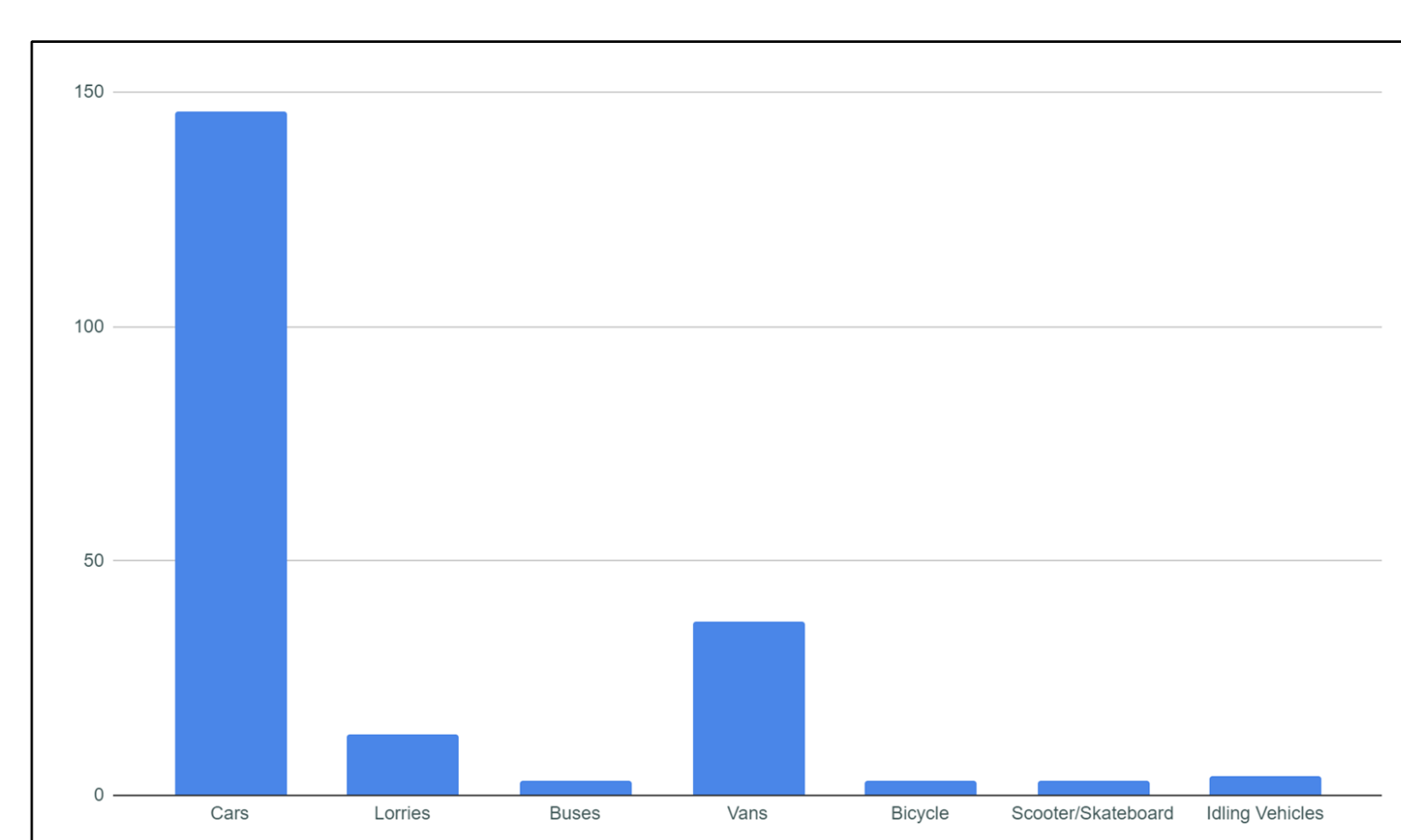


Results

The following charts and tables describe statistics gathered from our traffic surveys:

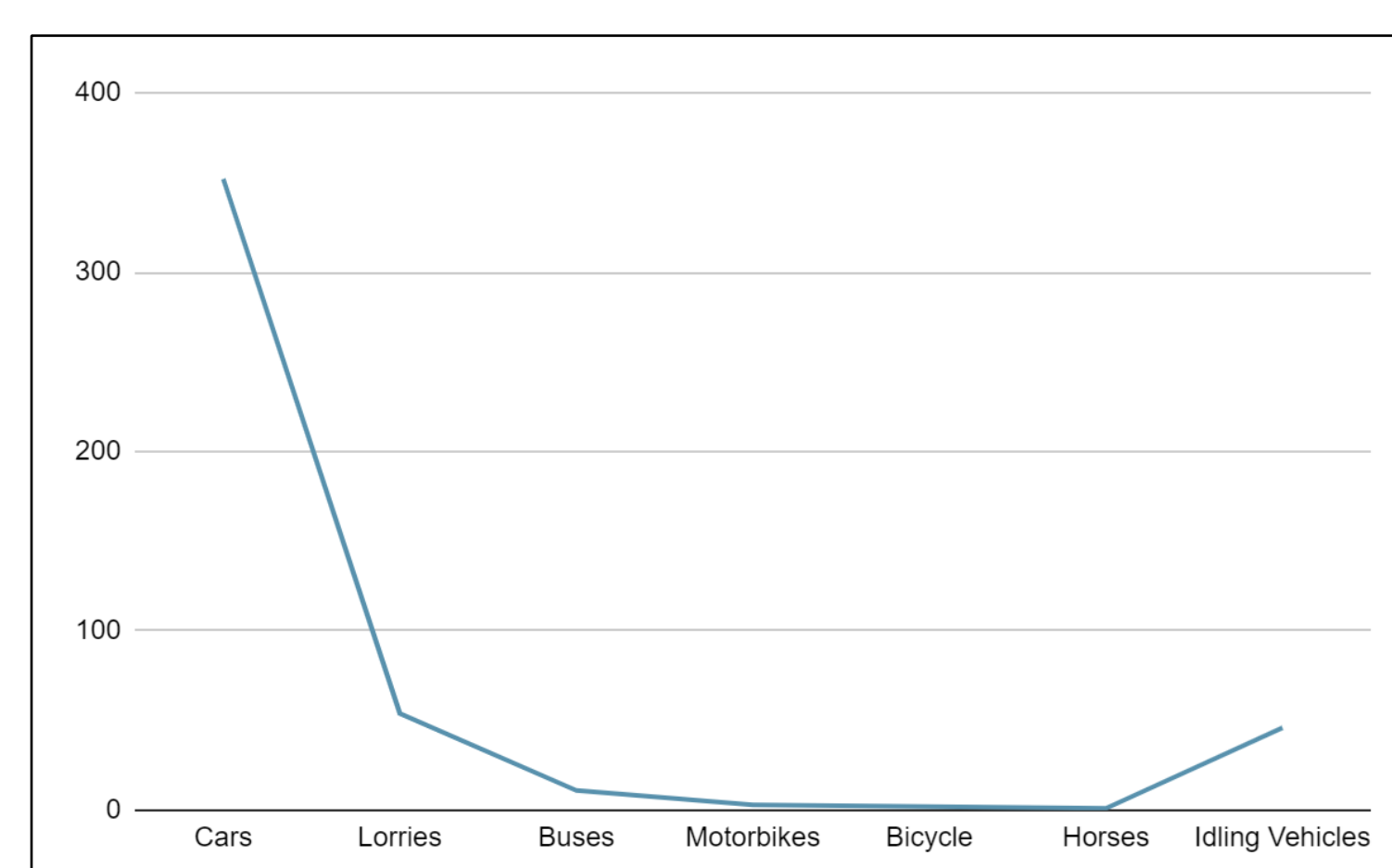
Location: Main Gate **06/11/2020** **Time: 12:01 - 12:21**

| Cars | Lorries | Buses | Vans | Bicycle | Scooter/Skateboard | Idling Vehicles |
|------|---------|-------|------|---------|--------------------|-----------------|
| 146 | 13 | 3 | 37 | 3 | 3 | 4 |



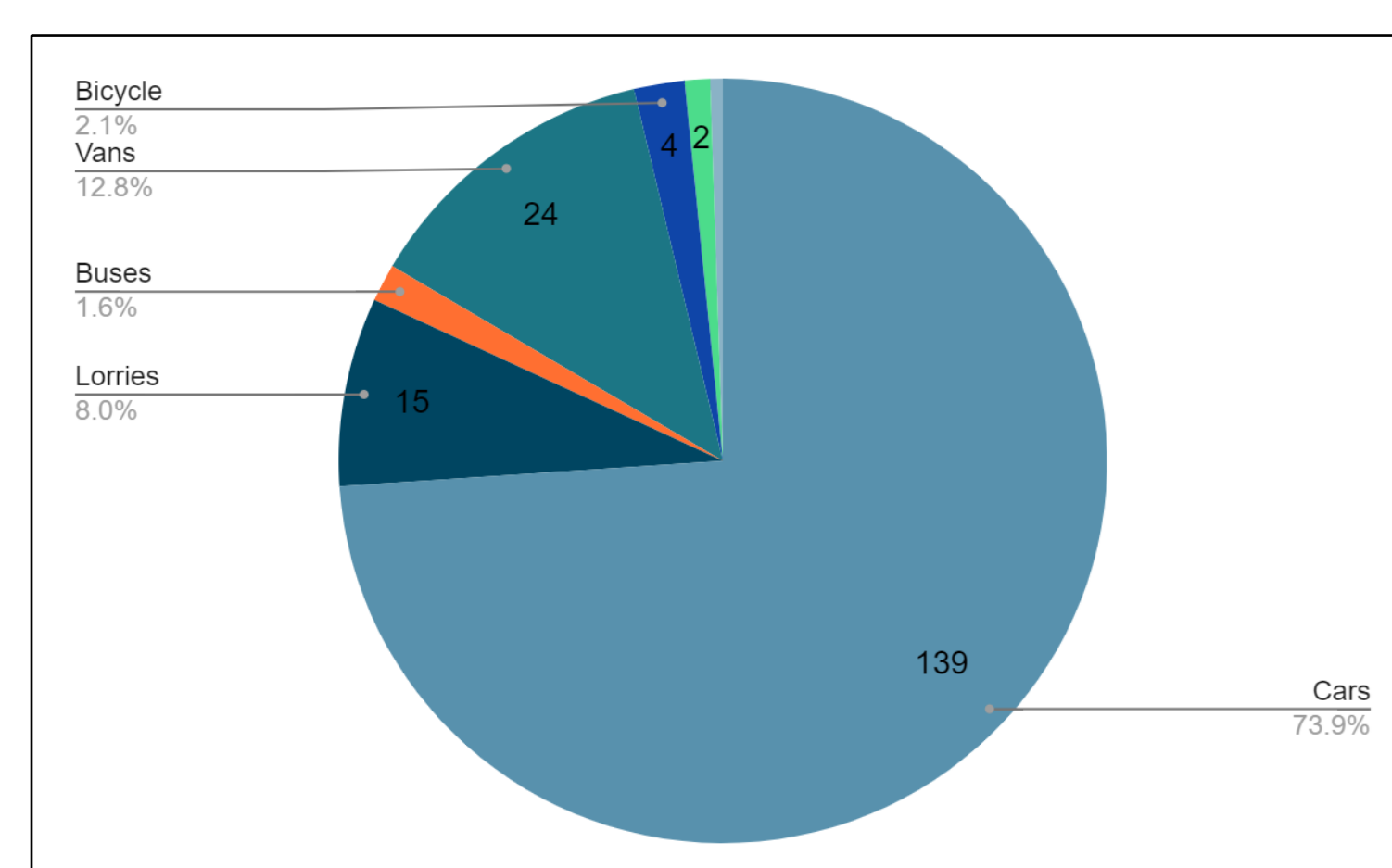
Location: Long Mile Road outside EuroCycles **06/11/2020**

| Cars | Lorries | Buses | Motorbikes | Bicycle | Horses | Idling Vehicles |
|------|---------|-------|------------|---------|--------|-----------------|
| 352 | 54 | 11 | 3 | 2 | 1 | 46 |



Location: Assumption **06/11/2020**

| Cars | Lorries | Buses | Vans | Bicycle | Scooter/Skateboard | Idling Vehicles |
|------|---------|-------|------|---------|--------------------|-----------------|
| 139 | 15 | 3 | 24 | 4 | 2 | 1 |



Discussion

NO2 is a gas that is extremely harmful to human health and the environment and there is no safe level. Exposure to low to medium levels of NO2 in the long term is associated with all sorts of health risks. Using the scale provided by the EPA Air Quality Team, our average level of NO2 is in the medium. Nitrogen Dioxide (NO2) from transport emissions pollute urban areas such as Walkinstown, the area we investigated.

The burning of solid fuel gives rise to poor health conditions in urban areas residing in light industry like Walkinstown. This combines for very poor air quality, causing health impacts such as strokes, heart disease and in Ireland's case, 1300 premature deaths due to PM2.5 air pollution. The heavy traffic in the Long Mile Road has a significant impact on air quality.

Our results support our hypothesis as our Sample 3, which was taken on the Long Mile Road outside Euro Cycles had the highest concentration of NO2 (32.41 µg/m3). From our traffic count, we can also see that the highest volume of traffic was also recorded here (Long Mile Road outside Euro Cycles).

To learn what impact traffic has on the surrounding air quality and to see whether our results support our hypothesis we can compare and contrast Sample 3 with Sample 5. Sample 5, which was taken at the Assumption had a significantly lower concentration of NO2 (17.22 µg/m3) compared to Sample 3 (32.41 µg/m3).

From our traffic count taken at the Assumption, (139 Cars, 15 Lorries, 3 Buses), we can see that the volume of traffic is significantly lower than the traffic count taken at Long Mile Road outside Euro Cycles. (352 Cars, 54 Lorries, 11 Buses).

From this we can understand that the amount of traffic at Long Mile Road outside of Euro Cycles, which was much higher than the amount of traffic at the Assumption, had a major influence on the concentration of NO2 (32.41 µg/m3). Therefore, with fewer vehicles comes fewer transport emissions that are released and the concentration of NO2 was equally much lower.

This answers our research question "What factors influence these results?".

Conclusions

From the results shown above, we were among the highest NO2 levels of schools listed in the Globe Program.

The conclusion was reached that we have to bring these NO2 levels down or it will cause many health issues to the surrounding people who are living there and also to the schools. We can do this by spreading these results to the community and asking their help to reduce the NO2 levels by walking, cycling or travelling by bus. This will surely reduce these levels, to spread this information we could create posters, flyers and videos.

We can do follow-up research in the near future and see how much the results have gone down. We can then compare and contrast these results.

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