Community-centred flight path optimisation for Urban Air Delivery

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Author's Note

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Abstract

Dublin's drone delivery network has stalled in mid-2026. Three hub applications were denied planning permission since 2025 despite independent noise assessments determining that the noise impact of the drones would not significantly impact the residents of the areas. Ireland has a very fragmented drone legislation system, and the laws differ from county to county. It also lacks a specific drone noise standard or tools which can be used to assess the impact of drones on their areas which leads to inaccurate noise assessments and complaints by the community. Two routing algorithms and a microhub siting model were developed and tested against Manna's actual and proposed hubs in Tallaght, Dundrum and D15. It uses an ISO 9613-2 based noise propagation model and CSO population data. Noise aware routing cut daily SEL by 4-7 dB and peak SPL by up to 7 dB on direct to destination routes. The noise energy level dropped by 60-70%, however distance, energy and money all increased by 30-50% on the tested routes. Microhubs improved the community average but subjected the buildings nearest to the hub to a concentrated and repeated noise produced during the deliver hover phase. Better routing strategies can reduce noise exposure; however, they cannot fix all the issues with urban air delivery. Before urban air delivery can expand in Ireland, things like a unified zoning framework, a modernised noise modelling and noise nuisance legislation and tools and quieter propeller hardware need to be developed and implemented. At the moment, drones still need to be improved before they can carry out deliveries across cities and not decrease the quality of life of the residents. Until then, they can be used to deliver essentials like medicine and food to people who really need them.

Introduction

Urban air mobility has taken off in recent years and has introduced many benefits, as well as challenges, to communities. It promises lower per-parcel emissions, less road congestion and negligible delivery times compared to traditional courier deliveries. Dublin, and other cities in Ireland, have been at the centre of this innovation with companies like Manna Drones Ltd. (further on Manna) setting up hubs in Dublin and Cork. Manna has spent years building a drone delivery network in Blanchardstown, a district of Dublin, where deliveries began in February 2024 and has completed almost 90 thousand deliveries across the span of 2 years. In total, across all its hubs, Manna has completed over 300 000 deliveries by mid-2026.

However, by the summer of 2026 their expansion had stalled, as Fingal County Council refused planning permission to retain the Blanchardstown hub in 2025, which was followed by a second refusal of a planning permission for a second hub near Coolmine Industrial Estate in early 2026 [1]. This came despite independent noise assessments concluding that the increased noise exposure of the new hubs would not significantly impact the residents underneath the flight paths and near the hubs themselves, with cumulative changes of 0-2 dB at most nearby residents [2], which is not deemed as a significant volume change. Even though changes of this size are deemed not significant under the EPA/IEMA criteria the Coolmine hub alone drew more than 200 noise complaints, with most of them citing noise as the main reason. Some weeks later, in June 2026, another hub was refused planning permission in Dundrum. Unlike in Coolmine, where the hub was denied planning permission despite an assessment, Dundrum argued that the noise impact was not sufficiently evidenced or modelled [3], as the noise report relied overly on $L_{Aeq,\ 12\ hr}$ (average sound energy over 12 hours) and L_{den} (environmental noise pollution over 24 hours), which did not account for the temporal character of the drone sufficiently. The noise impact assessment (NIA) did also not address the specific tonal characteristics of the drones and their impact on nearby wildlife and biodiversity [3]. On June 19th, 2026, Manna has announced a strategic pause of its Irish operations, as the absence of a clear national policy framework for commercial drone delivery leads to each new cases being assessed locally, leading to uncertainty about the planning and infrastructure requirements for future growth.

In both cases, residents and local politicians pushed against the company regardless of what the NIA concluded. This discrepancy suggests that population-weighted, energy-averaged noise indicators do not fully capture what the residents object to when drones are flying overhead. This gap is something that can be addressed with better routing algorithms. A report by Kyi and Feng [4] shows in a demand driven simulation, that routing strategy, like altitude-aware, population-weighted A* routing, and delivery structure (like micro hubs) can alter the noise exposure on residents.

This report builds from the Manna example in Dublin and explores the problems with urban air delivery. It also develops a community-centred approach to modelling and mapping UAV delivery noise and uses Dublin as a testbed for a more generally applicable tool which can be used to reduce the noise exposure from drones on communities and will benefit the residents and the delivery operators alike.

Regulatory and community context

At the moment, Ireland regulates drone delivery in two, mostly separate ways. The flights themselves are regulated by the Irish Aviation Authority (IAA) on the national level and by EASA on the Eu level. The IAA can license operators under the EASA regulations and the Department of Transportation's National Policy Framework for Unmanned Aircraft Systems, which was published in August 2025, sets out how airspace should be managed in the future, as drone operations scale. This would be done through instruments like UAS geographical zones, where drones would be banned from flying over certain areas like hospitals, schools, etc. and through a U-space airspace, which is a designated geographic zone where drone operations are allowed only with the support of digital traffic and safety services, a digital version of traditional ATC [5]. However, the hubs themselves, where drones land, are maintained and loaded, is considered a development under ordinary planning law and the regulations for them differ from hub to hub, depending on which county they sit in. The Policy Framework's own actions task the IAA and local authorities with more zoning, data-gathering and training, however, none of them set a methodology or threshold for assessing drone noise in urban areas specifically, which was also highlighted by the Coolmine NIA [2], as "*no Irish standard or planning guidance yet exists for measuring drone-related environmental noise"*, which left consultants applying tools used for measuring noise emission of roads, rail and industry, like the mentioned $L_{Aeq,\ 12\ hr}$, L_{den} and the EPA/IEMA significance bands. The problem with these tools is that they were never calibrated for the specific tonal and temporal pattern of drones and can be deemed unreliable for measuring the noise impact of such vehicles [6].

Another regulatory gap is an older document from 1992. Section 108 (4) of the Environmental Protection Agency Act 1992 excludes aircraft from Ireland's ordinary noise nuisance mechanism. As drones are legally aircraft, an individual has no statutory noise complaint to bring at all, and some complaints have been ignored due to this reason [7]. Roderic O'Gorman, a Green party leader, has introduced a bill in 2025 to close this gap and allow residents to express their annoyance publicly, but it has not been enacted yet [8]. All these regulatory gaps combined leave residents with less legal ground to complain against drones and as already mentioned leaves councils, consultants and delivery companies alike

with no legal framework which would allow expansion for companies and better tools to assess the impact of drones.

This gap was a big reason for the refusals of the planning applications and as already mentions, the Coolmine's retention application was denied because the assessment was judged not to prove adverse effects could be neglected [1], not because the 2dB average noise increase would be deemed as too significant. Fingal City Council also noted that the EPA bands assume that the new noise is materially similar to the existing soundscape, which does not hold when the existing soundscape is road traffic and the new noise is a hovering drone, as they possess entirely different acoustic signatures. Additionally, the Dun Laoghaire-Rathdown's June refusal also found the $L_{Aeq,\ 12\ hr}$ and the L_{den} to be unsuited to the "*intermittent, short-duration and repetitive source"* [3].

The aspects missed by the NIA spur up in the complaints. Drone Action D15's archive runs 90 objections against Coolmine and 153 against the earlier Junction 6 applications. A recurring theme in all complaints is the specifically annoying pitch, loudness and repeated noise coming from the drones, on multiple occasions daily, rather than being annoyed by just one drone delivering a package. The residents are most annoyed by flyovers and hovering of drones above their private gardens, from where most of the privacy and noise complaints stem. On top of that, the drone's noise has a severe impact on people who are least capable of filtering noise out, like autistic people [9, Appendix A, part II], people with disabilities, as they their sense of hearing or have to take their hearing aids out and people working night shifts [9, Appendix A, part III], as the noise overhead impacts their sleep [9, Appendix A, part III].

Underneath both refusals lies a routing decision, as commercial drone routing today is built to minimise distance, delivery times and battery use. The current algorithms disregard what's beneath the flight paths and how many times a certain area has already been overflown in a day. Even though a geo-block exists in Manna's case, where residents can opt to ban drones flying over their houses, it has turned out the geo-block is not very effective and drones still fly over certain areas, or very close to them, making essentially zero difference on the noise impact on the residents [9, Appendix A, part I]. As the number of

flyovers over a house is not specifically tracked, the cumulative noise exposure cannot be specifically modelled. Fingal's environmental health officer had conditioned in the original Blanchardstown Centre permit (FW23A/0151) that flights follow existing road networks rather than the shortest path, which would significantly reduce the number of gardens overflown [10]. However, this condition was then dropped from later planning permissions. Manna is now refocusing toward the US, as it has a better national framework for drone operations. Manna has, due to the lack of a national framework, paused all its Irish operations, as the current approach is too complex and uncertain.

Methodology

When designing the algorithm, all arguments made in the concept section were taken into consideration. The core idea of the routing algorithm developed is to keep the drones as far away from people as possible. This is done via several methods. The most efficient ones are flying higher, following already-busy roads, hoping that existing road traffic would mask the drone noise, and avoiding of high-density areas. Another concept introduced is microhubs, which move the loudest part of the delivery away from private gardens and to a nearby microhub location instead. To reduce the overall perceived noise impact from the drones, certain areas, such as parks, places of worship, schools and kindergartens have been designated as avoidance zones, which will keep these places as quiet as possible while still continuing deliveries. Hospitals are also considered hubs.

Noise propagation was a vital part of calculating the noise exposure on residents. Sound pressure level at a ground receiver is modelled as a moving point source, loosely following ISO 9613-2 [11], stating that the Sound Propagation Level (SPL) equals

$$SPL = L_0 - A_{div} - A_{atm} + G \qquad \text{[eq. 1]}$$

where $A_{div} = 20\log_{10}(d) + 11$, where d is the the distance in metres, A_{atm} is a simplified broadband atmospheric term, and G is a small ground effect correction. G depends on the type of surface, as soft ground attenuates more than hard. The reference source L_0 is based on the Coolmine NIA's own delivery point measurement ($L_{A,max}$ is 78 dBA, drone hovering at 15m, 5m horizontal offset) [2] and is cross validated against the report's separately measure cruise value to within 1.1 dB. A route's exposure at a receiver is reported as a peak instantaneous SPL and as the Sound Exposure Level (SEL), calculated as an energy-domain integral over the whole event,

$$SEL = 10\log\sum_{i=0}^{n} 10^{\left(\frac{SPL_i}{10}\right)} \cdot \frac{\Delta t_i}{t_0} \qquad \text{[eq. 2]}$$

where t_0 is 1 second [12]. The SEL captures duration and loudness. A 90-second hover at the delivery point is added to the transit exposure and is scaled to 20 daily flights.

The people affected are calculated within a 300-metre search radius of the flight path and the hover point and every nearby CSO Small Area is checked against its own combined, major road masked SEL, and if it clears a 45dB threshold, its population is added to the total number of people affected. A worst-case peak SPL is calculated to assess the highest noise exposure of any one receiver along the route and is reported separately.

Three strategies and two routing algorithms were developed on the map of Dublin's Tallaght, Dundrum and D15, with actual or proposed Manna's hub location in each, and the noise impact of each strategy and algorithm was assessed to allow comparison between them. The first routing strategy was a simple least-fuel, shortest-distance path, which flies just high enough to clear obstacles safely. This algorithm is used as a baseline for what is already used by delivery drones. The second algorithm is the one that optimises for all the issues mentioned in the above sections. The algorithm builds altitude and road preference into the cost of each segment, using real population data from CSO's 2022 Small Area Population Statistics and the maps are imported from OpenStreetMap. Segments are weighted by how many people live nearby, using the aforementioned data, and that cost is then discounted if the path follows a major road, since existing traffic will mask some of the noise. Similarly, altitude increases wherever more people are affected below, up to a ceiling of 80m above ground level. A more complex version of this, which would also consider time of day, building height and materials to calculate the echo and resonance, and the tonal character of the drones was considered, but it was too complex to build in the given timeframe. However, the version built captures the most important factors.

The third strategy considers microhubs as an alternative to direct garden or door delivery. Rather than the drone hovering for over a minute above a garden, disturbing all nearby residents, the packages would be delivered to a predetermined location like a deposit box, gas station, convenience store, etc. These are sited in advance via a greedy set-cover algorithm that picks the building with the most still uncovered residents, avoiding schools,

kindergartens, places of worship, elderly homes and similar establishments, to determine a microhub. This is a similar concept suggested by Kyi and Feng [4]. Deliveries are therefore routed to the nearest hub, which concentrate the loudest part of the delivery at a small number of already vetted locations.

A separate check is used to look at whichever ordinary residential building sits nearest to the delivery hover point or the take-off area and reports its combined sound exposure level (SEL), because a route that helps the community average can still make things worse for some houses, especially in the cases of delivery hubs. Additionally, increased operating costs are calculated for each flight to determine how much more expensive the designed algorithm would be for the company. The energy consumed is calculated as

$$W_t = W_{horizontal} \cdot d_{horizontal} + W_{climb} \cdot h_{climb} + W_{descent} \cdot h_{descent} \quad \text{[eq. 3]}$$

where $W_{horizontal} = 0.039\ Wh/m$, $W_{descent} = 0.039\ Wh/m$ and $W_{climb} = 0.4944\ Wh/m$. The cost is calculated by multiplying the energy consumed with the energy prices. The drone's mass with payload is considered 25 kg, all derived from Manna's publicly available figures.

The algorithm tries to be as accurate as possible and provide the best route available, however there are some limitations worth noting. The tonality and the perceptual cost of repeated events are not modelled, there is no time-of-day sensitivity, altitude tiers don't consider building height and ground attenuation, and road-class weights, masking distances and density thresholds are placeholder judgment calls and there may be other noise sources that haven't been accounted for. The microhubs are selected by a greedy heuristic algorithm. The algorithm was never tested in real life and is purely theoretical.

Results and evaluation

The algorithm was tested on Dublin's Tallaght, Dundrum and D15 areas. In Figure 1 is an example of the final working map, specifically Dundrum, with population density overlays and hubs, and with routes to three destinations planned out.

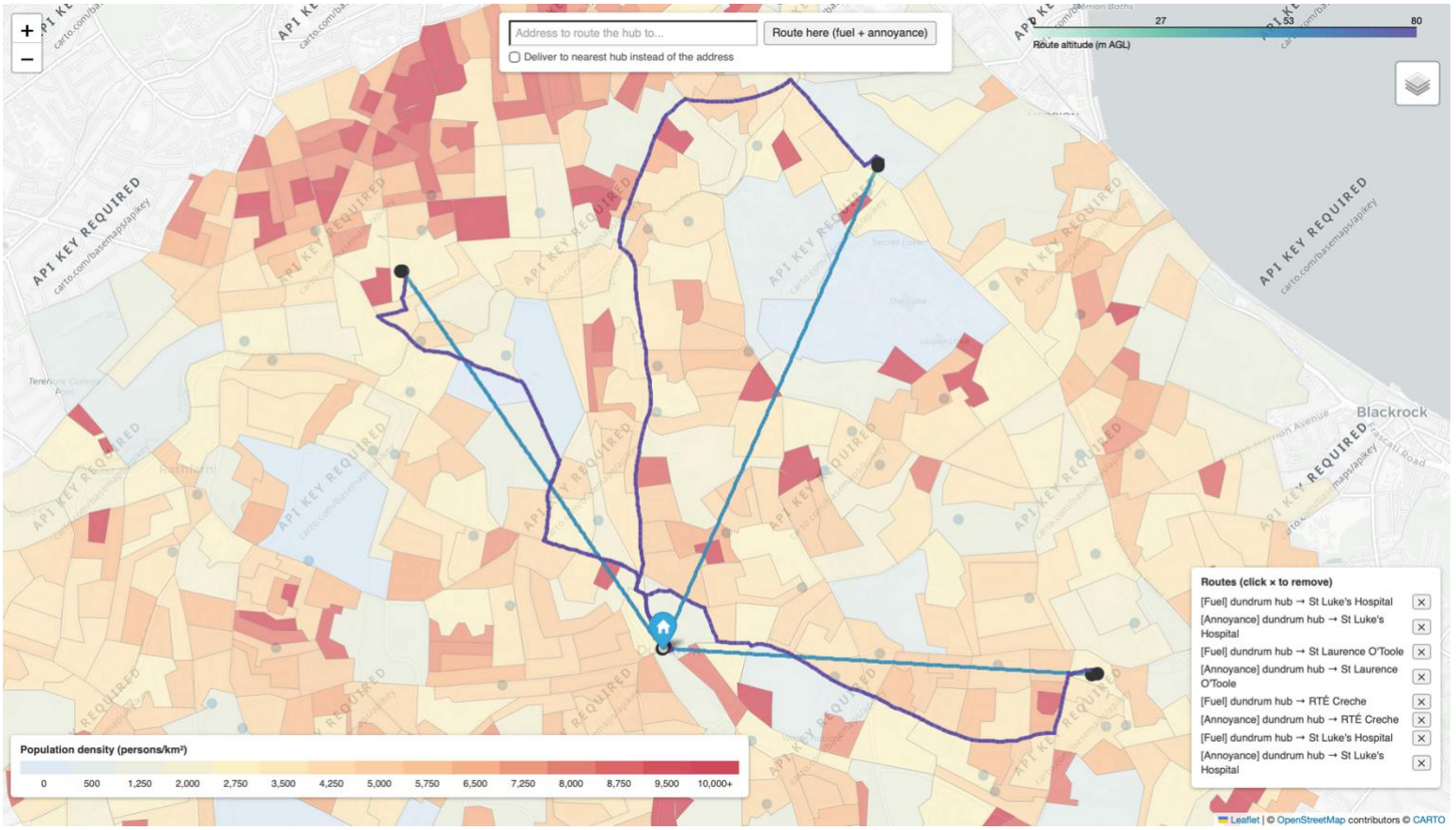


Figure 1: Map of Dundrum with some routes and population density overlay

The population density is shaded from the CSO's 2022 small area data, split up into small areas and shaded pale for low density and darker red for very large densities above 10000 persons/km^2. Sensitive receptors, which are preferably avoided, can also be specifically marked as seen in Figure 2. Route altitude is shown as a colour gradient along the path itself, going darker with higher altitudes, up to 80 metres. The dark violet colour is therefore the noise aware route, whereas the lighter, lower altitude path is the direct fuel aware route. The paler blue dots spread across the maps are the microhubs. Upon enter a new destination, another HTML file opens with all the data about noise exposure, using formulas

outlined in the methodology section, which allows for calculation and comparison of the routes. Two destinations were randomly picked, one in D15 (figure 2) and one in Dundrum (figure 3 and 4). They include 2 different destinations, and 2 routes rerouted to the nearest hub instead of the actual entered destination.

Figure 2: D15 direct route (left) and to nearest hub (right) to Little People's Academy

Figure 3: Dundrum routes direct to destination Laurence O'Toole Elementary School

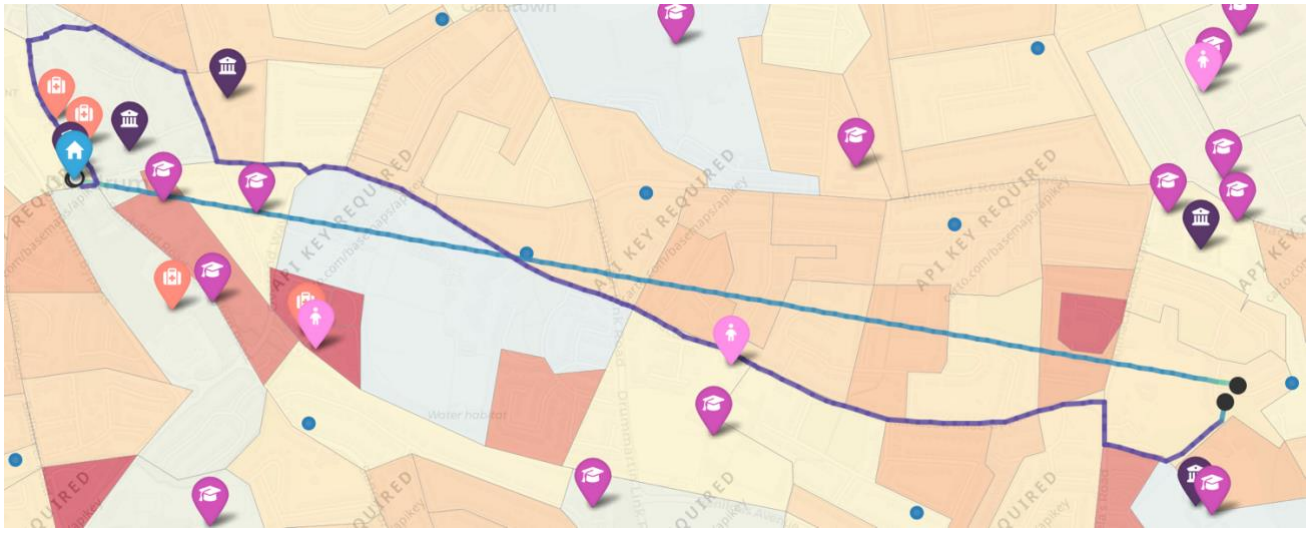


Figure 4: Dundrum routes to nearest hub, same destination as Figure 3

The data gathered from the D15 sample routes is presented below, in Tables 1 and 2 and in Graph 1. Figure 5 places the peak SPL levels against familiar reference sounds to give a physical sense of what these numbers mean. Daily SEL is a different quantity, it is the energy equivalent dose of the entire duration of the noise, rather than the noise heard at any

instant. It is also important to note that dB is not a linear but a logarithmic scale, meaning the changes in the noise energy are much larger than they seem.

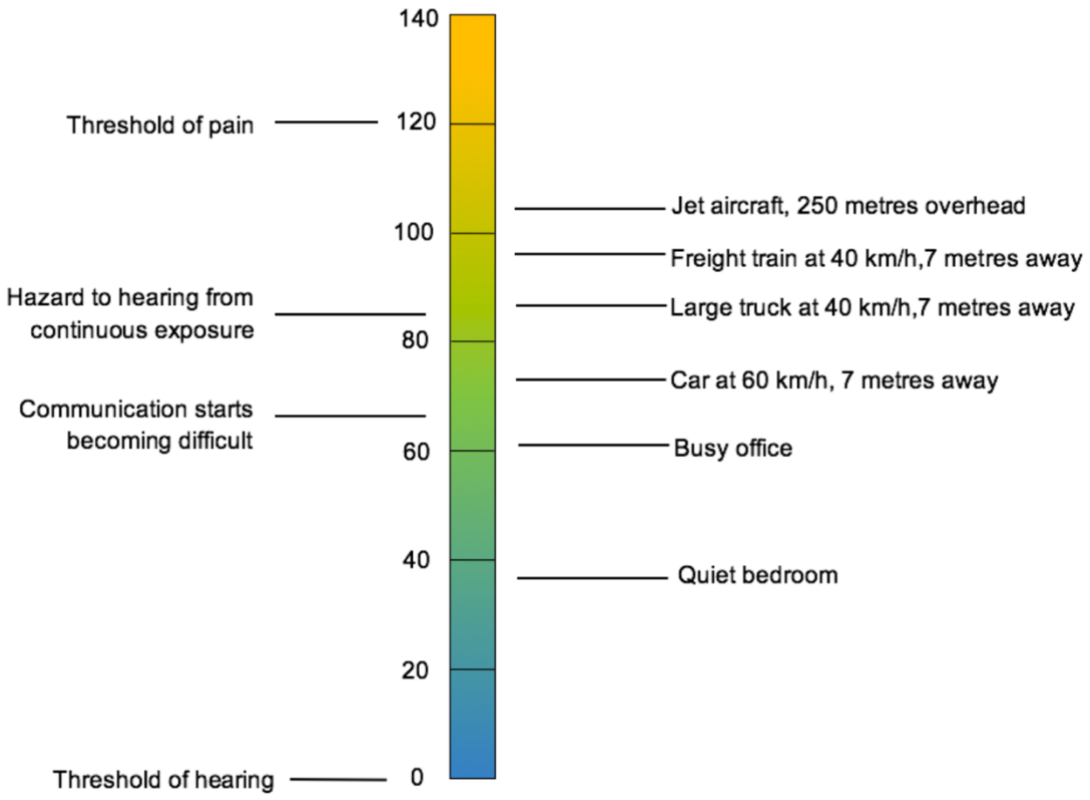
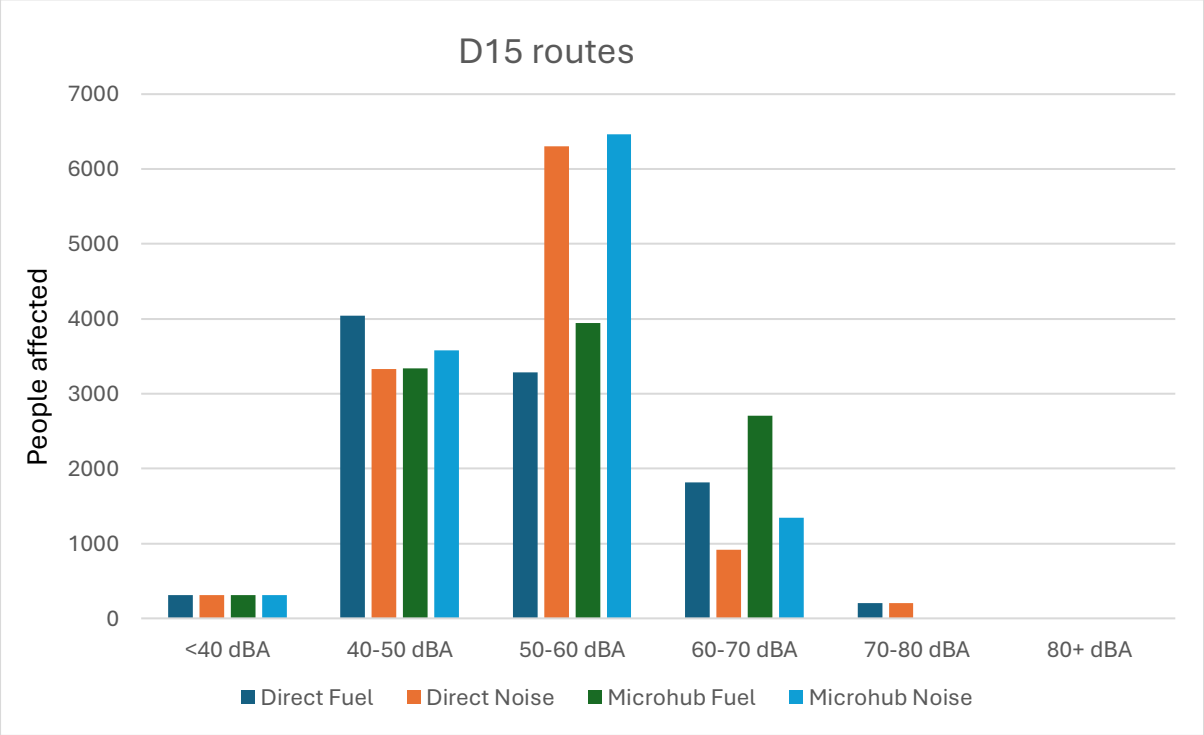


Figure 5: dB scale for comparison

Table 1: DBA bands for the D15 sample routes

DBA band	People Affected					
	Direct to Destination			to Nearest Microhub		
	Fuel-aware	Noise-Aware	Δ	Fuel-aware	Noise-Aware	Δ
<40 dB	306	306	0	306	306	0
40-50 dB	4,043	3,325	-718	3,340	3,581	241
50-60 dB	3,285	6,303	3,018	3,940	6,462	2,522
60-70 dB	1,819	919	-900	2,702	1,339	-1,363
70-80 dB	200	200	0	0	0	0
80+ dB	0	0	0	0	0	0

Table 1 shows a consistent shape on both legs, as the noise aware routing pulls people out of the loudest band, but pushes more people into the moderate bands. At routes direct to destination the 60-70 dB band falls by 900 people, as the 50-60 dB band rises sharply by 3018 people, while the 40-50 dB band falls by 718 people, which is slightly unexpected. When routed to the nearest microhub, a similar shift happens slightly more emphatically on the louder end and the 60-70 dB band falls by 1,363 people, while both moderate bands rise. Nobody is exposed above 70 dB on either leg and the <40 dB and the 80+ dB bands are untouched throughout.



Graph 1: DBA bands against people affected on D15 routes

Table 2 below shows metrics related to each D15 sample path.

Table 2: Metrics for the D15 sample routes

	Direct to Destination			to Nearest Microhub		
Metric	**Fuel-aware**	**Noise-Aware**	Δ	**Fuel-aware**	**Noise-Aware**	Δ
Distance [m]	1,517	1,842	326	1,678	2,005	327
Energy [Wh]	85.3	113.5	28.2	91.6	119.8	28.3
Operating cost [€]	0.132	0.176	0.044	0.142	0.186	0.044
People Affected	9,653	11,053	1,400	10,288	11,688	1,400
Daily SEL [dB]	133.7	129.7	-4.1	125.1	124.5	-0.6
Peak SPL [dB]	79.2	74.3	-5.0	63.0	61.6	-1.4
Loudest house SEL	97.9	92.8	-5.1	98.8	92.4	-6.5
Loudest house distance to hover point	6.1	21.5	15.4	0	23.0	23.0

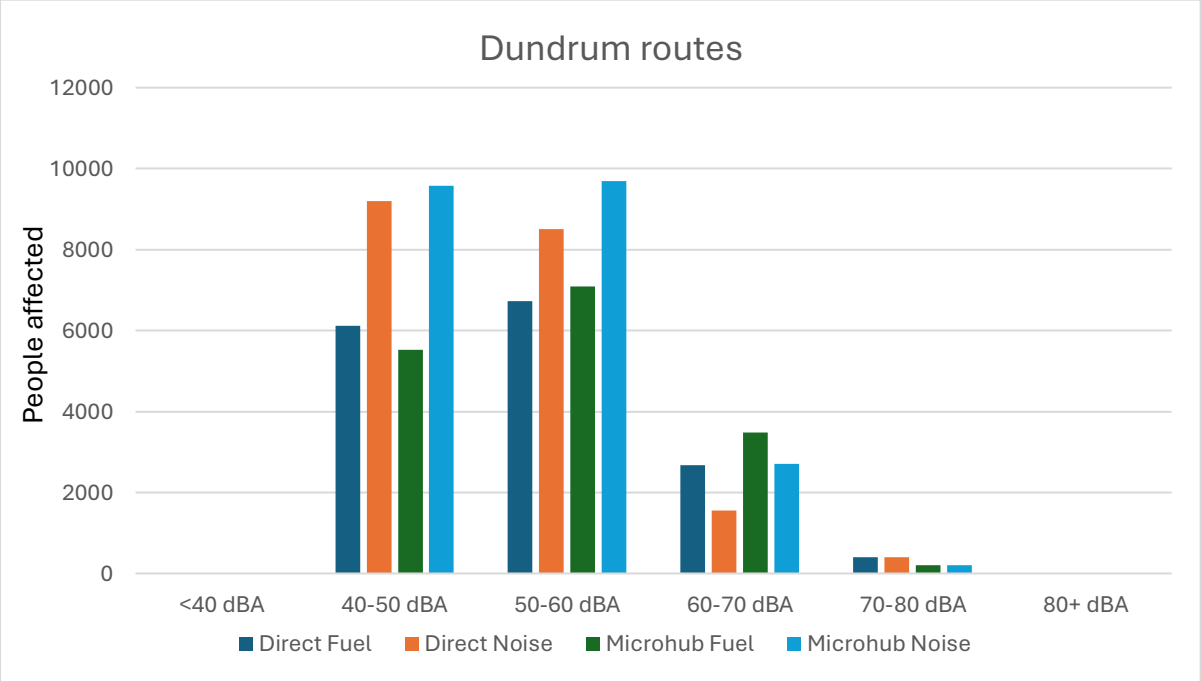
Table 2 confirms that the overall noise exposure drops on the noise aware path, as expected. Daily SEL falls 4 dB on the direct path and 0.6 dB on the microhub leg. This translates to a 61% and 13% population-weighted energy drop respectively. The peak SPL also drops by 4.9 dB direct and 1.4 dB hub, which is a significant improvement. The associated costs with operating on a more noise-aware route rise proportionally, as the distance increase by roughly 21% and 31-33% more energy is required due to longer distance and a higher climb needed. The costs rise by 14.5% and 13.6% on the direct and the hub route respectively. Every noise metric improves by choosing the noise aware route, as expected the daily SEL, the peak SPL and the loudness bands all move in the predicted direction, however that improvement costs roughly a third more in distance and energy and is also more expensive to operate. The noise-aware route also affects more people, even though the actual sound level is lower. The nearest house to hover point also improves on both legs, as its SEL falls by 5.1 and 6.1 dB for direct and the hub route, as the hover point moves further away, preventing the hover point from being directly next to someone's house.

The data concluded from the Dundrum sample routes is presented in Tables 3 and 4 and shown in Graph 2.

Table 3: DBA bands for the Dundrum sample routes

DBA band	People Affected					
	Direct to Destination			to Nearest Microhub		
	Fuel-aware	Noise-Aware	Δ	Fuel-aware	Noise-Aware	Δ
<40 dB	0	0	0	0	0	0
40-50 dB	6,114	9,201	3,087	5,519	9,583	4,064
50-60 dB	6,727	8,509	1,782	7,093	9,692	2,599
60-70 dB	2,669	1,556	-1,113	3,489	2,704	-785
70-80 dB	400	400	0	200	200	0
80+ dB	0	0	0	0	0	0

The Dundrum sample routes present a similar shift as already described in the previous section, as exposure moves away from the loudest band into the quieter ones. However, there are some slight divergencies between Tables 2 and 4, as described below Table 4.



Graph 2: DBA bands against people affected on Dundrum

Table 4: Metrics for the Dundrum sample routes

	Direct to Destination			to Nearest Microhub		
Metric	**Fuel-aware**	**Noise-Aware**	Δ	**Fuel-aware**	**Noise-Aware**	Δ
Distance [m]	2,490	3,516	1,026	2,826	4,449	1,624
Energy [Wh]	123.2	178.8	55.6	136.3	213.8	77.5
Operating cost [€]	0.191	0.277	0.086	0.211	0.331	0.120
People Affected	15,910	19,666	3,756	16,301	22,179	5,878
Daily SEL [dB]	133.0	127.9	-5.1	124.6	125.2	0.6
Peak SPL [dB]	79.2	72.0	-7.2	62.2	74.7	12.5
Loudest house SEL	84.6	87.9	3.3	98.8	93.3	-5.5
Loudest house distance to hover point	66.2	42.3	-23.8	0	19.9	19.9

At paths direct to destination, the pattern matches the previously described one, the daily SEL falls 5.1 dB and the overall emitted noise energy falls by 69%. The peak SPL also falls by 7.2 dB, at the cost of a bit more than 40% in distance, energy and price. However, when delivering to a hub, the daily SEL rises slightly by 0.6 dB and the peak SPL is considerably higher, as it rises by over 12 dB. This route also has by far the largest cost and distance premium, as it is 57% longer than the shortest path and it also affects 5,878 people more, which is very significant. The peak SPL rise is likely because the routing algorithm aims to decrease the average community noise exposure and doesn't consider if this negatively impacts an individual house. At the nearest house to hover point, the direct to destination route gets louder under noise aware routing, as the closest distance is shorter. The SEL decreases on the hub leg, as it again moves from directly next to the house to 20 metres away.

Noise-aware routing is consistent across both worked examples, as it reduces the daily SEL as well as the peak SPL on every direct to destination route tested, however it requires between 20-58% more distance for a 60-70+ percent cut in noise energy. The limits of this approach are consistent, with distance, energy, cost and the raw number of people affected

rising. This is due to a wider, quieter noise footprint touching more people than a narrow and loud one. Also worth noting is that the algorithm optimises a population-weighted average and doesn't limit the closest approach to any building which means that a route that improves a community wide result can make matters significantly worse for an individual building, which showed up in the example of Dundrum's route to a hub. Another important thing to note is that over many reports and complaints it is not only the pure loudness but also the tone and pitch of the drone noise which annoy the people, however modelling that would be very difficult and this should be taken as a limitation/constraint of the approach.

Microhubs have potential as a working solution, as they concentrate the hovering over a predetermined area rather than gardens, however they should not be determined via a greedy set algorithm. As a hub absorbs every delivery's hover for its whole catchment, the house nearest to it takes on a repeated and concentrated exposure, as seen in D15, where the house closest to the hub had reached a combined SEL of 98.8 dB, and the fuel aware path had the drone hovering directly in front of the house. The greedy set cover algorithm optimises only for coverage with no regard to how loud its location is to the nearest neighbours. This is why each hub should be reviewed individually and assessed according with relevant planning laws.

Recommendations and conclusion

The report set out to test whether better routing algorithms, rather than policy alone, can close the gap between the benefits of delivery drones the negative noise impact on the communities. The results of the designed algorithm show that it is possible up to an extent. Noise-aware routing can cut daily SEL by 4-7 dB and peak SPL by a similar margin, for roughly 30-50% more distance, energy and cost and counterintuitively also a wider although quieter footprint. Microhubs reduced overall community average sound exposure but have made sound exposure way worse for the house sitting nearest to the hub.

Better routing alone cannot integrate drones into Irish society, as Ireland needs a unified, national zoning and planning framework for UAVs, rather than the current case specific approach, which has already led to the technology leaving Dublin. Before legislation is modernised to account for the rapid development of this field, no large expansion can be made in Ireland, no matter how good and silent the routing algorithms could be.

Despite that, drone delivery is an amazing service and offers many benefits to the communities, especially those with harder mobility, like disabled people, the elderly and similar groups. As things stand currently, the drone delivery benefits are not yet earning their noise budget. A minority of people ordering things fast food, coffee and ice cream create a massive disturbance for the entire neighbourhood. Until the noise problem is solved or at least improved, drone delivery should be prioritised to deliver medicine, deliveries and essentials to elderly and disabled residents who have a hard time leaving the house, not just convenience orders to everyone. This, along with a better routing algorithms can already massively improve the current soundscape of the affected neighbourhoods.

There are many things that this report hasn't considered in its routing algorithm, like the tone of the drones, building height and there is space for improvement of it. However, even a perfect routing algorithm can only change where the noise falls, not how loud the source is. Drones are by design inheritably loud at close range and no software fix can amend that. Taken all things into consideration, well-planned microhubs, sited by resident exposure hub by hub can be the most feasible short-term solution, however the implementation of them

would likely hurt drone deliveries as it defeats the whole garden delivery purpose of drone delivery. Drones are already massively improving society in many areas of life, however, when it comes to urban delivery, their noise impact is still too intrusive to everyday life. Going forward, drone deliveries could see an increase in popularity, only when a better, modernised legislation is in place, when drones reach a noise level and character that is no longer that intrusive to ordinary residents and when better, community aware routing algorithms are in place. Until then, drones still need to see some improvement until they are widely accepted by society but can continue to be used as an emergency delivery method for medicines and essentials to people who really need them. Until all these issues are fixed, drones will continue to serve humanity every day in dangerous fields and areas outside of cities, where noise is less of a problem.

References:

[1] “Citizen Portal Planning,” *Agileapplications.ie*, 2026. https://planning.agileapplications.ie/fingal/application-details/102352 (accessed Sept. 05, 2026).

[2] Amplitude Acoustics, “Air Delivery Hub Coolmine Noise Impact Assesment”, April 2026

[3] “Citizen Portal Planning,” *Agileapplications.ie*, 2026. https://planning.agileapplications.ie/dunlaoghaire/application-details/102655 (accessed Sept. 05, 2026).

[4] Kyi and Feng, “Noise-aware urban drone delivery: Integrating demand modelling, routing optimization and spatial noise exposure assessment”, Journal of Urban Air Mobility, Volume 9, 2026

[5] Government of Ireland, Dept. of Transportation, “National Policy Framework for Unmanned Aircraft Systems”, August 2025

[6] D. Keany, ICAN Acoustics, “Acoustics survey for Manna Drones Ltd.” Rev. 4, 28 May 2021

[7] Environmental Protection Agency Act 1992, s. 108(4), Available: Irish Statue Book, [Online] Available: irishstatuebook.ie

[8] Dáil Éireann, “Regulation of Drones Bill 2025,” *Oireachtas.ie*, Oct. 15, 2025. https://www.oireachtas.ie/en/bills/bill/2025/61/ (accessed Sept. 07, 2026).

[9] Drone Action D15, “Archive of third-party planning submissions on Manna Drones Ltd. Applications FW25A/0384E and FW25A/0428E”, unpublished compilation, provided to author

[10] “Citizen Portal Planning,” *Agileapplications.ie*, 2026. https://planning.agileapplications.ie/fingal/application-details/95133#documents (accessed Sept. 07, 2026).

[11] Acoustics, Attenuation of sound during propagation outdoors, “Part 2: Engineering methods for the prediction of sound pressure levels outdoors”, Edition 2, 2024

[12] Acoustics – description, measurement and assesment of environmental noise – Part 1; Basic quantities and assessment procedures, ISO Standard 1996-1:2016.

Appendices:

Appendix A:

I

[redacted]

Submission : an attachment of a mail thread between myself and Manna, in which I repeatedly requested that they stop flying drones over my home — requests that have been ignored. In fact, it seems that the number of drones crossing my property has increased since then. I'm not sure the email chain adds much beyond illustrating this ongoing issue, but I'm attaching it again here as part of my objection.

I believe it is an absolute disgrace that Manna has been allowed to establish three drone bases in the D15 area, all apparently without proper planning permission. This demonstrates a complete disregard for the law and for local residents. I sincerely hope this operation is halted and prevented from expanding further, as it is already having a detrimental impact on the area.

Email thread BETWEEN [redacted] and [redacted], Community Engagement Manager Manna Community Team.

:
Manna,
Following up on this one again as I have not had a response. Despite the "geo block" being in place I can confirm I have had a number of drones fly directly over my property yesterday and today.

Can you once again confirm that there is a Geo Block in Place and what exactly does this mean, how do I still have drones flying directly over my garden? And if you could please address my question form the 16th I would appreciate it Could you please clarify with some specific examples of when a safety situation would require a drone to route directly over my property? Given that my back garden is only 25 feet wide, I struggle to see a scenario where there would be a genuine operational need to fly directly overhead.

As I understand it, any other drones in the area would also be operated by Manna, so avoidance of traffic or congestion would not seem to justify overflight either.

Regards [redacted]
/…/

Dear [redacted],

Thank you for following up and for clearly outlining your concerns. I appreciate the opportunity to provide further clarity on how our operations and geoblocks function.

Rationale for Overflights
Our drones are programmed to follow routes that prioritise safety, regulatory compliance, and efficiency. A geo-block diverts flights away from the designated property, but on rare occasions, for safety reasons, a drone may temporarily cross into the zone. Examples include avoidance of unexpected airspace hazards, weather-related diversions, or rerouting due to temporary restrictions elsewhere. These events are exceptions, not the norm.

Frequency and Notification
Once a geo-block is applied, our system routes drones around the property at all times. In exceptional circumstances, as noted above, a flight may enter the zone. These occurrences are rare and are only triggered when necessary to maintain safe operations. There is no set maximum number, but our routing logic is designed to minimise these instances as much as possible. While we do not provide real-time notifications for individual flights, your property remains blocked in our system at all times.

Decision Criteria
The decision to override a geo-block is strictly safety-driven. This happens only if alternative safe routing options are unavailable or would compromise the drone's ability to complete its delivery safely. It is never a routine or convenience-based decision.

Verification of Geo-block
I can confirm that your Eircode has been entered into our routing system as a geo-blocked zone. This means that under standard operating conditions, drones are diverted around your property.

At Manna, we take community engagement seriously and are committed to building trust through openness and responsible operations. I hope this response provides the clarity you were looking for. Please feel free to let me know if you would like us to arrange the demonstration mentioned above.

Kind regards,
[redacted]
Community Engagement Manager
Manna Community Team

/…/

To Whom It May Concern,

I am writing to formally request that a no-fly zone for drones be designated over my property located in [redacted]. The Eircode is [redacted]. We experience multiple drones passing overhead every day, and the noise is extremely disruptive. The constant hum is comparable to a helicopter hovering in the distance, making it very difficult to rest, especially as I work shifts and often need to sleep during the day. The situation also causes distress to our dog, leading to persistent barking, which adds further disturbance for us and our neighbours. Several of my neighbours have also raised concerns and have asked what steps they can take. I will support them in submitting similar requests so that our community can regain some peace and quiet in our homes.

Please confirm receipt of this request and advise whether it has been formally registered and what actions will be taken.

Kind regards,
[redacted]

II

From [redacted]

My sister who is severely autistic among a list of other issues lives with my parents weekdays at Rushbrook and comes to stay with me [redacted] in Clonsilla at weekends to give my parents a break as Respite can only offer one night a month. The drones means we cannot sit out in our back gardens in nice weather because my sister has panic attacks from the noise it causes. The noise of the drones are constant over my address at weekends.

Many thanks
[redacted]

III

From : [redacted]
FW25A/0428E

Note
I chose NEIGHBOUR in the dropdown menu and would like to point out that by giving planning permission to this business, the neighbourhood that will be significantly affected will extend to a radius of 3 km from base, thereby creating a nuisance for significantly more residents and others.

GROUNDS FOR OBJECTION

1. Impact on the Residential Amenity

Noise and Disturbance
The delivery service which is currently operating on this site without planning is extremely disturbing. The character of our area has changed to one where a drone can fly over at any moment. They create an unquestionably loud and annoying sound, with similar impact to that of a motorbike crossing our gardens.

They totally destroy the feeling of peace and privacy in a typical back garden area, and often cause disturbance which can be heard from indoors, even when a resident has double or triple glazed windows. The frequent, but random nature of the drone flights has a detrimental effect on mental wellbeing. Walks in the area, including on quieter suburban roads, along the Royal Canal, near the river Tolka, through Coolmine Woods or Millenium Park and in the many smaller parks and green spaces in the area are negatively impacted. The noise creates a particular difficulty for people who work at

night and are trying to sleep during the day, for babies, people with special sensitivities for example many autistic children or adults, disabled people such as the blind, who rely on sound feedback from their sticks on the pavement to orient themselves. I am a hearing aid wearer and find that I have to remove my hearing aids as the noise can reach painful levels.

Loss of Privacy
The company has stated that the cameras are used when deliveries occur and that their field “bleeds into other gardens” (PRIME TIME programme). A recent French television company recorded Manna’s operation in Blanchardstown. It clearly demonstrated that the drone operators can see into neighbouring gardens. Residents have no control over the company’s cameras operating above their property. Quite apart from the actual camera work, the perception of residents that they can be spied upon from morning till night is incredibly upsetting and disturbing.
Effect on Wildlife

Studies on the environmental impact must happen BEFORE we forever change the nature of our skies and create arial traffic congestion along with associated dangers (such as mechanical failures) above us. It is vital that this service does not continue causing damage to the environment, likely to be confirmed in Environmental Impact Assessments when it is too late. This might have legal implications in time. /…/

I am certain that the operation of these drones is damaging wildlife in this area, which includes the Royal Canal Waterway, the Tolka Valley, Coolmine Woods, Porterstown Park, Millenium Park, much treasured back garden habitats, original farmland hedgerows which remain between gardens as well as the many smaller green areas, the care and protection of which come under the remit of Fingal County Council itself. I have noticed a distinct change in bird activity in my garden, and feel that there has been a serious diminution in the number of birds in my area. I have not had to protect fruit bushes from birds which was always a problem before now. As mentioned above, I have to remove my hearing aids due to the pain caused by the drone noise.

Birds have ears too!

2. Traffic and Safety:

Safety
While the IAA have regulated industry for safety, we have been told that in the event of accidents, householders may find that their insurance companies will not provide cover. We are aware that an accident in Balbriggan was investigated by IAA. Faults were identified but no legal sanctions were initiated and there were no legal measures put in place either to prevent repeat issues or quantify sanctions for breaches. Is it the case that there is no criteria for identifying preventable faults or sanctioning the operator?

For example, the company’s license has restrictions on drone operation in high winds. We have evidence that they have been flying in high winds despite this. IAA have informed us that they do audits but that if a member of the public notices that the winds are dangerously high, they should ring IAA and point this out. I am not kidding!! In the event of an accident causing loss of life, injury or damage to property, the granting of permission by your council may become a matter of legal liability. I live in your area in a state of high alert and discomfort. I look to my council to defend my interests.

Traffic
An important note. The company’s suggestion that putting traffic in the sky reduces traffic on the road is disingenuous, as much of the hugely disturbing air traffic they are creating is new. We never had our ice-cream or coffee delivered by car before. Additionally, there is increased road traffic caused by extra supplies to the ground sources. Each delivery places an unrequested plastic bottle of water in the package and a large quantity of string is left behind. This detritus is a hazard as well as being environmentally unfriendly. The impact of the business operating out of this aerial delivery hub has been unprecedented in the area, or in any part of Ireland, or further afield as far as we can tell. This has been described by the company as the **world's busiest drone delivery operation** (see picture below). Do we really wish to accept this accolade. A recent survey carried out by residents group Drone Action D15 and presented at a public meeting attended by local TDs and councillors on 6th October 2025 revealed that:

- 53% of residents expressed opposition to the service
- 65 % have never used it all,
- A mere 2.3 % used the service more than five times since the service began. (indicating that a service for a tiny proportion of the public is negatively impacting a majority) *

Other local surveys by residents groups confirmed similar results, including

- 68% against drones on our own road.

When barely over 2% of the population are having deliveries, generally for coffee, ice cream and fast food (these are quoted as top products) the disruption expressed by a possible 90,000 people in the area, most commonly because of noise and lack of privacy needs to be respected.

*The company quotes a daily average of 100 flights giving 36,500 flights a year. The average user using the service 12 times per year (RTE Prime Time July 2025) This gives probably around 3,000 regular users – 2 percent of the population, thus Manna’s own figures confirm findings in our survey.

3.

Compliance with recent National Policy Framework for UAS

The development or operation of the Drone / UAS service in Dublin 15 is not in accordance with the National Policy Framework for UAS published in August 2025. Local authorities are now charged with representing the public in determining use of and restriction of drone services. Fingal cannot proceed in approving this service under the new Policy Framework. Under the policy a National Working Group on UAS Geographical Zones will be set up, and local government will request geographical zones. Planning policies under the framework will be obliged to have due regard for this process. While this process is under development it would not be appropriate for Fingal to facilitate further expansion or continuation of drone delivery services. Residents of Dublin 15 deserve to experience the same conditions as the rest of the country – a framework and a mechanism of consultation and consent. Fingal must either say no to drone delivery flights, and respect the clearly expressed views of the public in Dublin 15, or say no until such time as the geozones are legally defined.

Original permission at main site.

The original application for Blanchardstown Centre argued that environmental assessments were not needed due to the opinion that quiet areas would not be significantly impacted. Experience has clearly demonstrated the opposite.
Manna's presentation to Fingal County Council in May 2024 included a report attributed to Trinity College. The report failed to differentiate between noise levels on loud traffic filled streets and in residential back gardens.
Instead, it gave an average level of noise and suggested that the drones would "blend into the background". This was inaccurate and unhelpful. Two years on from the granting of this permission we are all wiser. Everyone living in the area knows how untrue are claims like 'quieter than a conversation', 'You likely will not hear them' and 'Blending into the background'.

Precedents in other councils

When applications were made by Manna Drones to South Dublin County Council and Dun Laoighre Rathdown for aerial delivery hubs, the councils understandably did not grant permissions. Instead, they asked for extensive evidence that the service would not impact the area unduly in a negative way. **This** application by Manna Drones seeking planning permission in Coolmine is accompanied by no such assurances, despite the company having several months to prepare such material for the other County Councils.

We are led to conclude that the independent information being sought elsewhere does not support the case for low impact on residents and the environment. Experience and public outcry seems to bear this out also.

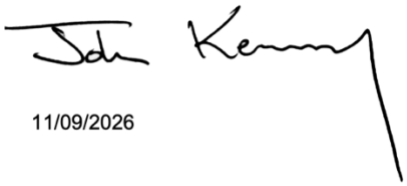
Conclusion

Fingal County Council needs to say no to this planning request, and to all requests relating to arial deliveries in Dublin 15, if they are to put the concerns of the residents regarding safety, noise, privacy, negative affects on wellbeing, on birdlife and the environment above the money making goals of a commercial company, which is funded by large corporations including Coca Cola.

We depend on Fingal County Council to represent the public and request a restricted UAS geographical zone, as set out in Summary/Policy Position/Actions/3 (page 5) for Dublin 15.

We DO NOT want delivery drones in our residential areas.

Research supervisor,



11/09/2026