Appendix 10.7

Appendix 10.7 – FWD Level 1 Pavement Surveys (PMS)

This report file is too large to upload on the online Application Form and includes a CD with video footage of the pavement survey as referred to in the report.

Appendix 10.7 and the associated videos will be submitted as a separate CD in addition to the hardcopy submission of the IED Licence Application to the Agency.

Appendix 10.8

SCOPING STUDY FOR:	**Drehid Waste Management Facility, Kildare**
CLIENT:	**Bord Na Mona**
LOCAL AUTHORITY	**Kildare County Council**
SCOPING FORM SENT TO:	**George Willoughby – Kildare County Council**
SENT BY:	**Maria Rooney** **DATE:** **17/08/16**

Ref	Item	Requirements
1	Location, Size and nature of proposed description of proposal	The current proposal is for: - changes to the volume and nature of wastes to be accepted at the landfill disposal facility - development of additional non-hazardous and hazardous landfill capacity to provide for sustainable landfill of these waste streams for a period of twenty five years - pre-treatment or processing of certain waste streams prior to landfill - to increase the volume of waste to be accepted at the composting facility and the removal of the restriction on the operating life of the composting facility. Refer to Table 1.
2	Is the development in line with National, County and Local Area Plan policy?	Yes
3	Description of existing uses of land	Existing Drehid Waste Management Facility/previously peat extraction
4	Does the development involve the relocation of an existing use?	No
5	What provisions are there for Pedestrians, Cyclists, Public Transport, Disabled access?	There are no regular bus services to this location due to its remoteness. No specific cycle lanes are allocated on the surrounding regional roads. Two disabled spaces are currently within the existing car parking. The car parking will upgraded along with the proposed development.
6	What is the carrying capacity of the existing transportation Networks?	To be confirmed through assessment of link capacity
7	What data sources, guidance is available?	Traffic Counts: junction count at existing entrance to site and two-way counts (ATC) as per drawing attached.
8	Are traffic surveys of the existing conditions available or required?	Yes counts have be undertaken in May 2016 as per counts site map attached.
9	Potential trip / traffic generation from the site. Initial estimates can be obtained from available databases, from existing similar development in the locality, or from existing travel patterns if the development is relocating.	Trip generation to be determined using count data. Also using information from Bord na Mona, on existing and projected staff numbers.
10	Are further traffic generation surveys required?	No
11	What are the targets for mode share and how are they achieved?	To be considered in report.

Ref	Item	Requirements
12	Are trip distribution and assignment models to be used?	Distribution based on existing and future distribution
13	Are further traffic surveys required or can TRICS database be used to estimate trip rates?	No requirement for using TRICS as Bord na Mona will supply information on staff and projected staff numbers. Also using count data from May 2016.
14	What is the rate of traffic growth locally?	As per TII (previously NRA) Project Appraisal Guidelines. Counts from previous EIS (2012 counts) will be used to confirm growth rates that will be applied from guidelines.
15	When is the critical time period of assessment? i.e. consider the peak hour for development traffic and also the peak hour for the network – it may be necessary to assess both periods if they are different.	To be confirmed from Traffic Counts
16	What are the assessment years?	Opening year 2019, 2024 and 2034
17	When will the site become fully operational? Are there significant phases to the project?	2019. Yes Construction and Operational.
18	Are there ways to reduce car dependency? Is a mobility management plan and future travel plans required?	Options
19	Will the site attract traffic from other adjacent sites?	No.
20	Are there any adjacent developments committed or proposed that will have significant trip / traffic implications?	Permitted Mechanical Biological Treatment Facility on the same landholding, that has not been developed to date. This will be included in assessment.
21	What is the cumulative impact of the development within the area?	This will be assessed as part of the traffic and transport assessment.
22	What will be the area of impact of the proposal, i.e. which adjacent local regional and National Road routes and junctions will be affected and require capacity calculations?	Existing Access to Waste Facility priority junction (May 2016 junction count) Existing R402/Johnstown Road Roundabout Link capacity on the R402,R403,R407,R409 and R415 (May 2016 Two way Count)
23	Is a new or modified highway access likely?	No.
24	Details of any adjacent highway improvement proposals and, if necessary, any proposals distant from the site	N/A
25	Will adjacent links or junctions become overloaded or be impacted significantly? Is a new or modified road access likely?	To be confirmed when junctions are assessed
26	What level of car parking provision is proposed?	Car parking provision is to be assessed, this will take into account Kildare Development Plan 2011-2017.
27	What sightlines/ visibility splays are available at the proposed development accesses?	There is no additional access proposed, the current access is permitted.
28	Do they comply with the requirements of the relevant standards, *NRA TD 41-42 Geometric Design of Major/Minor*	There is no additional access proposed, the current access is permitted.

Ref	Item	Requirements
	Priority Junctions and Vehicular Access to National Roads & DMURS for Urban Areas	
29	Are there any road safety implications?	There is no additional access proposed, the current access is permitted.
30	Is a Road Safety Impact assessment or Road Safety Audit required? Refer to DMRD standards.	There is no additional access proposed, the current access is permitted.
31	What type of transport analysis is most suitable, i.e. what type of traffic modelling software is most appropriate to give the best understanding of the potential impacts?	JUNCTION 9 computer analysis program (previously PICADY and ARCADY)

Process	Nature of Waste	Volume of Waste	Life of facility	Physical Changes
Existing Landfill	Non Hazardous	120,000 TPA	2028	No – already permitted
Existing Composting	Non- Hazardous	25,000 TPA	Remove 2028 restriction	No – already permitted
Proposed Recovery	Non- Hazardous	15,000 TPA	25 Years	Yes – metals recovery facility
Proposed Landfill	Non- Hazardous	250,000 TPA	25 Years	Yes – Additional cells
Proposed Landfill	Hazardous	85,000 TPA	25 Years	Yes – Additional cells
Proposed Pre-Treatment	Hazardous	Inc above	25 Years	Yes – Pre-Treatment Facility
Proposed composting	Non- Hazardous	20,000 TPA	Unrestricted	No – capacity available in existing plant
Proposed composting	Non- Hazardous	45,000 TPA	Unrestricted	Yes – approx same size as existing plant footprint

Table1 Nature of proposed development.

Appendix 10.9

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2010	Car	Other	Monday	07:00-10:00	80km/h
Minor	2005	Car	Angle, right turn	Tuesday	23:00-03:00	30km/h
Minor	2012	Car	Other	Sunday	23:00-03:00	80km/h
Minor	2005	Car	Single vehicle only	Saturday	07:00-10:00	80km/h
Minor	2005	Car	Angle, right turn	Saturday	23:00-03:00	80km/h
Minor	2007	Good Vehicle	Angle, right turn	Thursday	07:00-10:00	80km/h
Minor	2010	Car	Other	Thursday	10:00-16:00	80km/h
Minor	2009	Good Vehicle	Other	Friday	19:00-23:00	80km/h
Minor	2012	Car	Rear end,straight	Thursday	19:00-23:00	60km/h

Proposed Haul Route Maynooth to Clane

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2009	Car	Rear end, Straight	Saturday	10:00-16:00	60km/h
Minor	2007	Car	Head-on conflict	Tuesday	10:00-16:00	50km/h
Minor	2007	Car	Other	Thursday	16:00-19:00	50km/h
Minor	2012	Car	Rear end, Straight	Sunday	19:00-23:00	50km/h
Minor	2010	Car	Head-on conflict	Friday	16:00-19:00	80km/h
Minor	2007	Car	Rear end, Straight	Monday	07:00-10:00	80km/h
Minor	2012	Car	Single vehicle only	Friday	03:00-07:00	80km/h
Minor	2011	Car	Other	Saturday	10:00-16:00	80km/h
Minor	2012	Car	Other	Wednesday	19:00-23:00	80km/h
Minor	2008	Car	Angle, right turn	Saturday	10:00-16:00	80km/h
Minor	2011	Car	Other	Thursday	10:00-16:00	100km/h
Minor	2012	Car	Single vehicle only	Saturday	03:00-07:00	80km/h
Minor	2007	Car	Rear end, Straight	Monday	16:00-19:00	80km/h
Minor	2013	Car	Rear end, Straight	Friday	10:00-16:00	80km/h
Minor	2006	Car	Head-on conflict	Saturday	07:00-10:00	80km/h
Minor	2013	Car	Other	Thursday	10:00-16:00	50km/h
Minor	2008	Car	Angle, right turn	Sunday	10:00-16:00	80km/h
Minor	2012	Car	Pedestrian	Thursday	16:00-19:00	50km/h
Minor	2013	Goods vehicle	Single vehicle only	Sunday	10:00-16:00	80km/h
Minor	2005	Motorcycle	Angle, right turn	Friday	19:00-23:00	80km/h
Minor	2010	Car	Pedestrian	Monday	10:00-16:00	80km/h
Minor	2009	Car	Rear end, Straight	Friday	16:00-19:00	50km/h
Minor	2009	Car	Pedestrian	Friday	03:00-07:00	60km/h
Serious	2005	Car	Angle,both straight	Sunday	03:00-07:00	80km/h
Serious	2013	Car	Other	Wednesday	07:00-10:00	80km/h
Serious	2012	Car	Pedestrian	Sunday	23:00-03:00	80km/h
Serious	2013	Car	Single vehicle only	Sunday	10:00-16:00	80km/h
Serious	2008	Motorcycle	Angle, right turn	Sunday	10:00-16:00	80km/h
Serious	2005	Car	Other	Sunday	19:00-23:00	80km/h
Fatal	2013	Goods vehicle	Other	Sunday	10:00-16:00	80km/h
Fatal	2011	Car	Pedestrian	Tuesday	19:00-23:00	80km/h

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2008	Car	Angle,Both Straight	Tuesday	10:00-16:00	60km/h
Minor	2010	Car	Single Vehicle only	Monday	16:00-19:00	80km/h
Minor	2008	Goods vehicle	Single Vehicle only	Friday	23:00-03:00	80km/h

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2005	Car	Pedestrian	Monday	07:00-10:00	60km/h
Minor	2008	Car	Head-on conflict	Sunday	10:00-16:00	80km/h
Minor	2008	Car	Single vehicle only	Monday	10:00-16:00	80km/h
Minor	2005	Goods Vehicle	Single vehicle only	Tuesday	19:00-23:00	80km/h
Minor	2012	Car	Angle,both straight	Monday	16:00-19:00	50km/h
Minor	2005	Car	Pedestrian	Tuesday	23:00-03:00	30km/h
Minor	2008	Car	Other	Friday	23:00-03:00	80km/h
Minor	2007	Motorcycle	Rear end, right turn	Monday	07:00-10:00	50km/h
Minor	2009	Car	Rear end, right turn	Saturday	10:00-16:00	80km/h
Minor	2010	Car	Head-on conflict	Thursday	16:00-19:00	80km/h
Minor	2009	Goods Vehicle	Other	Wednesday	07:00-10:00	80km/h
Minor	2007	Car	Single vehicle only	Saturday	16:00-19:00	80km/h
Minor	2013	Car	Head-on conflict	Wednesday	07:00-10:00	50km/h
Minor	2006	Car	Head-on conflict	Thursday	07:00-10:00	80km/h
Minor	2011	Car	Single vehicle only	Thursday	03:00-07:00	50km/h
Minor	2012	Goods Vehicle	Other	Saturday	10:00-16:00	50km/h
Minor	2007	Car	Rear end, right turn	Monday	19:00-23:00	50km/h
Minor	2012	Car	Rear end,straight	Wednesday	16:00-19:00	50km/h
Minor	2005	Motorcycle	Head-on, right turn	Thursday	19:00-23:00	50km/h
Minor	2007	Car	Unknown	Saturday	23:00-03:00	80km/h
Minor	2008	Car	Angle,both straight	Tuesday	10:00-16:00	60km/h
Minor	2009	Car	Pedestrian	Sunday	03:00-07:00	80km/h
Minor	2010	Car	Single vehicle only	Monday	16:00-19:00	80km/h
Serious	2010	Other	Other	Tuesday	07:00-10:00	80km/h
Fatal	2005	Car	Single vehicle only	Friday	23:00-03:00	80km/h
Fatal	2008	Other	Pedestrian	Wednesday	19:00-23:00	60km/h
Fatal	2013	Car	Single vehicle only	Wednesday	10:00-16:00	80km/h

Proposed Haul Route Kilcock to Prosperous

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2008	Goods vehicle	Rear end, straight	Monday	10:00-16:00	50km/h
Minor	2009	Car	Rear end, straight	Thursday	19:00-23:00	50km/h
Minor	2008	Car	Single vehicle only	Saturday	07:00-10:00	80km/h
Minor	2009	Car	Angle, right turn	Saturday	19:00-23:00	80km/h
Minor	2006	Goods vehicle	Other	Wednesday	10:00-16:00	80km/h
Minor	2012	Car	Angle, right turn	Tuesday	19:00-23:00	60km/h
Minor	2007	Car	Other	Wednesday	10:00-16:00	60km/h
Minor	2013	Car	Other	Monday	10:00-16:00	80km/h
Minor	2006	Car	Head on right turn	Thursday	16:00-19:00	50km/h
Minor	2013	Goods Vehicle	Single vehicle only	Friday	03:00-07:00	80km/h
Minor	2008	Car	Single vehicle only	Sunday	10:00-16:00	80km/h
Minor	2011	Goods Vehicle	Single vehicle only	Monday	16:00-19:00	80km/h
Minor	2006	Car	Angle, both straight	Friday	19:00-23:00	80km/h
Minor	2009	Car	Single vehicle only	Friday	23:00-03:00	80km/h
Minor	2010	Car	Head on right turn	Friday	16:00-19:00	50km/h
Minor	2010	Car	Single vehicle only	Monday	07:00-10:00	80km/h
Minor	2013	Goods vehicle	Rear end, straight	Wednesday	10:00-16:00	80km/h
Minor	2009	Car	Other	Tuesday	10:00-16:00	80km/h
Minor	2012	Car	Pedestrain	Friday	19:00-23:00	80km/h
Minor	2005	Goods Vehicle	Head on right turn	Friday	16:00-19:00	80km/h
Minor	2007	Car	Head on right turn	Tuesday	19:00-23:00	80km/h
Minor	2005	Goods Vehicle	Head-on conflict	Wednesday	10:00-16:00	100km/h
Minor	2005	Goods Vehicle	Rear end, straight	Thursday	10:00-16:00	100km/h
Minor	2005	Bus	Pedestrain	Wednesday	07:00-10:00	80km/h
Minor	2010	Car	Other	Wednesday	07:00-10:00	50km/h
Minor	2012	Car	Rear end, straight	Thursday	19:00-23:00	80km/h
Serious	2008	Car	Single vehicle only	Friday	19:00-23:00	80km/h
Serious	2008	Car	Other	Saturday	10:00-16:00	80km/h
Serious	2009	Car	Head-on conflict	Tuesday	03:00-07:00	80km/h
Fatal	2013	Car	Single vehicle only	Sunday	07:00-10:00	80km/h
Fatal	2009	Goods Vehicle	Head-on conflict	Wednesday	10:00-16:00	80km/h

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2013	Car	Rear end, straight	Tuesday	07:00-10:00	80km/h
Minor	2013	Car	Single vehicle only	Sunday	03:00-07:00	80km/h
Minor	2013	Other	Rear end, right turn	Monday	19:00-23:00	80km/h
Minor	2007	Car	Angle, right turn	Saturday	10:00-16:00	50km/h
Minor	2008	Goods vehicle	Head-on conflict	Thursday	10:00-16:00	50km/h
Minor	2011	Goods vehicle	Rear end, straight	Monday	19:00-23:00	50km/h
Minor	2011	Car	Rear end, straight	Monday	10:00-16:00	60km/h
Minor	2010	Other	Other	Saturday	07:00-10:00	80km/h
Minor	2005	Motorcycle	Angle, right turn	Friday	16:00-19:00	50km/h
Minor	2005	Goods vehicle	Angle, both straight	Saturday	16:00-19:00	80km/h
Minor	2009	Car	Head-on right turn	Monday	10:00-16:00	60km/h
Minor	2011	Car	Single vehicle only	Wednesday	19:00-23:00	80km/h
Minor	2013	Goods vehicle	Head-on conflict	Tuesday	10:00-16:00	50km/h
Minor	2013	Car	Other	Tuesday	10:00-16:00	50km/h
Minor	2006	Car	Head-on right turn	Friday	07:00-10:00	60km/h
Minor	2011	Car	Pedestrian	Saturday	16:00-19:00	50km/h
Minor	2005	Car	Other	Tuesday	07:00-10:00	50km/h
Minor	2010	Car	Single vehicle only	Monday	19:00-23:00	80km/h
Minor	2010	Car	Single vehicle only	Monday	19:00-23:00	80km/h
Minor	2008	Car	Single vehicle only	Sunday	07:00-10:00	80km/h
Minor	2007	Motorcycle	Single vehicle only	Monday	16:00-19:00	50km/h
Minor	2010	Motorcycle	Other	Friday	23:00-03:00	50km/h
Minor	2010	Car	Angle, both straight	Monday	23:00-03:00	80km/h
Minor	2012	Car	Other	Tuesday	16:00-19:00	80km/h
Minor	2013	Car	Other	Wednesday	07:00-10:00	50km/h
Minor	2008	Car	Single vehicle only	Thursday	03:00-07:00	80km/h
Minor	2012	Car	Other	Tuesday	16:00-19:00	50km/h
Minor	2008	Car	Single vehicle only	Wednesday	23:00-03:00	50km/h
Minor	2005	Car	Angle, both straight	Thursday	07:00-10:00	80km/h
Minor	2013	Car	Other	Wednesday	19:00-23:00	50km/h
Minor	2005	Motorcycle	Other	Monday	10:00-16:00	30km/h
Minor	2011	Car	Other	Monday	19:00-23:00	50km/h
Minor	2013	Car	Other	Monday	07:00-10:00	30km/h
Minor	2013	Car	Other	Monday	10:00-16:00	30km/h
Minor	2009	Car	Pedestrian	Monday	16:00-19:00	50km/h
Minor	2008	Car	Pedestrian	Tuesday	10:00-16:00	50km/h
Minor	2009	Car	Single vehicle only	Friday	23:00-03:00	80km/h
Minor	2009	Goods Vehicle	Other	Thursday	07:00-10:00	80km/h
Minor	2012	Car	Head-on right turn	Monday	16:00-19:00	50km/h
Minor	2007	Car	Head-on conflict	Tuesday	23:00-03:00	50km/h
Minor	2009	Motorcycle	Single vehicle only	Thursday	07:00-10:00	50km/h
Minor	2007	Car	Other	Tuesday	19:00-23:00	50km/h
Minor	2009	Car	Other	Tuesday	16:00-19:00	50km/h
Minor	2009	Goods Vehicle	Rear end, straight	Sunday	10:00-16:00	60km/h
Minor	2009	Bicycle	Single vehicle only	Wednesday	10:00-16:00	50km/h
Minor	2011	Goods Vehicle	Rear end, straight	Saturday	16:00-19:00	50km/h
Minor	2012	Car	Other	Thursday	23:00-03:00	60km/h
Minor	2010	Car	Head-on conflict	Saturday	10:00-16:00	80km/h

Minor	2006	Goods Vehicle	Head-on conflict	Saturday	07:00-10:00	50km/h
Minor	2006	Car	Head-on conflict	Friday	undefined	50km/h
Minor	2008	Car	Pedestrian	Thursday	07:00-10:00	50km/h
Minor	2009	Car	Single vehicle only	Friday	16:00-19:00	80km/h
Minor	2005	Other	Rear end, straight	Thursday	23:00-03:00	60km/h
Minor	2013	Car	Angle, both straight	Saturday	10:00-16:00	80km/h
Minor	2008	Motorcycle	Head-on right turn	Thursday	10:00-16:00	80km/h
Minor	2010	Motorcycle	Head-on right turn	Sunday	10:00-16:00	50km/h
Minor	2005	Car	Rear end, straight	Monday	16:00-19:00	50km/h
Minor	2009	Car	Pedestrian	Tuesday	10:00-16:00	50km/h
Minor	2008	Goods Vehicle	Other	Friday	10:00-16:00	50km/h
Minor	2011	Other	Other	Thursday	10:00-16:00	50km/h
Minor	2010	Car	Angle, both straight	Monday	07:00-10:00	60km/h
Minor	2010	Car	Angle, right turn	Wednesday	10:00-16:00	50km/h
Minor	2005	Other	Angle, both straight	Thursday	10:00-16:00	80km/h
Minor	2007	Goods Vehicle	Pedestrian	Wednesday	10:00-16:00	60km/h
Minor	2005	Car	Head-on right turn	Tuesday	23:00-03:00	80km/h
Minor	2012	Car	Single vehicle only	Sunday	03:00-07:00	80km/h
Serious	2005	Motorcycle	Angle, both straight	Thursday	03:00-07:00	80km/h
Serious	2006	Car	Head-on conflict	Sunday	10:00-16:00	50km/h
Serious	2008	Car	Single vehicle only	Friday	23:00-03:00	80km/h
Serious	2008	Car	Head-on conflict	Monday	10:00-16:00	80km/h
Serious	2009	Goods vehicle	Other	Sunday	03:00-07:00	60km/h
Serious	2012	Car	Pedestrian	Sunday	07:00-10:00	50km/h
Serious	2013	Car	Single vehicle only	Sunday	03:00-07:00	80km/h
Serious	2005	Other	Head-on conflict	Saturday	07:00-10:00	50km/h
Fatal	2006	Car	Single vehicle only	Sunday	16:00-19:00	50km/h
Fatal	2009	Car	Single vehicle only	Tuesday	23:00-03:00	50km/h
Fatal	2013	Car	Single vehicle only	Sunday	16:00-19:00	60km/h
Fatal	2011	Car	Other	Saturday	10:00-16:00	80km/h

Proposed Haul Route Kildare to Miltown

Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2005	Car	Single vehicle only	Sunday	16:00-19:00	120km/h
Minor	2005	Other	Pedestrian	Wednesday	10:00-16:00	50km/h
Minor	2013	Bicycle	Other	Wednesday	16:00-19:00	50km/h
Minor	2009	Goods vehicle	Pedestrian	Tuesday	10:00-16:00	50km/h
Minor	2008	Car	Other	Sunday	19:00-23:00	50km/h
Minor	2011	Motorcycle	Head-on conflict	Thursday	19:00-23:00	50km/h
Minor	2005	Other	Other	Saturday	03:00-07:00	30km/h
Minor	2012	Car	Pedestrian	Wednesday	10:00-16:00	50km/h
Minor	2007	Car	Unknown	Monday	03:00-07:00	60km/h
Minor	2006	Car	Head-on conflict	Friday	07:00-10:00	50km/h
Minor	2007	Car	Single vehicle only	Sunday	03:00-07:00	50km/h
Minor	2007	Car	Pedestrian	Wednesday	10:00-16:00	50km/h
Minor	2007	Bicycle	Other	Sunday	19:00-23:00	60km/h
Minor	2013	Car	Single vehicle only	Saturday	10:00-16:00	80km/h
Minor	2006	Car	Single vehicle only	Tuesday	07:00-10:00	80km/h
Minor	2007	Other	Angle,both straight	Friday	19:00-23:00	80km/h
Minor	2008	Car	Rear end, right turn	Saturday	19:00-23:00	80km/h
Minor	2007	Motorcycle	Single vehicle only	Sunday	16:00-19:00	50km/h

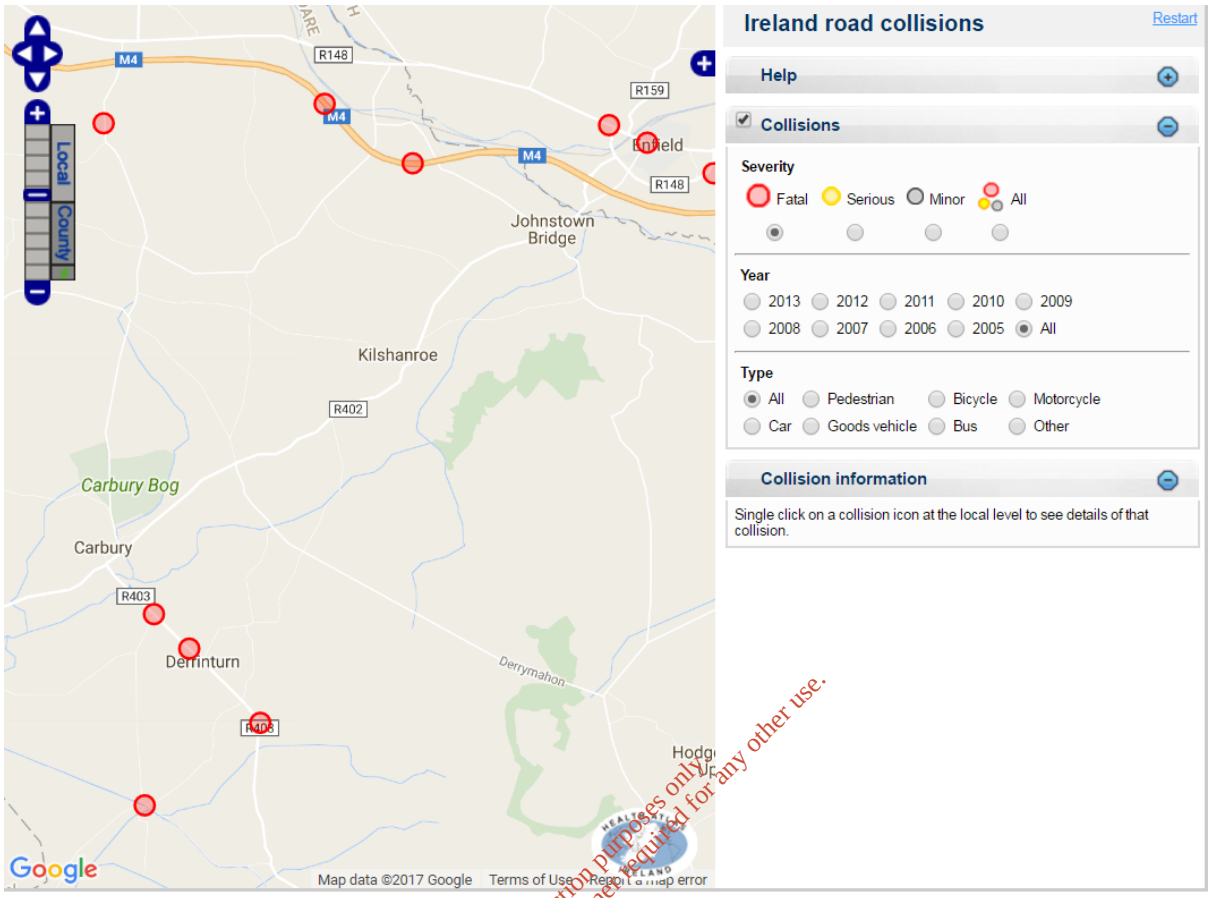
Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2008	Car	Pedestrian	Sunday	19:00-23:00	50km/h
Minor	2005	Other	Rear end, straight	Sunday	10:00-16:00	50km/h
Minor	2012	Motorcycle	Pedestrian	Friday	16:00-19:00	80km/h
Minor	2012	Car	Head-on conflict	Saturday	10:00-16:00	60km/h
Minor	2009	Motorcycle	Single vehicle only	Saturday	19:00-23:00	80km/h
Minor	2010	Other	Other	Wednesday	07:00-10:00	80km/h
Minor	2010	Car	Other	Monday	16:00-19:00	50km/h
Minor	2011	Goods vehicle	Other	Friday	10:00-16:00	80km/h
Minor	2013	Car	Other	Saturday	16:00-19:00	60km/h
Minor	2011	Car	Other	Tuesday	16:00-19:00	50km/h
Minor	2009	Goods vehicle	Rear end,straight	Thursday	16:00-19:00	50km/h
Minor	2005	Car	Other	Sunday	10:00-16:00	50km/h
Minor	2005	Car	Rear end, straight	Friday	16:00-19:00	80km/h
Minor	2013	Car	Other	Saturday	23:00-03:00	60km/h
Minor	2005	Car	Rear end, straight	Monday	07:00-10:00	50km/h
Minor	2013	Car	Single vehicle only	Friday	19:00-23:00	60km/h
Minor	2012	Car	Single vehicle only	Saturday	10:00-16:00	50km/h
Minor	2009	Car	Head-on conflict	Monday	19:00-23:00	80km/h
Minor	2008	Goods vehicle	Head-on right turn	Monday	16:00-19:00	80km/h
Minor	2012	Car	Other	Friday	10:00-16:00	80km/h
Minor	2005	Car	Single vehicle only	Wednesday	19:00-23:00	80km/h
Minor	2013	Car	Single vehicle only	Sunday	19:00-23:00	60km/h
Minor	2008	Car	Head-on conflict	Saturday	10:00-16:00	50km/h
Minor	2012	Car	Single vehicle only	Wednesday	07:00-10:00	50km/h
Minor	2009	Car	Rear end, straight	Friday	07:00-10:00	50km/h
Minor	2013	Car	Head-on conflict	Thursday	19:00-23:00	50km/h
Minor	2006	Car	Angle, right turn	Wednesday	10:00-16:00	50km/h
Minor	2005	Car	Rear end, straight	Friday	10:00-16:00	50km/h
Minor	2008	Car	Other	Tuesday	07:00-10:00	50km/h
Minor	2009	Car	Other	Tuesday	16:00-19:00	50km/h
Minor	2009	Car	Single vehicle only	Tuesday	23:00-03:00	50km/h
Minor	2011	Car	Head-on conflict	Saturday	03:00-07:00	50km/h
Minor	2013	Car	Other	Sunday	19:00-23:00	50km/h
Minor	2013	Car	Rear end, straight	Saturday	16:00-19:00	60km/h
Minor	2008	Car	Angle, right turn	Tuesday	19:00-23:00	50km/h
Minor	2012	Car	Other	Tuesday	07:00-10:00	50km/h
Minor	2012	Car	Other	Thursday	07:00-10:00	80km/h
Minor	2006	Car	Rear end, straight	Friday	23:00-03:00	60km/h
Minor	2011	Car	Other	Sunday	07:00-10:00	50km/h
Minor	2013	Car	Rear end, straight	Sunday	10:00-16:00	60km/h
Minor	2009	Car	Angle,both straight	Tuesday	16:00-19:00	50km/h
Minor	2009	Car	Single vehicle only	Friday	19:00-23:00	120km/h
Minor	2007	Car	Unknown	Saturday	10:00-16:00	120km/h
Minor	2010	Car	Rear end, straight	Friday	23:00-03:00	120km/h
Minor	2011	Car	Rear end, straight	Sunday	19:00-23:00	120km/h
Minor	2006	Car	Rear end, straight	Tuesday	16:00-19:00	120km/h
Minor	2013	Car	Single vehicle only	Saturday	23:00-03:00	120km/h
Minor	2007	Car	Rear end, straight	Friday	19:00-23:00	120km/h

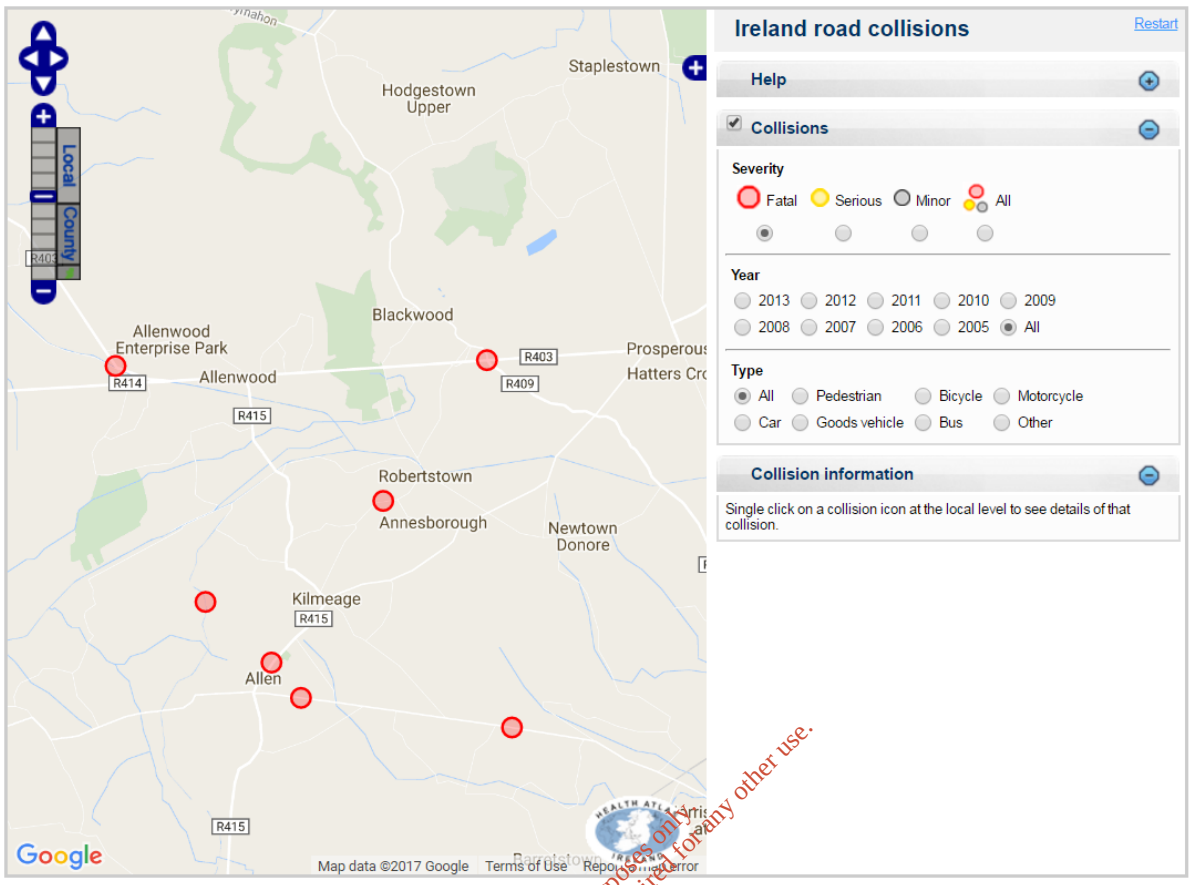
Minor	2012	Car	Single vehicle only	Friday	23:00-03:00	100km/h
Minor	2007	Car	Rear end, straight	Tuesday	16:00-19:00	120km/h
Minor	2007	Car	Rear end, straight	Friday	19:00-23:00	60km/h
Minor	2012	Car	Rear end, straight	Thursday	16:00-19:00	120km/h
Minor	2008	Car	Single vehicle only	Friday	23:00-03:00	120km/h
Minor	2006	Car	Rear end, straight	Monday	23:00-03:00	120km/h
Minor	2006	Car	Rear end, straight	Thursday	16:00-19:00	120km/h
Minor	2007	Car	Rear end, straight	Tuesday	07:00-10:00	120km/h
Minor	2007	Car	Single vehicle only	Saturday	10:00-16:00	120km/h
Minor	2012	Goods vehicle	Rear end, straight	Monday	07:00-10:00	120km/h
Minor	2011	Car	Single vehicle only	Tuesday	19:00-23:00	120km/h
Minor	2010	Car	Single vehicle only	Tuesday	23:00-03:00	80km/h
Minor	2005	Car	Single vehicle only	Sunday	07:00-10:00	120km/h
Minor	2012	Car	Rear end, straight	Wednesday	03:00-07:00	120km/h
Minor	2012	Car	Rear end, straight	Friday	19:00-23:00	120km/h
Minor	2009	Goods vehicle	Rear end, straight	Wednesday	16:00-19:00	120km/h
Minor	2013	Car	Rear end, straight	Monday	16:00-19:00	120km/h
Minor	2012	Car	Rear end, straight	Friday	16:00-19:00	120km/h
Minor	2008	Car	Single vehicle only	Friday	19:00-23:00	120km/h
Minor	2008	Goods vehicle	Single vehicle only	Saturday	07:00-10:00	120km/h
Minor	2013	Goods vehicle	Angle, both straight	Tuesday	10:00-16:00	120km/h
Minor	2008	Car	Single vehicle only	Wednesday	19:00-23:00	120km/h
Minor	2007	Car	Angle, right turn	Thursday	07:00-10:00	120km/h
Minor	2010	Car	Single vehicle only	Friday	16:00-19:00	120km/h
Minor	2012	Car	Single vehicle only	Saturday	19:00-23:00	120km/h
Minor	2005	Car	Single vehicle only	Saturday	19:00-23:00	120km/h
Minor	2013	Motorcycle	Single vehicle only	Saturday	16:00-19:00	120km/h
Minor	2012	Car	Rear end, straight	Sunday	10:00-16:00	120km/h
Minor	2011	Goods vehicle	Rear end, straight	Tuesday	07:00-10:00	120km/h
Minor	2012	Car	Rear end, straight	Thursday	23:00-03:00	120km/h
Minor	2005	Goods vehicle	Rear end, straight	Saturday	03:00-07:00	120km/h
Minor	2010	Car	Single vehicle only	Friday	07:00-10:00	120km/h
Minor	2006	Car	Other	Thursday	07:00-10:00	120km/h
Minor	2007	Car	Single vehicle only	Friday	03:00-07:00	120km/h
Minor	2010	Car	Single vehicle only	Tuesday	23:00-03:00	80km/h
Minor	2011	Car	Rear end, straight	Monday	16:00-19:00	80km/h
Minor	2010	Car	Rear end, straight	Thursday	16:00-19:00	50km/h
Minor	2013	Car	Rear end,right turn	Tuesday	16:00-19:00	50km/h
Minor	2009	Car	Pedestrian	Tuesday	10:00-16:00	50km/h
Serious	2008	Car	Head-on conflict	Sunday	19:00-23:00	60km/h
Serious	2005	Car	Head-on conflict	Monday	10:00-16:00	80km/h
Serious	2008	Car	Other	Friday	16:00-19:00	80km/h
Serious	2011	Car	Head-on conflict	Wednesday	07:00-10:00	80km/h
Serious	2005	Goods vehicle	Pedestrian	Saturday	10:00-16:00	50km/h
Serious	2011	Car	Single vehicle only	Tuesday	19:00-23:00	50km/h
Serious	2005	Car	Single vehicle only	Monday	03:00-07:00	120km/h
Serious	2010	Car	Rear end, straight	Monday	16:00-19:00	80km/h
Serious	2007	Goods vehicle	Rear end, straight	Tuesday	07:00-10:00	120km/h
Fatal	2013	Car	Angle,right turn	Tuesday	19:00-23:00	80km/h
Fatal	2010	Goods vehicle	Pedestrian	Saturday	10:00-16:00	50km/h

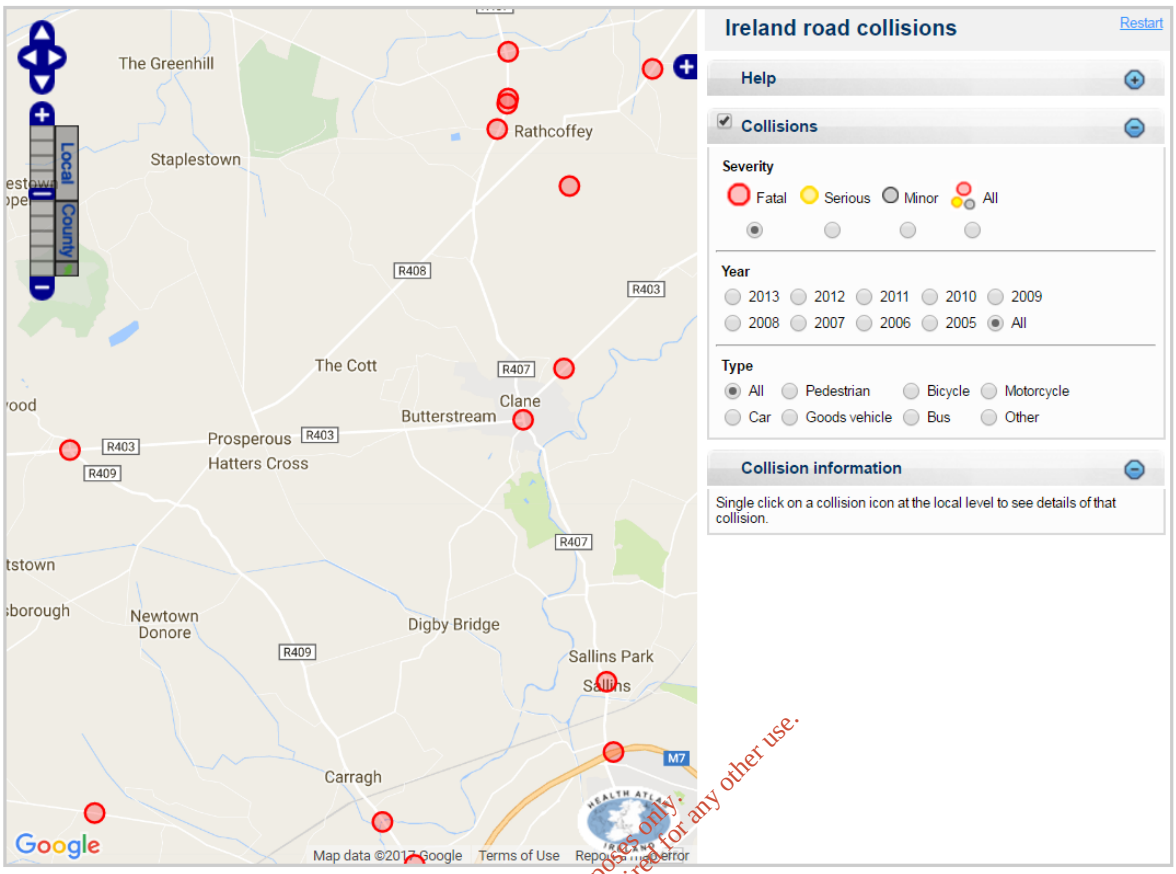
Fatal	2011	Car	Pedestrian	Monday	23:00-03:00	50km/h
Fatal	2006	Car	Single vehicle only	Saturday	07:00-10:00	120km/h
Fatal	2010	Car	Pedestrian	Friday	10:00-16:00	120km/h
Fatal	2007	Goods vehicle	Single vehicle only	Friday	03:00-07:00	120km/h

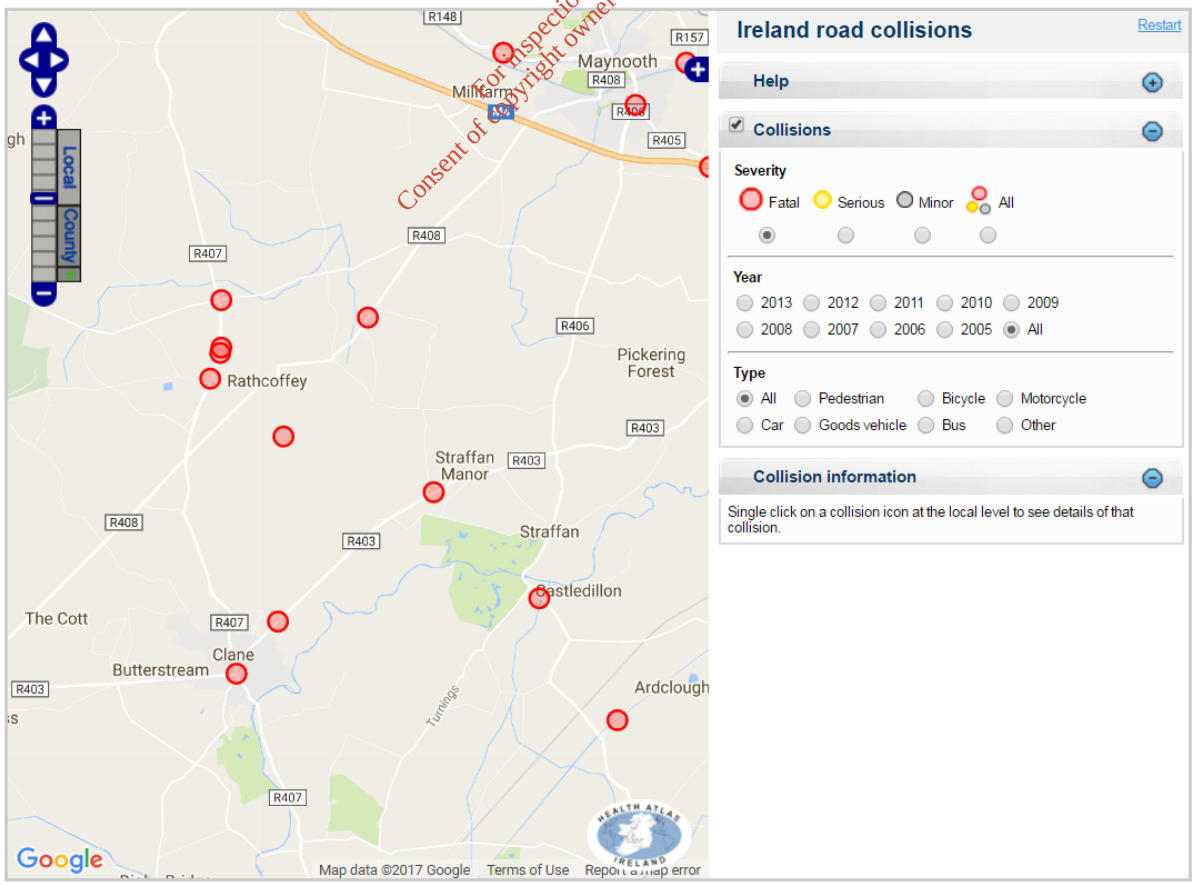
Severity	Year	Vehicle	Circumstance	Day of week	Time	Speed Limit
Minor	2013	Car	Rear end, straight	Thursday	19:00-23:00	60km/h
Minor	2010	Car	Other	Friday	07:00-10:00	50km/h
Minor	2011	Motorcycle	Single vehicle only	Saturday	10:00-16:00	50km/h
Minor	2006	Motorcycle	Angle, right turn	Saturday	16:00-19:00	50km/h
Minor	2005	Car	Rear end, straight	Tuesday	10:00-16:00	30km/h
Minor	2012	Motorcycle	Single vehicle only	Sunday	10:00-16:00	50km/h
Minor	2013	Car	Rear end, straight	Thursday	07:00-10:00	50km/h
Minor	2009	Goods vehicle	Other	Thursday	16:00-19:00	80km/h
Minor	2007	Car	Head-on right turn	Sunday	19:00-23:00	80km/h
Minor	2013	Car	Rear end, straight	Wednesday	07:00-10:00	80km/h
Minor	2008	Car	Single vehicle only	Tuesday	03:00-07:00	80km/h
Minor	2010	Car	Rear end, straight	Sunday	23:00-03:00	80km/h
Serious	2007	Car	Angle, right turn	Wednesday	10:00-16:00	80km/h
Serious	2009	Car	Single vehicle only	Sunday	03:00-07:00	80km/h
Fatal	2010	Other	Single vehicle only	Monday	16:00-19:00	80km/h
Fatal	2007	Goods vehicle	Angle, right turn	Saturday	10:00-16:00	80km/h

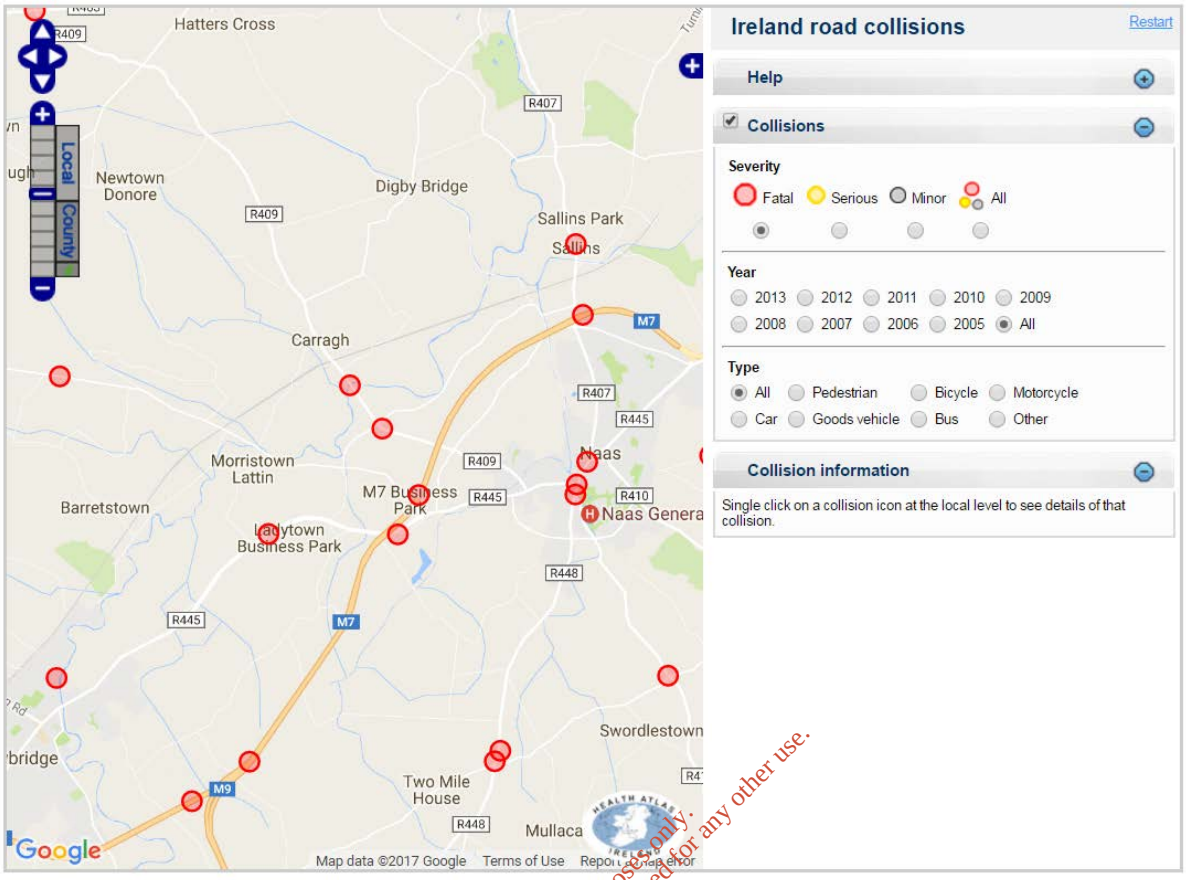
Fatal Accidents (All vehicles type)

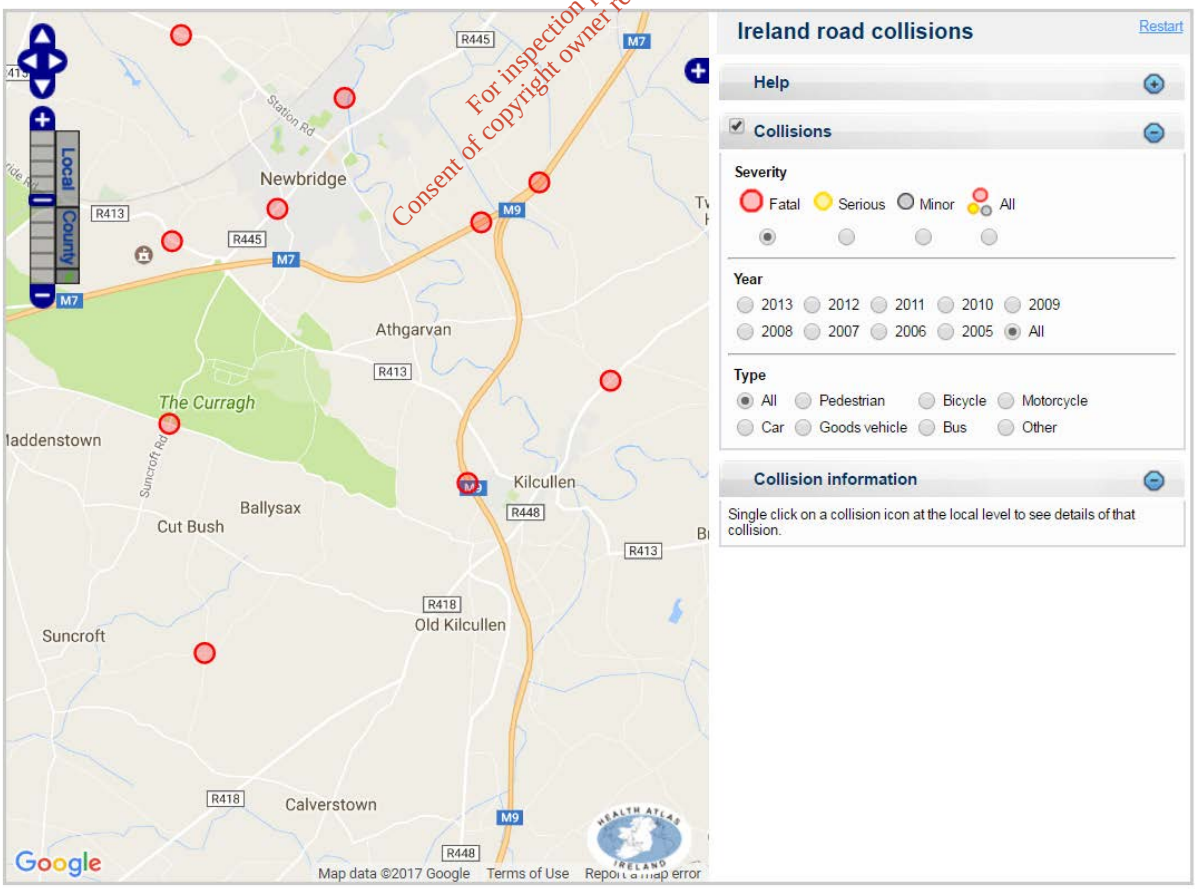


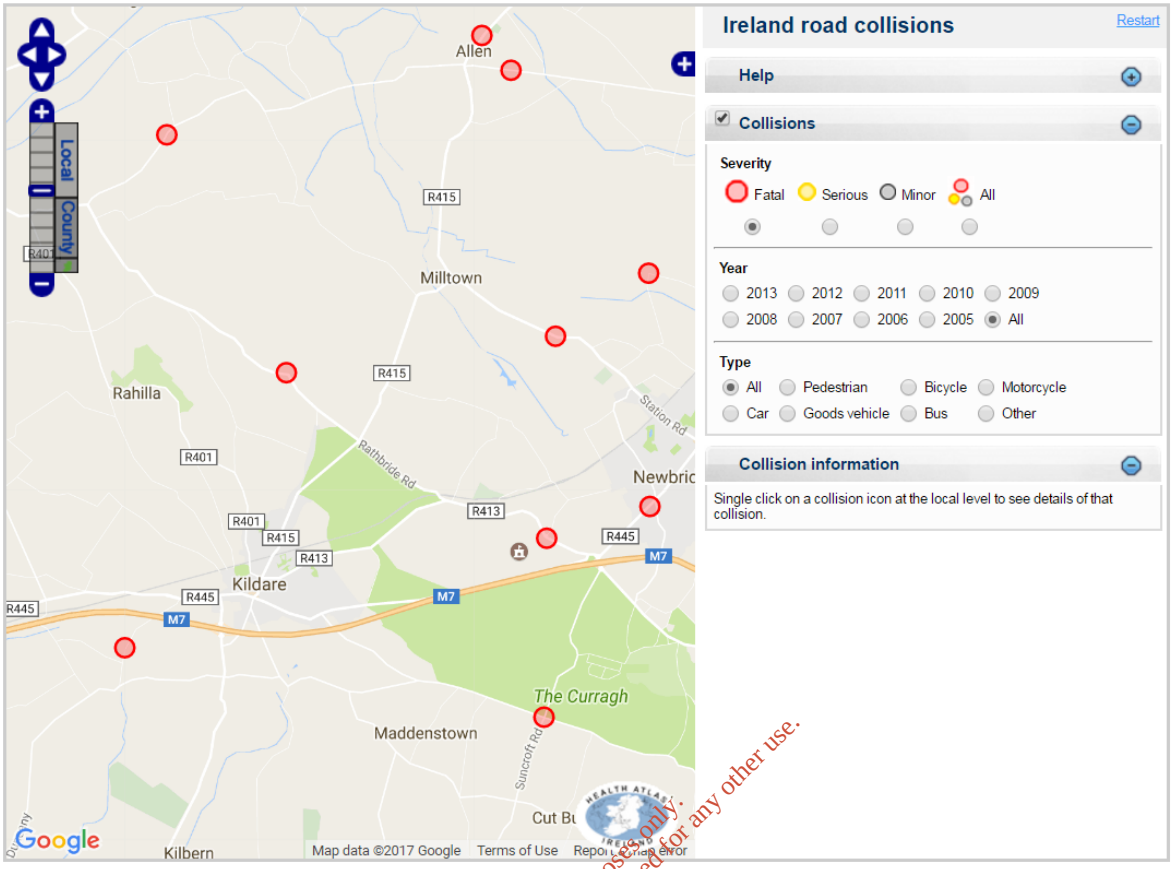


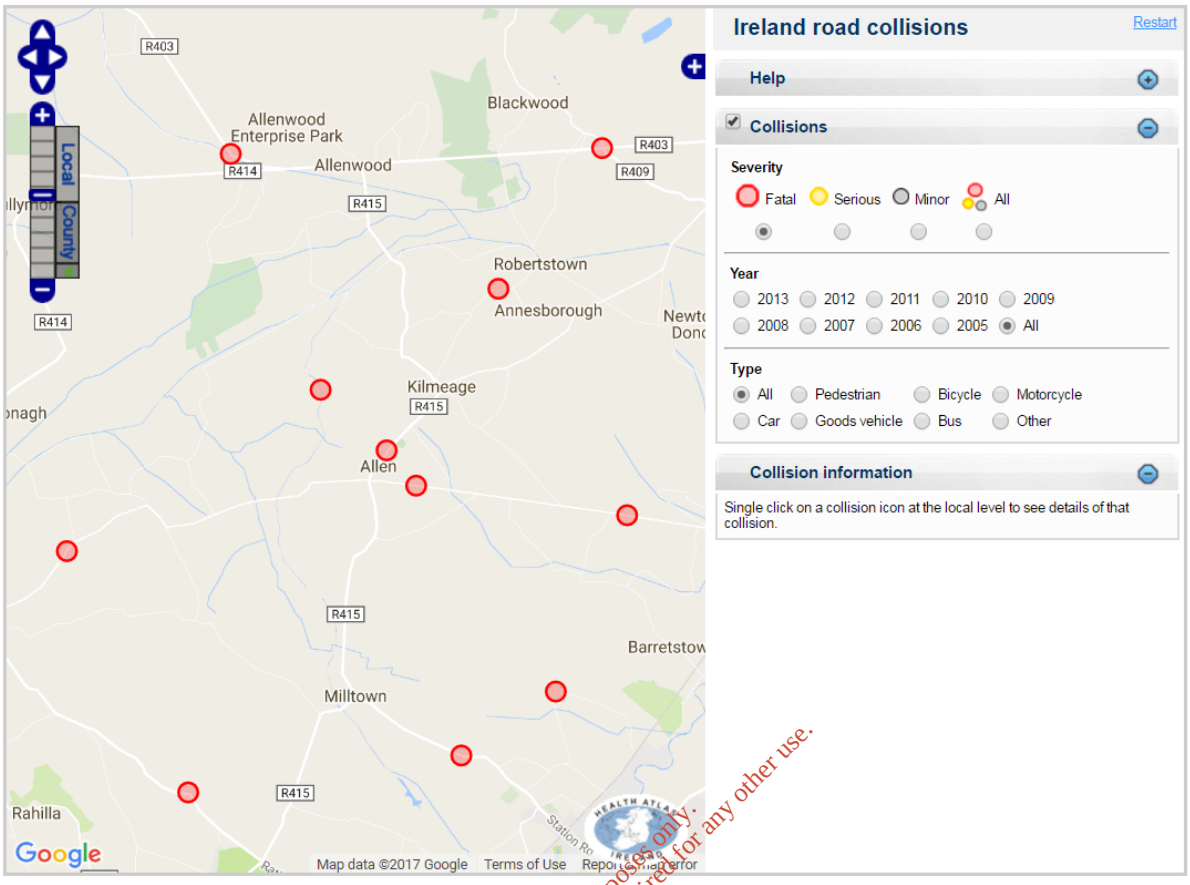




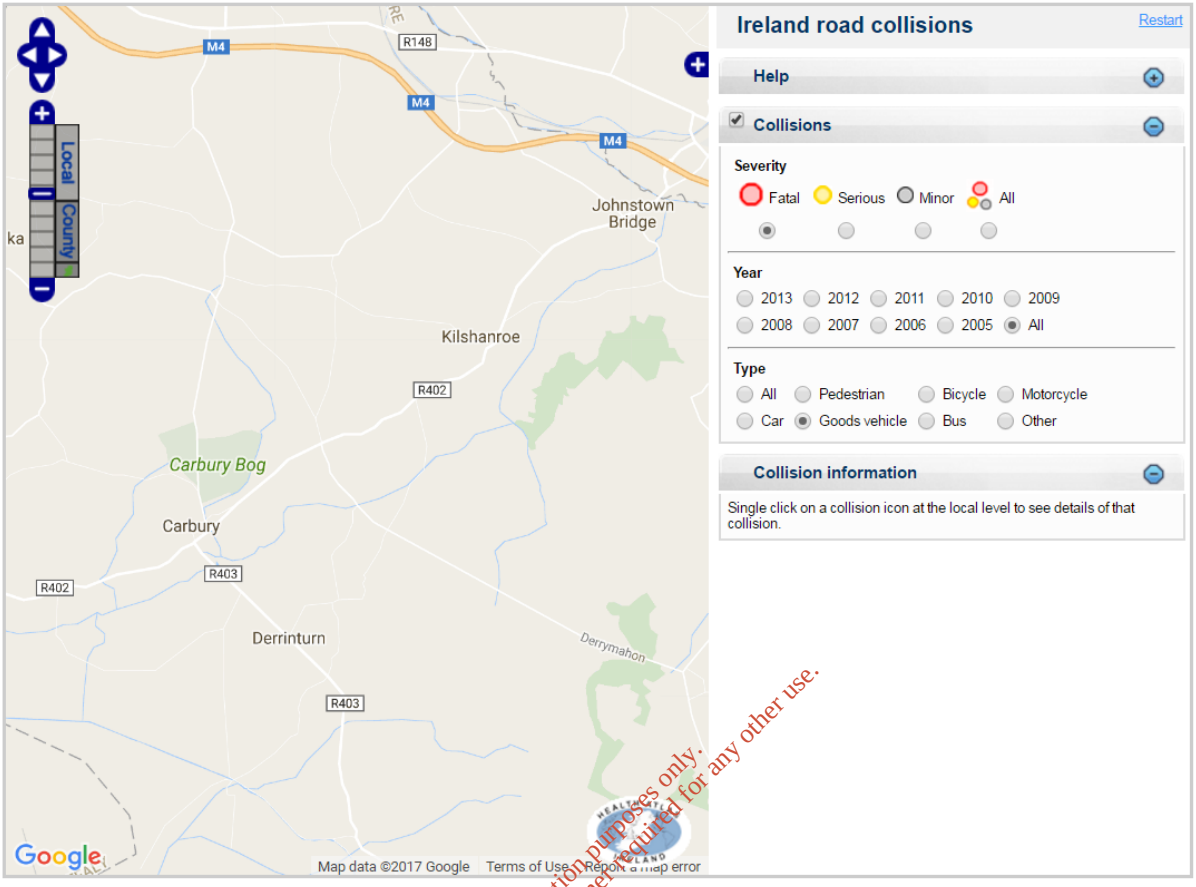


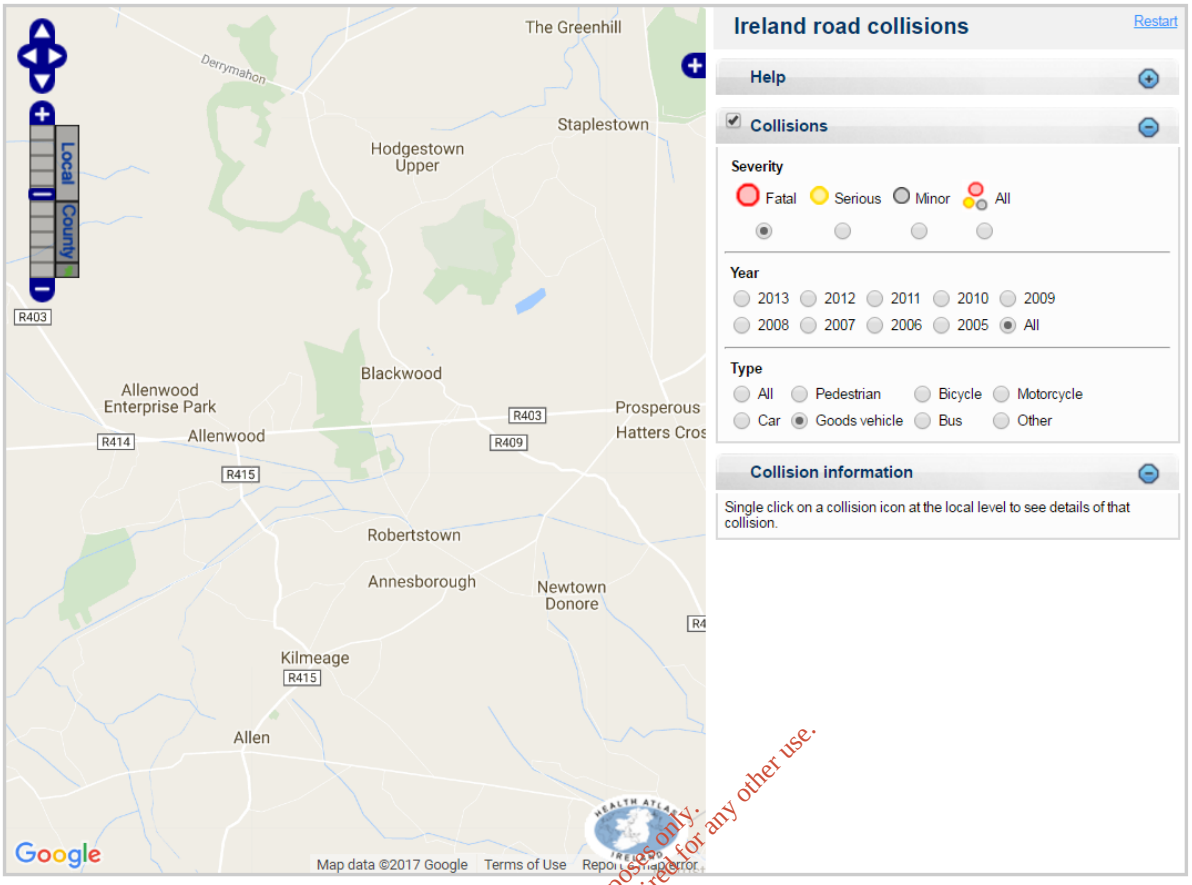


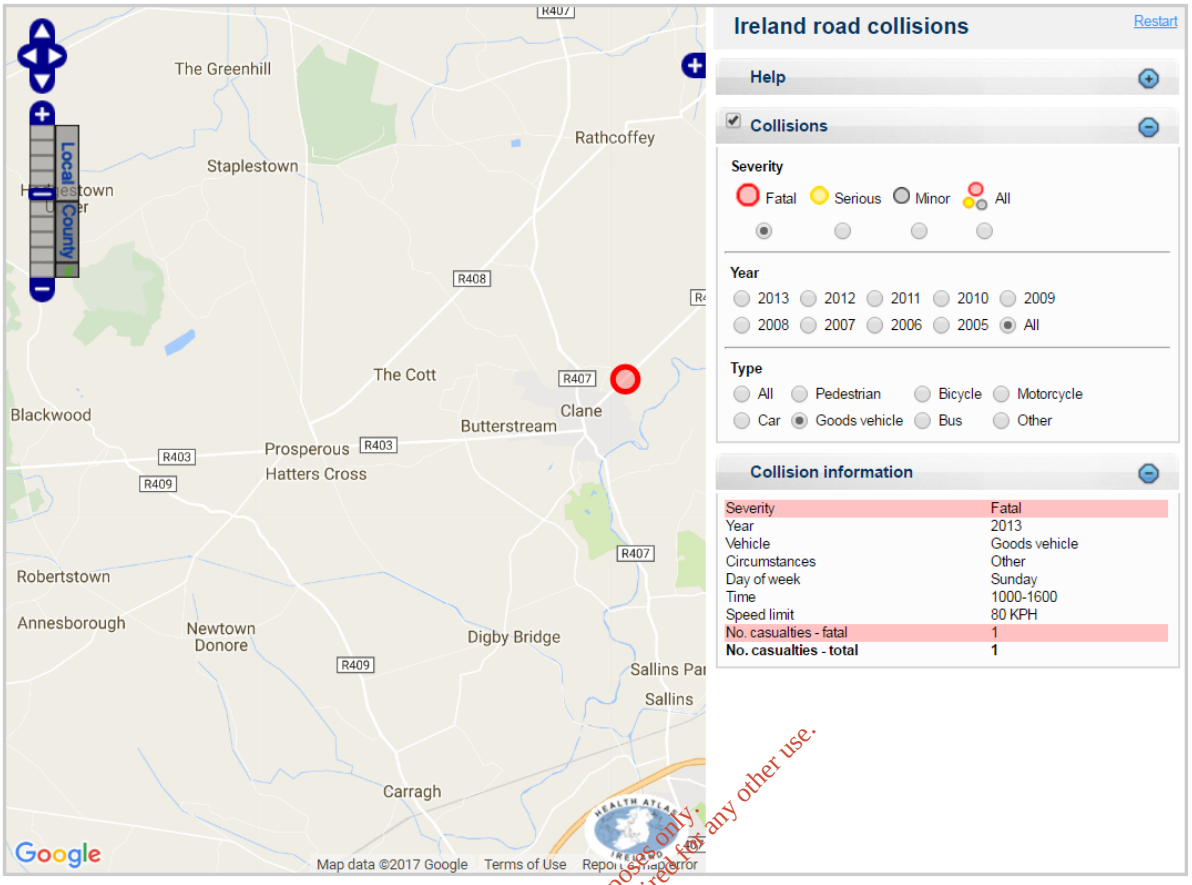


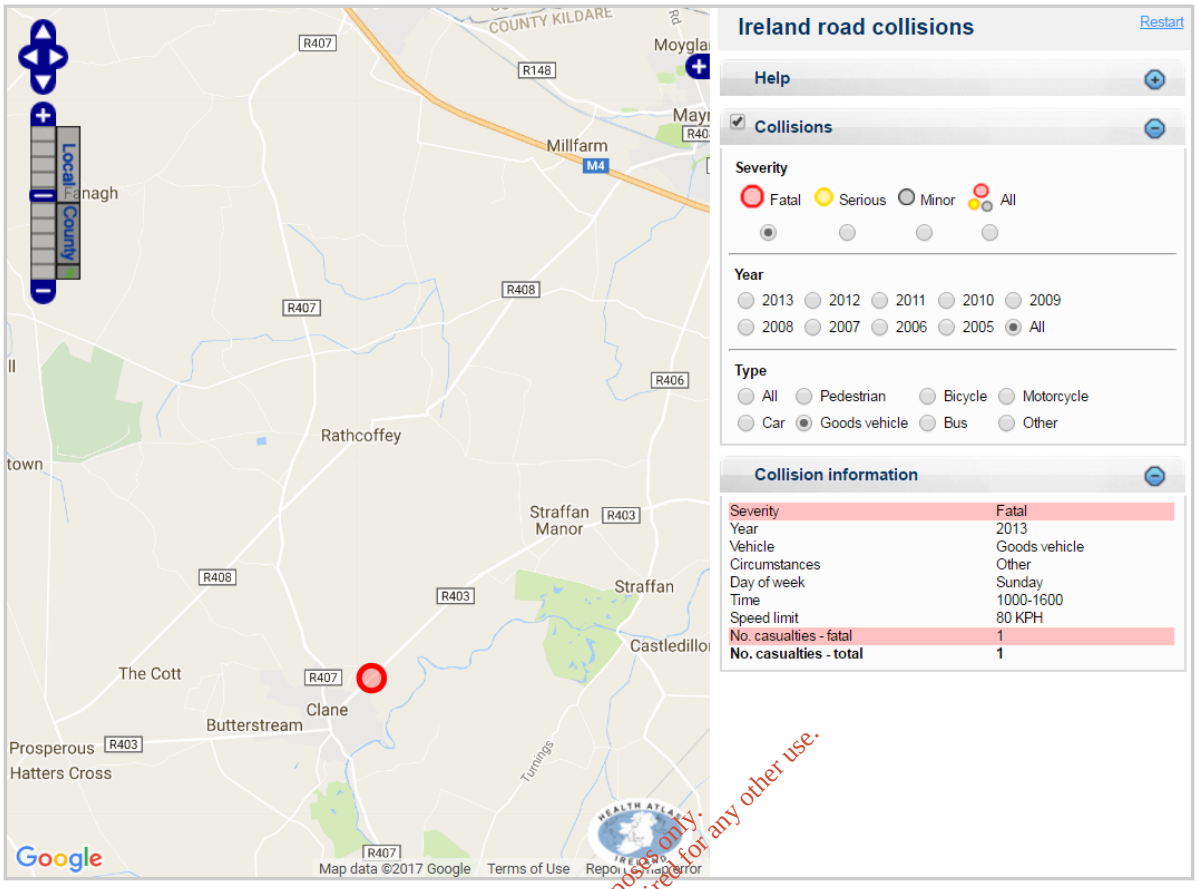


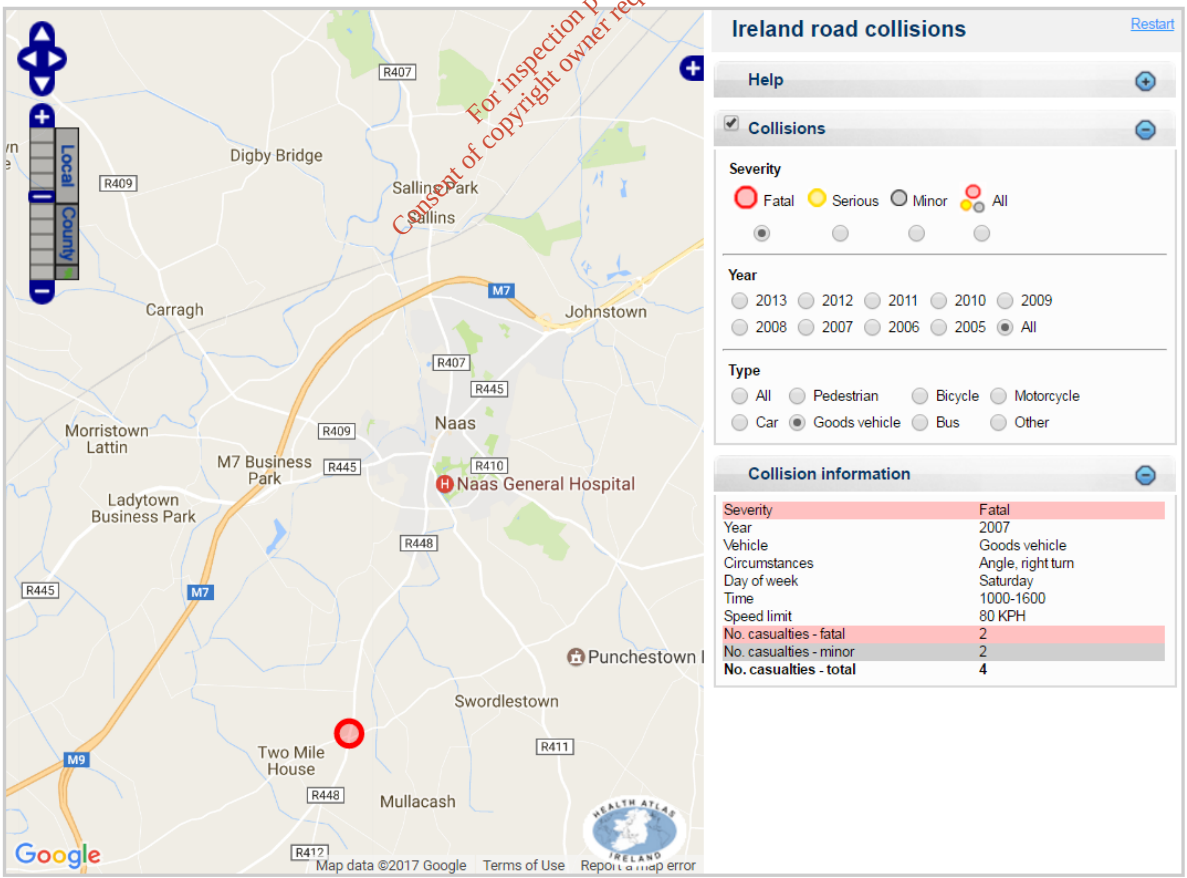
Fatal Accidents (HGVs (*'Goods Vehicles'*) 2005-2013

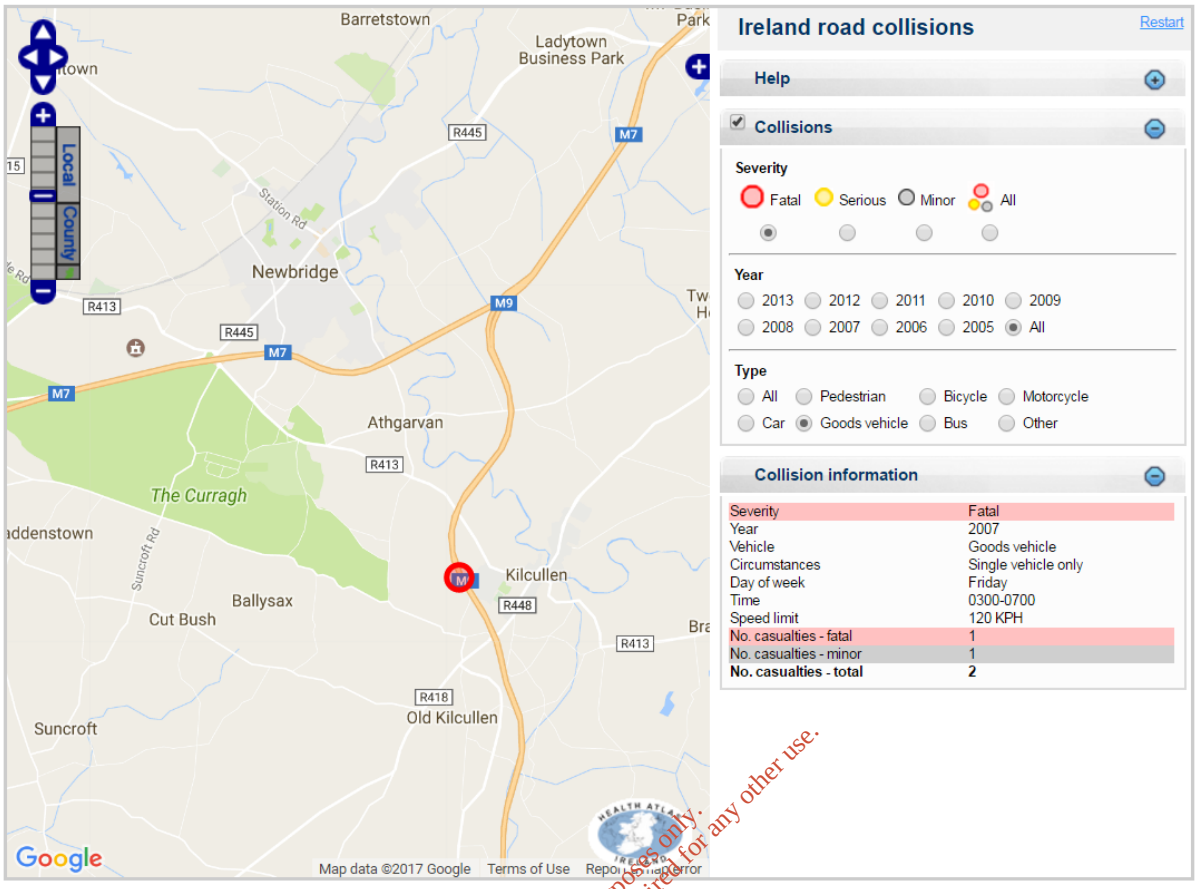












Ireland road collisions

Restart

Help

Collisions

Severity

Fatal ● Serious ○ Minor ○ All ○

Year

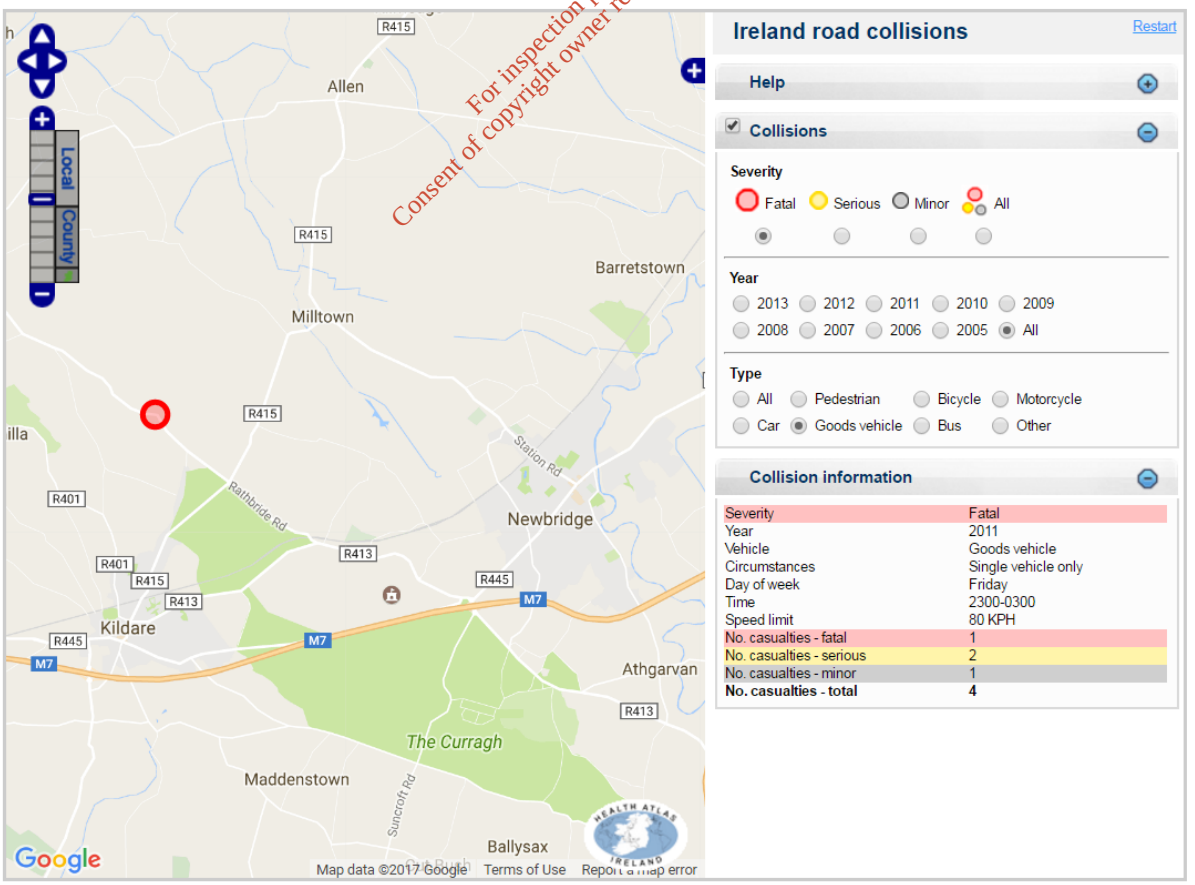
2013 ○ 2012 ○ 2011 ○ 2010 ○ 2009 ○
2008 ○ 2007 ○ 2006 ○ 2005 ○ All ●

Type

All ○ Pedestrian ○ Bicycle ○ Motorcycle ○
Car ○ Goods vehicle ● Bus ○ Other ○

Collision information

Severity	Fatal
Year	2007
Vehicle	Goods vehicle
Circumstances	Single vehicle only
Day of week	Friday
Time	0300-0700
Speed limit	120 KPH
No. casualties - fatal	1
No. casualties - minor	1
No. casualties - total	**2**



Ireland road collisions

Restart

Help

Collisions

Severity

Fatal ● Serious ○ Minor ○ All ○

Year

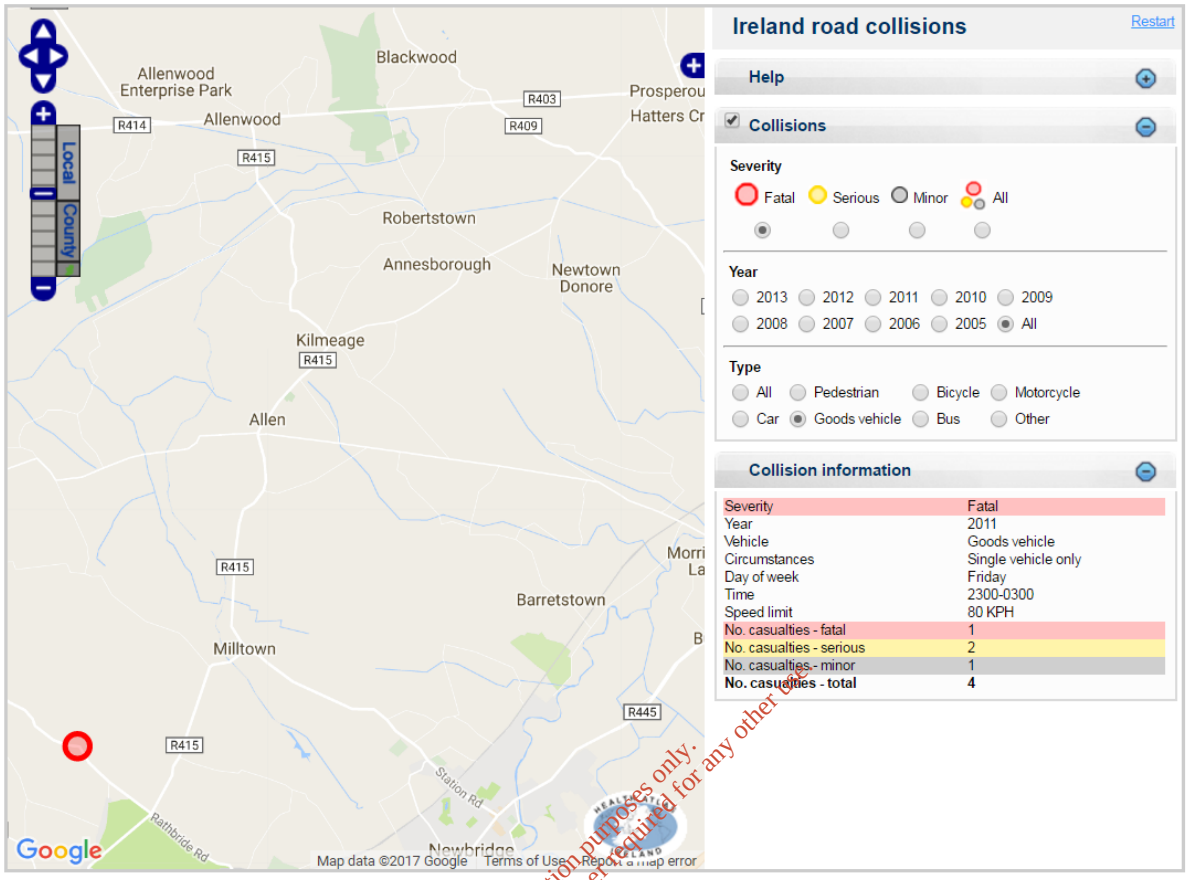
2013 ○ 2012 ○ 2011 ○ 2010 ○ 2009 ○
2008 ○ 2007 ○ 2006 ○ 2005 ○ All ●

Type

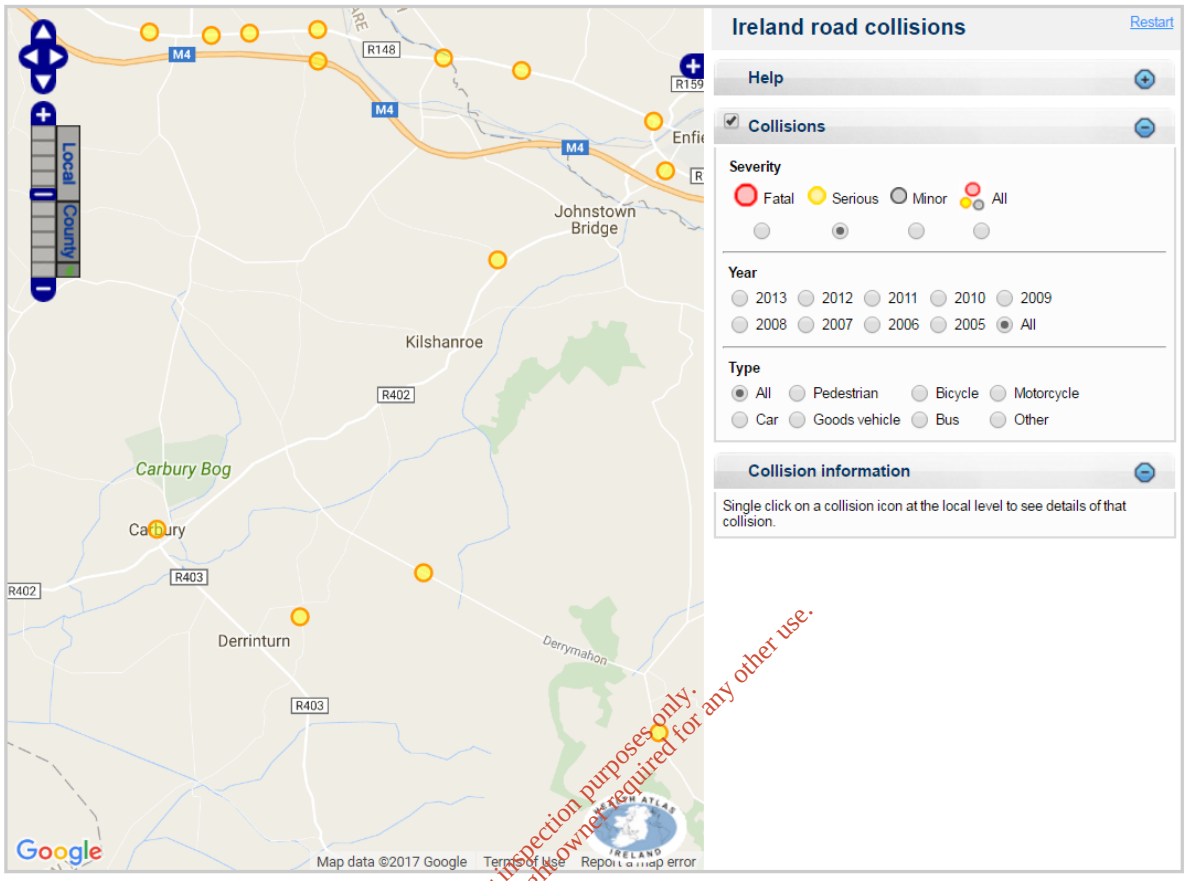
All ○ Pedestrian ○ Bicycle ○ Motorcycle ○
Car ○ Goods vehicle ● Bus ○ Other ○

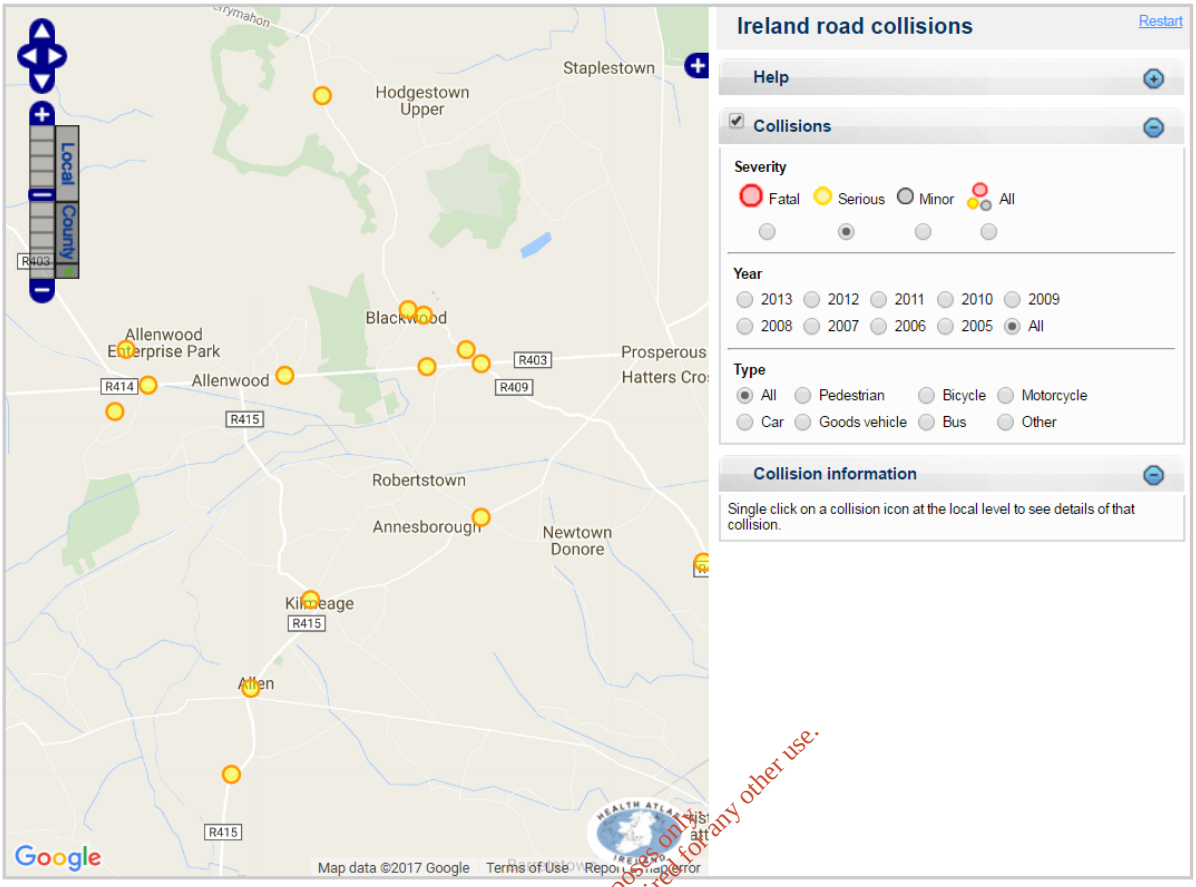
Collision information

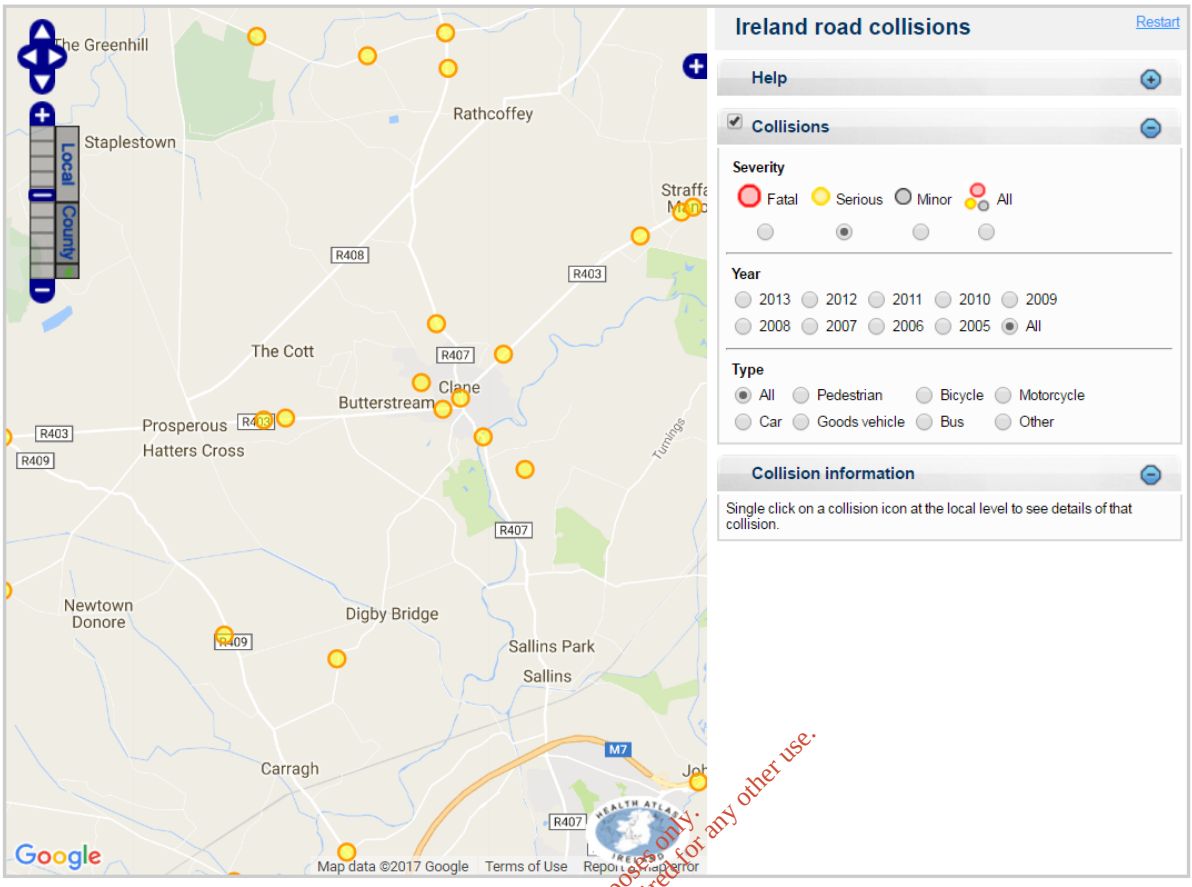
Severity	Fatal
Year	2011
Vehicle	Goods vehicle
Circumstances	Single vehicle only
Day of week	Friday
Time	2300-0300
Speed limit	80 KPH
No. casualties - fatal	1
No. casualties - serious	2
No. casualties - minor	1
No. casualties - total	**4**

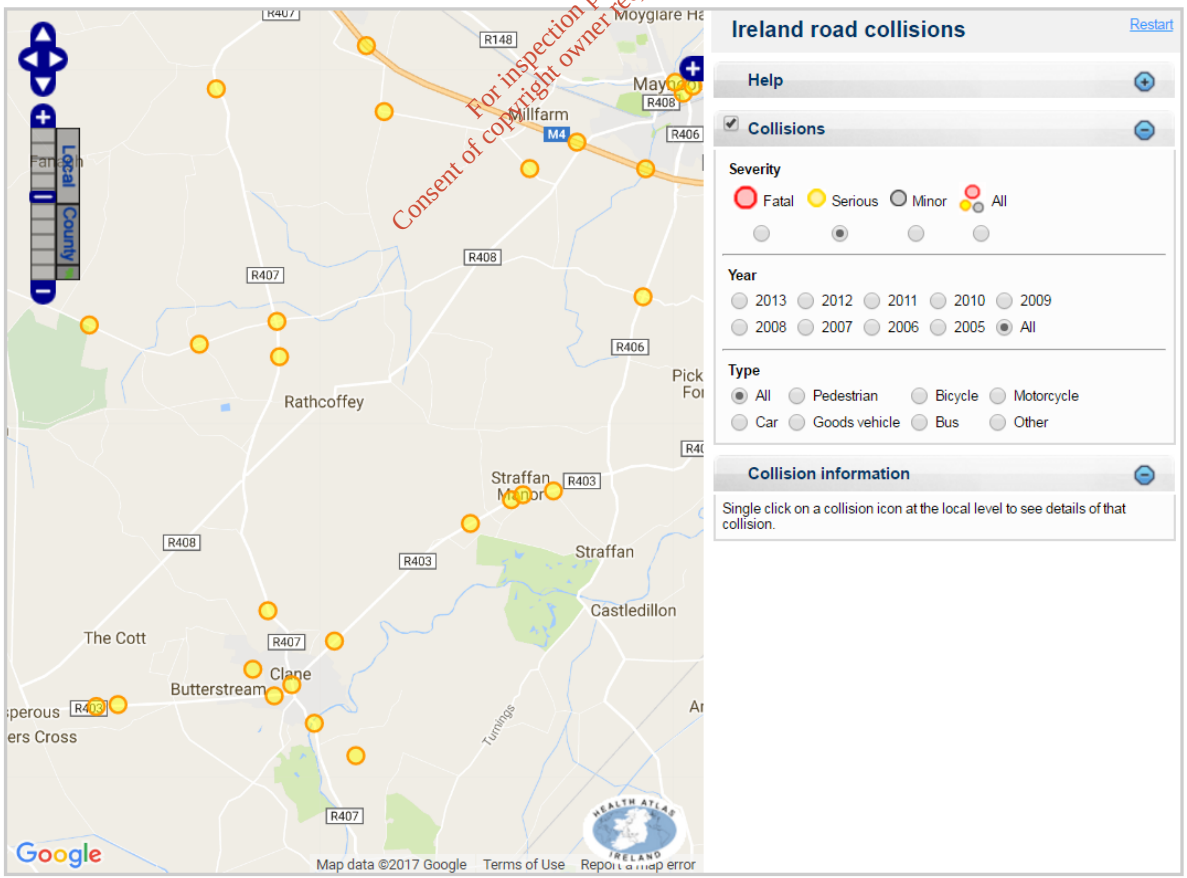


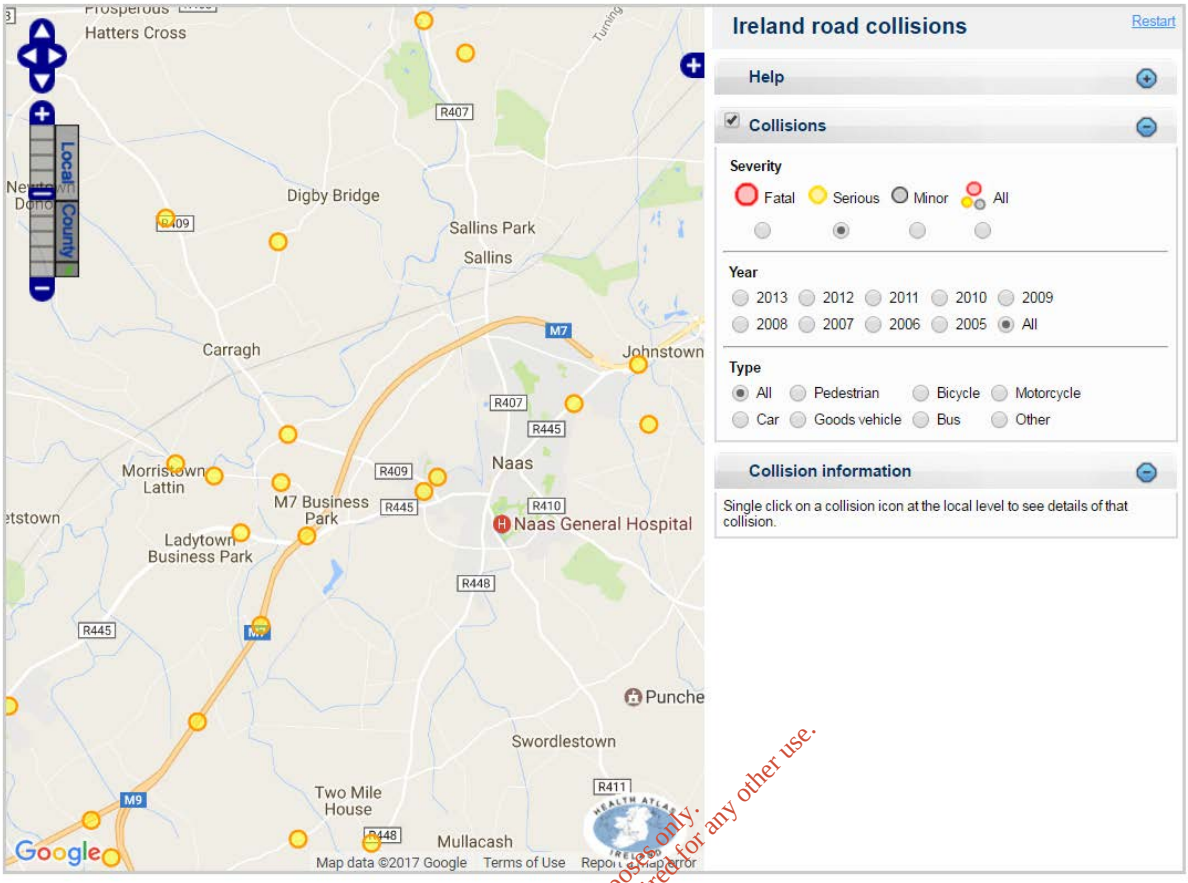
Serious Accidents (All vehicles type) 2005-2013

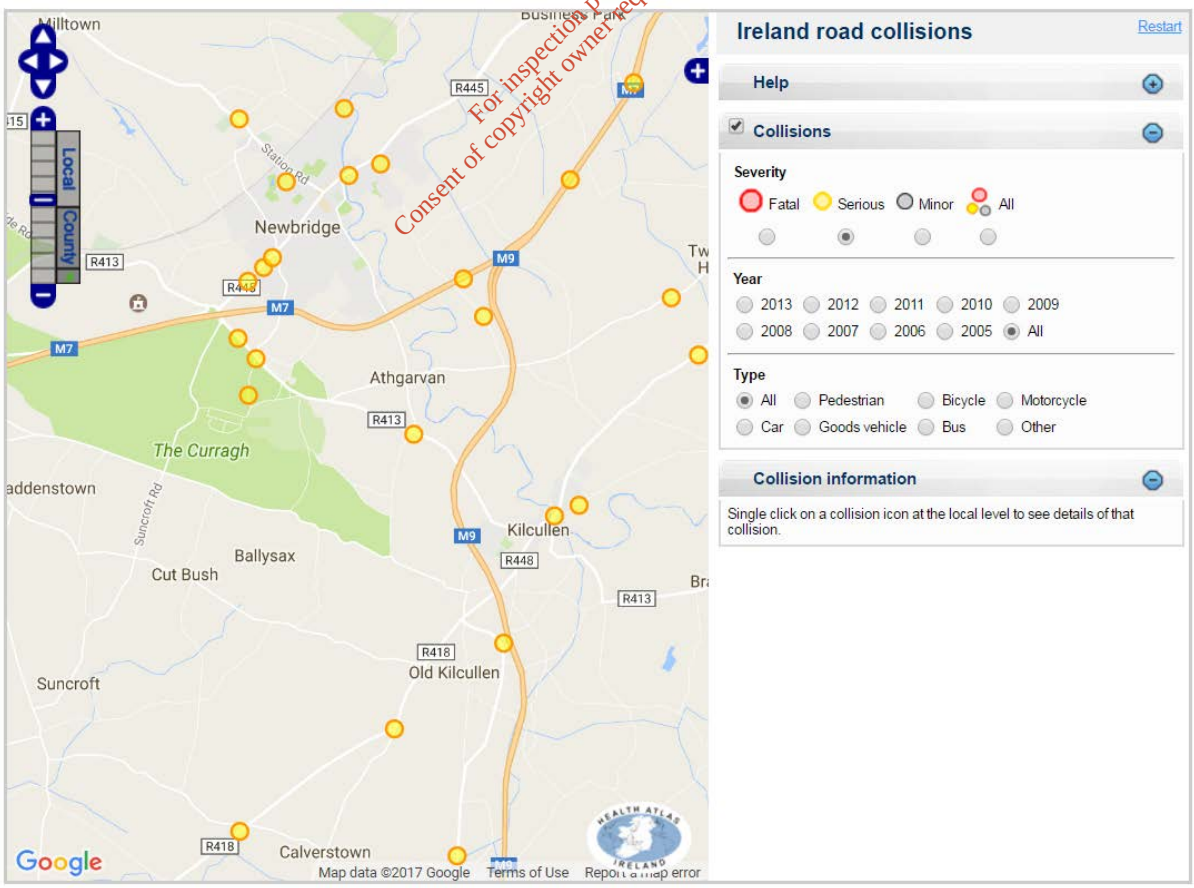


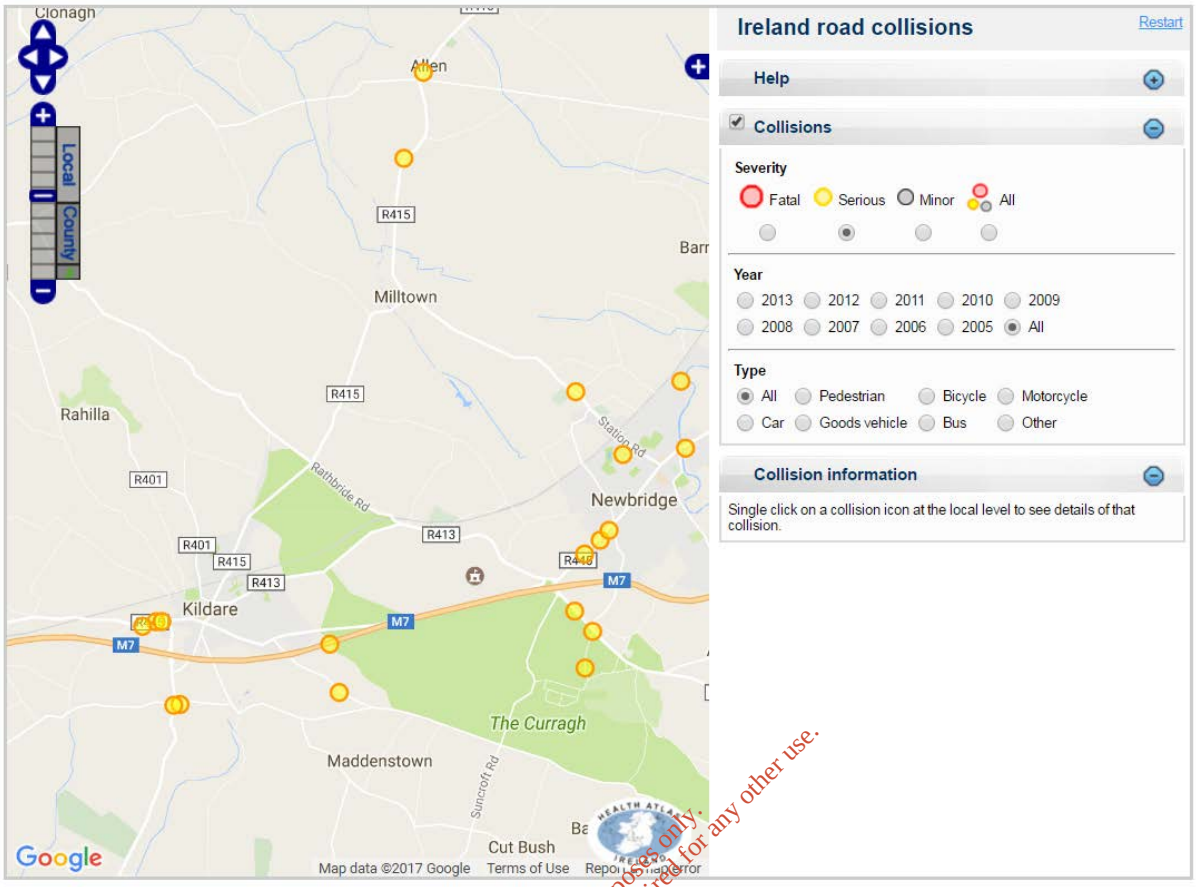


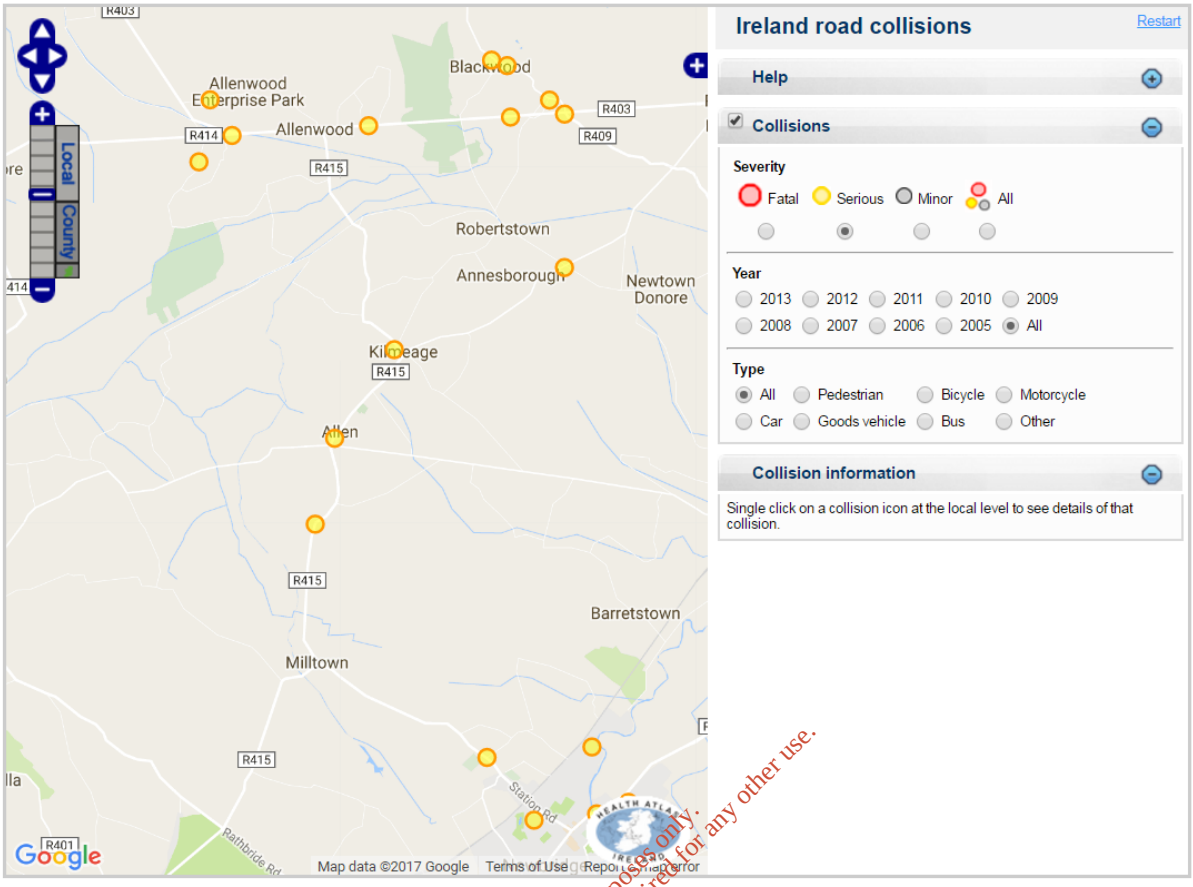




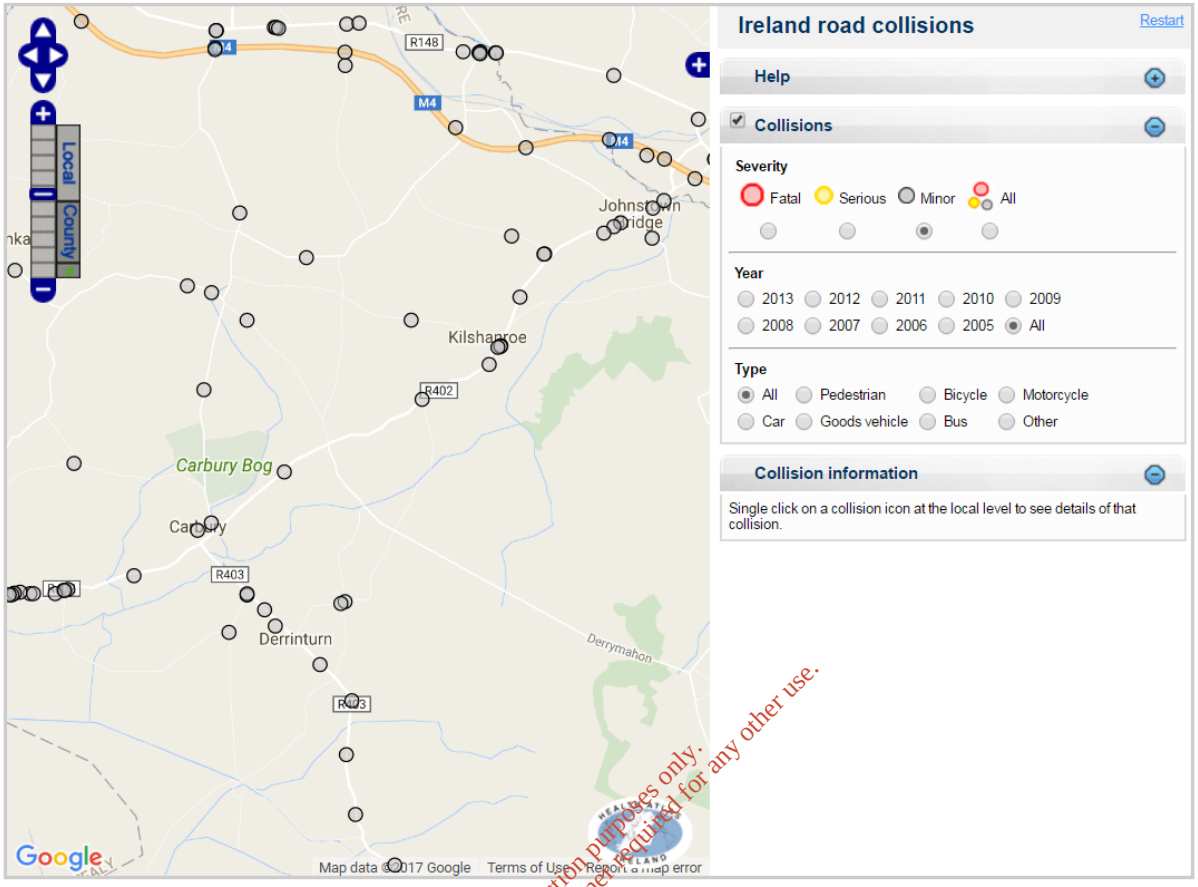


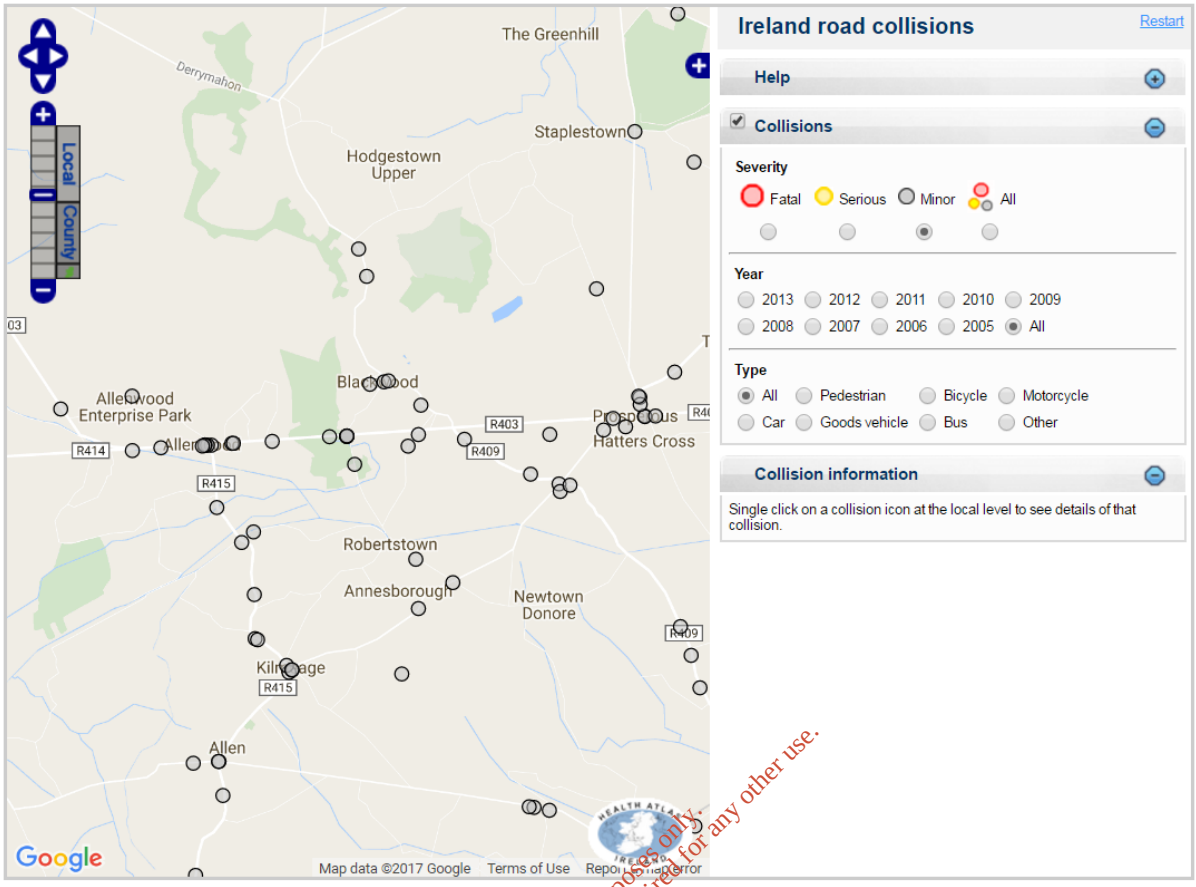


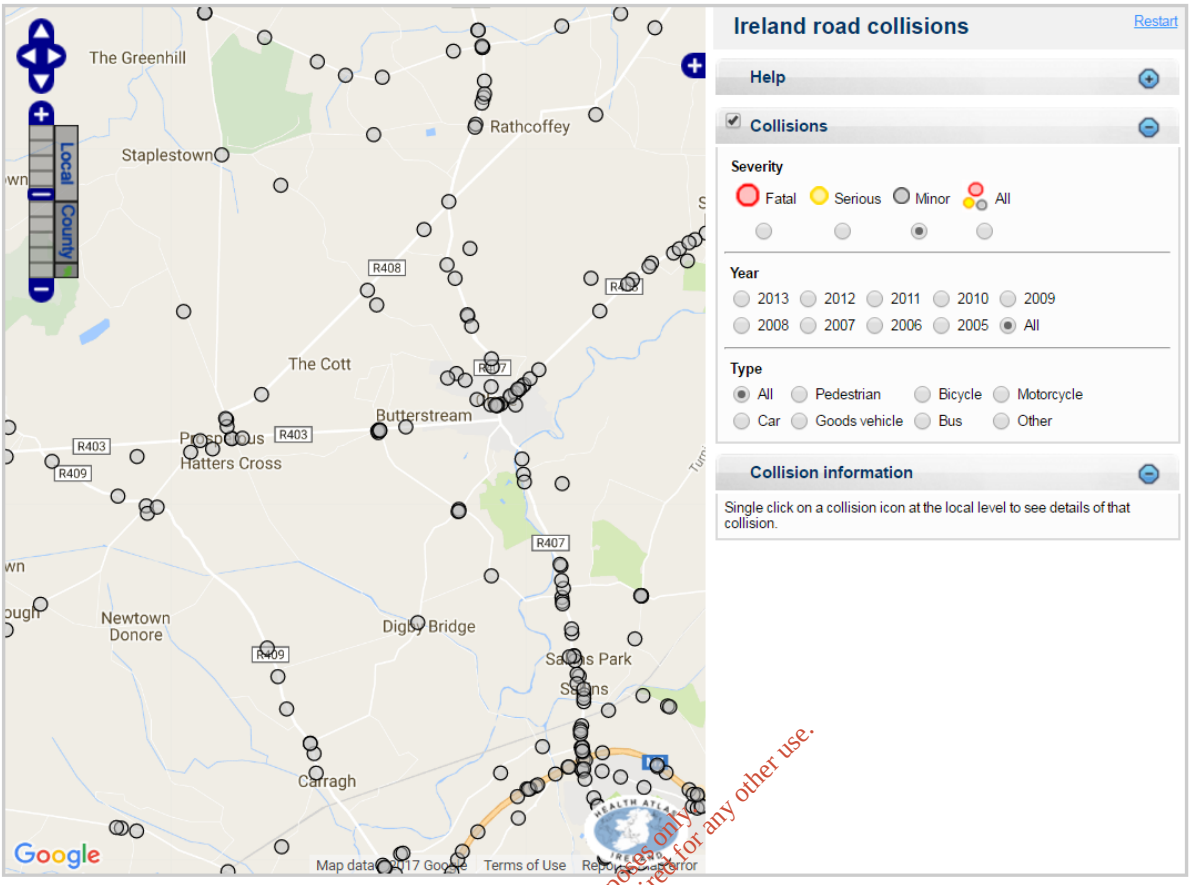


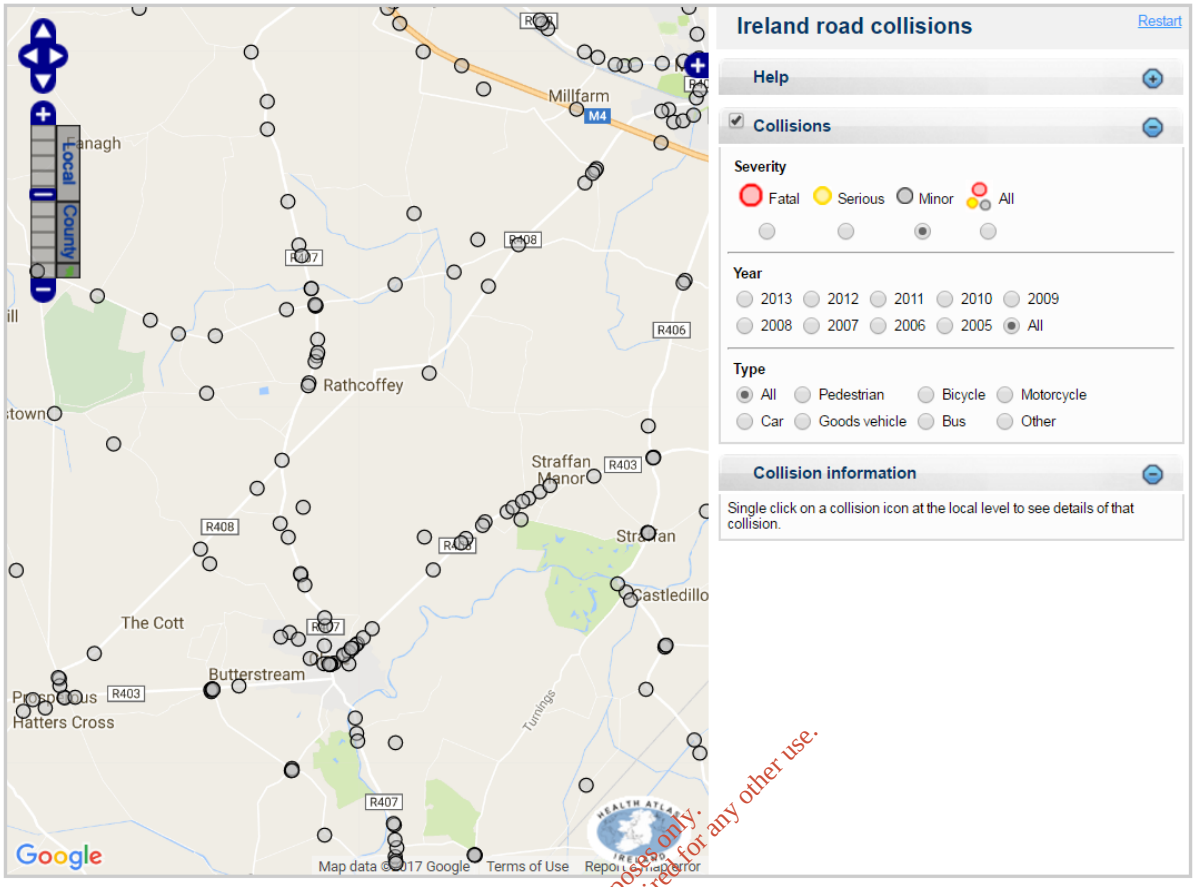


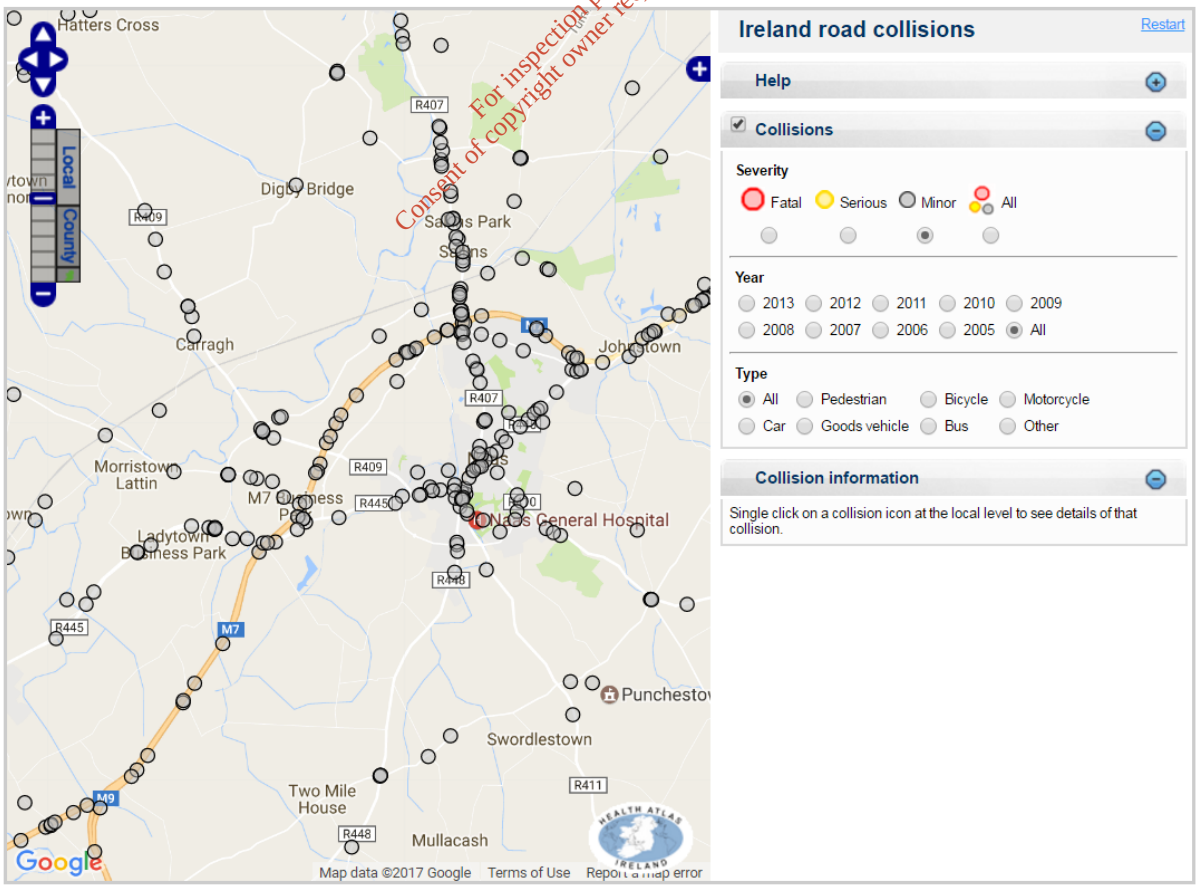
Minor Accidents (All vehicles type) 2005-2013

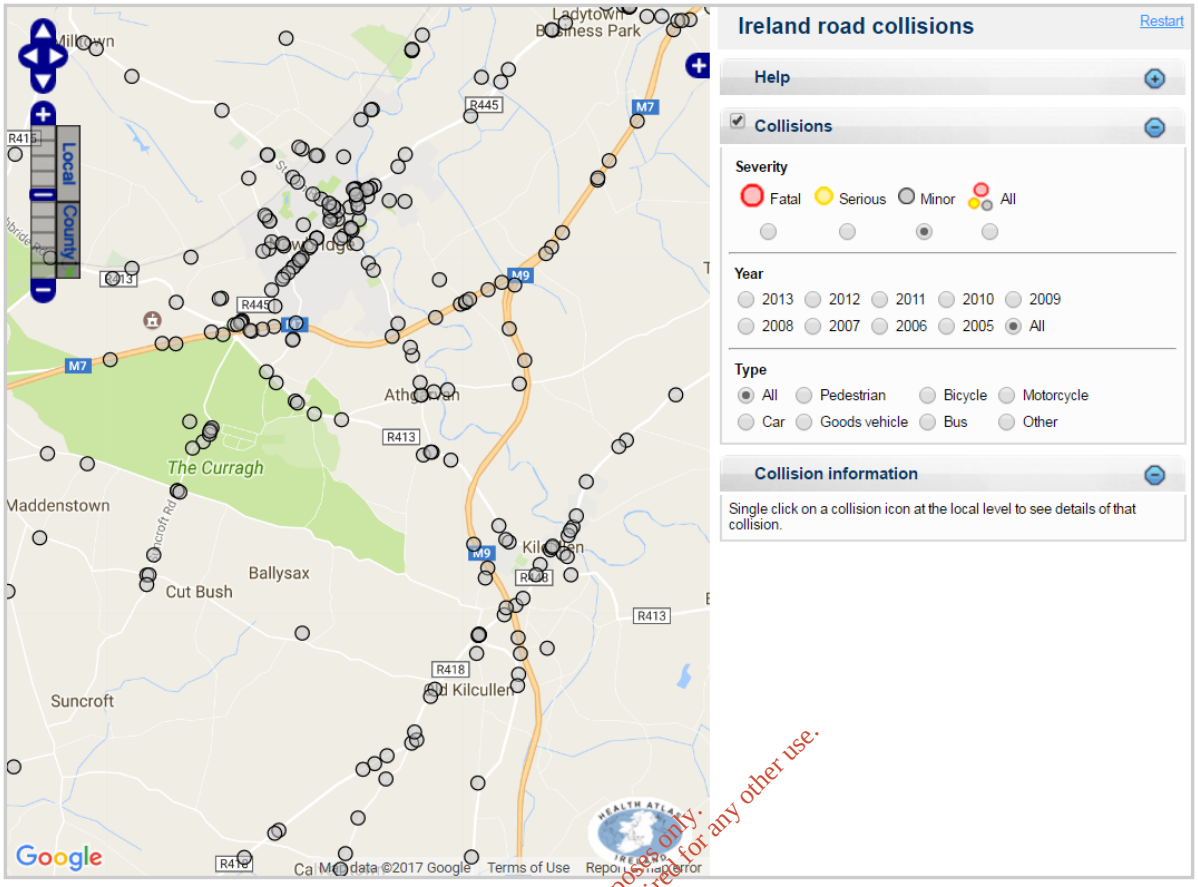


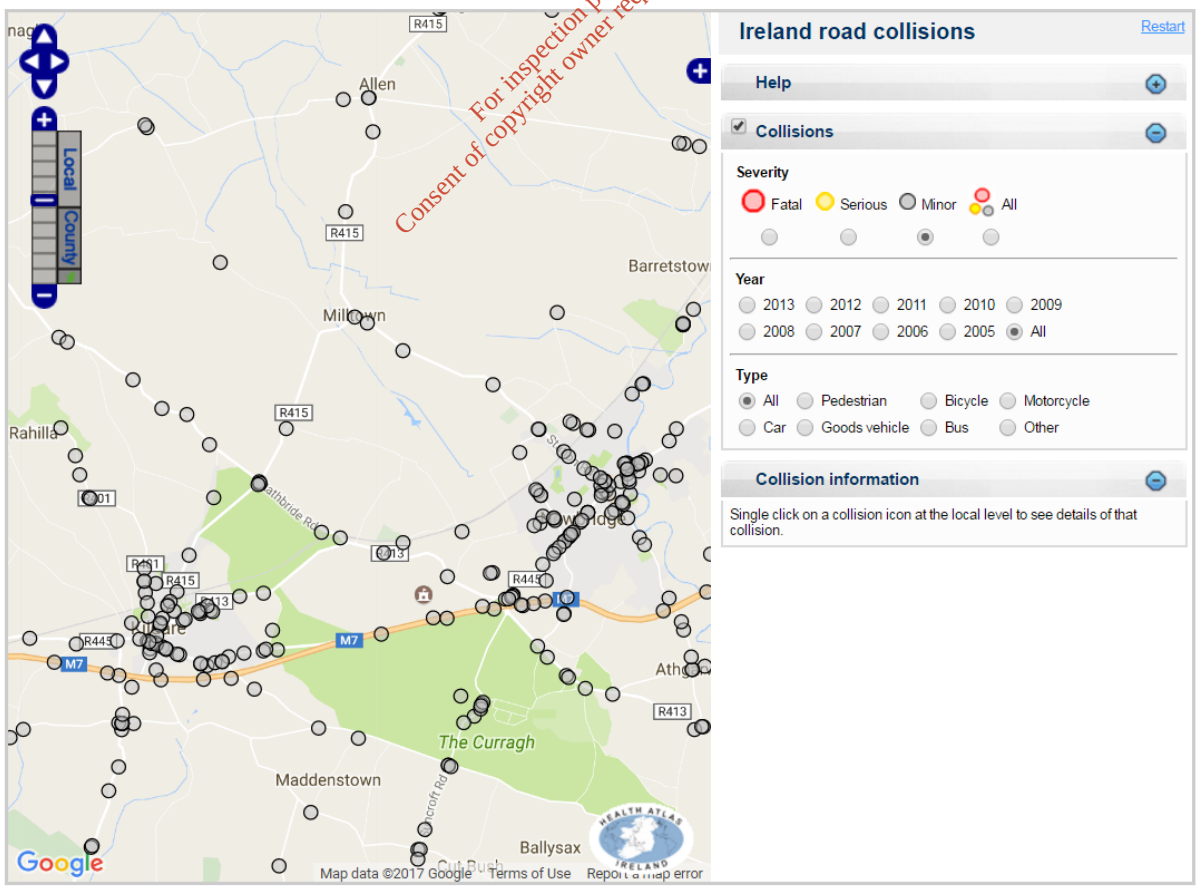


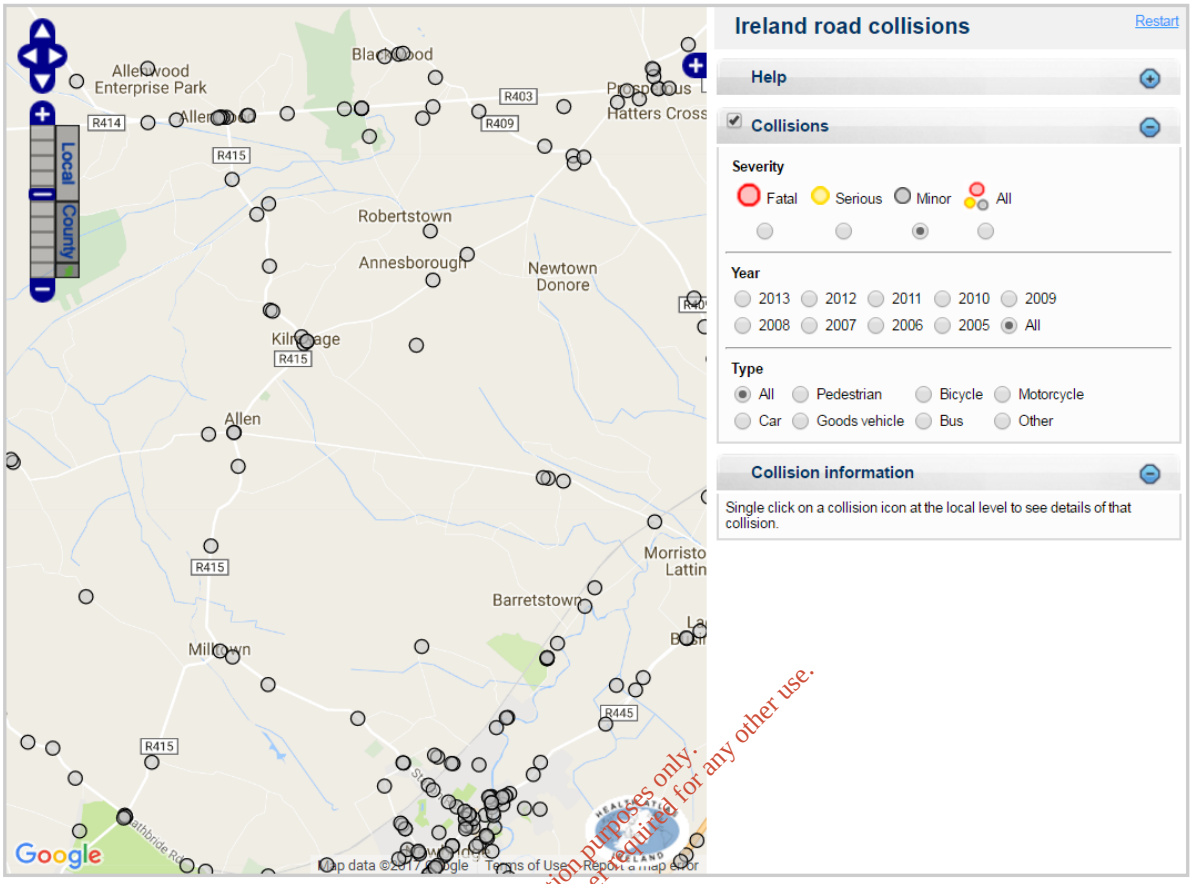




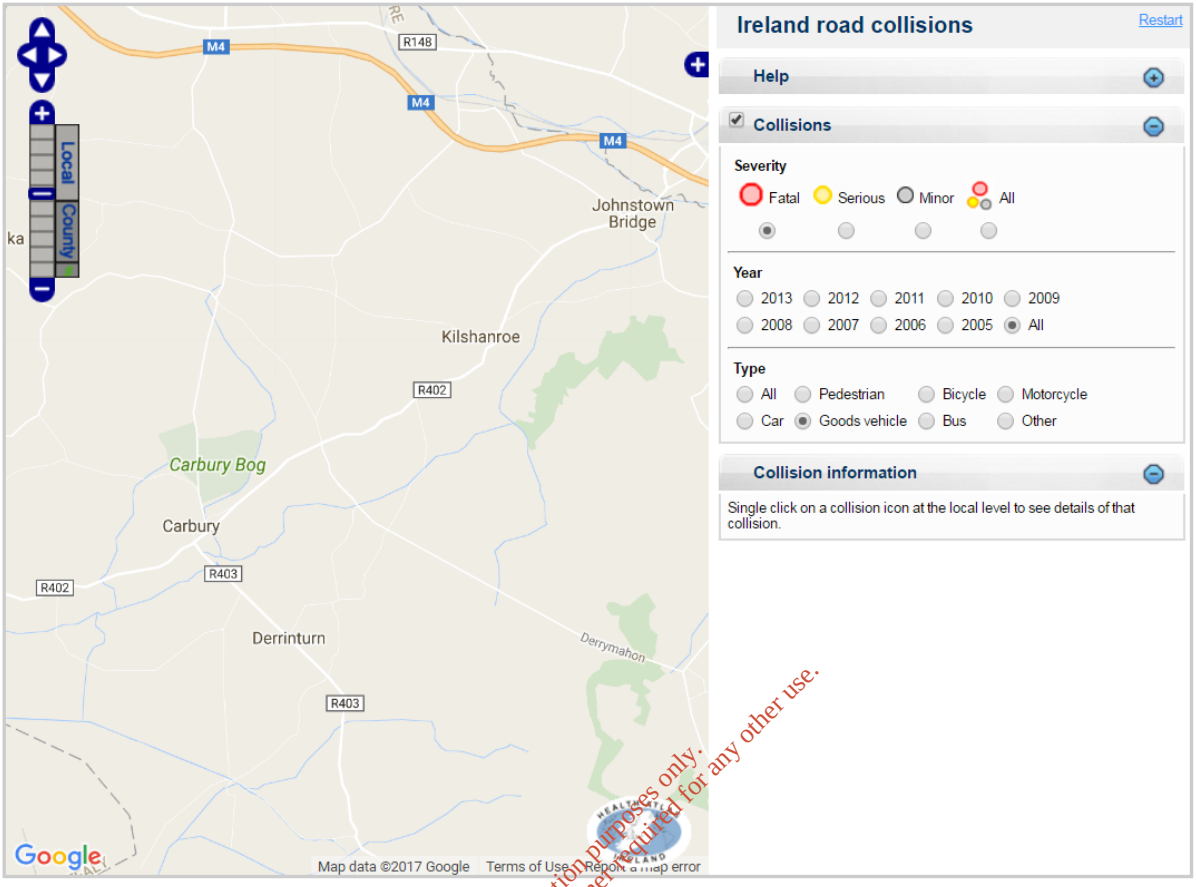


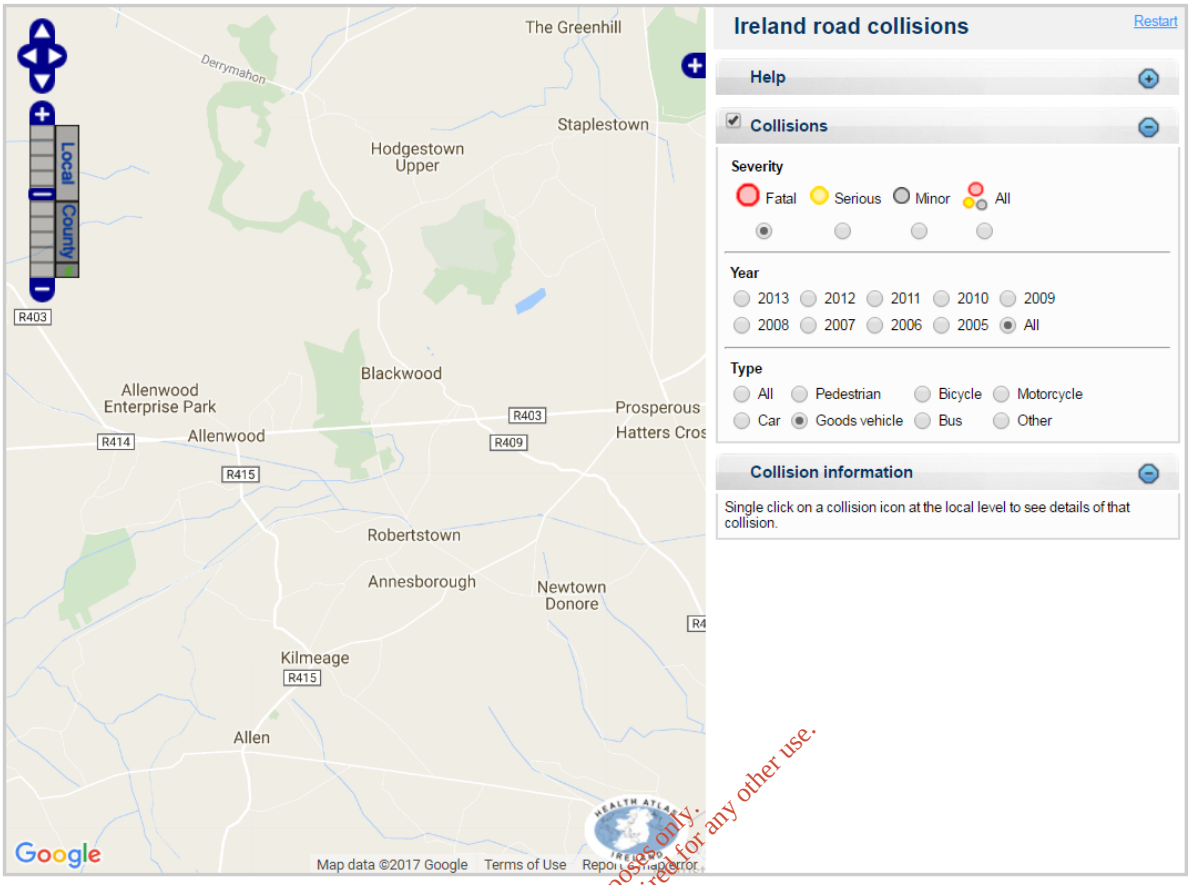


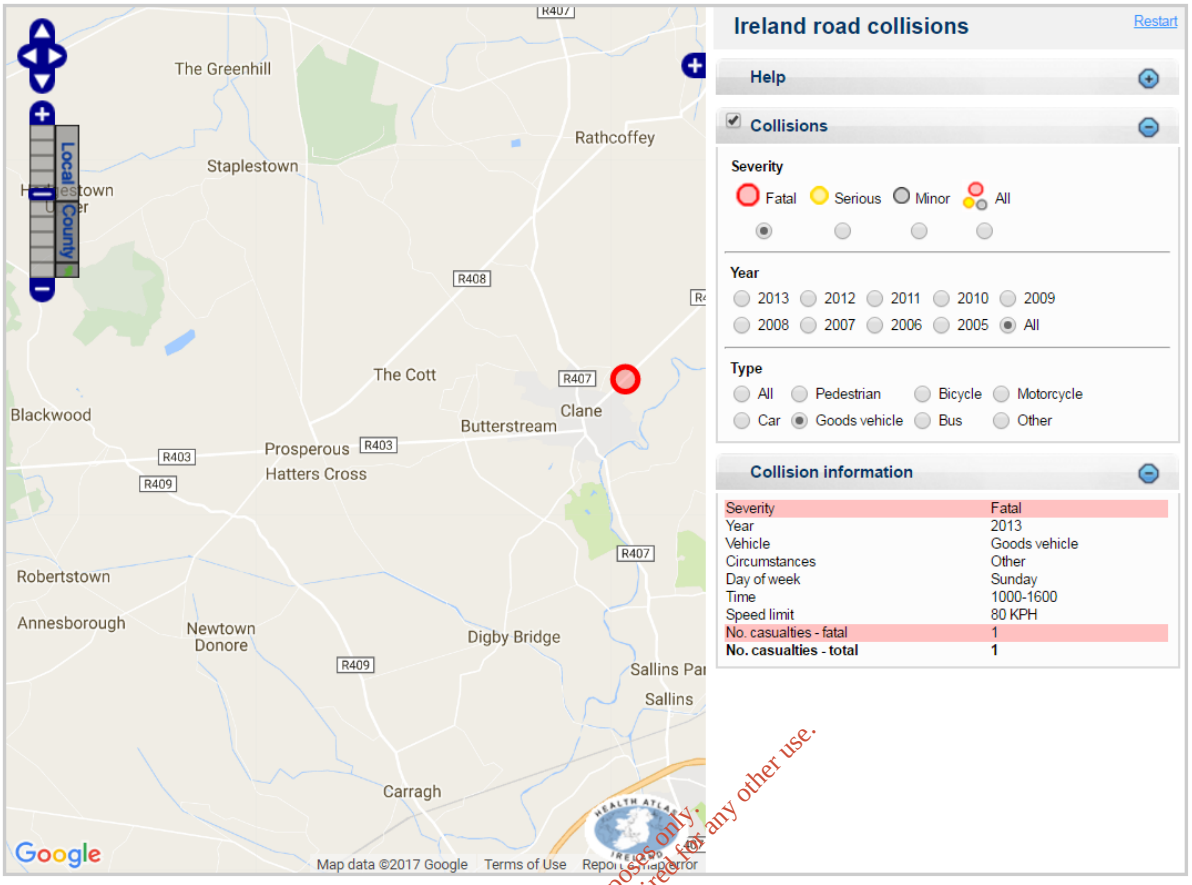


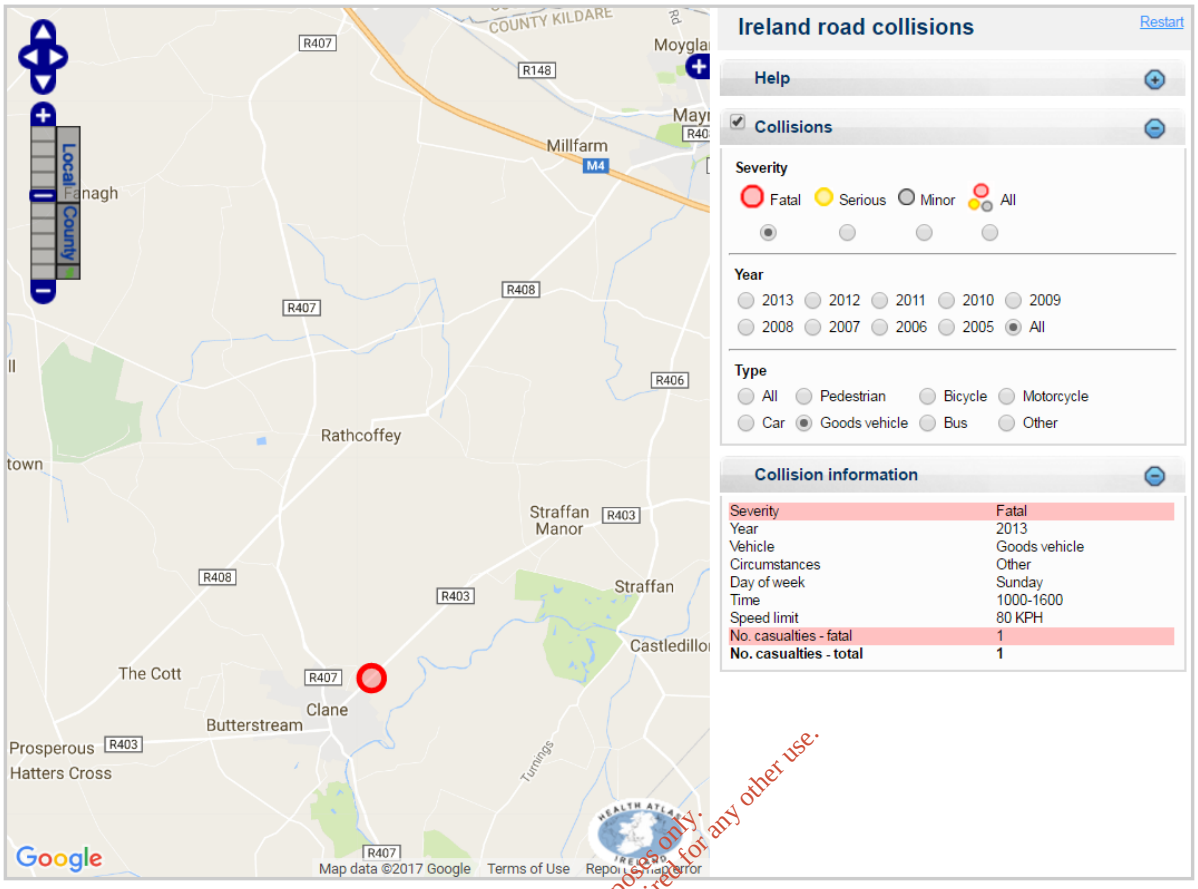


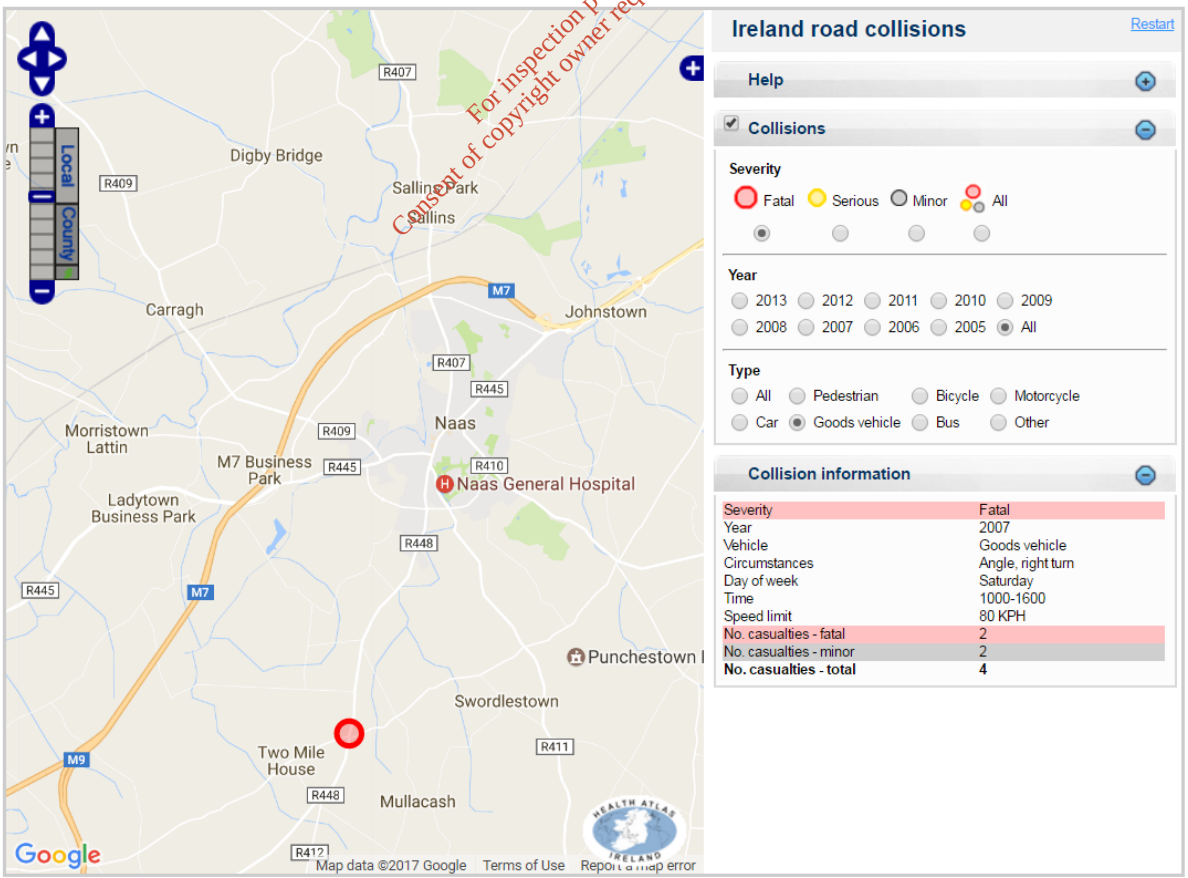
Fatal Accidents (HGVs (*'Goods Vehicles'*) 2005-2013

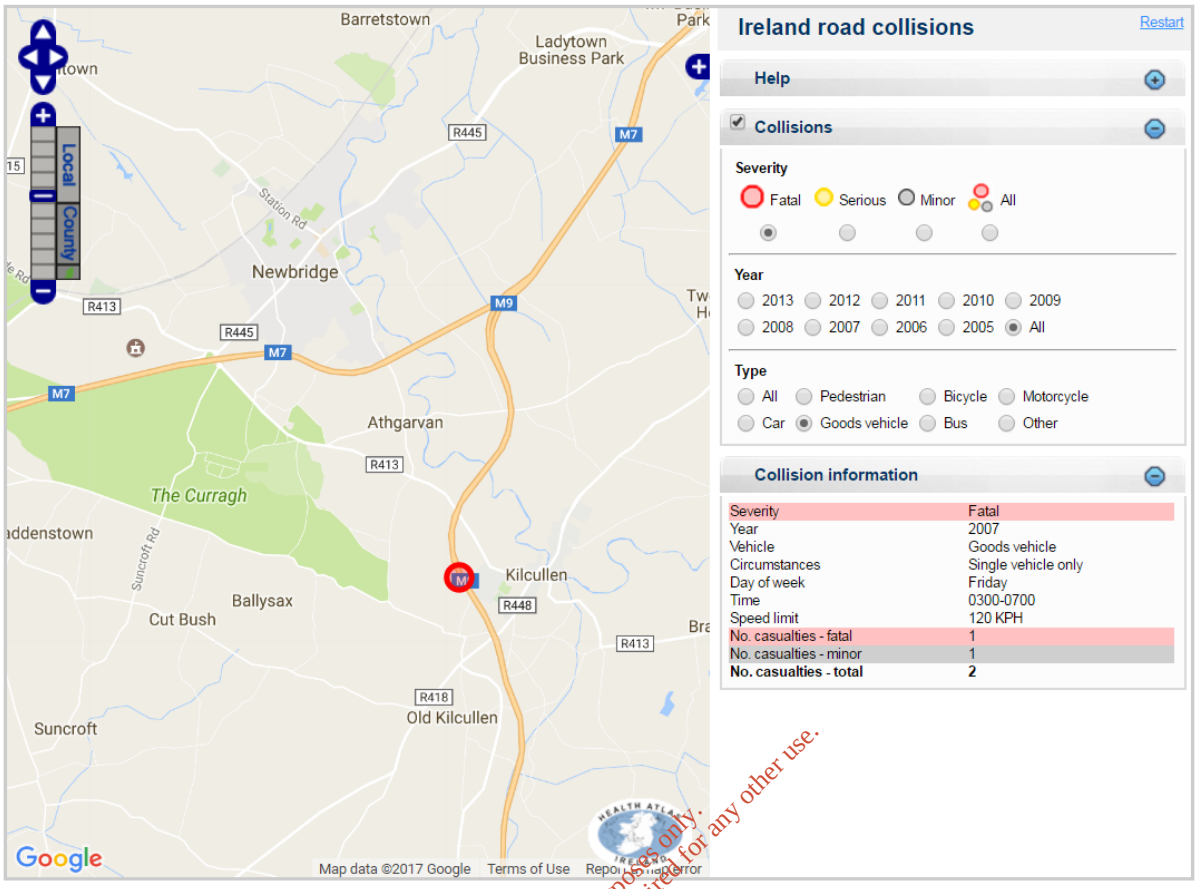


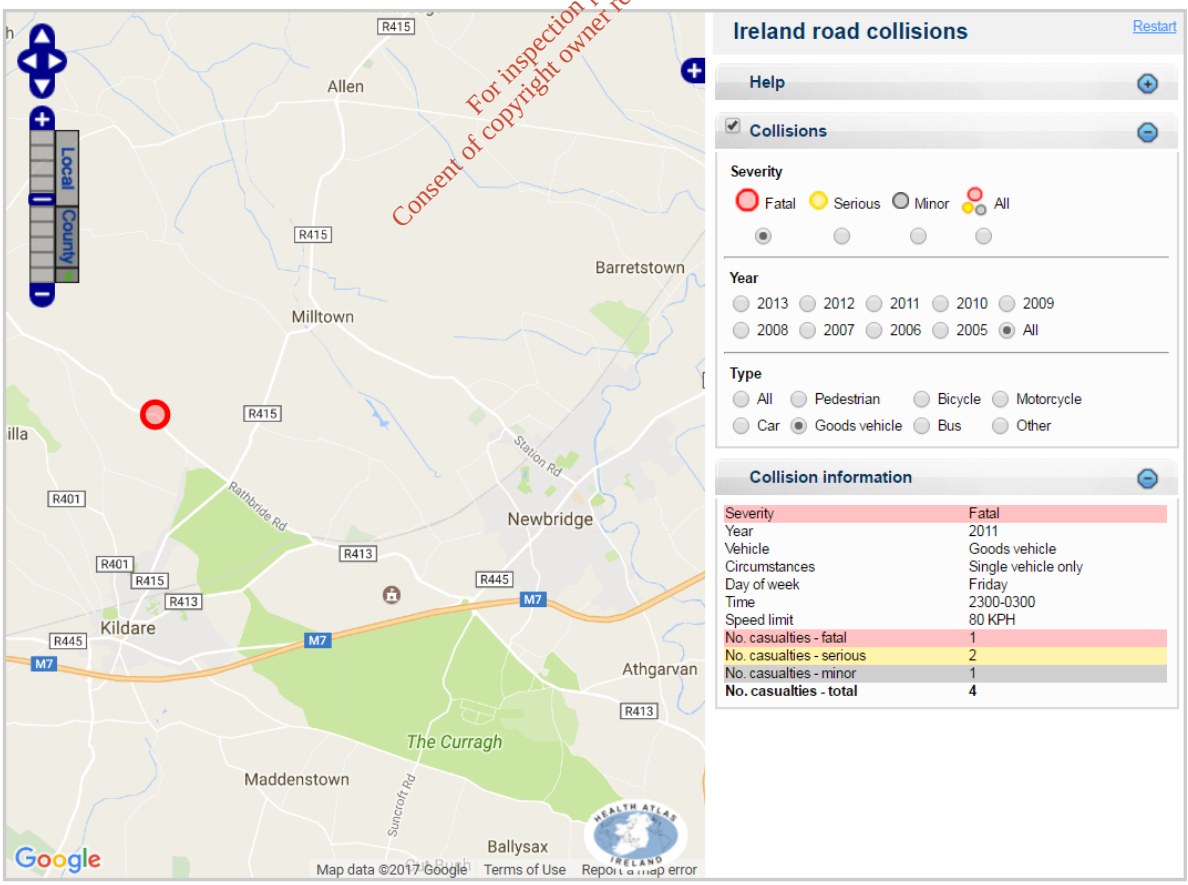


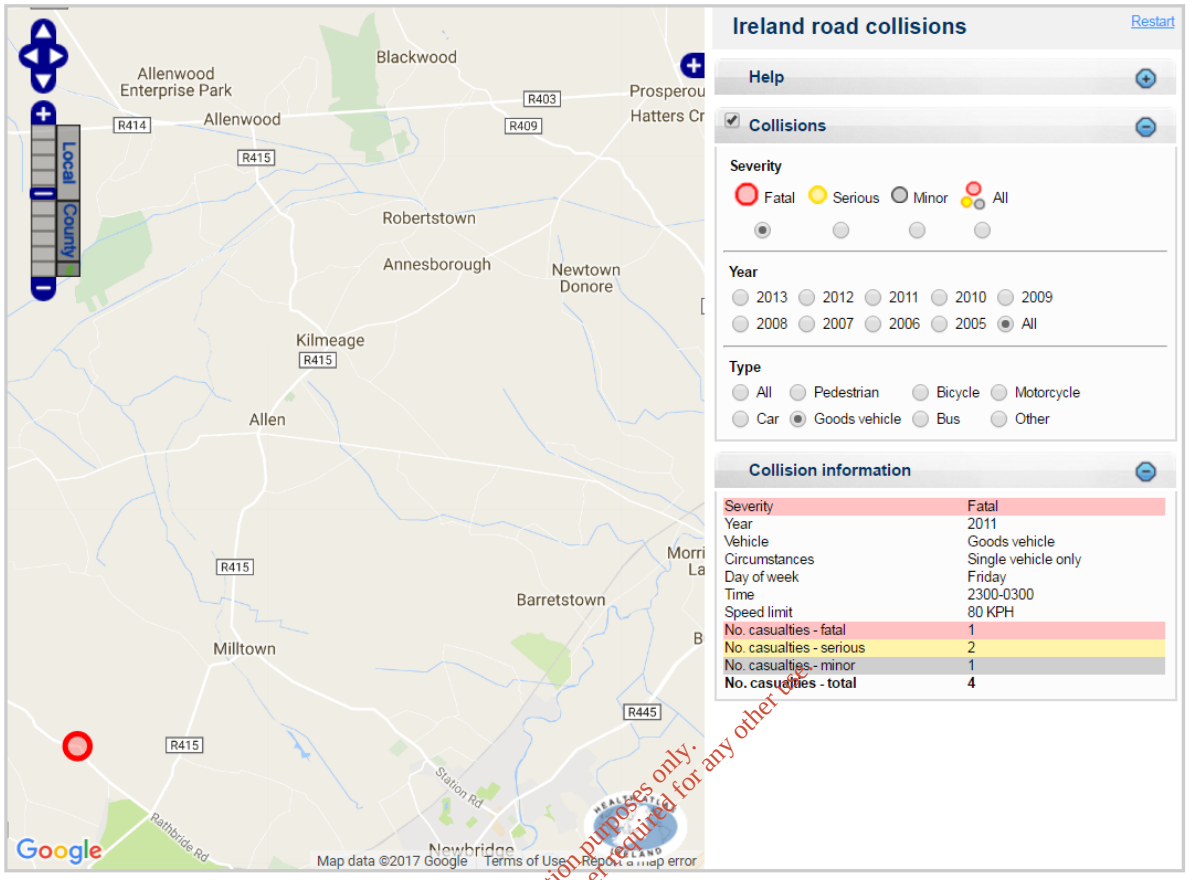




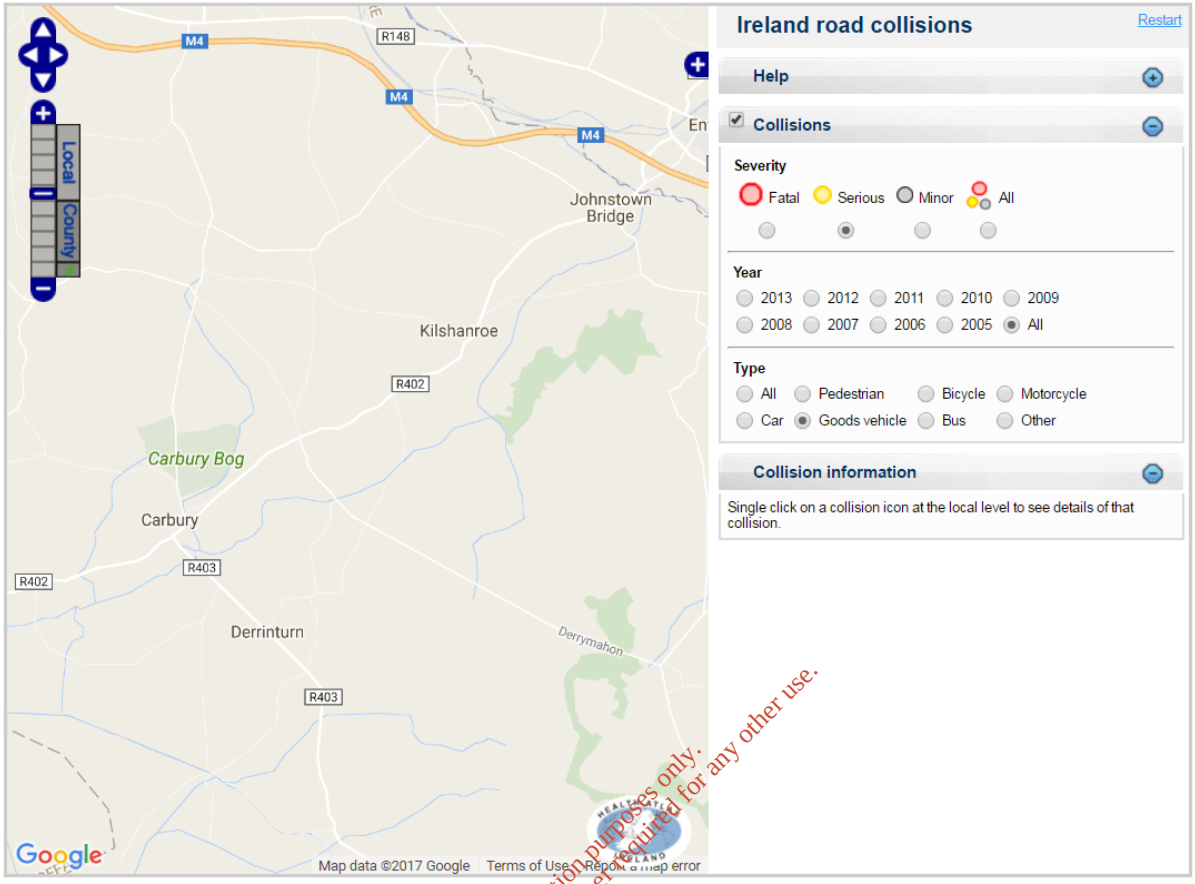


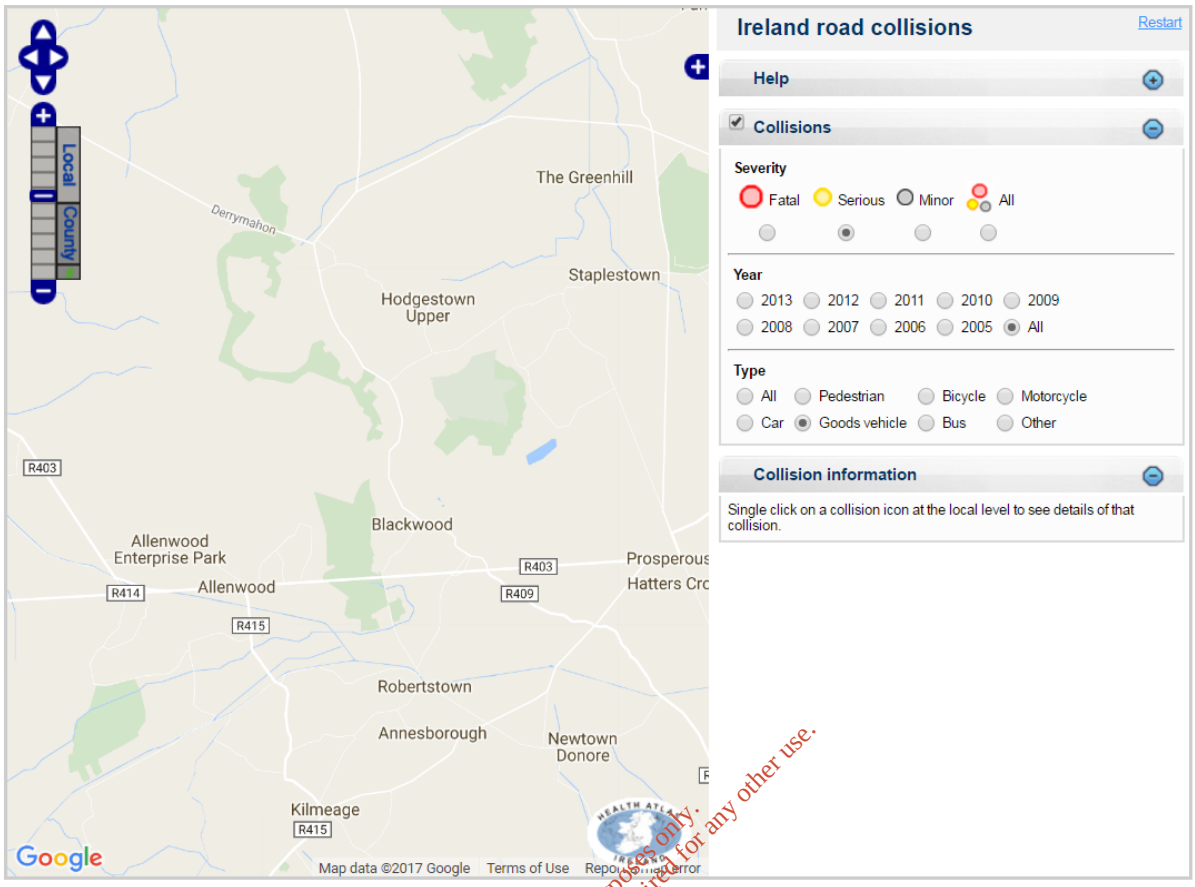


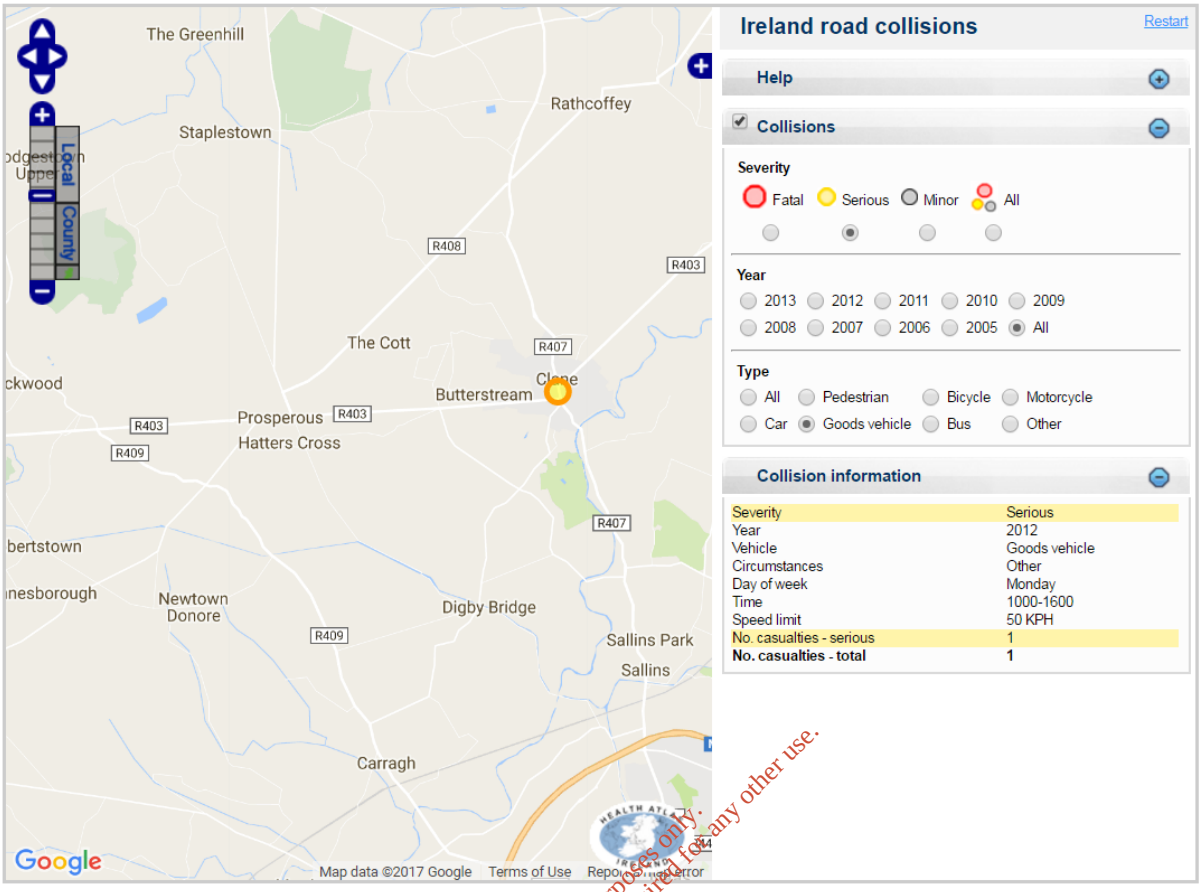


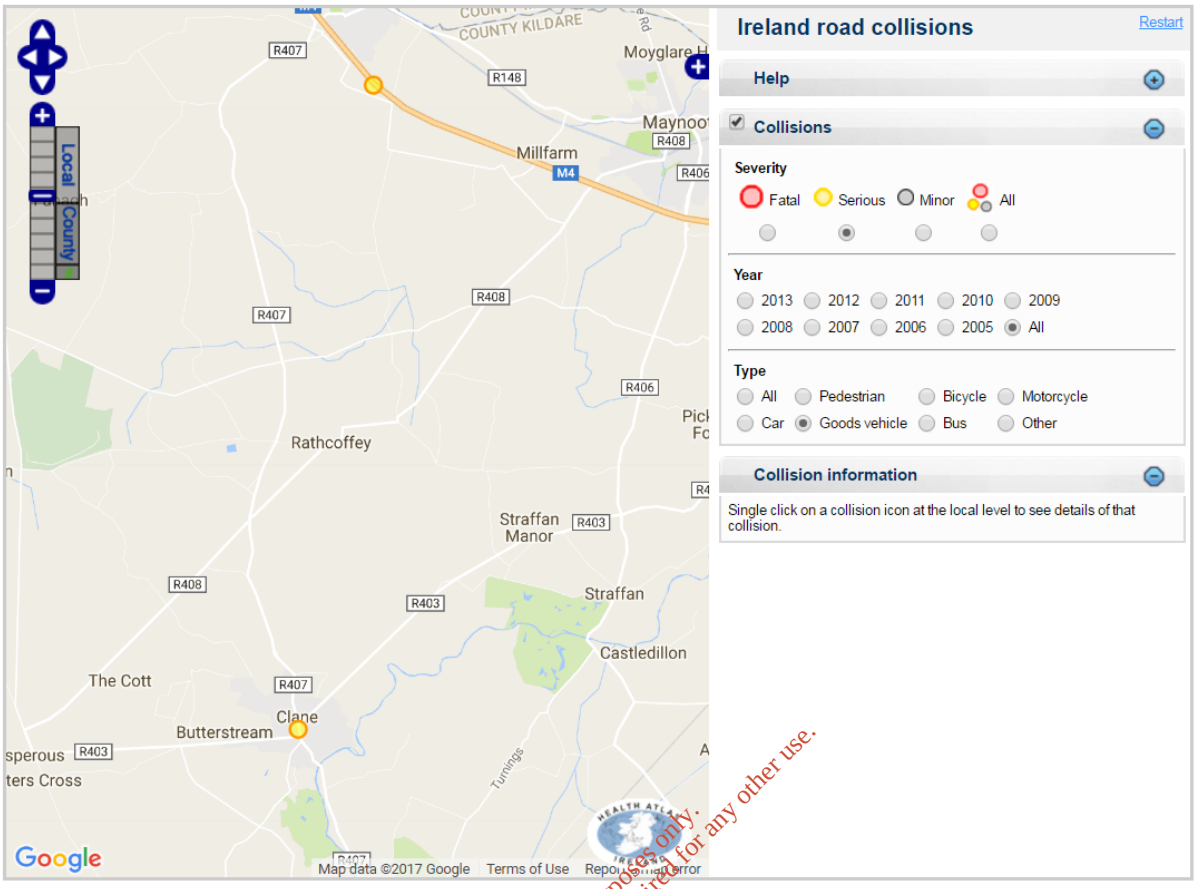


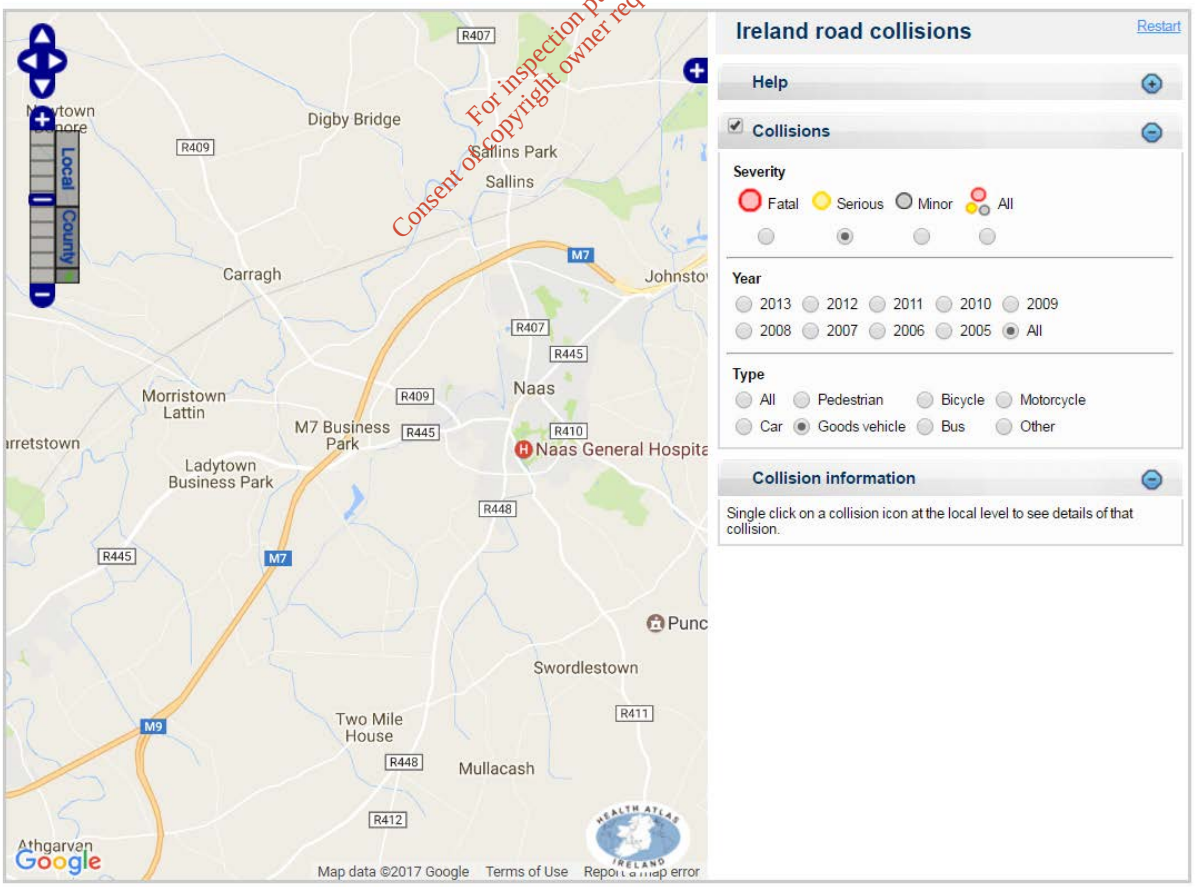
Serious Accidents (HGVs (*'Goods Vehicles'*) 2005-2013

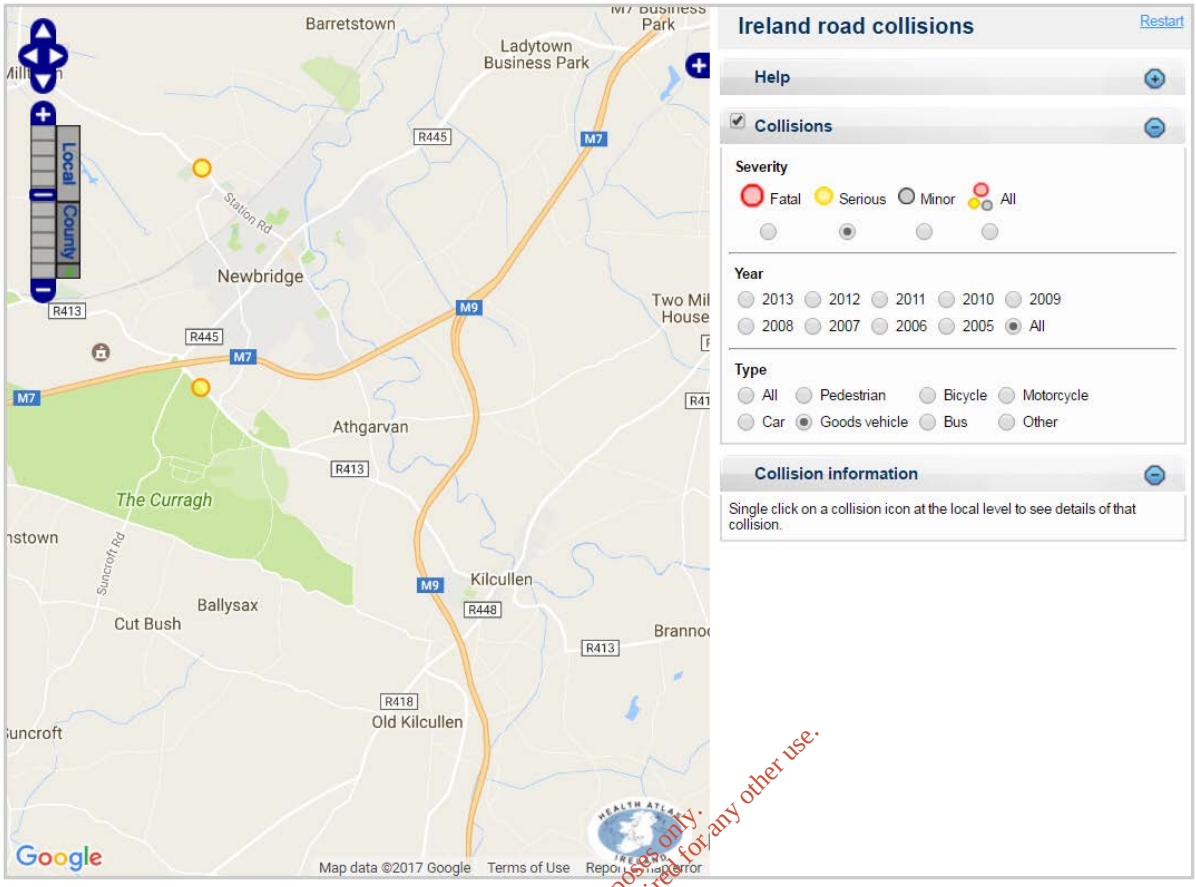


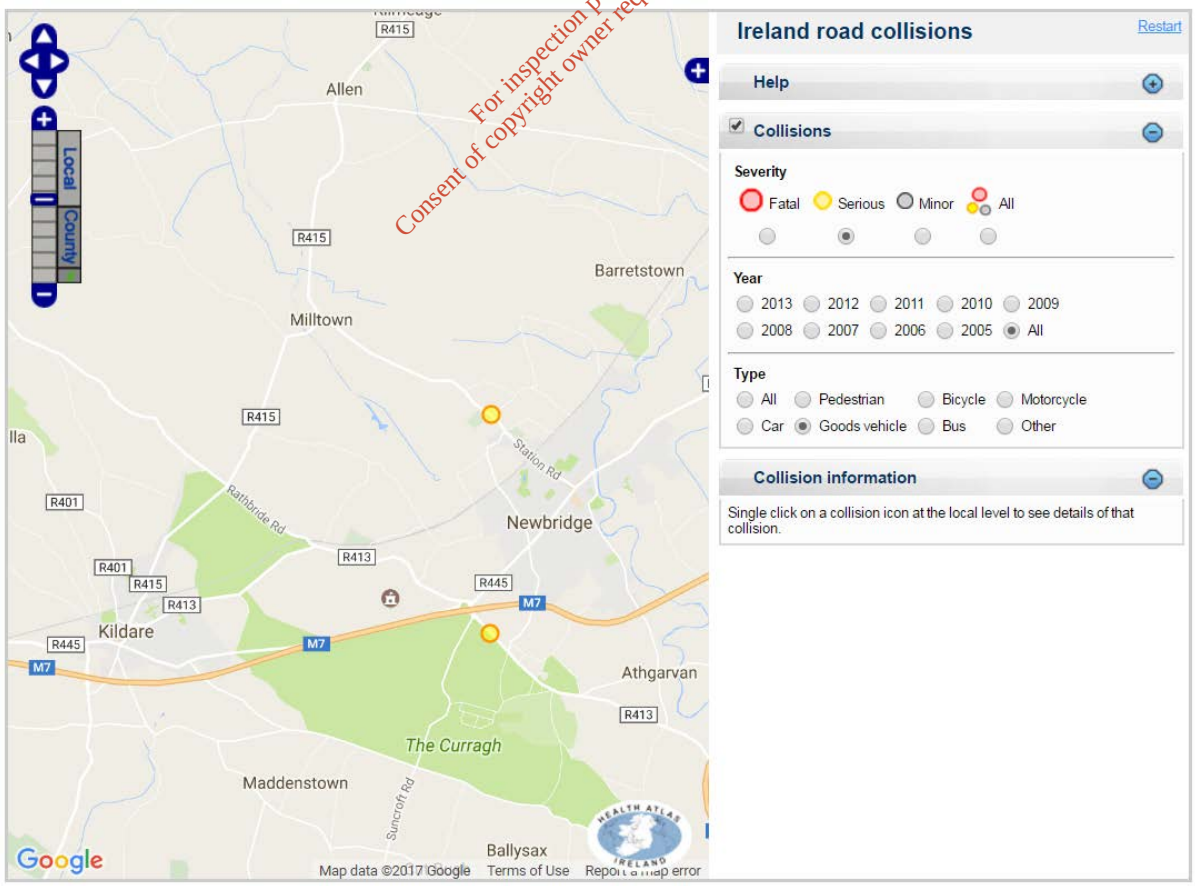


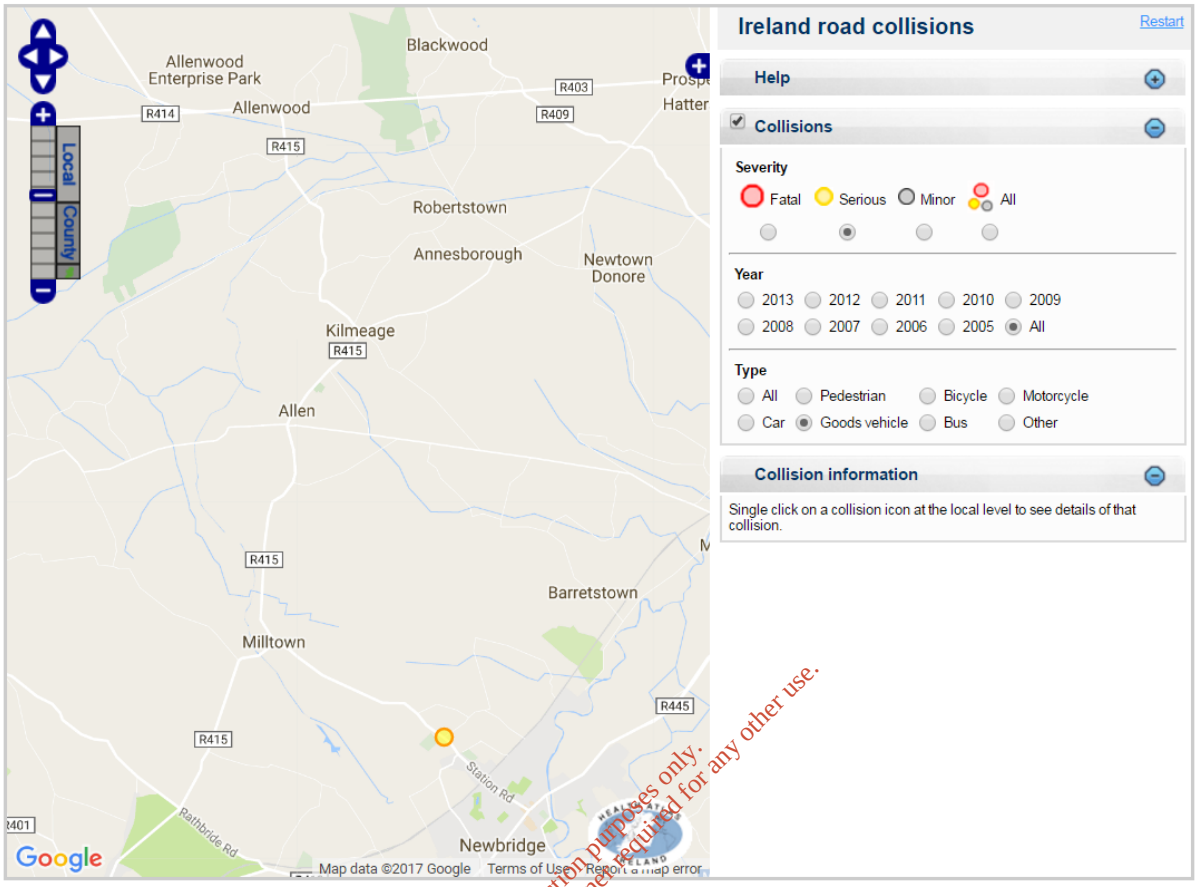












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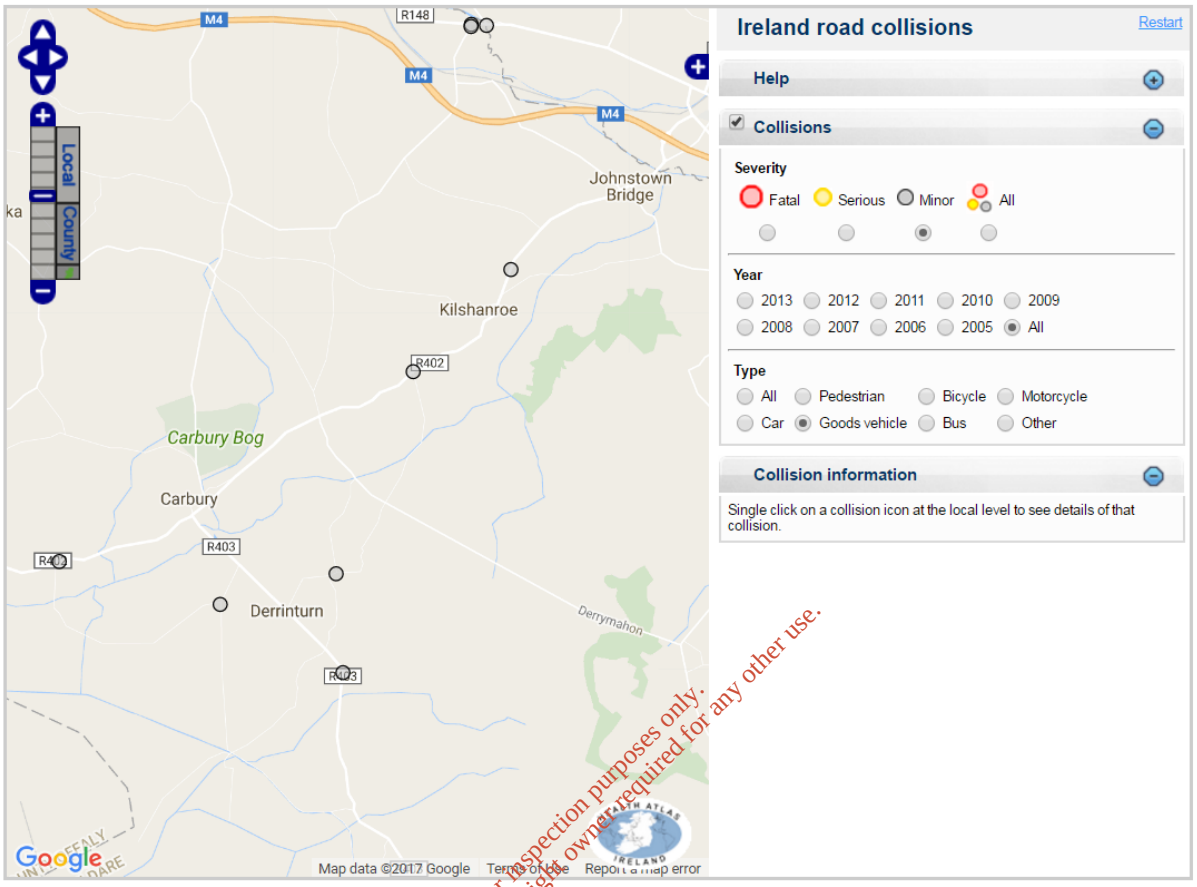

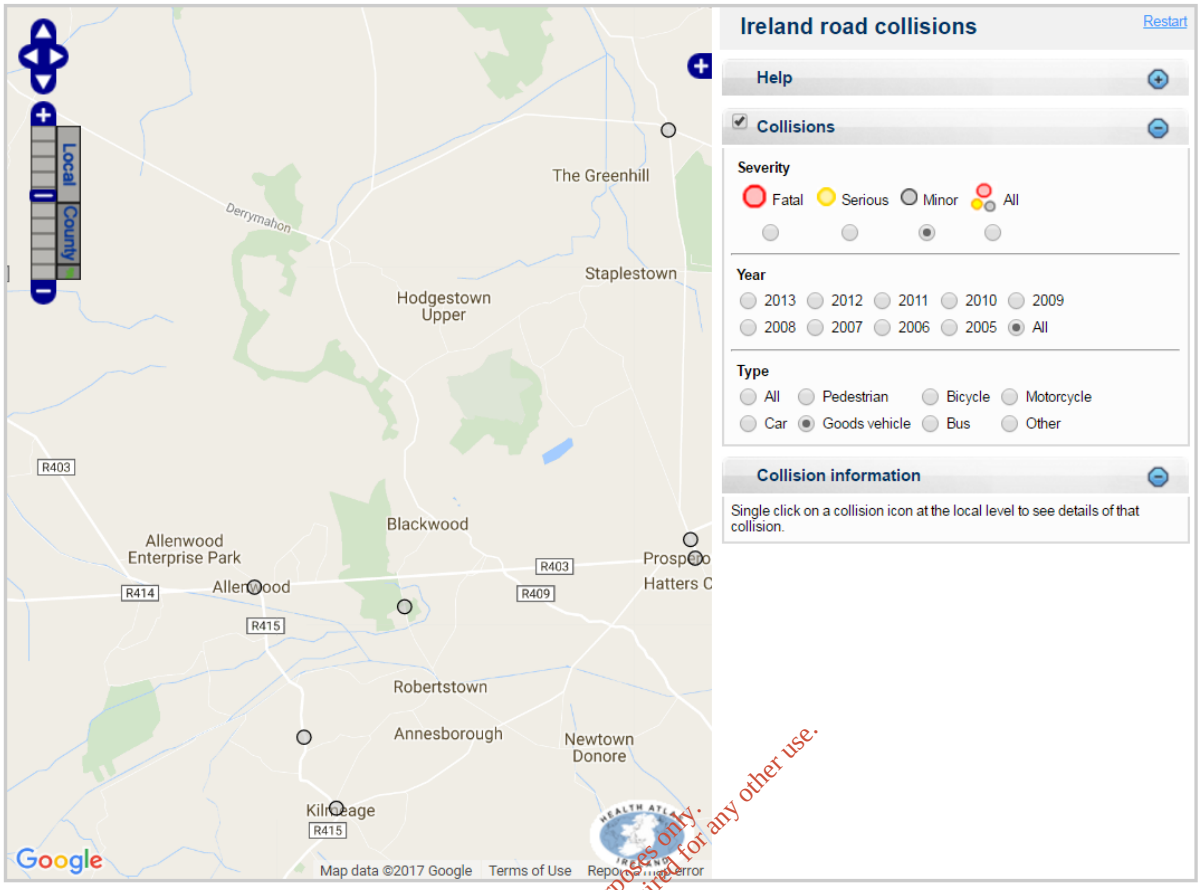

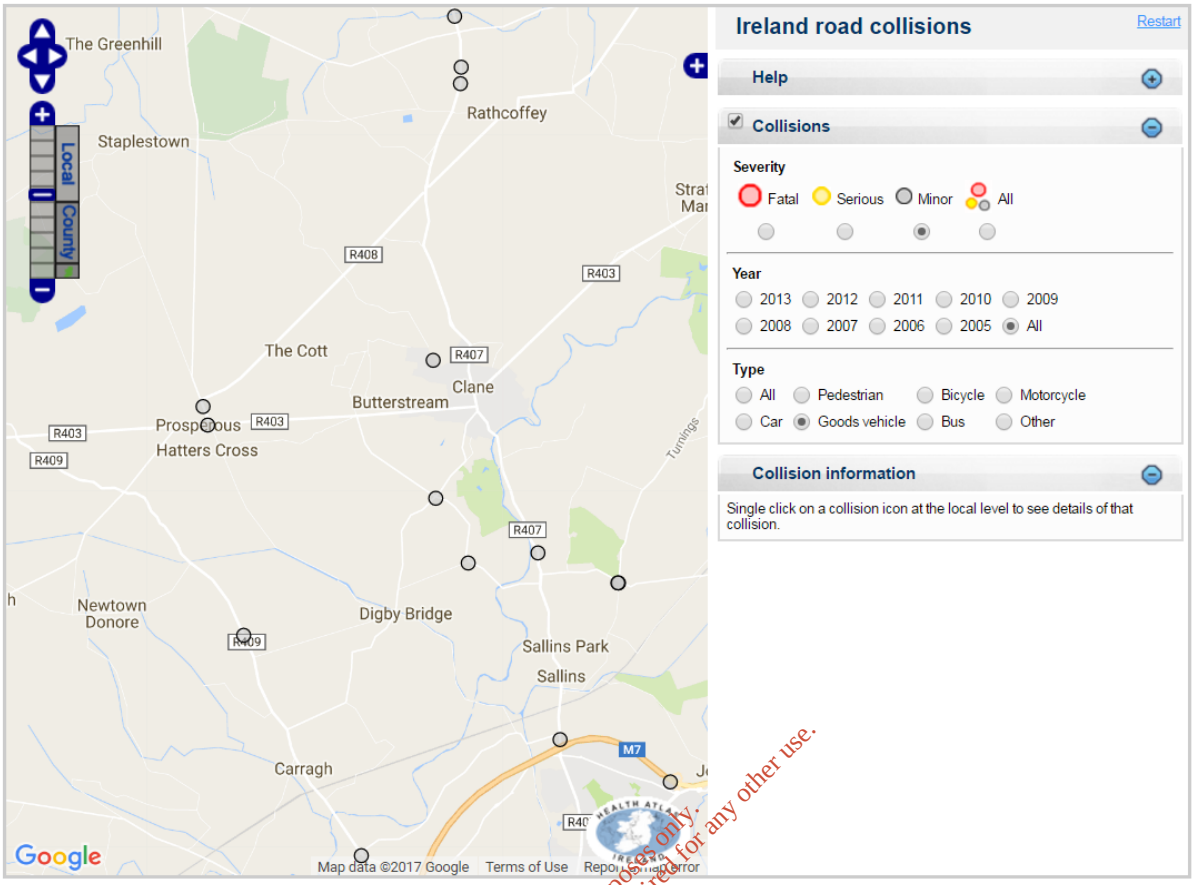

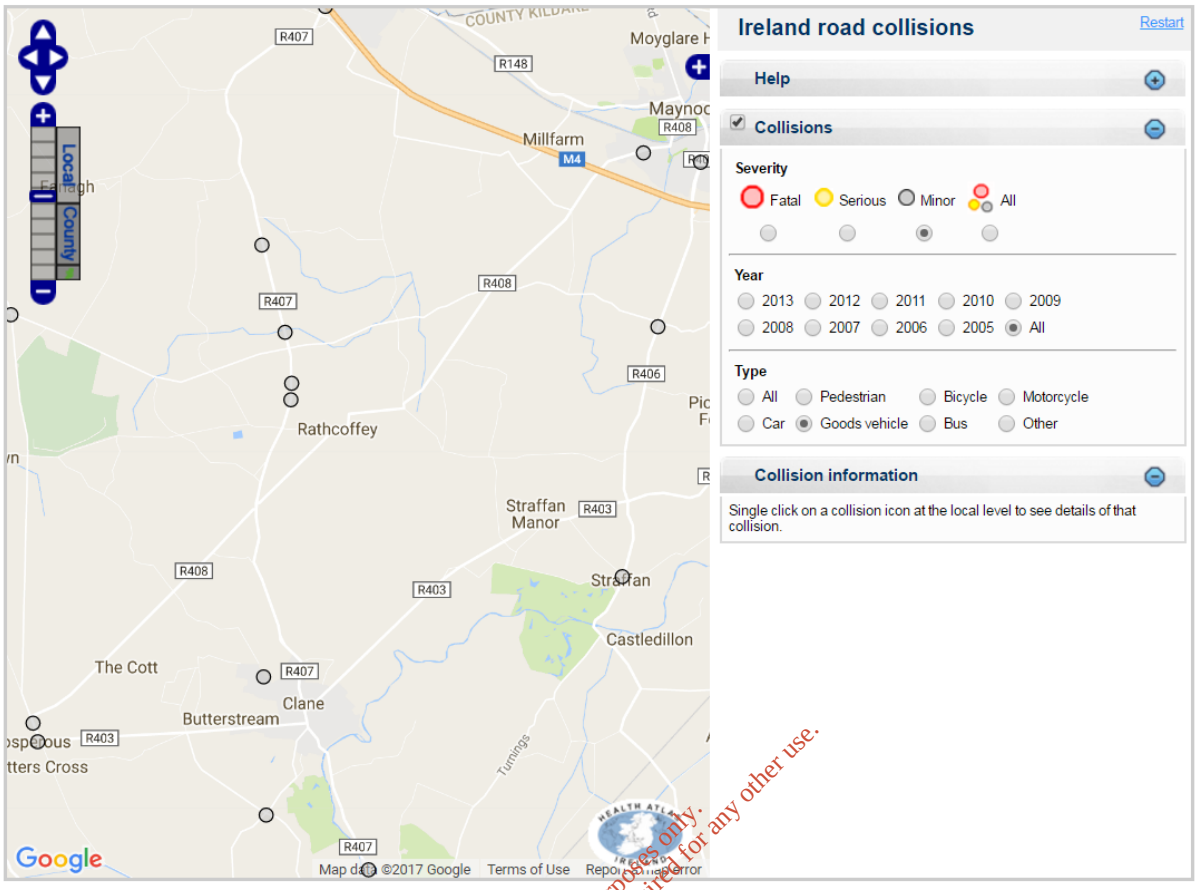

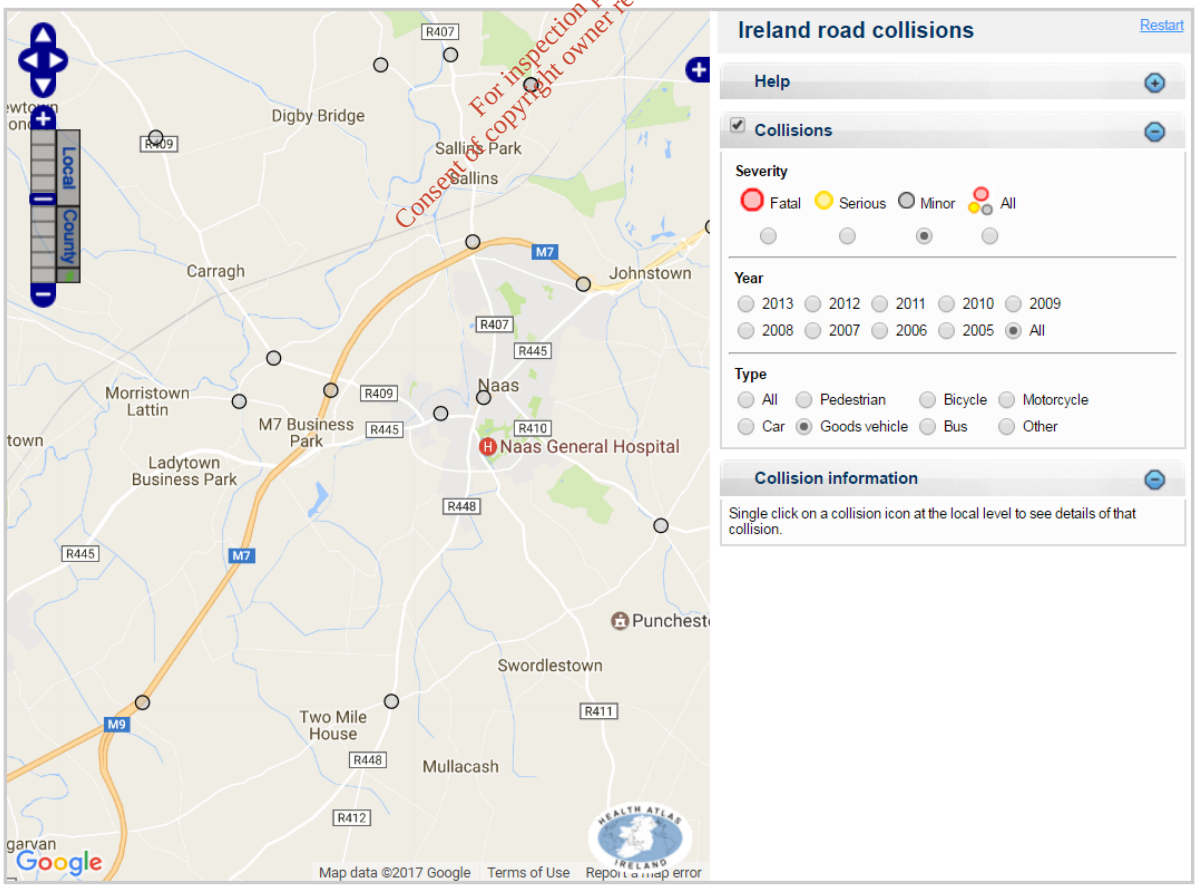

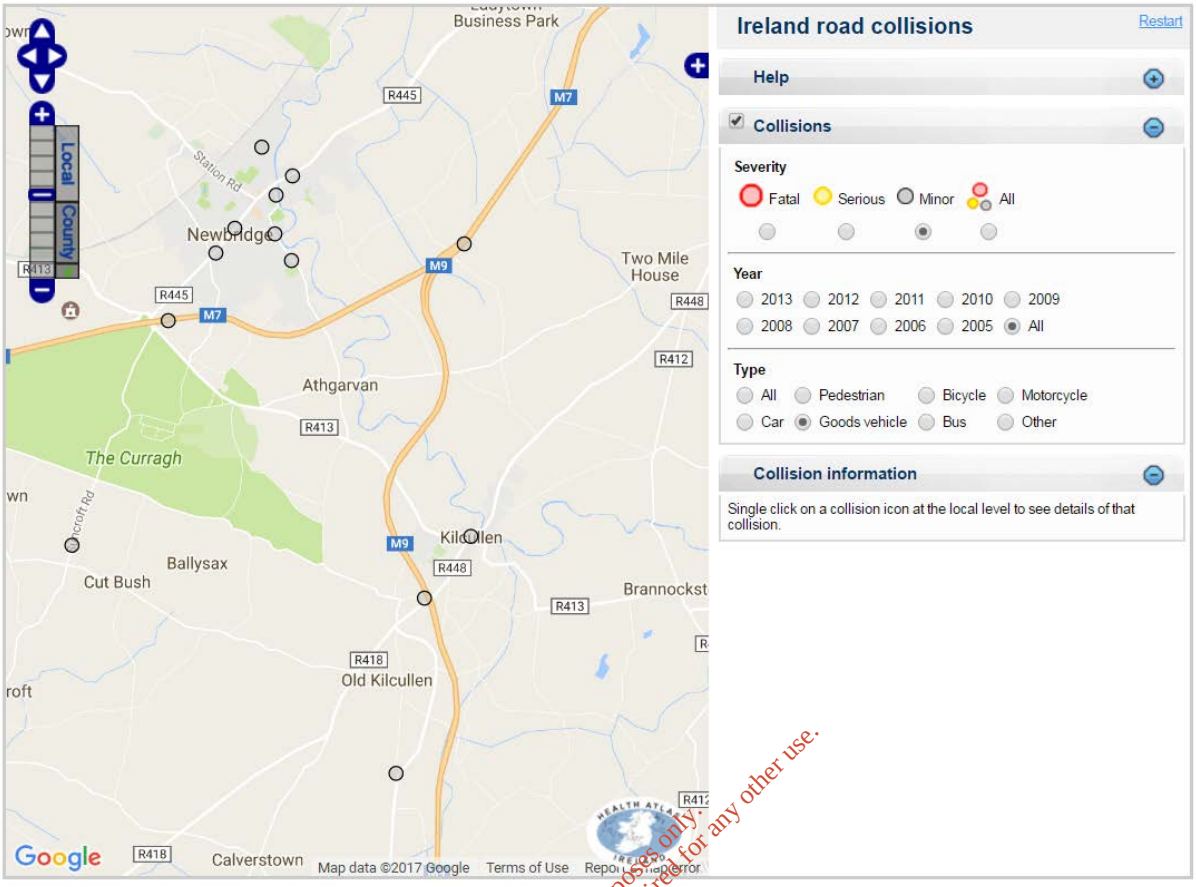

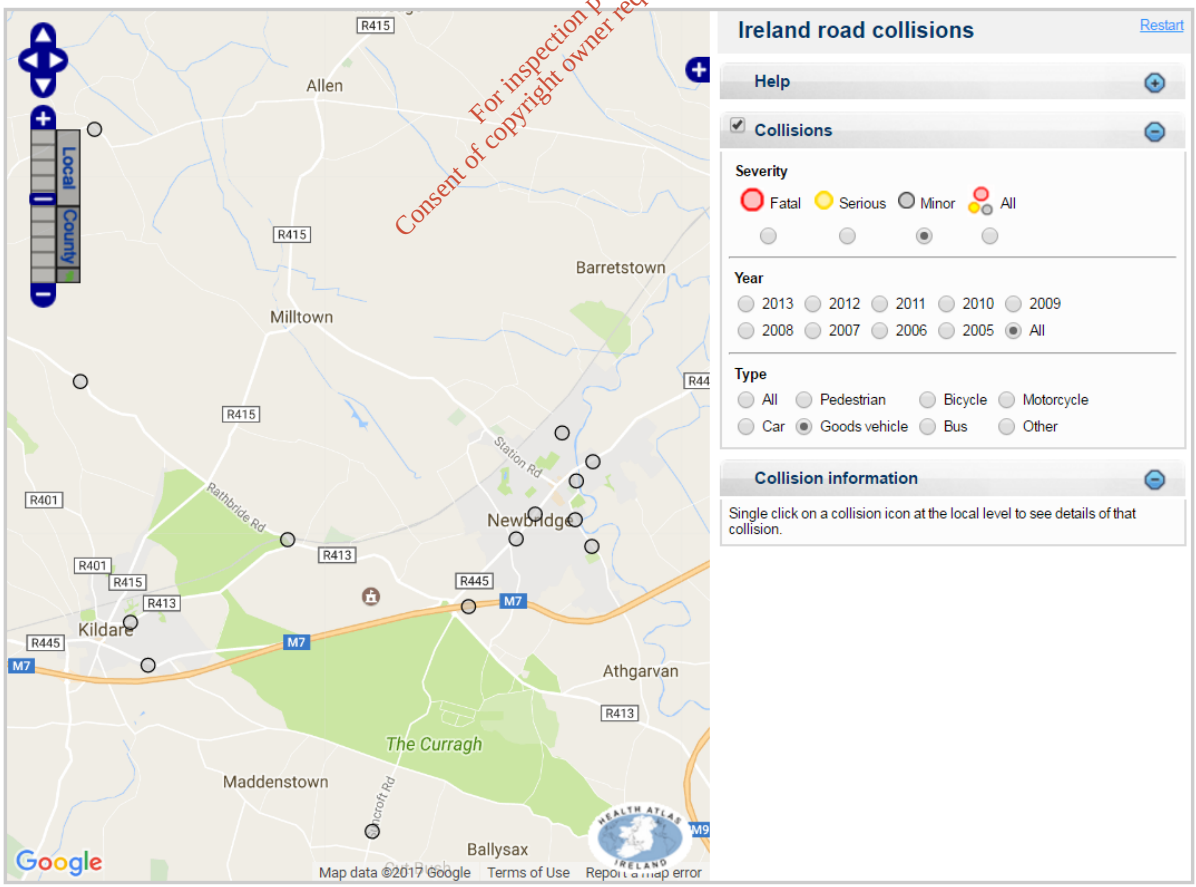

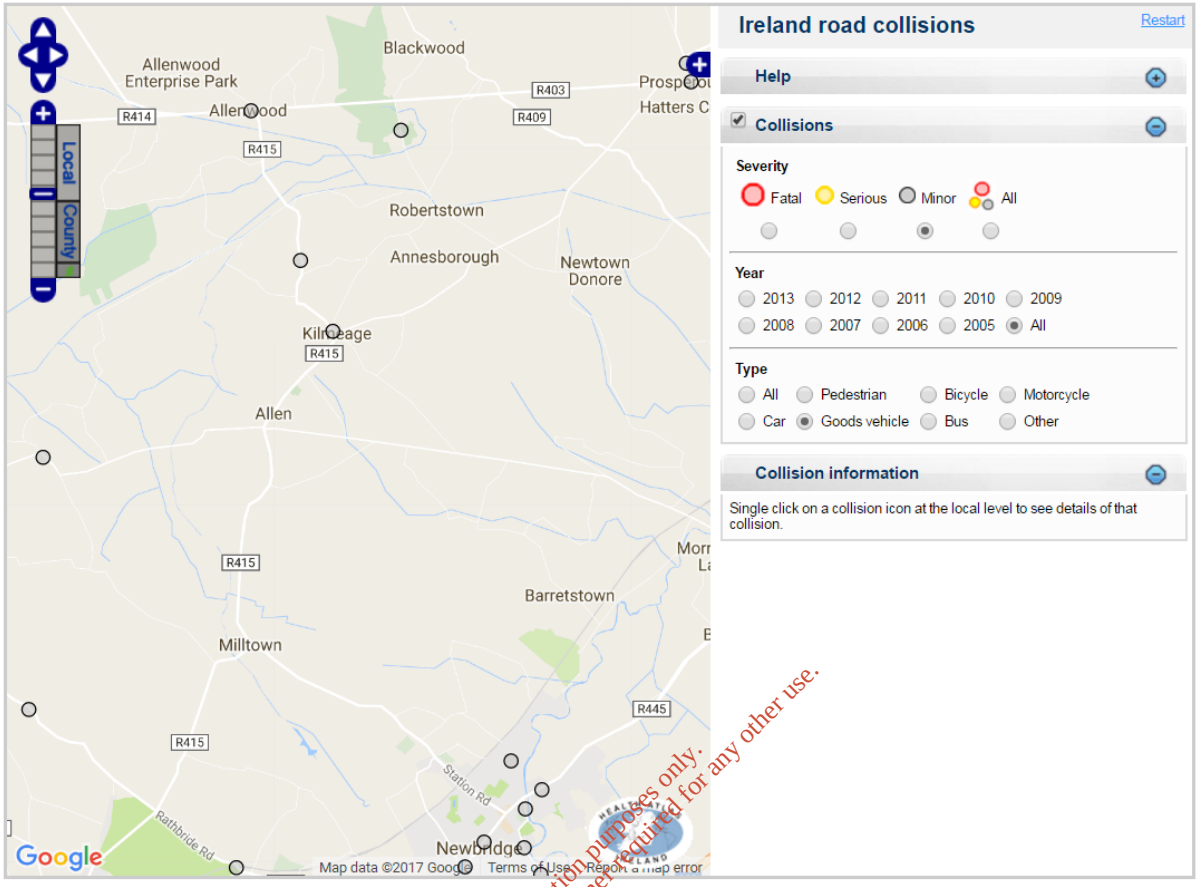

Appendix 11.1

APPENDIX 11-1 DESCRIPTION OF THE AERMOD MODEL

The AERMOD dispersion model has been recently developed in part by the U.S. Environmental Protection Agency (USEPA) (USEPA 2004a). The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

Improvements over the ISCST3 model include the treatment of the vertical distribution of concentration within the plume. ISCST3 assumes a Gaussian distribution in both the horizontal and vertical direction under all weather conditions. AERMOD with PRIME, however, treats the vertical distribution as non-Gaussian under convective (unstable) conditions while maintaining a Gaussian distribution in both the horizontal and vertical direction during stable conditions. This treatment reflects the fact that the plume is skewed upwards under convective conditions due to the greater intensity of turbulence above the plume than below. The result is a more accurate portrayal of actual conditions using the AERMOD model. AERMOD also enhances the turbulence of night-time urban boundary layers thus simulating the influence of the urban heat island.

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets[7].

Due to the proximity to surrounding buildings, the PRIME (Plume Rise Model Enhancements) building downwash algorithm has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered. The PRIME algorithm takes into account the position of the stack relative to the building in calculating building downwash. In the absence of the building, the plume from the stack will rise due to momentum and/or buoyancy forces. Wind streamlines act on the plume leads to the bending over of the plume as it disperses. However, due to the presence of the building, wind streamlines are disrupted leading to a lowering of the plume centreline.

When there are multiple buildings, the building tier leading to the largest cavity height is used to determine building downwash. The cavity height calculation is an empirical formula based on building height, the length scale (which is a factor of building height & width) and the cavity length (which is based on building width, length and height). As the direction of the wind will lead to the identification of differing dominant tiers, calculations are carried out in intervals of 10 degrees.

In PRIME, the nature of the wind streamline disruption as it passes over the dominant building tier is a function of the exact dimensions of the building and the angle at which the wind approaches the building. Once the streamline encounters the zone of influence of the building, two forces act on the plume. Firstly, the disruption caused by the building leads to increased turbulence and enhances horizontal and vertical dispersion. Secondly, the streamline descends in the lee of the building due to the reduced pressure and drags the plume (or part of) nearer to the ground, leading to higher ground level concentrations. The model calculates the descent of the plume as a function of the building shape and, using a numerical plume rise model, calculates the change in the plume centreline location with distance downwind.

The immediate zone in the lee of the building is termed the cavity or near wake and is characterised by high intensity turbulence and an area of uniform low pressure. Plume mass captured by the cavity region is re-emitted to the far wake as a ground-level volume source. The volume source is located at the base of the lee wall of the building, but is only evaluated near the end of the near wake and beyond. In this region, the disruption caused by the building downwash gradually fades with distance to ambient values downwind of the building.

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3 (USEPA 2004a). ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height[(2)]. The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

AERMOD also contains improved algorithms for dealing with low wind speed (near calm) conditions. As a result, AERMOD can produce model estimates for conditions when the wind speed may be less than 1 m/s, but still greater than the instrument threshold.

Appendix 11.2

APPENDIX 11-2 METEOROLOGICAL DATA - AERMET

AERMOD incorporates a meteorological pre-processor AERMET (USEPA 2004b). AERMET allows AERMOD to account for changes in the plume behaviour with height. AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. A morning sounding from a representative upper air station, latitude, longitude, time zone, and wind speed threshold are also required.

Two files are produced by AERMET PRO for input to the AERMOD dispersion model. The surface file contains observed and calculated surface variables, one record per hour. The profile file contains the observations made at each level of a meteorological tower, if available, or the one-level observations taken from other representative data, one record level per hour.

From the surface characteristics (i.e. surface roughness, albedo and amount of moisture available (Bowen Ratio)) AERMET calculates several boundary layer parameters that are important in the evolution of the boundary layer, which, in turn, influences the dispersion of pollutants. These parameters include the surface friction velocity, which is a measure of the vertical transport of horizontal momentum; the sensible heat flux, which is the vertical transport of heat to/from the surface; the Monin-Obukhov length which is a stability parameter relating the surface friction velocity to the sensible heat flux; the daytime mixed layer height; the nocturnal surface layer height and the convective velocity scale which combines the daytime mixed layer height and the sensible heat flux. These parameters all depend on the underlying surface.

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use types was carried out in line with USEPA recommendations[4].

Surface roughness

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on an upwind area-weighted average of the land use within the sector, by using the eight land use categories outlined by the USEPA. The inverse-distance weighted surface roughness length derived from the land use classification within a radius of 1km from Casement Aerodrome Meteorological Station is shown in Table A8.1.

Table A11-1 Surface Roughness based on an inverse distance weighted average of the land use within a 1km radius of Casement Aerodrome Meteorological Station.

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[note 1]
0-360	100% Grassland	0.050	0.100	0.010	0.010

Note 1: Winter defined as periods when surfaces covered permanently by snow whereas autumn is defined as periods when freezing conditions are common, deciduous trees are leafless and no snow is present (Iqbal (1983) (Auer Jr 1978) Thus for the current location autumn more accurately defines "winter" conditions at the proposed facility.

Albedo

Noon-time albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. A 10km x 10km square area is drawn around the meteorological station to determine the albedo based on a simple average for the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10km from Casement Meteorological Station is shown in Table A8.2.

Table A11.2 Albedo based on a simple average of the land use within a 10km × 10km grid centred on Casement Aerodrome Meteorological Station.

Area-weighted Land Use Classification	Spring	Summer	Autumn	Winter[1]
0.5% Water, 30% Urban, 0.5% Coniferous Forest 38% Grassland, 19% Cultivated Land	0.155	0.180	0.187	0.187

(1) For the current location autumn more accurately defines "winter" conditions in Ireland.

Bowen Ratio

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. A 10km x 10km square area is drawn around the meteorological station to determine the Bowen Ratio based on geometric mean of the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10km from Casement Meteorological Station is shown in Table A11-3.

Table A11-3 Bowen Ratio based on a geometric mean of the land use within a 10km × 10km grid centred on Casement Aerodrome Meteorological Station.

Geometric Mean Land Use Classification	Spring	Summer	Autumn	Winter[1]
0.5% Water, 30% Urban, 0.5% Coniferous Forest 38% Grassland, 19% Cultivated Land	0.549	1.06	1.202	1.202

(1) For the current location autumn more accurately defines “winter” conditions in Ireland.

Appendix 11.3

APPENDIX 11-3 AIR QUALITY STANDARDS

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, was passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM10, 40% for the hourly and annual limit value for NO2 and 26% for hourly SO2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and does so every 12 months by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, details limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. This has also been passed into Irish Law under the Air Quality Standards Regulations 2011 (S.I. 180 of 2011). Provisions were also made for the inclusion of new ambient limit values relating to PM2.5. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for PM2.5 are included in Directive 2008/50/EC. The approach for PM2.5 is to establish a target value of 25 µg/m3, as an

annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m3, as an annual average (to be attained everywhere by 2018), coupled with a target to reduce human exposure generally to PM2.5 between 2010 and 2020. This exposure reduction target will range from 0% (for PM2.5 concentrations of less than 8.5 µg/m3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m3. Where the AEI is currently greater than 22 µg/m3 all appropriate measures should be employed to reduce this level to 18 µg/m3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008-2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m3 has been set to be complied with by 2018, again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 2008/50/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 2008/50/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 2008/50/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 2008/50/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NOx (NO and NO2) is applicable for the protection of vegetation in highly rural areas away from major sources of NOx such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive 2008/50/EC identifies that monitoring to demonstrate compliance with the NOX limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and

its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Appendix 11.4

APPENDIX 11-4 TRAFFIC MODEL

The inputs to the Design Manual for Roads and Bridges model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The Design Manual for Roads and Bridges underwent an extensive validation exercise as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK Department for Environment, Food and Rural Affairs national air quality monitoring network. The validation exercise was carried out for NOx, NO2 and PM10, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations.

In relation to NO2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO2 mirrors that of NOx showing that the over-prediction is due to NOx calculations rather than the NOx:NO2 conversion. Within most urban situations, the model overestimates annual mean NO2 concentrations by between 0 to 40% at confined locations and by 20 to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict PM10. Within most urban situations, the model will over-estimate annual mean PM10 concentrations by between 20 to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of ±50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable.

Appendix 11.5

APPENDIX 11-5 DUST MINIMISATION PLAN

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within two hundred metres of the construction area.

In order to ensure mitigation of the effects of dust nuisance, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate, dry sweeping of large areas should be avoided. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Vehicles using site roads shall have their speeds restricted where there is a potential for dust generation. Vehicles delivering material with dust potential to an off-site location shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust. Access gates to be located at least 10m from receptors where possible.

Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. Record should be kept of all inspections of the haul routes and any subsequent action in a site log book.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods, activities such as scabbling should be avoided. Bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

At all times, the procedures put in place will be strictly monitored and assessed by the contractor. In the event of dust nuisance occurring outside the site boundary, satisfactory procedures will be implemented to rectify the problem. Dust monitoring should be put in place to ensure dust

mitigation measures are controlling emissions. Dust monitoring should be conducted using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m2*day) during the monitoring period between 28-32 days.

The Dust Minimisation Plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. The name and contact details of a person to contact regarding air quality and dust issues should be displayed on the site boundary, this notice board should also include head/regional office contact details. Community engagement before works commence on site should be put in place, including a communications plan. All dust and air quality complaints should be recorded and causes identified, along with the measures taken to reduce emissions. This complaints log should be available for viewing by the local authority, if requested. Daily on and off site inspections should occur for nuisance dust and compliance with the dust management plan. This should include regular dust soiling checks of surfaces such as street furniture, windows, and cars within 100m of the site boundary. Cleaning should be provided if necessary.

Appendix 11.6

APPENDIX 11-6

BASELINE AIR MONITORING FOR THE PROPOSEDM DREHID WASTE MANAGEMENT FACILITY – NON-HAZARDOUS & HAZARDOUS WASTE LANDFILL EXTENSION

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BASELINE AIR MONITORING FOR THE PROPOSED DREHID WASTE MANAGEMENT FACILITY – NON-HAZARDOUS & HAZARDOUS WASTE LANDFILL EXTENSION

Technical Report Prepared For

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EXECUTIVE SUMMARY

AWN Consulting was requested by Tobins Consulting Engineers to perform a detailed baseline assessment PM_{10}/$PM_{2.5}$ (particulate matter <10µm and <2.5µm) as part of the air quality assessment for the proposed Drehid Waste Management Facility – Non-Hazardous & Hazardous Waste Landfill Extension. This report details the results of the baseline particulate monitoring programme carried out.

The average PM_{10} concentration measured over the monitoring period is 8.6 $\mu g/m^3$ using an Osiris light scattering monitor. The average concentration is less than 22% of the EU annual limit value of 40 $\mu g/m^3$.

The average $PM_{2.5}$ concentration measured over the two month monitoring period is significantly below the annual EU limit value of 25 $\mu g/m^3$. The average $PM_{2.5}$ concentration measured over the one-month period is 3.0 $\mu g/m^3$ which is significantly below the annual average EU limit value of 25 $\mu g/m^3$.

In summary, existing baseline levels of PM_{10} and $PM_{2.5}$ are significantly below the ambient air quality standards in the region of proposed development.

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1.0 INTRODUCTION

AWN Consulting was requested by Tobins Consulting Engineers to perform a detailed baseline assessment for PM_{10} and $PM_{2.5}$ (particulate matter <10 µm and <2.5 µm) as part of the air quality assessment for the proposed Drehid Waste Management Facility – Non-Hazardous & Hazardous Waste Landfill Extension as shown in Figure 1. The survey period ran from June to August 2016.

2.0 METHODOLOGY

2.1 PM_{10} and $PM_{2.5}$

A Turnkey Instruments Osiris Environmental Dust Monitor was used to monitor both $PM_{2.5}$ and PM_{10}. The Osiris instrument is a light scattering device capable of continuous measurement of PM_{10} and $PM_{2.5}$. The air sample was continuously drawn into the instrument by a pump through a heated inlet at a flow rate of 600 ml/min. The incoming air passed through a laser beam in a photometer. The light scattered by the individual particles of dust was measured by the photometer and this information used to measure the size and concentration of the dust particles.

3.0 AMBIENT AIR QUALITY COMPLIANCE CRITERIA

3.1 PM_{10}

EU Directive 2008/50/EC has set 24-hour and annual limit values for PM_{10} (see Table 1). A 24-hour limit of 50 µg/m^3 is set as a 90th%ile, i.e. it must not be exceeded more than 35 times per year. EU Directive 2008/50/EC has also set an annual limit value of 40 µg/m^3.

3.2 $PM_{2.5}$

The new ambient standards for $PM_{2.5}$ is included in Directive 2008/50/EC (see Table 1). It sets a limit value of 25 µg/m^3, as an annual average, coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3. Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018 - 2020. Additionally, an exposure concentration obligation of 20 µg/m^3 has been set to be complied with by 2015 again based on the AEI.

4.0 RESULTS AND DISCUSSION

PM_{10}

Daily concentrations of PM_{10} measured using the sequential PM_{10} sampler are shown in Figure 2. The 24-hour PM_{10} concentrations measured over the monitoring period are generally below the 24-hour EU limit value of 50 µg/m^3.

The average PM_{10} concentration measured over the monitoring period is 8.6 µg/m^3. This is less than 22% of the EU annual limit value of 40 µg/m^3.

No exceedances of the 24-hour limit value were recorded over the 62 day period (Table 2) of this monitoring campaign. The 90th%ile, which is equivalent to the 36th highest value measured over a full year, is compared to the limit value. Since no exceedances were recorded over the period of this monitoring survey, it is very unlikely that 35 exceedances would occur over 365 days at the current location.

$PM_{2.5}$

Daily concentrations of $PM_{2.5}$ measured using the light scattering Osiris $PM_{2.5}$ sampler are shown in Figure 2 and Table 2. The average $PM_{2.5}$ concentration measured over the two-month period is 3.0 $\mu g/m^3$ which is significantly below the annual average EU limit value of 25 $\mu g/m^3$ which is applicable since 2015.

5.0 SUMMARY

Ambient PM_{10} and $PM_{2.5}$ concentrations were measured for a two month period (June to August 2016) using a light scattering technique discussed within this report.

The 24-hour PM_{10} concentrations measured over the monitoring period are below the 24 hour EU limit value of 50 $\mu g/m^3$. There are no exceedances of the 24-hour limit value recorded over the 62 days of data monitored by the light scattering Osiris method. Therefore, it is very unlikely that 35 exceedances would occur over 365 days at the current location. The average PM_{10} concentration measured over the monitoring period is 8.6 $\mu g/m^3$ using the light scattering method which is 22% of the EU annual limit value of 40 $\mu g/m^3$.

The average $PM_{2.5}$ concentration measured over the monitoring period is significantly below the annual EU limit value of 25 $\mu g/m^3$. The average $PM_{2.5}$ concentration measured over the monitoring period is 3.0 $\mu g/m^3$ which is only 12% of the EU annual limit value of 25 $\mu g/m^3$.

In summary, existing baseline levels of PM_{10} and $PM_{2.5}$ are significantly below the ambient air quality standards in the region of the proposed development.

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Project
Drehid Landfill

Reference
16/9009AR01

Figure 1
Monitoring Location

awnconsulting

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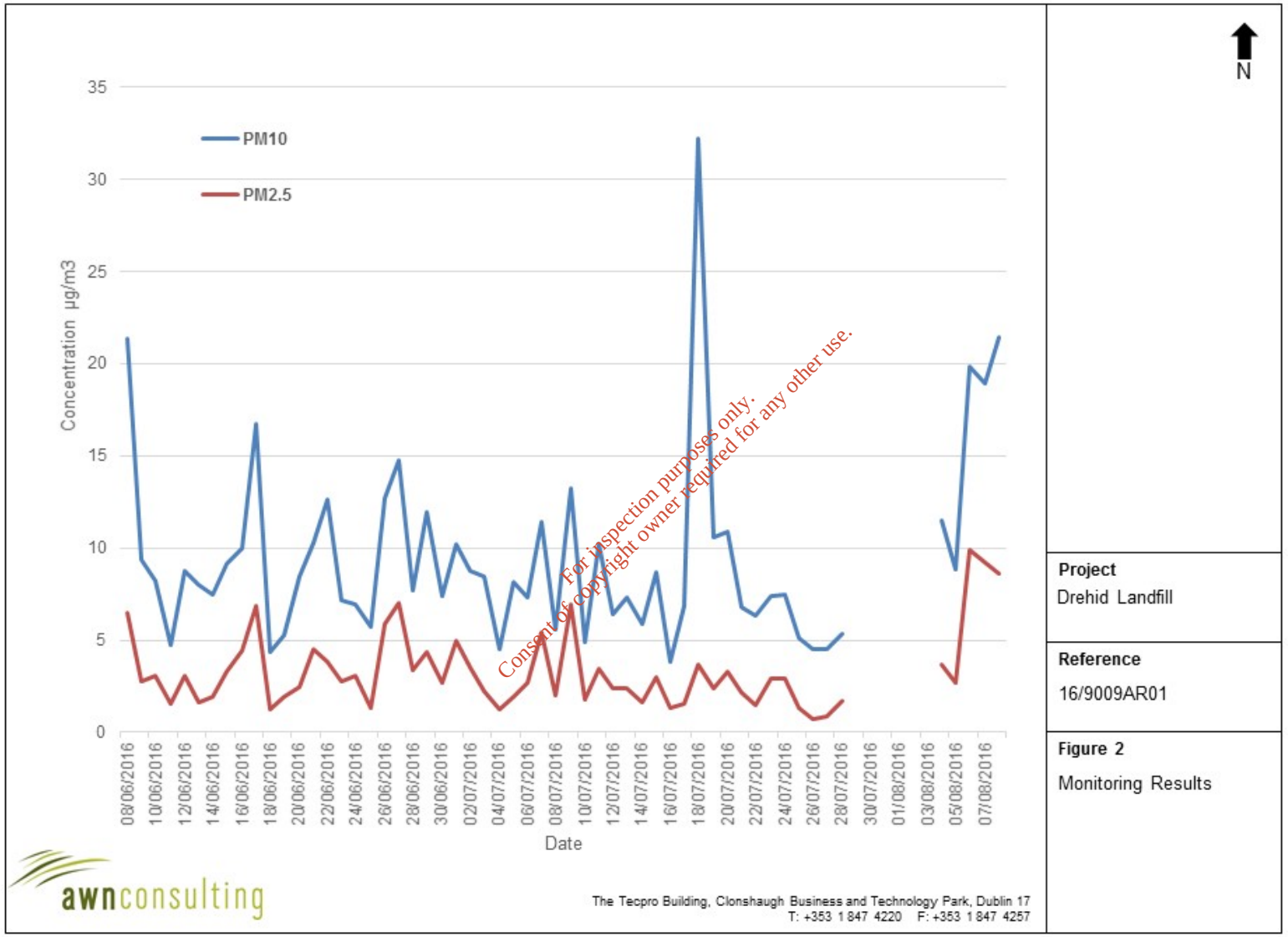


Figure 2 Baseline 24-Hour Average PM_{10} and $PM_{2.5}$ Concentrations

Pollutant	Regulation Note 1	Limit Type	Margin of Tolerance	Value
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m^3 PM_{10}
		Annual limit for protection of human health	20%	40 µg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2)	-	Annual limit for protection of human health	Compliance Date of 2020	20 µg/m^3 $PM_{2.5}$

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Table 1 European Union Ambient Air Quality Standard (Based on Directive 2008/50/EC)

Date	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Date	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)
08/06/2016	21.4	6.5	10/07/2016	4.9	1.8
09/06/2016	9.4	2.7	11/07/2016	10.2	3.5
10/06/2016	8.2	3.1	12/07/2016	6.4	2.4
11/06/2016	4.8	1.6	13/07/2016	7.3	2.4
12/06/2016	8.8	3.0	14/07/2016	5.8	1.6
13/06/2016	8.0	1.7	15/07/2016	8.6	3.0
14/06/2016	7.5	1.9	16/07/2016	3.8	1.3
15/06/2016	9.2	3.3	17/07/2016	6.9	1.6
16/06/2016	10.0	4.4	18/07/2016	32.2	3.7
17/06/2016	16.7	6.9	19/07/2016	10.6	2.4
18/06/2016	4.4	1.2	20/07/2016	10.9	3.3
19/06/2016	5.3	1.9	21/07/2016	6.8	2.2
20/06/2016	8.4	2.5	22/07/2016	6.3	1.5
21/06/2016	10.3	4.5	23/07/2016	7.4	2.9
22/06/2016	12.6	3.8	24/07/2016	7.4	2.9
23/06/2016	7.1	2.8	25/07/2016	5.2	1.3
24/06/2016	6.9	3.1	26/07/2016	4.5	0.7
25/06/2016	5.7	1.3	27/07/2016	4.5	0.9
26/06/2016	12.7	5.9	28/07/2016	5.3	1.7
27/06/2016	14.8	7.0	29/07/2016	0.0	0.0
28/06/2016	7.7	3.3	30/07/2016	0.0	0.0
29/06/2016	11.9	4.3	31/07/2016	0.0	0.0
30/06/2016	7.4	2.7	01/08/2016	0.0	0.0
01/07/2016	10.2	5.0	02/08/2016	0.0	0.0
02/07/2016	8.7	3.5	03/08/2016	0.7	0.2

Date	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Date	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)
03/07/2016	8.4	2.2	04/08/2016	11.5	3.7
04/07/2016	4.5	1.3	05/08/2016	8.8	2.7
05/07/2016	8.2	1.9	06/08/2016	19.9	9.9
06/07/2016	7.3	2.7	07/08/2016	18.9	9.2
07/07/2016	11.4	5.4	08/08/2016	21.5	8.6
08/07/2016	5.6	2.0	**Average**	**8.6**	**3.0**
09/07/2016	13.2	7.0	***Limit Values***	***40*** Note 1	***25*** Note 1

Note 1 EU Council Directive 2008/50/EC - annual limit value.

Table 2 PM_{10} and $PM_{2.5}$ Concentrations Measured at On-Site Monitoring Station (using the Osiris light scattering method)

Appendix 13.1

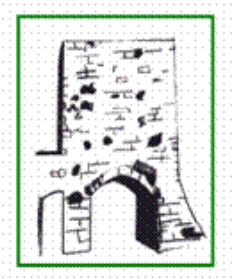
REPORT ON THE

ARCHAEOLOGICAL RECORDING

OF DRAINS IN COOLCARRIGAN,

DREHID,

CO. KILDARE



Arch Consultancy Ltd., Athenry, Co. Galway.

REPORT ON THE

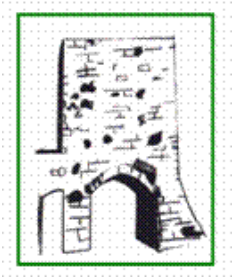
ARCHAEOLOGICAL RECORDING

OF DRAINS IN COOLCARRIGAN,

DREHID,

CO. KILDARE

Fiona Rooney B.A.



Arch Consultancy Ltd., Athenry, Co. Galway.

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Plates 22 & 23: Drain 7 from the south and gravel ridge encountered below the peaty sod.

Plates 24 & 25: Drain 8 from the north and at southern end.

III ABBREVIATIONS AND TERMS USED IN TEXT

Barony, Parish, Townland *These terms refer to land divisions in Ireland. The barony is the largest land division in a county, which is formed from a number of parishes. These parishes are in turn made up of several townlands, which are the smallest land division in the country. The origins of these divisions are believed to be in the Early Medieval/Christian period (AD500-AD1000), or may date earlier in the Iron Age (500BC-AD500).*

First Edition *This relates to editions of the OS 6 inch maps for County Kildare. The first edition map completed for the area dates to the early 1840s and this is referred to in the text as the first edition".*

m *Metres, all dimensions are given in metres or part of a metre.*

OS *Ordnance Survey*

Ph *Parish*

SMR *Sites & Monuments Register, all known archaeological sites are marked and listed in an accompanying inventory. The register is based on the 6 inch map series for the country and are recorded on a county basis.*

Sheet *This relates to the six inch map for County Kildare which are divided into sheets. This project is concerned with sheet number 008 .*

1 Introduction

This report forms part of the archaeological assessment associated with the proposed extension to the existing Drerhid Waste Management facility in County Kildare. The proposed extension is located in the townland of Coolcarrigan immediately south of the existing Waste Management Facility and located within the Bord na Móna landholding at Drehid, County Kildare.

Background

The owners (Bord na Mona) are seeking planning permission for extension of the existing facility and Arch Consultancy Ltd. are preparing the archaeological component of the Environmental Impact Statement. A draft of the archaeological assessment was sent by the consulting engineers of the project to the National Monuments Service (NMS), Department of Art, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA). The department observations/recommendations were as follows.

- All previous surveys of the bog should be examined
- A new survey of the bog should be carried out. This survey should include cleaning the drains and walking the bog. It might be necessary to have drains re-cut to facilitate examination.
- Survey work should be carried out by an archaeologist working under the terms of an excavation license granted by this department. This will facilitate sampling for species identification and dating.
- The proposed site layout should be considered in light of the surrveys.
- Having identified areas of archaeological importance, buffer areas where no ground disturbance will take place should be established, in order to facilitate preservation in situ of archaeological features.
- Archaeological mitigation should be suggested to take place in advance and/or during groundworks.
- It is likely, that where material is to be preserved in situ, empirical measurements into the future of hydrology of the site will be required, e.g. by means of the use of dipwells (piezemoters).

The site survey, including the monitoring and recording of existing drains, was undertaken over a period of ten days from the 20th of September 2016.

2 Site location and topography

The proposed extension to the landfill facility lies in the townland of Coolcarrigan in County Kildare.

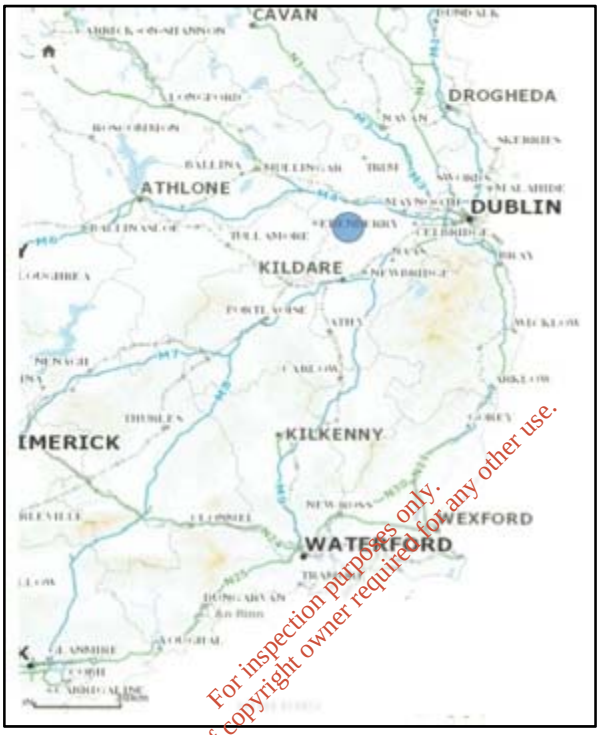

Fig. 1: General location map.

Surrounding townland names indicate they originate from Irish and often refer to landscape and topographical features. When recorded in the nineteenth century many of the names were anglicised and some changed completely. Drehid bog is in the barony of Carbury, Co. Kildare. Although usually known as Drehid bog, after Drehid townland, the bog is also known as Timahoe Bog. Timahoe derives its name from Tígh Mochua or the house of Mochua, from the monastery founded here by St. Mochua in the fifth century. The remnants of a church and a well-preserved twelfth-century round tower are all that survive of this monastic settlement. The area had previously been known as Sidh Neachtain or "The Fairy Hill", a name derived from Nuadha Neacht of Neachtain, who was High King of Ireland for a year, before being slain in 45 AD.

The proposed development is located in the townland of Coolcarrigan to the southwest of Timahoe. The townland name Cúil Charraigin translates as the 'Nook of the little rock' (Flanagan & Flanagan, 194). Placenames and townland names are often indicators of past

settlement and specific monument types, with Cill (Kill) for example, referring to a church, monastic settlement, churchyard or graveyard. The townlands of Ballynakill (Upper and Lower) located to the southwest of the proposed development refer to the 'town of the church or wood'. Other townland names in the vicinity of the proposed development refer to features of the landscape, such as Corduff, meaning the 'black round hill' (Joyce 1990).

The site is located 40km west of Dublin city centre, 15km NW of Naas and the M7 motorway and 10km south of the M4 motorway. The existing facility and the area of the proposed extension are accessed from a new road which runs for a distance of 5km from the R403.

Boglands cover one-sixth of the total landmass of Ireland and can be divided into two main types; riased bogs and blanket bogs. The former are particularly concentrated in the central lowlands while the latter are usually confined to upland environments and portions of the west. The wet, anerobic conditions of bogs creates a unique circumstance for the preservation of organic materials that survive in the peat. Organic material such as leather, textiles, wood and bog butter are frequently recovered from the peat and demonstrate the existence of people living around these areas from a very early period. The surface area of the bog at Coolcarrigan comprises of a large tract of open, low-lying, bog that in many areas is overgrown with young trees and bushes and throughout the site there is a covering of heather and/or grass. As a previously worked bog environment there is abundant surface water resources in the form of drainage channels and rivers.

Plate 1: Young trees and abundant heather in the east of the proposed development site.

An examination of historical maps and aerial photographs of the site revealed nothing of archaeological significance. The 1752 map by Noble and Keenan records the Bog of Allen with Timahoe and Drehid marked. The area of the proposed development is indicated as part of the vast bog in this mid 18th century map. Alexander Taylor's map of 1783 similarly depicts the area as a vast bog with the Cashanure River to the west. The first edition

ordnance survey map produced in the mid 19th century highlights Coolcarrigan Demesne to the east of the site but no features are indicated in the area proposed for development. More recent maps and aerial photographs highlight the drainage channels throughout the site. Nothing of archaeological significance is marked in the area of the proposed development on any of the maps or aerial photographs.

3 Historical Background and Archaeological Landscape

Historical Background

Coolcarrigan is located to the north of the 'Hill of Allen' which has associations with Irish myths and legends. It was here that "Almhuin (was) the palace of Fionn Mac Cumhal in Leinster", Almhuin being the Hill Of Allen. The Annals of The Four Masters records two battles being fought here in 526 AD and 718 AD (O'Donovan 2002, 100). The last reference to Sidh Neachtain was in the Annals of the Four Masters which records the death of Laoghaire, High King of Ireland, at Sidh Neachtain in 458. The area then became known as "Cairbre Og Ciartha" or Carbury. Cairbre was Laoghaires' brother and his dynasty controlled the area until the Norman period when Meider Fitzhenry was granted the Carbury area. Fitzhenry subsequently lost the property in 1181.

The Fitzgeralds, a powerful Irish family, were the next major holders of the Carbury lands with the 7th Earl serving as Chief Governor of Ireland on a number of occasions. Unfortunately for the Fitzgeralds, their power came to an end because of their involvement in the 1641 rebellion. In the aftermath of the Cromwellian War, Timahoe became the property of the Duke of York, brother of Charles II, who later became King of England, and who was defeated at the Battle of the Boyne in 1690. Subsequently, the property was confiscated and given to two brothers, John and Robert Curtis. They leased the property to Theobold Burke and Richard Aylmor, who in turn leased it to a group of Quakers from Northern Ireland. They built a meeting house adjacent to their own cemetery and also a windmill nearby.

The bog played an important part in the 1798 rebellion in North Kildare. "The Prosperous and Clane rebels formed a camp at Timahoe. It was sited on Hodgestown Hill..." (Cullen 1998, 13). This was an area of dry land within the bog thus making access almost impossible for English cavalry and artillery. At one point there were almost 2,500 rebels camped there, growing to 4,000 when rebels from Wexford and Wicklow joined them. This latter group moved on however, after just a day, (Ibid, 25).

To the east of the proposed development is Coolcarrigan Demesne which contains a Georgian House built in the 1830's and has a small 19th century Church of Ireland church in the grounds.

Archaeological Landscape

There are a number of recorded archaeological monuments within Timahoe Bog (Fig. 2). North of the proposed development, in the area immediately north of the existing Drehid Waste Management Facility site, two trackways or toghers, (KD009-018 & 019, also known as KD008-029 & 030) are recorded. The monuments were excavated by E. Rynne in the 1960's and by Monroe in 1986, (O'Carroll 2002). One of the trackways was a substantial oak plank trackway whilst the other was a less substantial birch trackway. Monroe thought that the trackways were broadly contemporary and the oak plank trackway was dendrochronologically dated to the Middle Bronze Age (1987, 22). A walkover survey conducted in preparation for the EIS of the waste management facility in 2002, found no extant trace of either trackway. Subsequent monitoring of all excavations works associated with the development (License 06E0746) revealed no features of archaeological significance.

The Irish Archaeological Wetland Unit identified ten sites in the vicinity of the recorded trackways in the 1990's. Two of these trackways were destroyed before they were plotted (information received from Irish Archaeological Wetland Unit). The trackways were predominantly recorded to the north and east of the existing waste management facility with one site identified in the northern section of the proposed landfill. This is recorded as a Togher 1m wide, 0.08m deep and 64m-72m long. The sites originally recorded by the Irish Archaeological Wetland Unit have, since 2010, been updated to the Sites and Monuments Record and the feature in the north of the development is recorded as KD008:038. No trace of this feature survives in the area today and no traces were recorded in either the monitoring of ground disturbance associated with the construction of the existing landfill facility or in any of the drains inspected as part of this archaeological assessment. The site is not scheduled to be included in the next revision of the Record of Monuments and Places (RMP).

Possible medieval activity in the area is indicated by the presence of the castle at Timahoe West (KD009-009). There is a church and graveyard (KD009-008 (001, 002) at Timahoe East. These are located *c.* 2.5km from the proposed development.

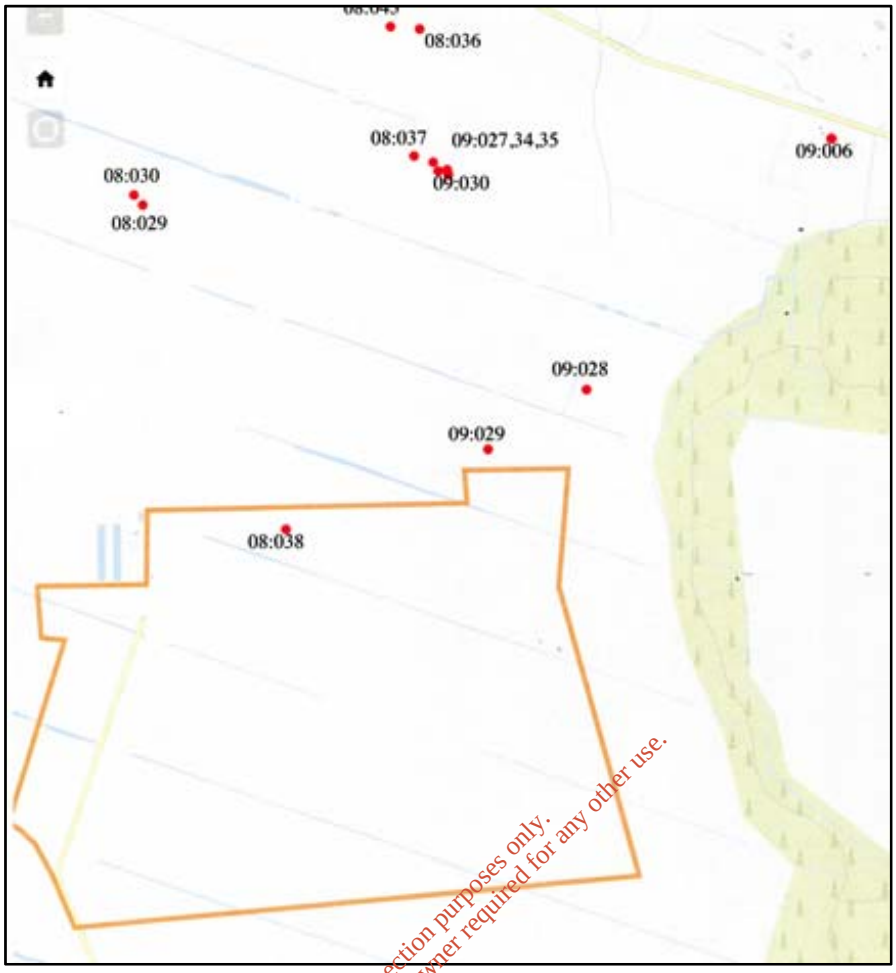

Fig. 2: Recorded monuments in the vicinity of the proposed development.

Monument Types in the area of the proposed development

Enclosures

Enclosures are usually distinguished on the basis of their anomalous characteristics, such as their large or small size, or lack of entrance features, which sets them apart from ringforts or other classifiable enclosures. The term usually refers to a site which consists of an enclosing bank surrounding a circular or subcircular area, and with no apparent entrance. Due to the lack of diagnostic remains it is difficult to suggest a period of construction or use for the monuments. Occasionally, the enclosures are surrounded by a ring of trees. The function of these sites is indeterminable from visual inspection alone, that is, without excavation and due to the lack of identifiable features. Sites which are now destroyed but which have been detected on aerial photographs, marked on various Ordnance Survey maps or locally described as circular or subcircular areas defined by banks and/or fosses are usually categorised as enclosures. Enclosures are recorded in the townlands of Collinstown (KD008:007), Parsonstown (KD008:023) and Coolmartin (KD009:007).

Children's burial ground

These sites are usually found either in isolation or associated with other monuments such as enclosures and are characterised by the presence of numerous small, uninscribed set stones, often arranged in rows. A Children's Burial Ground is recorded from Timahoe West (KD009:006.1), to the northeast of the proposed development.

Churches

Medieval churches, which often incorporate the fabric of early Christian churches, are distinguished on the basis of their ground plan and date. Nave and chancel churches are dated to the twelfth to thirteenth century, while single-celled churches are assigned a thirteenth to seventeenth century date. The single-celled churches were generally orientated east/west and were entered at the west end of either the north or south wall. Some churches had opposing doorways at the west end of the church. These churches may also have had a subdivision at the west end of the church, in the form of a cross-wall, or the presence of corbels or beam-holes which indicate the former presence of a loft. These quarters comprised the accommodation for the parish priest. A Church and Graveyard is recorded in the townland of Timahoe East (KD009:008).

Moated Site

Moated sites are square, rectangular or occasionally circular areas, sometimes raised above the ground, enclosed by a wide, often water-filled, fosse, with or without an outer bank and with a wide causewayed entrance. They date to the late 13th/early 14th centuries and were primarily fortified residences/farmsteads of Anglo-Norman settlers though they were also built by Gaelic lords. A moated site is recorded in the townland of Drehid (KD008:024).

Toghers

A togher or tóchar is a brushwood trackway or more usually a roadway constructed from timber beams held in place by wooden pegs, traversing bogland or wetland. Stone-built roads or tracks were also constructed, and are known in some cases to connect with wooden trackways. Both the roads of wood and stone construction have a broad date span, with some dating to the Neolithic period, while others are assigned a late medieval date. In many cases modern roads follow the line of their more ancient antecedents (O'Brien and Sweetman 1997, 51). The Archaeological Suvey of Ireland have divided these Roads into various classes. Togher sites are recorded to the north of the proposed development in the townlands of Parsonstown and Timahoe West (KD008:029/KD009:019, KD008:030/KD009:018). A number of toghers originally identified by the Irish Archaeological

Wetland Unit have now been updated to the Sites and Monuments Record and are included in figures 2 and 3. These sites are located predominantly to the north and north-east of the proposed development in the townlands of Coolcarrigan and Timahoe West and are recorded as unclassified roads, peatland structures and toghers. One site (KD008:038) was identified in the north of the proposed development site. Nothing of this site survives and it is not scheduled to be included in the next revision of the Record of Monuments and Places (RMP). Further north, togher sites are recorded from the townland of Drehid (KD008:025, KD008:026, KD008:027).

Castles

Stone castles date to the Anglo Norman period and would have come after an earlier earth and timber castle, as they took longer to build and were more expensive. A castle was recorded in the townalnd of Timahoe West (KD009:009), however no surface trace survives today.

Recorded Archaeological monuments in the area

The following archaeological monuments in the townlands surrounding the proposed development are included to highlight the type of sites that survive in the vicinity of the proposed development. The closest recorded monument to the proposed development is located in the townland of Coolcarrigan and registered as a road/unclassified togher (KD008:038). The site, of which nothing survives, is not scheduled to be included in the next revision of the Record of Monuments and Places (RMP).

Townland	**Archaeological Site Type**	**SMR number**	**RMP**
Parsonstown	Enclosure	KD008:016	YES
Parsonstown	House-indeterminate date	KD008:016001	YES
Parsonstown	Enclosure	KD008:023	YES
Drehid	Moated Site	KD008:024	YES
Drehid	Road Unclassfied Togher	KD008:025/KD009:17	YES
Drehid	Road Unclassfied Togher	KD008:026	YES
Drehid	Road Unclassfied Togher	KD008:027	YES
Timahoe West	Road / Togher	KD008:036	YES
Coolcarrigan	Road Unclassified Togher	KD008:038	NO
Timahoe West	Road Class 2 Togher	KD008:037	YES
Timahoe West	Peatland Structure	KD008:043	YES
Timahoe West	Road Trackway	KD009:006	YES
Timahoe West	Children Burial Ground	KD009:006001	YES
Coologmartin	Enclosure	KD009:007	YES
Timahoe East	Church & Graveyard	KD009:008	YES
Timahoe West	Castle	KD009:009	YES

Timahoe West	Peatland Structure	KD009:027	NO
Timahoe West	Peatland Structure	KD009:028	NO
Coolcarrigan	Unclassified Road	KD009:029	NO
Timahoe West	Peatland Structure	KD009:030	NO
Timahoe West	Peatland Structure	KD009:034	NO
Timahoe West	Peatland Structure	KD009:035	NO
Parsonstown/Timahoe West	Road Class 1 Togher	KD008:029/KD009:19	YES
Parsonstown/Timahoe West	Road Class 1 Togher	KD008:030/KD009:18	YES

PARSONSTOWN/TIMAHOE WEST KD008:029/KD009:019

Locational details

Classification: Road Class 1 Togher

Nat. Grid Ref. 274478/232403

RMP: Yes

Site description: A wooden trackway (L2275m) crossed Timahoe Bog on an east-southeast – west southwest orientation linking dry ground near Ardnacoolia in Timahoe West to dry ground in Loughnacush and Parsonstown townlands. It intersected a second oak trackway (KD008:030/KD009:018) mid-way across the bog. Two small sections were excavated by Munroe in 1986 (Munroe 1987:22). The trackway was found to consist of small logs laid end to end in an irregular pattern. Besides the rough trimmings of the ends there was no carpentry evident. The site was radiocarbon dated to 2466-2200 BC.

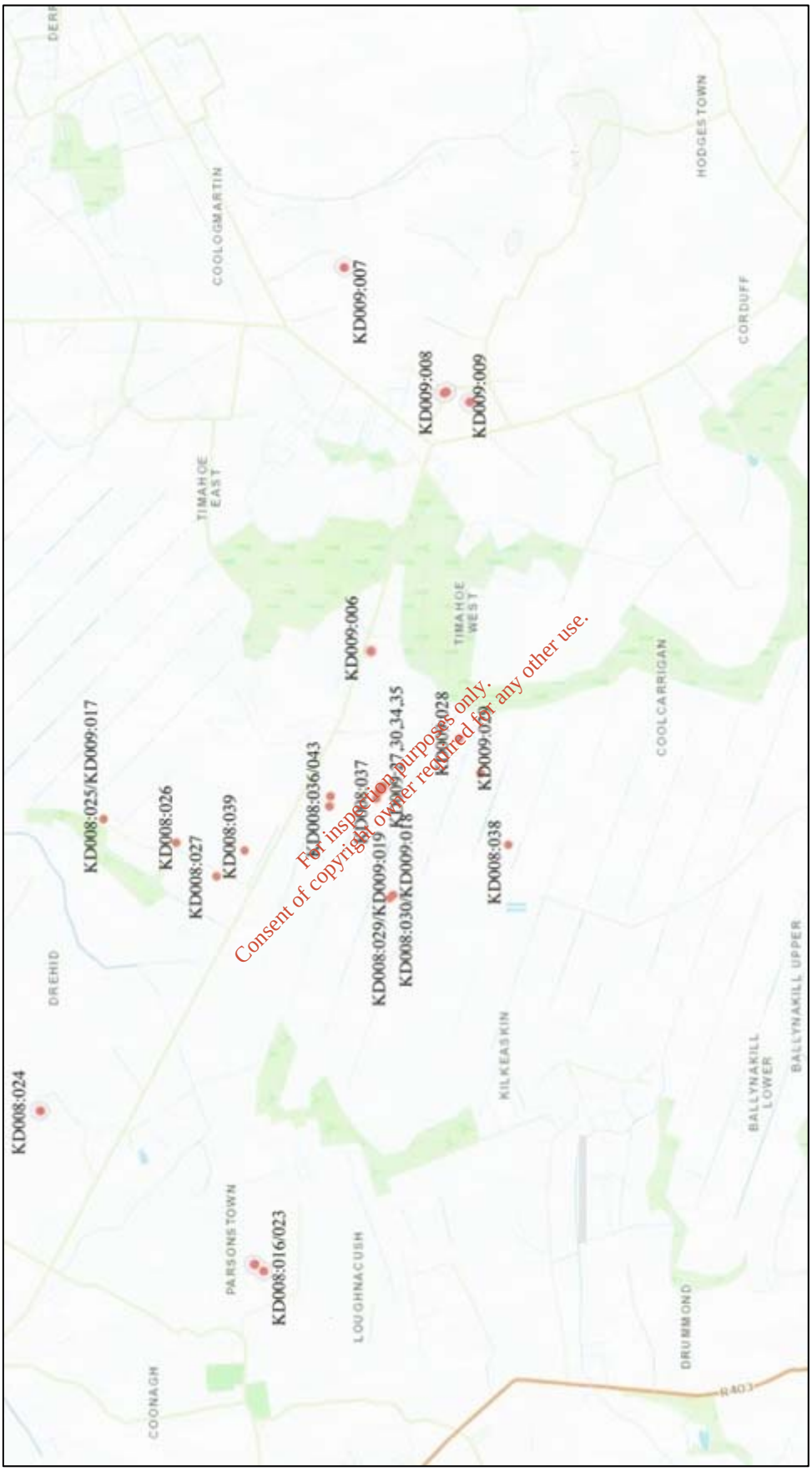

Fig. 3: Recorded Archaeological Sites in the general area.

TIMAHOE WEST KD008:030/ KD009:018

Locational details

Classification: Road Class 1 Togher

Nat. Grid Ref.: 274458/2326425

RMP: Yes

Site description: A narrow oak trackway on a brushwood substructure may originally have traversed approximately 2600m of Timahoe Bog (east-northeast -west-southwest) between dry ground at Drumachon Island to the east and dry ground in Kilkeaskin townland in the west. It is intersected by a second togher KD008:029/KD009:019 which crosses the same stretch of bog. This site was examined by Rynne (1966) and Munroe (1986) and the Wetland Unit in 1992. It consists of a haphazard arrangement of large oak planks laid longitudinally and transversely, with occasional narrow side planks, supported on a sub-structure of roundwood runners. Dendro dating suggests a two phase structure. The sub-structure is dated to 1484 BC and the superstructure to 1378 BC. The surviving remains were surveyed by the Wetland Unit in 1992. Extending for a length of 218.9m east-northeast and 2.5m wide the togher consisted of transversely laid roundwoods, brushwoods and planks. Oak and birch brushwood, up to eight rods deep, was used as filler. Displaced timbers in the area indicate the site was originally more extensive.

PARSONSTOWN **KD008:016**

Location Details

Classification: Enclosure

National Grid Ref.: 27228/23322

RMP: Yes

Site Description: This site is marked on the first and third edition of the Ordnance Survey Maps. It has been levelled and survives as a sub-circular mound with traces of a ditch encircling it, visible at the south and west. The site is clearly visible on the aerial photographs.

The interior contains a possible house (KD008-016001-) in the NE sector. The monument was described in 1955 as a ringfort with three fosses and three banks, with an entrance at the NW and with a possible hut site in the interior. According to the Archaeological Survey of Ireland, despite the presence of a possible house site, the siting of this monument together with the relatively insubstantial enclosing elements is not typical of A ringfort.

PARSONSTOWN **KD008:016001**

Location Details

Classification: House – indeterminate date

National Grid Ref.: 27228/23322

RMP: Yes

Site Description: In the north sector of a multivallate enclosure (KD008-016) is the remains of a grass covered, earthen, square area (dims. 7m N-S; 7m E-W) defined by a low scarp (H 0.4-0.6m). According to the Archaeological Survey of Ireland it may be the remains of a house.

PARSONSTOWN **KD008:023**

Location Details

Classification: Enclosure

National Grid Ref.: 27217/23315

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps. It consists of an oval enclosure, largely denuded, located 30m south of Parsonstown multivallate rath. It has an entrance causeway at the north-east and there are earthworks between it and the rath.

DREHID **KD008:024**

Location Details

Classification: Moated Site

National Grid Ref.: 27318/23449

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps. There is no visible trace of this site. The present field remnants point towards a rectangular earthwork but this may be due to later disturbance. The present landholders note that the previous owners called it the 'rath'-treating it with suspicion as one of their kins hair turned white over some incident. During the Emergency the trees at centre were felled for timber. It was mentioned that they were in a circle. This area has been hollowed out for yellow clay for house buildings, leaving a water-filled pond. Later reclaimed, the pond was drained and the area levelled by a bulldozer. It is now left as a haggard. The morphology suggests it may have been a moated site.

DREHID **KD008:025/009:017**

Location Details

Classification: Road Unclassified Togher

National Grid Ref.: 27492/23412

RMP: Yes

Site Description: This site consists of a scatter of broken and displaced timbers noted along the north-facing bank in an area of peat cutting. To the west, in an area of uncut peat,

timbers were noted in the face of old cutting. It is probably the same togher, apparently running north-west/south-east across a narrow part of Timahoe Bog.

DREHID **KD008:026**

Location Details

Classification: Road Unclassified Togher

National Grid Ref.: 27478/23369

RMP: Yes

Site Description: In 1995 a timber structure was uncovered here during the course of bog drainage operations. In a drainage cutting, which was about 1m wide and on average 2m in depth, a timber structure some 5m wide, 0.17m in thickness and 1.6m below the present (shrunken) surface of the bog was apparent. This togher or timber causeway was comprised (in this first cutting excavated) of light branches laid on each other, some crosswise, and others slanting, but not interwoven in any regular fashion. Below these branches was some 0.06m of what is locally described as 'ciabh' or sedge on which the timbers had been placed. There were more peat foundations below this sedge layer. In other cuttings inspected some large hewn timbers were observed. One of these measured over 1.05m in length and 0.22m in width and 0.08m in thickness. There were no traces of any work on the large beams, such as mortice and tenons. A portion of the togher in the first cutting was excavated and the only finds were a number of broken hazel nut shells.

DREHID **KD008:027**

Location Details

Classification: Road Unclassified Togher

National Grid Ref.: 27458/23345

RMP: Yes

Site Description: Timbers of a trackway were identified at this location on several occasions lying close to the present surface and have been dated to the medieval period.

TIMAHOE WEST **KD008:036**

Location Details

Classification: Togher/ Road

National Grid Ref.: 275061/232772

RMP: Yes

Site Description: The site (L115m, W 2.1m, D 0.2m) is orientated NW-SE and consists of a compact layer of longitudinal ash and oak roundwoods (Diam. 0.08-0.16m) with occasional

hazel brushwood rods. Some of the roundwoods have been split in half. Pegs, worked into wedge and chisel points, secure the outer edge of the structure. In some areas the upper surface of the timbers are charred and some hazelnuts are present.

TIMAHOE WEST **KD008:037**

Location Details

Classification: Road Class 2 Togher

National Grid Ref.: 275048/232504

RMP: Yes

Site Description: A two layered structure (L61.8m, W 3.1m, D 0.33m) lying just 0.3m above the mineral soil. It is composed of a compact longitudinal roundwood and brushwood superstructure over a thin, dispersed layer of brushwood (hazel, birch and yew) four rods deep. A number of pieces are worked into wedges and chisel points.

COOLCARRIGAN **KD008:038**

Location Details

Classification: Road Unclassified Togher

National Grid Ref.: 274775/231721

RMP: No

Site Description: The site (L72m, W 1m) consists of several pieces of hazel brushwood (diam. 0.01-0.25m) in a haphazard arrangement, probably the destroyed remains of a more substantial structure.

TIMAHOE WEST **KD008:043**

Location Details

Classification: Peatland Structure

National Grid Ref.: 274999/232778

RMP: Yes

Site Description: The site is exposed in section in the north face of a turf bank 2.5m high. It comprises a partially removed and degrading deposit of over 15 pieces of light brushwood and twigs.

TIMAHOE WEST **KD009:006**

Location Details

Classification: Road Trackway

National Grid Ref.: 27592/23253

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps. A trackway, 3m wide and with a fosse on either side is visible running for a short distance in a southern direction from the children's burial ground (KD009:00601). It is cut by a crop mark of a former field boundary, probably connected although not shown on the OS first edition. A second track to the west of site is also visible.

TIMAHOE WEST **KD009:006001**

Location Details

Classification: Children's burial ground

National Grid Ref.: 27592/23253

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps. It is located on a small low rise on the edge of a bog. It is enclosed and overgrown (D. c. 30m). The uneven appearance of the surface is probably due to the collapse of old trees and grass-covered stumps. No headstones or indeed stones of any sort are visible.

COOLOGMARTIN **KD009:007**

Location Details

Classification: Enclosure

National Grid Ref.: 27819/23270

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps and is located on Coologmartin Hill. The owner stated that there was formerly a 'depression' on the hill-top, just to the north of the summit. The depression was filled in and the area levelled and re-seeded more recently. There is no indication of an earthwork apart from a slight depression to the north of the summit.

TIMAHOE EAST **KD009:008**

Location Details

Classification: Church & Graveyard

National Grid Ref.: 27744/23210

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps. According to O'Donovan's Ordnance Survey Letters (1838-40) 'at Timahoe village, which is between the townlands of East and West Timahoe, there is an old church in ruins'. According to the field inspection carried out by the National Monuments Service the overgrown foundations of a rectangular structure are visible (c. 20m by 5m). Small portions of the wall adjacent to the south-west corner still stand but are in very poor condition, consisting chiefly of the rubble core of the wall, with a lintelled gap where a former window was. The graveyard is oval-shaped (40m by 31m) and is slightly smaller than the area enclosed by the modern wall. It is higher than the surrounding field level and contains a large number of headstones, many of eighteenth-century date.

TIMAHOE WEST **KD009:009**

Location Details

Classification: Castle

National Grid Ref.: 27739/23195

RMP: Yes

Site Description: This site is marked on both the first and third edition of the Ordnance Survey Maps. According to O'Donovan's Letters (1838-1840) 'in the east portion of west Timahoe townland there is a field called Castlefield, close to the village. In this field there stood formerly a castle, the walls of which were entirely cleared away more than thirty years ago'. According to the National Monuments Service this site lies in open, in very slightly undulating pastureland. There are some lazy beds in the vicinity but not visible over the site.

TIMAHOE WEST **KD009:027**

Location Details

Classification: Peatland Structure

National Grid Ref.: 275404/232014

RMP: No

Site Description: A single dried out piece of broken yew roundwood with one edge worked into a wedge point. It was revealed by turf cutting operations and may be associated with KD009:028.

TIMAHOE WEST **KD009:028**

Location Details

Classification: Peatland Structure

National Grid Ref.: 275338/232441

RMP: No

Site Description: The site consists of transversed and longitudinal roundwoods and brushwood of birch. Many pieces had their ends worked into wedges and chisel points.

COOLCARRIGAN **KD009:029**

Location Details

Classification: Unclassified Road

National Grid Ref.: 275199/231889

RMP: No

Site Description: The site consists of a number of roundwoods lying upon occasional longitudinals with scatters of brushwood nearby. Several timbers were burned.

TIMAHOE WEST **KD009:030**

Location Details

Classification: Peatland Structure

National Grid Ref.: 275120/232466

RMP: No

Site Description: A single worked yew roundwood the end of which had been worked into a wedge point and may have formed part of a peatland structure KD009:028.

TIMAHOE WEST **KD009:034**

Location Details

Classification: Peatland Structure

National Grid Ref.: 275087/232491

RMP: No

Site Description: A small area formed by several worked roundwoods predominantly of yew. The end of one roundwood is worked into a chisel point.

TIMAHOE WEST **KD009:035**

Location Details

Classification: Peatland Structure

National Grid Ref.: 275099/232473

RMP: No

Site Description: A single dried out broken yew roundwood with its end worked into a wedge.

Cultural Heritage Sites in the area

It is the policy of Kildare County Council as published in the County Development Plan 2011-2017 to promote an appreciation of the landscape and historical importance of traditional and historic gardens, demesnes and parks within Kildare in general and particularly where they constitute an important setting to a protected structure. Two buildings of architectural/ cultural heritage significance are located in the vicinity of the proposed development. Coolcarrigan House and Church (Reg. B09-10, B09-11) are located over 1km east of the proposed development and will not be directly impacted. The house was constructed in the 1830's and was originally used as a shooting lodge. It has extensive gardens and a 19th century Hiberno-Romanesque church on the grounds. A mixed coniferous and deciduous tree belt along the eastern edge of the existing bog ensures that these structures will not be visually impacted by the proposed facility.

Archaeological artefacts recorded from the area

The following archaeological artefacts are included to highlight the type of archaeological activity in the area and the importance of archaeological monitoring as stray finds are frequently found in the course of monitoring of ground works. Archaeological finds recorded in the topographical files of the National Museum of Ireland indicate human activity in the general area from the Neolithic period with many of the artefacts recovered from a peat environment. While the bogs have since been harvested it is possible that further artefacts and/or features survive in the lower levels of peat. A study of the topographical files housed in the Irish Antiquities Division, National Museum of Ireland yielded the following archaeological artefacts:

Townland	Allenwood South
Registration No.	1987:72
Find Type	leather shoe
Found	in bog 1.25m deep

Townland	Allenwood South
Registration No.	1987:71
Find Type	Bronze Cauldron (15th /16th century)
Found	in bog 1.25m deep

Townland	Allenwood Middle

Registration No. 1942:1870

Find Type Bronze Rapier

Found in bog

Townland Ardkill

Registration No. 1937:2433

Find Type Stone Axehead

Found

Townland Ballybrack

Registration No. 1937:2438-44

Find Type Stone Implement

Found

Townland Ballybrack

Registration No. 1937:2421

Find Type Stone Axehead

Found

Townland Ballynakill Lower/Upper

Registration No. 1962:75

Find Type Iron Axehead “bearded” type

Found in boggy land

Townland Ballyteague

Registration No. -

Find Type Designed Stone

Found near Castle

Townland Coolcarrig

Registration No. 1979:7

Find Type wooden shovel blade

Found 5.5m below bog surface

Townland Coolcarrig

Registration No. 1979:9

Find Type wooden keg with bog butter

Found in bog

Townland Demense

Registration No. 1950:31

Find Type Stone object (point)

Found open field during ploughing

Townland Downings

Registration No. 1945:268

Find Type Stone Axehead

Found

Townland Drehid

Registration No. 1972:355 A&B

Find Type Bent wooden stake (in two parts)

Found 4ft deep in bog cutting

Townland Kilkeaskin

Registration No. 1937:2420

Find Type Stone axehead

Found

Townland Kilkeaskin (‘The River Field’)

Registration No. 1968:438-439

Find Type 2 polished stone axeheads

Found

Townland Killinagh

Registration No. 1994:72

Find Type wood in bog

Found

Townland Killinagh

Registration No. 1929:1298

Find Type bog butter

Found at depth of 6ft in bog

Townland Mulgeeth

Registration No. 1980:46

Find Type wooden object

Found in bog of unknown depth

Townland Mylerstown

Registration No. 1991:44

Find Type Stone axehead

Found Field close to bog

Townland Ticknevin

Registration No. 1987:140

Find Type Leather Shoe

Found Bog

Townland Timahoe East

Registration No. 1943:132

Find Type Portion of solid wooden wheel

Found Bog

Townland	Timahoe East
Registration No.	1938:8560
Find Type	Fragment of large stone axehead
Found	

Townland	Timahoe East
Registration No.	1943:286
Find Type	Silver bracelet
Found	Bog

Townland	Timahoe East
Registration No.	1943:130-131
Find Type	Wooden yoke and long perforated timber
Found	Bog

Townland	Timahoe East
Registration No.	1950:7
Find Type	Iron axe
Found	at depth of 6ft during cutting operations

Townland	Timahoe Bog
Registration No.	
Find Type	Bog body –human forearm
Found	in 1959 during hand-work operations

Townland	Timahoe
Registration No.	1950:4a, 4b, 4c
Find Type	3 portions of wooden vessel
Found	in bog at depth of 7ft.

Townland Timahoe (Derrymahon Bog)

Registration No. 1942:409

Find Type Wooden object

Found 3 ft. below bog

Townland Timahoe East or West

Registration No. 1978:3

Find Type Leather shoe

Found

Townland Timahoe

Registration No. 1941:1120

Find Type Bronze spearhead

Found

Townland Timahoe Bog, Timahoe West

Registration No. 1966:2

Find Type Flint arrowhead (barbed)

Found

Townland Timahoe West

Registration No. 1970:139

Find Type Rough out for two handled wooden vessels

Found

Townland Timahoe Bog

Registration No. -

Find Type Human skeletal remains

Found in area of Drummond or Ballynakill Lower Townland

Townland Roberstown

Registration No.	1994:62
Find Type	bronze socketed axehead
Found	in bog

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4. Previous Archaeological Work in the area

Timahoe Bog is part of Bord na Móna's Allen group of bogs which were first brought into industrial peat production in the 1950's. Peak production at Timahoe Bog was achieved during the 1960's when the bog was in sod peat production. The peat was removed from the bog via a railway system, with some very small sections of the tracks, still in place along the west of the proposed development site. Industrial production at the site was gradually phased out over the last twenty/thirty years as most of the bog was cut away and the poor quality of the remaining peat made further peat harvesting uneconomical. Small scale production for domestic purposes continues at the margins of the commercially cut away bog.

To reduce the moisture content of the peat material during the years of peak industrial activity it was necessary to drain the entire bog. This was achieved by the excavation of a network of west to east running drains that discharged into a central underground culvert that ran from north to south. The drainage network facilitated heavy plant and machinery to safely traverse the bog. As a result of the drainage channels the entire site is divided into plots referred to as 'peat fields'.

As detailed above two trackways or toghers, (KD009-018 & 019, also known as KD008-029 & 030) were recorded and excavated to the north of the existing landfill facility and m to the north of the proposed extension. The features were excavated by E. Rynne in the 1960's and by Monroe in 1986. The excavations were undertaken to facilitate the removal of the remaining peat banks and were funded by Bord na Móna. Munroe describes two distinct tracks: A flimsy path of birch logs (discovered by D. Cummins) and a substantial oak built track excavated by Rynne. Excavations by Munro in 1986, exposed two areas of birch track (Munro, 1986). One was 35m long and the other 6m long and it was shown to be constructed of logs laid end to end in an irregular pattern, with at most, four logs in any section of the track. There was no brushwood or roundwood. The oak track cut across the bank so only 25m of it remained. Dating evidence of 1483 BC and 1378BC suggested to Munroe two phases (1987, 22).

A survey of the Timahoe Bog by the Irish Archaeological Wetland Unit in 1992 recorded ten trackway sites or possible sites. Two of these trackways were destroyed before they were plotted while three others were probably concerned the recorded monuments KD009:018 and KD009:019 (information received from Irish Archaeological Wetland Unit). The trackways were predominantly recorded to the north and east of the existing waste management facility with one site identified in the northern section of the proposed landfill. This is recorded as a Togher 1m wide, 0.08m deep and 64m-72m long. The sites originally recorded by the Irish Archaeological Wetland Unit have, since 2010, been updated to the Sites and Monuments Record and the feature in the north of the development is recorded as KD008:038. No trace of this feature survives in the area today and no traces were recorded in either the monitoring of ground disturbance associated with the construction of the existing landfill facility or in any of the drains inspected as part of this archaeological assessment. The site is not scheduled to be included in the next revision of the Record of Monuments and Places (RMP).

An archaeological assessment of a proposed landfill facility at Drehid-Drumachon-Loughnacush was undertaken by Noel Dunne and Roisin Barton for Valerie J Keeley Ltd. in 2001 while an archaeological inspection on the proposed facility site selection was undertaken by Eileen Reilly for Margaret Gowen and Company Ltd in January 2002.

These assessment predominantly concerned the area to the north of the existing landfill facility and the area covering the existing facility. The initial assessment included a desk-based and walk over survey while the latter was a walk-over inspection. The field survey in 2001 was undertaken over a period of two days and, due to the scale of the study area, was described as a preliminary reconnaissance. No features of archaeological significance were identified. The second involved a single day field walking and it too noted the limited capacity to assess such a large area. Both reports highlighted the need to assess the existing drain faces as part of any comprehensive survey.

An archaeological assessment of the existing landfill facility was undertaken by Arch Consultancy Ltd. in 2003/2004. This involved a both a desk based and walk over survey of the area in general and a more detailed survey of the area of the proposed landfill footprint. The latter was relatively free of vegetation and it was therefore possible to examine the existing drain faces. No artefacts or features of archaeological significance were encountered in the area of the landfill. One artefact (a flint blade) was recorded to the north of the existing landfill facility and in the general area of KD009:019.

Archaeological monitoring of all ground disturbance associated with the landfill development has been underway since 2006. Archaeological monitoring of the initial phases of groundworks was carried out by Archaeological Development Services Ltd (Turrell & Flood 2007) in 2006. Between 2008 and 2010 further monitoring was carried out in advance of the construction of additional landfill cells (Phases 3, 4 & 5) to the north of the waste facility (Turrell 2009). Further monitoring associated with a biowaste composting facility at the site was undertaken in 2010-2011. In 2011 archaeological monitoring of ground works for phase 6 of the waste reception area was undertaken. Further phases of the development at the site were monitored between November 2014 and May 2015 (Jane Whitaker License 06E0746 Ext.). No finds or features of archaeological significance have been reported during the course of monitoring works. Archaeological monitoring of ground disturbance associated with the landfill development to the immediate north of the proposed extension is underway at the time of completing this assessment. Nothing of archaeological significance has been uncovered to date.

5. Archaeological Assessment

The site of the proposed development is located immediately south of the existing Drehid Waste Management Facility. The assessment involved a walkover survey of the proposed development concentrating on the areas of cutover bog and drain faces - where it might be possible to identify archaeological features more readily. In addition archaeological monitoring of the cleaning down of section faces of existing drains within the landfill footprint was undertaken under license (License 16E0467) from the National Monuments Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA).

Walk-over Survey

The northern end of the proposed development site and sections in the east and centre are free of thick vegetation but elsewhere on site young trees, bushes and heather have flourished since the ending of peat production at the site. The vegetation is particularly abundant along the drainage chanels that predominantly run west-east through the bog (Fig. A walk-over survey of the areas clear of vegetation or with little vegetation revealed no artefacts or features of archaeological significance. A Togher (KD008:038) was recorded in the north of the site, close to the location of the existing landfill facility. A survey of this area, combined with an examination of the exposed section faces to the south and east and the results of the archaeological monitoring of the existing landfill to the north all failed to uncover any remnants of this feature. It appears likely that it has been removed in the

course of peat production and the monument is not scheduled to be included in the next revision of the Record of Monuments and Places (RMP).

Plate 2: General view of the northern end of the site from the north.

Plare 3: View of the area of the recorded monument KD008-038 with the existing landfill to the NW taken from the south-west.

Timahoe Bog is part of Bord na Móna's Allen group of bogs which were first brought into industrial peat production in the 1950's. Peak production at Timahoe Bog was achieved during the 1960's when the bog was in sod peat production. Peak harvesting of peat on the site was achieved by the 'Bagger' production process. Baggers were very large Geman machines powered by electricity via trailing cables plugged into the local power supply. The machines worked long NW-SE orientated turf plots. The peat was produced in sods by excavating linear trenches and spreading the peat on the adjacent flat bog. Continued cutting resulted in lower ground, or low bank, that increased each year at the expense of the original bog surface.

The peat was removed from the bog via a railway system which was located immediately east of the existing access road. The tracks of the railway still survived up to a number of years ago although most have now been lifted and are stored on site. Industrial production at the site was gradually phased out over the last twenty/thirty years as most of the bog was

cut away and the poor quality of the remaining peat made further peat harvesting uneconomical. Small scale production for domestic purposes continues at the margins of the commercially cut away bog.

To reduce the moisture content of the peat material during the years of peak industrial activity it was necessary to drain the entire bog. This was achieved by the excavation of a network of north-west to south-east running drains that discharged into a central underground culvert that ran from north to south. The drainage network facilitated heavy plant and machinery to safely traverse the bog. As a result of the drainage channels the entire site is divided into plots referred to as 'peat fields'. These turf plots span the length of the bog. In some areas they have been exploited to a depth of 0.5m or less above the natural mineral soil.

Following consultation with National Monuments Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA) a detailed survey of the existing drains in the area of the proposed development was undertaken under license (License 16E0467) by Fiona Rooney and Martin Fitzpatrick of Arch Consultancy Ltd. The work involved monitoring the cleaning down of the section face of existing drains within the area of the proposed development to record the stratigraphy and identify any possible archaeological remains. The investigation was undertaken over a period of ten days in September/October 2016.

A total of five large northwest-southeast orientated drains disect the site and date to the period of peat production in the bog. In addition a more recently cut drain, located off centre to the east of the proposed development, runs northeast-southwest while there are smaller drains running northwest-southeast in the north of the site. A recently cut drain associated with the construction of the access road to the existing landfill facility is located adjacent to the roadway and runs northeast- southwest. The excavation of this drain was archaeologically monitored during the construction of the landfill facility. No finds of archaeological signbificance are reported from this monitoring.

Fig. 4: Aeriel view of site indicating the location of drains cleaned (Blue) and more recently excavated drains (yellow) with the location of KD008:038 also highlighted.

Archaeological monitoring involved the clearing of vegetation adjacent to the drains to facilitate the cleaning down of the drain faces by a mechanical excavator utilizing a toothless bucket. A total of nine drains were identified and recorded within the area of the proposed development. The stratigraphy of five northwest-southeast drains (Drains 1-5), three northeast-southwest drains (Drains 6-8) and one curving northeast-southwest drain (Drain 9) are catalogued below. Individual sections of the five northwest-southeast drains and the entire lengths of the northeast-southwest and east-west drain were recorded as part of this investigation. The results indicate that apart from the the north the site and a section off cente to the west, the area of the proposed development has been reduced to natural ground level with little or no peat covering. No features or artefacts of archaeological significance were uncovered in the area of the proposed landfill extension.

Drain 1: (Section A)

The south facing section of this drain was investigated for a total length of 200m.

Located in the north-east of the proposed development site this drain runs northwest southeast from the south-east corner of the existing landfill facility and it ranges from 1-3m

in width. The drain originally ran through the area of the existing landfill facility but has been removed in this area as part of the construction process. Part of the western end of the drain is backfilled and the section between the existing landfill and Drain 6 is 1-1.2m in width and c. 1m deep. The stratigraphy consists of peat to the water level. The drain on the east side of Drain 6 is over 3m in width and 1.5-1.8m in depth with peat exposed to the existing water level. The stratigraphy revealed peat for a depth of 1.5-1.8m to the water level. No artefacts or features of archaeological significance were noted in the section face.

Plates 4 & 5: Details of Drain 1 to the west and east of Drain 6.

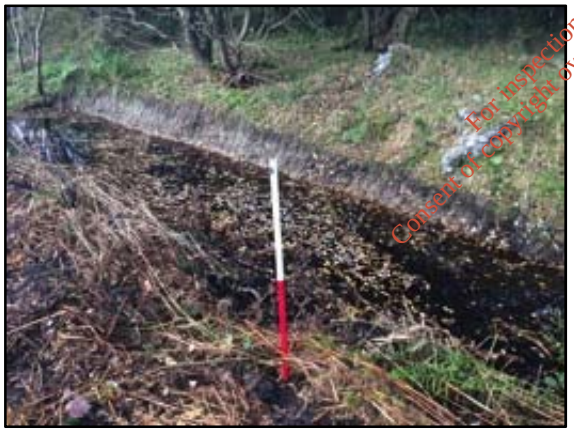
DRAIN 2 : (Section B)

Drain B:

Located c. 200m south of Drain A in the north of the proposed development site this drain runs northwest-south-east through the bog and was investigated for a distance of 500m. The drain is c. 3m in width and the sides extend c. 2-2.5m above the water level of the drain in the east and 0.25m obove the water level in the west. The north facing section of the drain was cleaned down using a mechaniccal excavator. The stratigraphy in the east consisted of a peaty topsoil (0.1-0.3m in depth) over a sandy silty with frequent stones extending for a depth of c. 1.8-2m. In the west of the site the banks of the drain extend 0.2-0.3m above the water line and consisted of peat throughout. Nothing of archaeological significance was encountered in this drain.


Plates 6 & 7: Drain B to the west of Drain 6 before and after cleaning section face.


Plates 8 & 9: Drain B to the east of Drain 6 before and after cleaning section face.




Plates 10 & 11: Details of the west end of Drain B.

Drain 3: (Sections C-E)

Located in the centre of the proposed development, this drain runs northwest-southeast through the bog and was investigated at three separate locations **C, D and E**.

Section C was investigated for a distance of 100m to the east of the existing access road to the landfill. The eastern end of this section is an active reed bed and was not disturbed by the machinical excavator. An examination of the section face indicated peat for a depth of 0.6m to the existing water level in the drain. Elsewhere the south facing section of the drain

was cleaned down revealing peat for a depth of c.1m to the water level of the drain. Nothing of archaeological significance was noted in the section face.

Plate 12: Detail of the western end Drain 2 being cleaned.

Section D: East of the landfill access road the drain was 3-4m in width and filled with water, preventing any investigation. A second, smaller, drain (c. 1m in width) was identified c. 15m south from the main drain and running parallel to it. The south facing section of this drain was cleaned down by the mechanical excavator. A peat depth of 1m was recorded to the existing water level of the drain. As this was a much smaller drain it was possible to dam the drain and record the depth of peat at either end. The peat depth at the west end of the drain (at ITM 674466 731492) was recorded at 2.8-3m with a depth of 1m recorded a further 160m to the east.

Plates 13 & 14: View of Drain D from the west and east.

Section E was located to the east of Sections C and D. It was planned that this section be investigated for a length of 200m however on clearing the thick vegetation it appeared that the drain had been backfilled filled possibily to facilitate access of machinery in this area. The drain was filled from ITM674786 731395 to ITM675106 731285. Where it was

uncovered again the vegetation was cleared and the north facing section cleaned down. This revealed a peaty topsoil 0.2m over a over a grey sandy silt with moderate stone inclusions.

Plate 15: View of south facing section of Drain 3 Section E.

DRAIN 4: (Sections F-G)

Located in the south of the proposed development, this drain runs northwest-southeast through the bog and was investigated at two separate locations **F and G**.

Section F was investigated for a distance of 100m to the east of the existing access road to the landfill. The area immediately surrounding the drain is heavily overgrown with young trees and scrub. Further S there is a large lagoon feature created by the extraction of gravel material during construction of access road to the existing landfill. A rough trackway allows access from the main road of the landfill facility to the location of sections F and C. Drain 4 (Section F) is over 4m wide at this location and has steep banks with water at the base. The north facing section of the drain was cleaned down revealing a sandy gravel layer at the surface and extending for a depth of c. 3m. Nothing of archaeological significance was noted in the section face.

Plate 16: Detail of Drain 4 (Section F) being excavated.

Section G: Located to the east of the access road to the landfill this drain was 3-4m in width and full of water at the west end. Removal of vegetation and both cleaning down of the south facing section with a mechanicl excavator and manual recording of the existing section face in areas very overgrown allowed a 500m length to be investigated.. A maximum peat depth of 0.5m was recorded to the existing water level of the drain in the west end At ITM 674542 731223 a grey sandy silt with stone inclusions was encountered below 0.1m of peaty sod. This layer continued for a length of 25m before peat ranging from 0.5-1m in depth was revealed. The peat extended for a length of 45m before the silty sand layer was again encountered directly below the sod and this layer continued to the end of the section excavated.. No features of archaeological significance were encountered in this trench.

Plates 17 & 18: Drain 4 (Section G) from the west and east.

DRAIN 5: (Section H)

This was investigated for a distance of 200m in the south-west of the proposed development site. Clearing of vegetation allowed the south facing section drain to be cleaned down by a mechanical excavator using a toothless bucket. This drain was c. 3m in width. The stratigraphy consisted of peaty sod 0.1-0.2m over a grey silty clay with occasional stones. Nothing of archaeological significance was encountered in this drain.

Plate 19: section H from the southwest.

DRAIN 6: (Section I)

Running northeast-southwest from the south-east corner of the existing landfill this drain has been excavated in recent years and was free of vegetation. The east facing section face of this drain was cleaned down by a mechanical excavator. Peat depth of up to 2.2m was encountered at the north-east end and rose sharply to be just 0.5m deep at 100m to the south where a silty sand with frequent stones was located below the peat. The remainder of the drain had peat depths ranging between 0 to 0.7m and in all cases overlay a grey silty sand with frequent stone inclusions. No finds or features of archaeological significance were encountered in this drain.

Plates 20 & 21: Details of drain 6 with silty sandy with frequent stones and peat.

DRAIN 7

Located in the north of the proposed development site this more recently cut drain extends for a length of 250m and is 1.2-1.8m in width. It was not necessary to mechanically clean the faces of this drain. The stratigraphy in the north and south consisted of peat recorded to a depth of 1-1.2m to the water level of the drain. Evidence for a gravel ridge was recorded in the section face at ITM674507 731595 where peat 0.3m overlay a sand a gravel deposit extending northwards for a length of c. 30m. Nothing of archaeological significance was


Plates 22 & 23: Drain 7 from the south and gravel ridge encountered below the peaty sod.

DRAIN 8

Located in the north of the proposed development site this drain extends for a length of 265-270m and is 1.2-2.2m in width. As it too was a more recently cut drain it was not neceassry to mechanically clean back the section face.. The stratigraphy consisted of peat recorded to a depth of 1-1 over the existing water level. Nothing of archaeological significance was encountered in the investigation of this drain.


Plates 24 & 25: Drain 8 from the north and at southern end.

DRAIN 9

Located in the north of the proposed development site this drain extends for a length of 300m and is 1-.2m in width. The stratigraphy consisted of peat recorded to a depth of 1-1. Nothing of archaeological significance was encountered.

6. Conclusions

The archaeological monitoring of the existing drains traversing the site of the proposed development found that in general peat levels throughout much of the site are less than 1m and in many places there is less than 0.5m of peat deposit remaining above the natural sandy silt (Fig. 5). The deepest levels of peat were recorded off centre to the west (ITM 674466 731492) of the proposed development site where the level of peat was 2.8m. The peat level 160m further east was 1m indicating a sharp rise in the peat deposit. The north of the site has peat levels of 1-1.2 m however in the north-east this depth is 2m in depth.

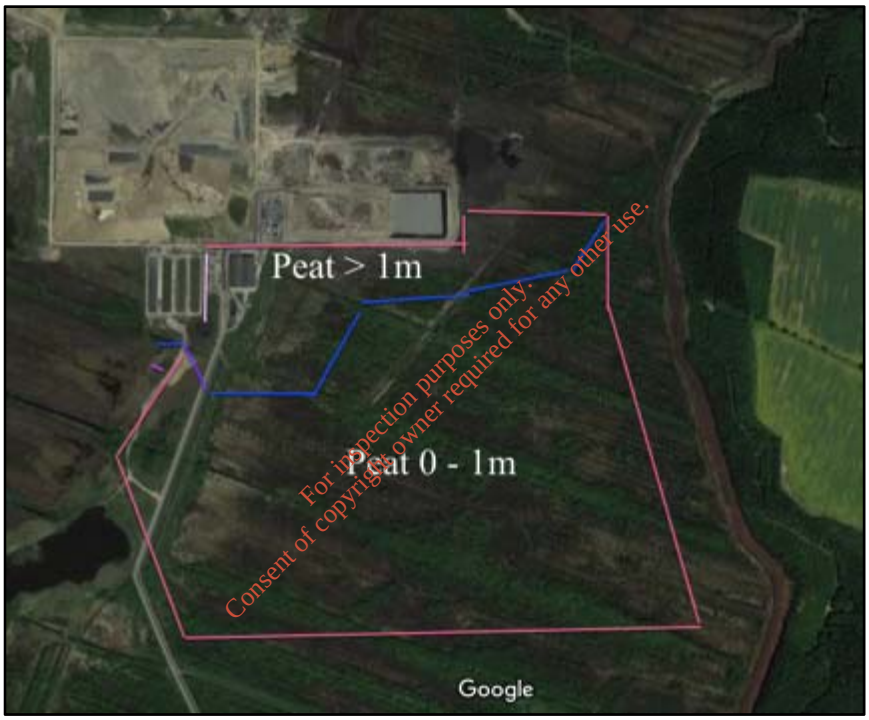


Fig. 5: Approximate levels of peat as uncovered in drains.

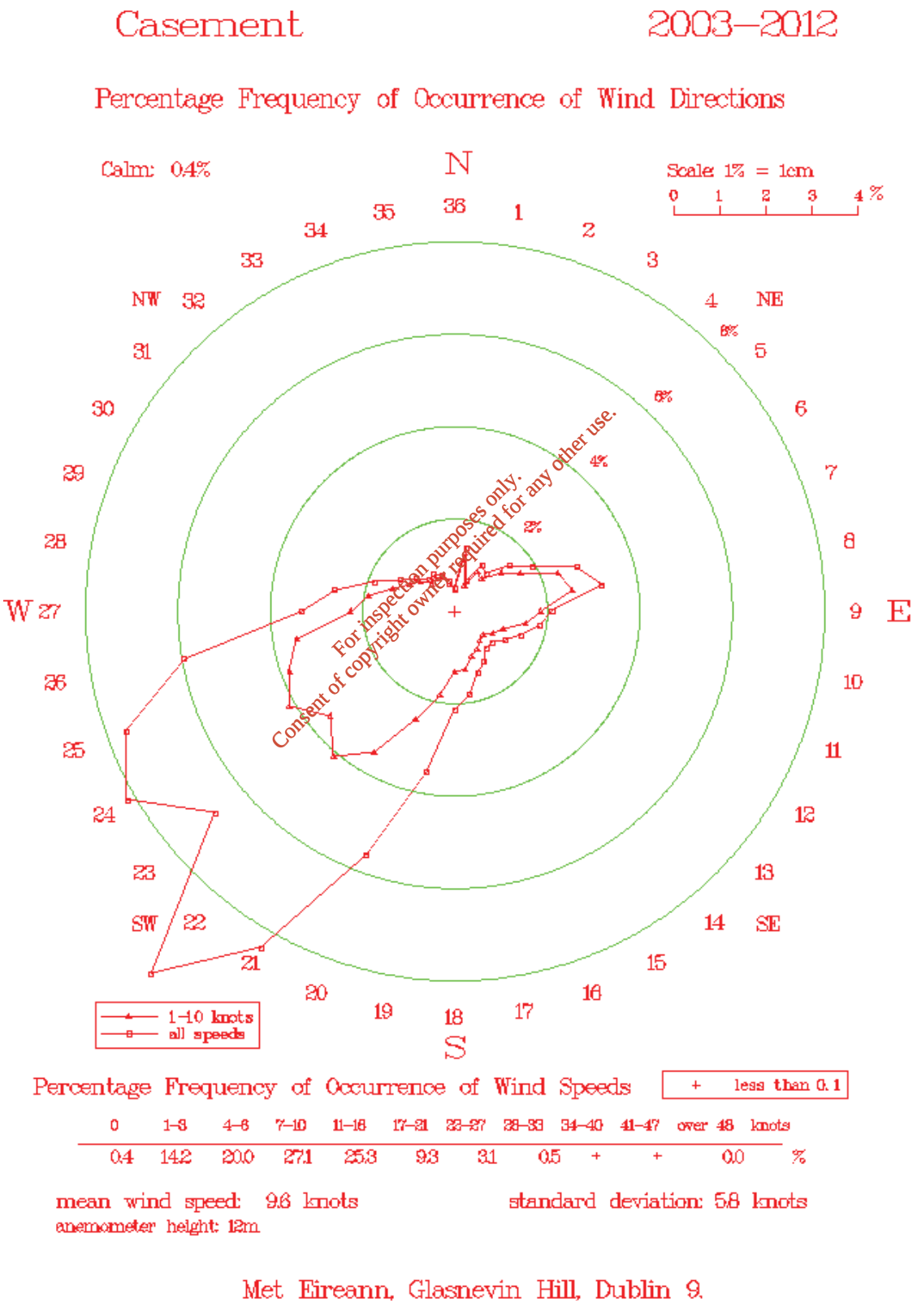
Prolonged peat production in the area of the proposed development has greatly reduced the levels of peat surviving today. The archaeological files recorded a Togher (KD008:038) in the north of the site, close to the location of the existing landfill facility. No surface trace of the feature survives on the ground today while an examination of the exposed section faces of drains 8,9 B and I uncovered no sub-surface traces. When one also considers that no remnants of the togher have been uncovered during archaeological monitoring of the existing landfill to the north it seems that the feature no longer exists. It appears likely that it has been removed in the course of peat production and the monument is not scheduled to be included in the next revision of the Record of Monuments and Places (RMP).

The assessment of the site has facilitated an appriasal of the archaeological potential. It appears that in the vast majority of the proposed development site peat levels have been almost completely removed and/or reduced to the natural sandy silt. No features of archaeologicxal significance were encountrered in the course of the assessment and it appears likely that any features that did exist at the site have been previously removed during peat production. It is still possible that sub-surface archaeological features may survive in the site particularly in the northern section where peat levels of 1m or greater survive. It is therefore recommended that all ground disturbance associated with the development are monitored by a suitably qualified archaeologist working under the appropriate license.

PLEASE NOTE: ANY RECOMMENDATIONS MADE IN THIS REPORT ARE SUBJECT TO APPROVAL BY NATIONAL MONUMENTS, DEPARTMENT OF ARTS, HERITAGE, REGIONAL, RURAL AND GAELTACHT AFFAIRS.

Appendix 14.1

Windrose (Baldonnel (Casement) Aerodrome Met Station 2003-2012



Appendix 15.1

TOURISM FACTS 2016

Preliminary

June 2017

Issued By:

Research & Evaluation
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All estimates are based on information from the CSO's Country of Residence Survey (CRS), Passenger Card Inquiry (PCI) Survey and Household Travel Survey (HTS), NISRA's Northern Ireland Passenger Survey (NIPS), NISRA's Continuous Household Survey (CHS), Fáilte Ireland's Survey of Overseas Travellers (SOT), Port Survey of Holidaymakers, Accommodation Occupancy Survey, Visitor Attractions Survey, Domestic Omnibus Survey, and SouthWestern Tourism Services (Register of Accommodation).

Tourism Ireland is responsible for marketing the Island of Ireland overseas. Information on Tourism Ireland's marketing activities and the performance of overseas tourism to the island of Ireland is available on www.tourismireland.com/corporate/

TOURISM FACTS 2016

Overseas tourist visits to Ireland in 2016 grew by 8.8% to 8.742 million. Short haul markets, Britain and Mainland Europe recorded respective growth of 8.5% and 7.7%. North America market also performed very strongly, increasing by 14.2%.

Britain remains our biggest source market for overseas tourists, representing 41% of all such visits. The next biggest source market is Mainland Europe, which accounts for 36% of international volume. Some 17% of overseas tourists come from North America. The balance, 6%, comes from other long haul markets.

Tourism Numbers 2013 – 2016 (*preliminary*)

Where did Ireland's tourists come from?

Numbers (000s)	2013	2014	2015	2016
Britain	**2,870**	**3,007**	**3,346**	**3,632**
Mainland Europe	**2,346**	**2,490**	**2,880**	**3,102**
France	*409*	*420*	*471*	*494*
Germany	*466*	*535*	*609*	*624*
Italy	*226*	*246*	*304*	*326*
Spain	*249*	*274*	*322*	*370*
Netherlands	*148*	*151*	*174*	*222*
Belgium	*95*	*99*	*121*	*127*
Denmark	*51*	*55*	*66*	*64*
Sweden	*72*	*60*	*64*	*59*
Switzerland	*73*	*84*	*105*	*107*
Austria	*51*	*57*	*53*	*58*
Norway	*50*	*50*	*58*	*50*
Poland	*152*	*140*	*161*	*176*
All Other Europe	*306*	*318*	*373*	*427*
North America	**1,039**	**1,146**	**1,294**	**1,477**
USA	*924*	*1,005*	*1,129*	*1,294*
Canada	*115*	*140*	*165*	*183*
Rest of World	**431**	**462**	**516**	**531**
Australia, New Zealand & Other Oceania	*192*	*191*	*204*	*206*
Other Areas	*240*	*271*	*312*	*325*
Total Overseas	**6,686**	**7,105**	**8,036**	**8,742**
Northern Ireland[1]	1,572	1,708	1,492	1,358
Total out-of-state	**8,258**	**8,813**	**9,528**	**10,100**
Domestic trips[2]	8,413	8,991	9,125	9,282

Source surveys are designed to measure area of residence groupings (bold figures). Figures in italics are indicative of approximate overall market size but do not provide a sufficient level of precision to accurately reflect absolute market size or trends over time.

Source: CSO/Fáilte Ireland/TSB, NISRA

1 Revised by NISRA May 2015

2 2012-2015 domestic data revised due to new methodological approach by CSO, August 2016

Tourism Revenue 2013 – 2016 (*preliminary*)

How much money did they spend?

Revenue (€m)	2013[3]	2014	2015	2016
Britain	**890.9**	**926.7**	**1,017.9**	**1,109.8**
Mainland Europe	**1,228.2**	**1,301.2**	**1,555.3**	**1,657.5**
North America	**829.0**	**940.3**	**1,199.7**	**1,337.4**
Other Overseas	**367.7**	**428.1**	**492.6**	**533.3**
TOTAL OVERSEAS	**3,315.7**	**3,596.4**	**4,265.3**	**4,638.0**
Northern Ireland[4, 5]	304.5	334.4	338.2	366.9
TOTAL OUT-OF-STATE	**3,620.3**	**3,930.7**	**4,603.5**	5004.9
Carrier receipts[6]	976.0	1,166.0	1,322.0	1,479.0
Overseas same-day visits	35.0	41.0	38.0	48.0
TOTAL FOREIGN EXCHANGE EARNINGS	**4,631.3**	**5,137.7**	**5,963.5**	**6,531.9**
Domestic trips[7]	1,533.0	1,713.5	1,725.3	1,776.1
TOTAL TOURISM REVENUE	**6,164.3**	**6,851.2**	**7,688.8**	**8,308.0**

Source surveys are designed to measure area of residence groupings (bold figures).
Source: CSO/Fáilte Ireland/TSB NISRA/Central Bank of Ireland

Revenue – some useful figures

Per diems – spend per person per day

Overseas tourists	€68
Overseas holidaymakers	€89
Domestic overnight trips	€71

3 Revised March 2014
4 NISRA GBP: Northern Ireland resident expenditure data provided in ST£. 2016 Euro exchange rate 0.81948 Source: Central Bank of Ireland
5 2013 Revised by NISRA May 2015 2015 revised 2016
6 2013 and 2014 revised March 2016
7 2012-2015 domestic data revised due to new methodological approach by CSO, August 2016

Regional Performance 2016

Where did tourists go in 2016? (EUROSTAT NUTS 3 REGIONS, see pg 12)

Numbers (000s) *Revenue (€m)*	Britain	Mainland Europe	North America	Other Areas	All Overseas	Northern Ireland	Domestic Trips
Dublin	1,893	2,231	1,169	394	5,687	310	1,406
	368	*764*	*496*	*347*	*1,975*	*106*	*272*
Mid East[8]	241	234	108	7	590	37	704
	68	*99*	*65*	*18*	*251*	*14*	*123*
Midlands[9]	128	64	28	70	289	18	401
	31	*25*	*13*	*2*	*72*	*6*	*66*
South East	358	290	227	71	946	67	1,355
	112	*73*	*56*	*32*	*273*	*25*	*233*
South West	593	772	591	122	2,079	84	2,006
	200	*280*	*317*	*52*	*849*	*38*	*401*
Mid West	377	401	357	80	1,215	9	817
	102	*133*	*120*	*36*	*390*	*2*	*170*
West	350	733	479	114	1,675	155	1,591
	110	*191*	*210*	*33*	*543*	*54*	*329*
Border	360	263	144	47	815	679	1,001
	120	*92*	*60*	*13*	*286*	*123*	*183*

Source: CSO/Fáilte Ireland NISRA/Central Bank of Ireland

Overseas Tourists in 2016

How did overseas tourists spend their money in Ireland?

Breakdown of spend in Ireland (%)	Total	Britain	Mainland Europe	North America	Rest of World
Bed & board	33	29	34	34	33
Other food & drink	34	40	33	32	32
Sightseeing/entertainment	6	5	7	6	7
Internal transport	12	12	12	13	11
Shopping	12	11	12	13	14
Miscellaneous	2	2	2	2	3

8 Caution – small sample sizes in individual market areas

9 Caution – small sample sizes in individual market areas

When did they arrive?

Seasonality (%)	Total	Britain	Mainland Europe	North America	Rest of World
January-March	19	22	18	13	17
April	8	9	9	6	6
May	9	8	10	10	8
June	10	8	10	12	10
July	11	9	12	13	12
August	12	11	12	12	12
September	9	9	9	11	10
October-December	22	23	21	23	23

Source: Fáilte Ireland estimates based on CSO

How did they arrive/depart?

(%)	Total	Britain	Mainland Europe	North America	Rest of World
Air					
From Britain	38	75	5	21	32
From Mainland Europe	38	1	88	22	30
Transatlantic	10	1	1	53	2
Asia/Middle East	2	-	-	-	28
Sea					
From Britain	8	16	3	2	5
From Mainland Europe	1	-	2	-	-
Via N. Ireland	3	6	1	2	4

Source: CSO (indicates less than 0.5 percent)*

Where did they stay? (distribution of bednights)

(%)	Total	Britain	Mainland Europe	North America	Rest of World
Hotels	18	22	13	31	11
Guesthouses/B&Bs	7	6	9	10	3
Self-catering	25	11	27	20	45
Caravan & camping	1	1	1	*	*
Hostels	3	1	5	4	2
Friends/relatives	25	49	19	21	19
Other	21	10	26	14	20
Source: SOT					
Nights (Million)	67.9	17.7	28.9	13.2	8.1
Source (CSO)					

(indicates less than 0.5 percent)*

What activities did they engage in?

	Overseas Participants (000s)
Hiking/cross country walking	2,077
Cycling	399
Golf	193
Angling	131
Equestrian	98

What was their main reason for visiting Ireland?

(000s)	Total	Britain	Mainland Europe	North America	Rest of World
Holiday	4,406	1,423	1,699	1,041	242
Visit friends/relatives	2,613	1,518	684	233	178
Business	1,338	633	487	139	79
Other	385	58	232	64	32

Source: CSO and NISRA

In 2016, just under one third (31%) of those coming to Ireland to visit friends/relatives were born in Ireland.

Overseas Holidaymakers 2016

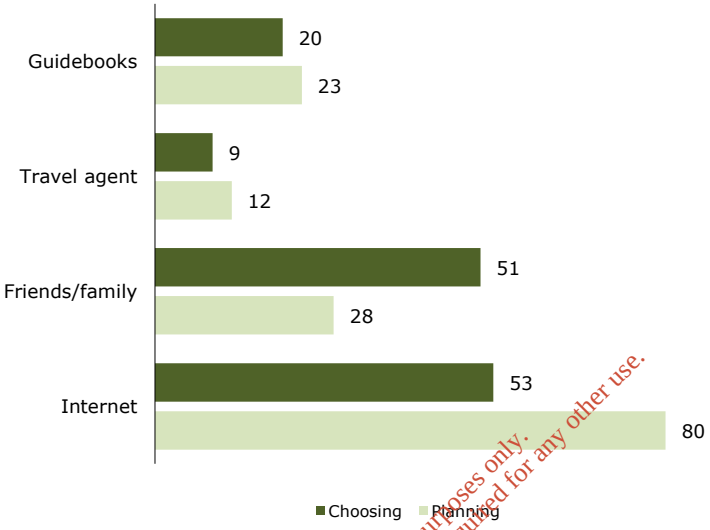
Holidaymakers in this section are defined as tourists who stated that their primary purpose for visiting Ireland was a holiday.

What was the total number of holidaymakers in 2016?

Holidaymakers (000s)	2011	2012	2013	2014	2015	2016
Britain	961	941	979	1,057	1,254	1,423
Mainland Europe	1,041	1,120	1,227	1,314	1,612	1,699
North America	591	634	718	803	926	1,041
Rest of World	167	184	220	219	243	242
Total	2,760	2,879	3,144	3,393	4,036	4,406

Source: CSO and NISRA

Sources of information for choosing/planning a holiday in Ireland (%)



Source: Fáilte Ireland's Port Survey of Holidaymakers 2016

How did they arrange their holiday?

(%)	Total	Britain	Mainland Europe	North America	Rest of World
Package*	17	6	15	28	16
Independent	83	94	85	72	84

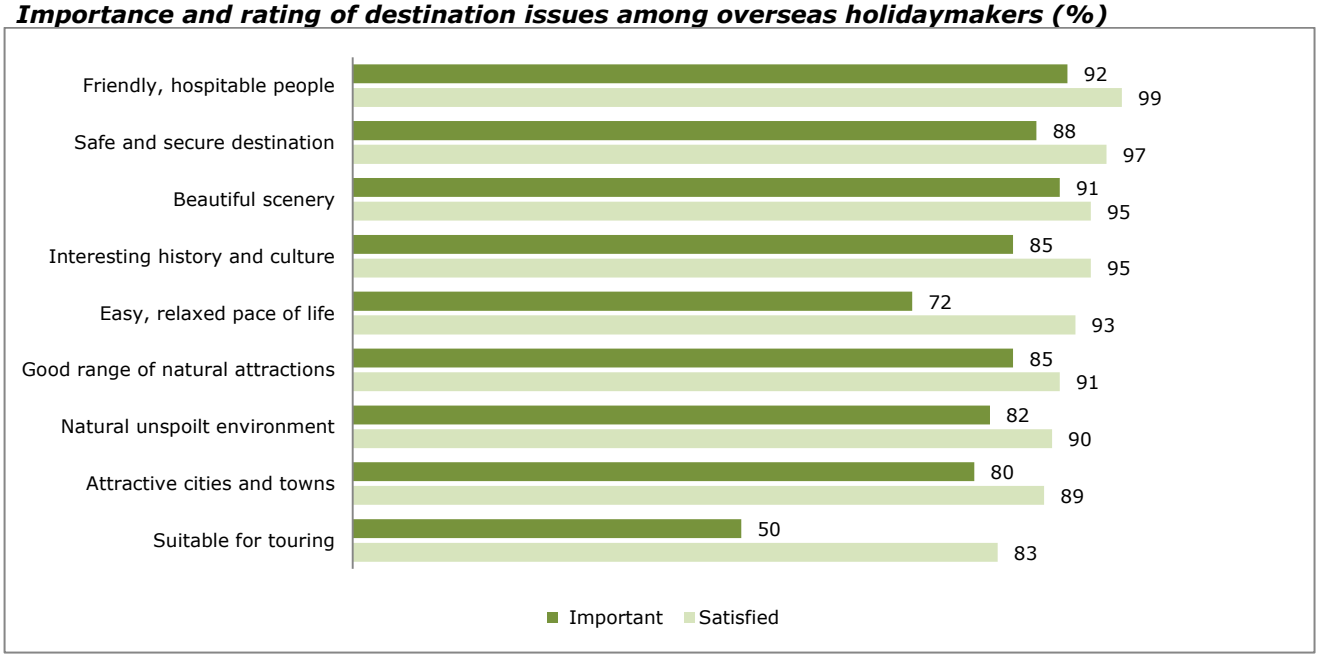
** Prepaid an inclusive price for fares to/from Ireland and at least one other element of the holiday.*
Source: Fáilte Ireland's Survey of Overseas Travellers

What were the characteristics of holidaymakers to Ireland (%)?

Experience of Ireland		Use of car		Age		Social class		Party composition	
First visit	64	Car brought	11	Under 25 years	22	Managerial/professional (AB)	30	Alone	19
Repeat	36	Car hired	31	25-34 years	24	White collar (C1)	57	Couple	42
Irish-born	1	Car not used	58	35-44 years	13	Skilled worker (C2)	10	Family	15
				45+ years	40	Unskilled worker (DE)	3	Other adult group	23

Source: Fáilte Ireland's Survey of Overseas Travellers

Importance and rating of destination issues among overseas holidaymakers (%)



Source: Fáilte Ireland's Port Survey of Overseas Holidaymakers 2016

Domestic Tourism in 2016[10]

Domestic trips (000s) by purpose of travel

	2013	2014	2015	2016
Holiday trips	4,073	4,436	4,658	4,830
- *Long (4+ nights)*	*1,088*	*1,144*	*1,078*	*1,144*
- *Short (1-3 nights)*	*2,985*	*3,292*	*3,580*	*3,686*
Visiting friends/relatives trips	2,988	2,918	2,921	3,032
Business trips	364	453	407	425
Other trips	988	1,184	1,138	994
Total trips	**8,413**	**8,991**	**9,125**	**9,282**

Source: CSO Household Travel Surveys 2013-2016

Domestic expenditure (€m) by purpose of travel

	2013	2014	2015	2016
Holiday trips	947.2	992.8	1,070.4	1,123.9
- *Long (4+ nights)*	*395.2*	*385.6*	*394.2*	*418.4*
- *Short (1-3 nights)*	*552.0*	*607.1*	*676.2*	*705.5*
Visiting friends/relatives trips	284.8	327.0	296.5	294.5
Business trips	84.2	110.3	98.0	104.7
Other trips	216.8	283.4	260.4	253.0
Total expenditure	**1,533**	**1,713.5**	**1,725.3**	**1,776.1**

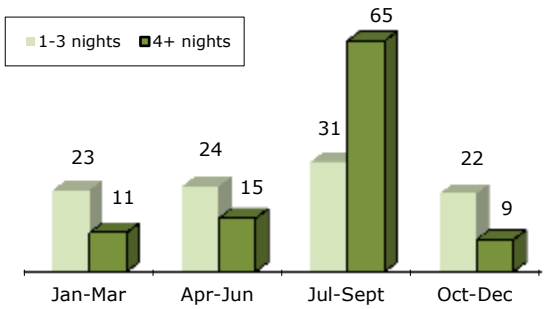
Source: CSO Household Travel Surveys 2013-2016

Accommodation bednights domestic holidaymakers (%)

	2013	2014	2015	2016
Hotels	34	34	35	28
Guesthouse/B&Bs	3	4	4	4
Caravan/camping	15	14	7	*n.a.*
Self-catering	22	23	22	15
Holiday home	15	12	19	9
Friends/relatives	10	13	10	34
Other	1	1	3	11

Source: CSO Household Travel Surveys 2013-2016

Seasonality of holidaymakers (%) 2016 by length of stay



Source: CSO Household Travel Survey 2016

10 2012-2015 domestic data revised due to new methodological approach by CSO, August 2016

Activities engaged in by domestic holidaymakers (%)

Hiking/walking	25
Houses/castles	24
National parks	23
Visits to spas	20
Heritage/ interpretive centres	20
Gardens	19
Watersports (excluding swimming)	19
Monuments	18
Museums/art galleries	14
Cycling	8
Golf	6
Angling	3
Attending horse racing	3

Source: Fáilte Ireland Domestic Omnibus 2016

The Tourism Product

Accommodation in 2016

	Premises	**Rooms**
Hotels	798	56,757
Guesthouses	203	2,584
Bed and Breakfasts	1,257	5,078
	Premises	**Beds**
Self-Catering (units)	3,143	16,694
Hostels	92	7,503
Welcome Standard	177	6,656
Caravan & camping (pitches)	92	5,333

Source: Capita

Accommodation occupancy in 2016

	%
Hotel Room Occupancy	72
Guesthouse Room Occupancy	66
B&Bs Room Occupancy	49
Hostels Bed Occupancy	66
Self-Catering Bed Occupancy	39
Caravan and Camping Bed Occupancy	24

Source: Fáilte Ireland Accommodation Survey

Attendance at popular visitor attractions in Ireland 2016

Top Fee-Charging Attractions			Top Free Attractions		
Name of Attraction	**County**	**2016**	**Name of Attractions**	**County**	**2016**
Guinness Storehouse	Dublin	1,647,408	The National Gallery of Ireland	Dublin	755,577
Cliffs of Moher Visitor Experience	Clare	1,427,166	Irish Museum of Modern Art	Dublin	584,856
Dublin Zoo	Dublin	1,143,908	National Botanic Gardens	Dublin	583,539
National Aquatic Centre	Dublin	1,037,992	Doneraile Wildlife Park	Cork	480,000
Book of Kells	Dublin	890,781	National Museum of Ireland - Archaeology, Kildare St	Dublin	479,261

Source: Fáilte Ireland Visitor Attraction Survey 2016

NUTS 3 Region	County
Dublin	Dublin City & County
South East	Carlow Kilkenny Tipperary (South) Waterford Wexford
South West	Cork Kerry
West	Galway Mayo Roscommon
Mid East	Kildare Meath Wicklow
Midland	Laois Longford Offaly Westmeath
Mid West	Clare Limerick Tipperary (North)
Border	Cavan Donegal Leitrim Monaghan Sligo Louth