Lyndsey Bell (belll@manchesterfire.gov.uk)
Clare Nolan (nolanc@manchesterfire.gov.uk)
Strategic Risk Analysts
Greater Manchester Fire & Rescue

The use of GIS at GMFRS

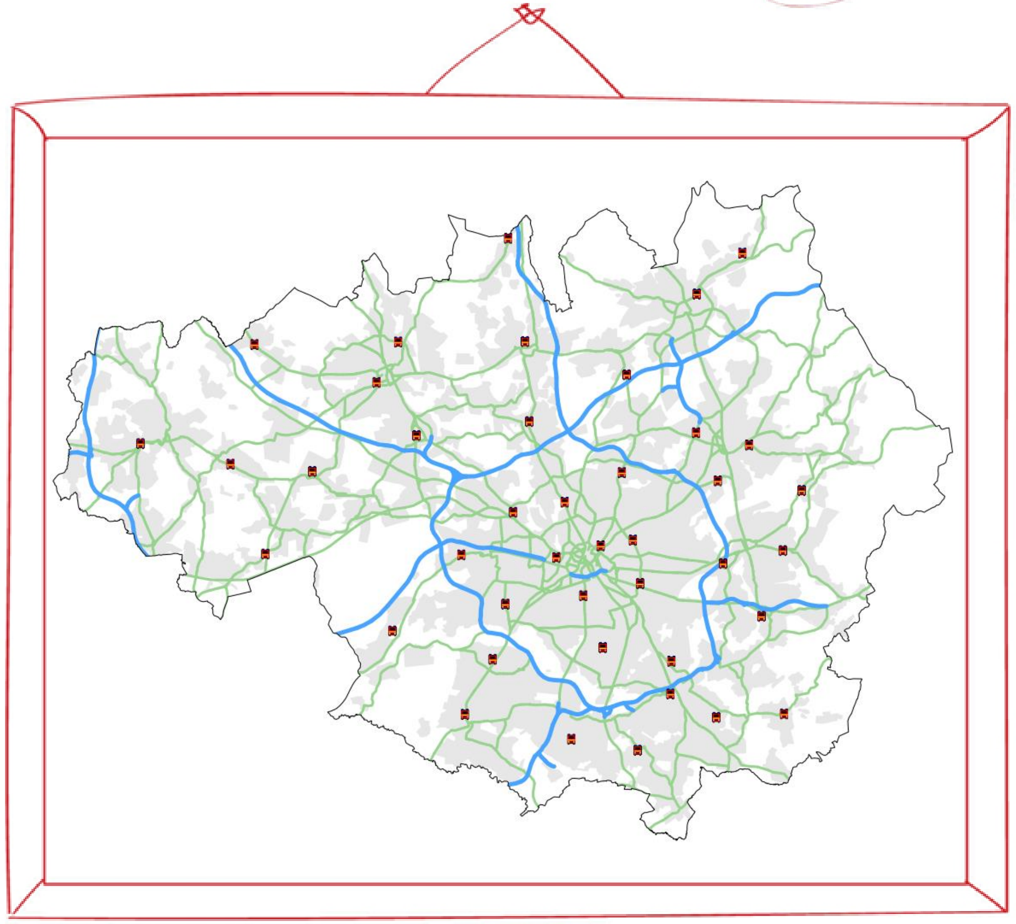
GREATER MANCHESTER FIRE AND RESCUE SERVICE

Introduction to GMFRS

Greater Manchester
- 493 square miles
- 2.7 million people

What we have now
- 2nd biggest fire service in England
- 41 Stations
- 56 Fire Engines
- 32 Special Appliances
- 1311 Firefighters

What we do (2014/15)
- 52,350 emergency calls
- 29,000 incidents
    - 11,800 fires
    - 3,800 special service (road traffic collisions, flooding, technical rescue)
- 58,000 mobilisations
- National and international resilience (USAR/ISAR)
- Cardiac Arrests and GMP incidents
- 61,000 home safety visits



GREATER MANCHESTER
FIRE AND RESCUE SERVICE

GIS at GMFRS

What?
- We have the full suite of Cadcorp products inc. Map Modeller, web mapping, Incident Support mapping, Workload modelling
- Also use QGIS, R and CrimeStat for analysis

Who?
- System admins responsible for GIS administration
- We use Map Modeller daily for analysis
- All staff have access and use GIS daily, but may not know it as “GIS”.
- North West Fire Control use a GIS system to mobilise our fire engines

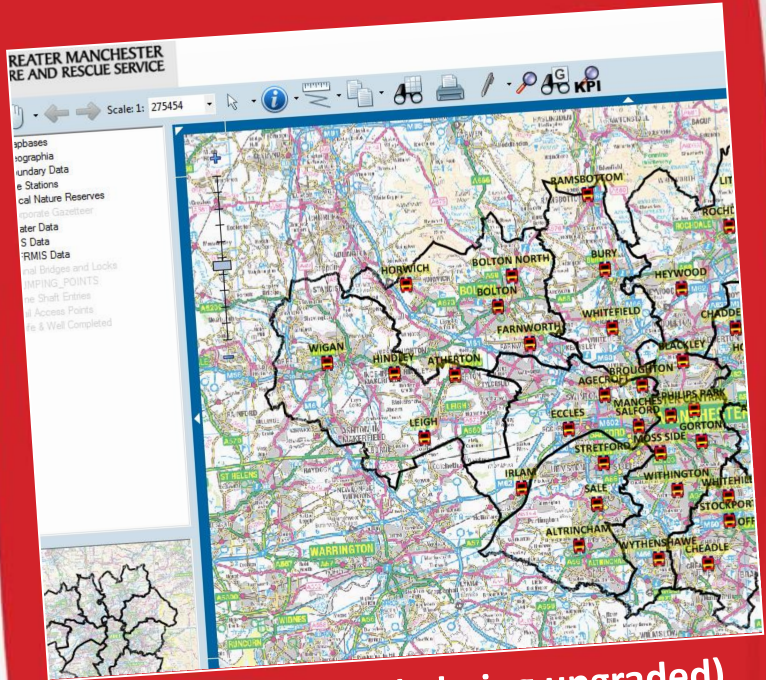
Data we use
- Ordnance Survey (covered by PSMA)
  - Address Base
  - ITN
- Openstreetmap

- Incident/mobilisation data with location
- Automatic vehicle location (AVLS)
- ONS/Census/Mosaic
- NWAS/GMP incident data

GREATER MANCHESTER FIRE AND RESCUE SERVICE

Maps at GMFRS

AIR Unit



Online GIS (currently being upgraded)

Mobile Data Terminals

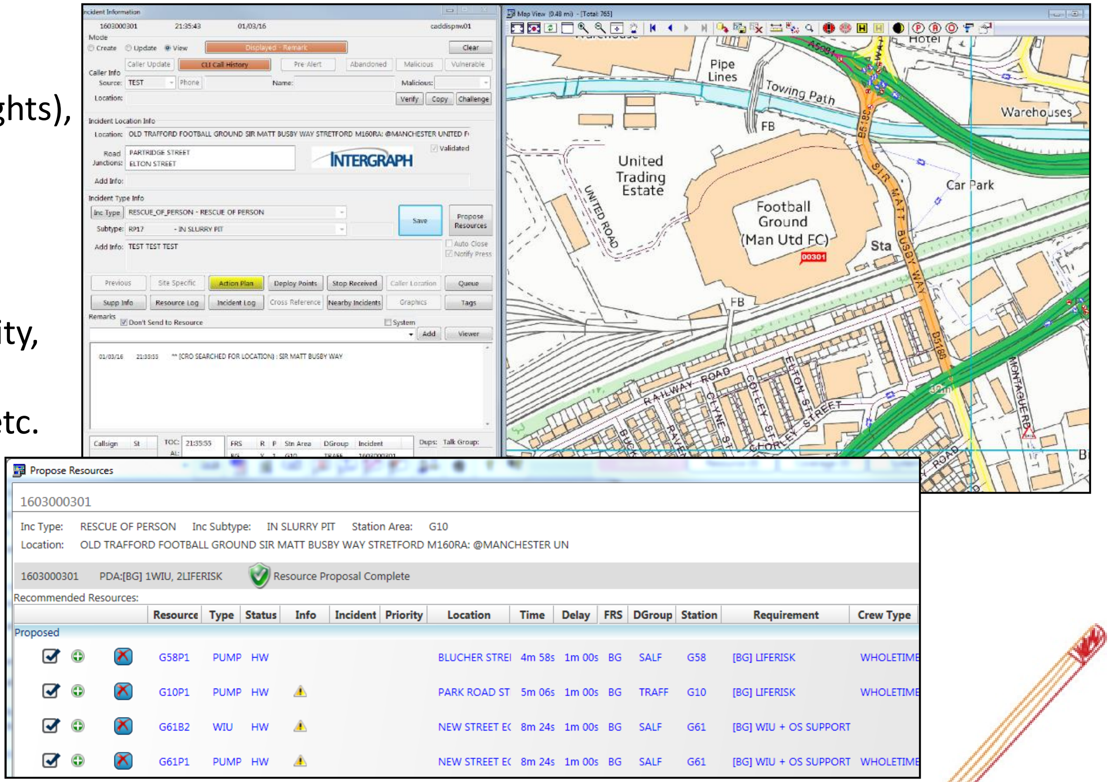
North West Fire Control

- NWFC mobilises for GMFRS, Lancashire, Cumbria and Cheshire. The mobilising system uses Address Base to locate premises and ITN layer to estimate travel time and propose resources.

- Geographical information e.g.
  high rise building polygons,
  road restrictions (weights/heights),
  motorway deployment points,
  standby zones etc.

- Non-geographical information
  e.g. appliance/officer availability,
  incident types,
  pre-determined attendances etc.

- After the incident all data relating to it is transferred directly to GMFRS



GIS Analysis

Prevention and Protection e.g.

- Safe and Well targeting
- RTC Prevention
- Seasonal campaigns (i.e. Bonfire Night)
- Flooding prevention
- Wheely bin fires / ASB

Response/Operational e.g.

- Creating bespoke road network
- Time/travel analysis ie. retained station catchment area or aerial appliance coverage
- Workload modelling
- Creation of new station areas
- Special appliance locations

Safe and Well Targeting

- GMFRS seek to visit 60,000 people per year to offer fire safety, heath and crime prevention advice.
- With a population of 2.7m we must try to prioritise those we deem to be at highest risk by creating a Risk Index using Mosaic Household data
- Accidental dwelling fires are matched against 66 Mosaic types for each borough

Risk Index = Target Population / Base Population * 100

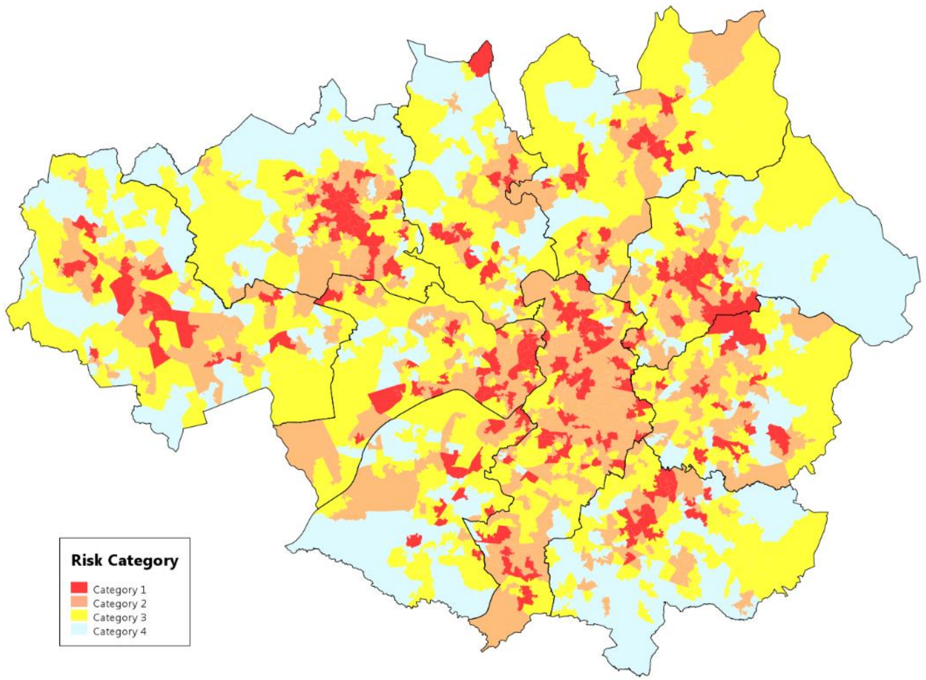
Mosaic Type (Borough)	Mosaic HH	%	Fires	%	RISK INDEX
(608) I41 Renters of older terraces in ethnically diverse communities (12)(MANCHESTER)	608	0.05%	12	0.20%	394.6
(2374) M59 People living in social accommodation designed for older people (46)(MANCHESTER)	2374	0.20%	46	0.78%	387.4
(211) G34 Students involved in college and university communities (4)(WIGAN)	211	0.02%	4	0.07%	379.0
(917) M59 People living in social accommodation designed for older people (17)(BURY)	917	0.08%	17	0.29%	370.7
Total	**1180005**	**100%**	**5902**	**100%**	

GREATER MANCHESTER FIRE AND RESCUE SERVICE

Safe and Well Targeting

Total Risk Score = Mosaic Risk * LSOA Risk from Risk Model

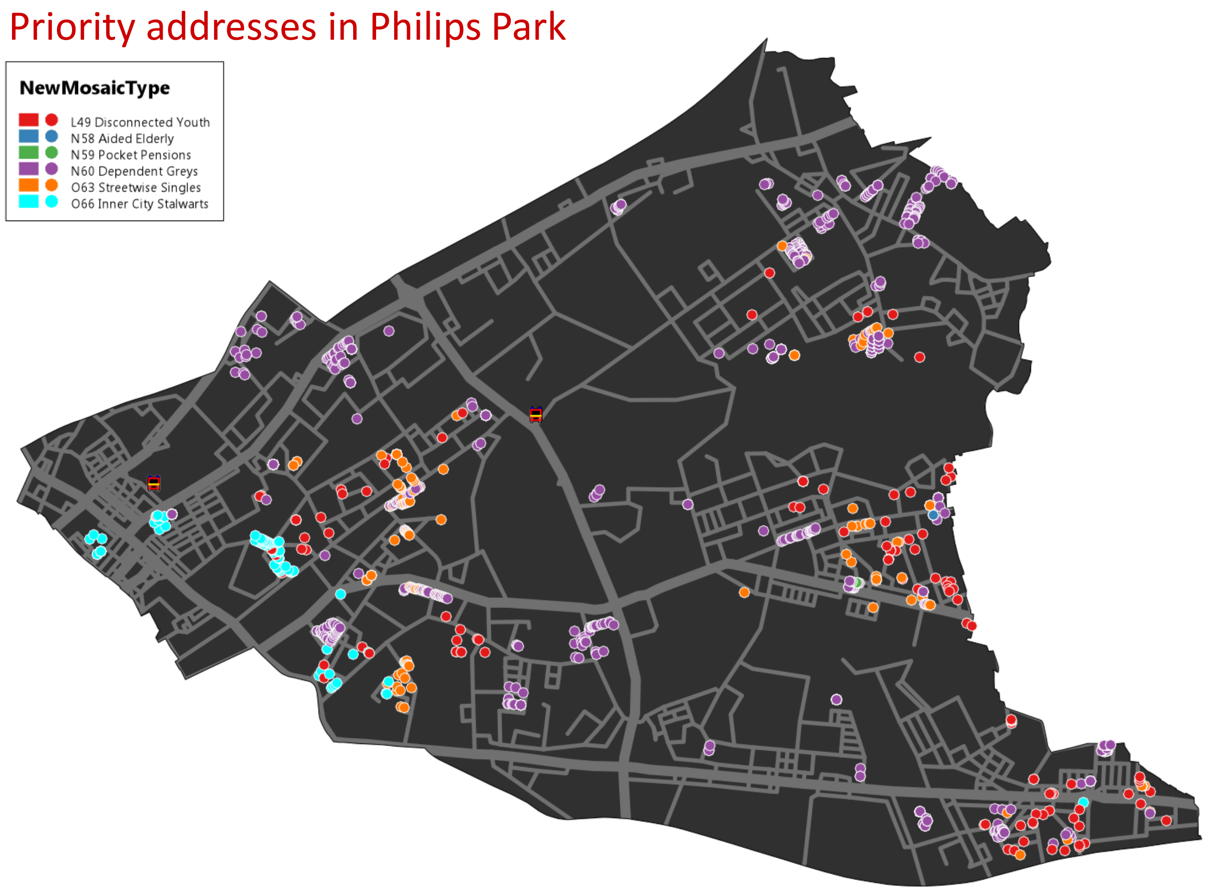
New Mosiac Type	Bolton	Bury	Manchester	Oldham	Rochdale	Salford	Stockport	Tameside	Trafford	Wigan
A03 Wealthy Landowners	0	231	0	114	0	0	86	410	0	0
B06 Bank of Mum and Dad	49	76	224	54	50	134	46	0	28	63
B08 Premium Fortunes	109	141	41	0	0	172	95	0	61	0
C12 Metro High-Flyers	0	0	74	0	0	239	0	0	0	0
C13 Uptown Elite	0	0	20	0	0	0	108	0	158	0
D14 Cafes and Catchments	86	221	38	0	0	255	51	0	70	0
D15 Modern Parents	16	27	386	53	52	0	0	57	0	33
G28 Local Focus	0	0	0	0	246	0	0	0	0	0
G29 Satellite Settlers	423	0	0	0	73	0	0	325	0	0
H32 Flying Solo	155	103	154	110	27	141	159	67	127	102
H33 New Foundations	0	0	61	0	0	101	0	345	98	0
I36 Cultural Comfort	186	309	108	167	0	338	0	0	139	0
I37 Community Elders	332	53	75	154	127	230	0	0	99	0
I38 Asian Heritage	113	157	118	118	162	172	0	214	170	0
I39 Ageing Access	97	0	60	525	0	120	91	0	95	0
J40 Career Builders	52	191	61	216	0	94	148	0	57	0
J41 Central Pulse	0	0	61	0	0	68	267	0	63	0
J44 Flexible Workforce	0	0	86	0	0	341	0	506	140	0
L49 Disconnected Youth	217	262	165	173	226	180	390	152	120	187
L50 Renting a Room	187	189	116	166	215	121	116	108	51	159
L51 Make Do & Move On	76	199	98	96	87	91	127	166	150	156
M53 Budget Generations	50	65	54	73	123	44	31	90	49	193
M54 Childcare Squeeze	99	88	73	88	86	99	84	87	112	90
M55 Families with Needs	182	161	143	162	155	127	222	178	213	198
M56 Solid Economy	106	239	128	88	82	0	187	43	195	262
N58 Aided Elderly	90	139	239	123	279	228	166	129	310	0
N59 Pocket Pensions	136	227	305	260	208	291	249	185	313	329
N60 Dependent Greys	320	190	300	293	272	210	281	258	669	238
N61 Estate Veterans	272	171	103	211	128	114	307	139	153	80
O62 Low Income Workers	91	158	100	71	95	102	114	123	73	116
O63 Streetwise Singles	252	187	184	205	260	216	253	167	188	257
O64 High Rise Residents	244	0	105	251	92	173	289	42	62	414
O65 Crowded Kaleidoscope	0	0	124	0	0	178	0	0	270	0
O66 Inner City Stalwarts	0	0	165	0	0	0	0	0	550	0



- The total risk score is applied to each individual household which are then ranked highest to lowest.
- Households which have received a visit within the past year are removed
- The remaining highest risk households are extracted and distributed to crews

GREATER MANCHESTER FIRE AND RESCUE SERVICE

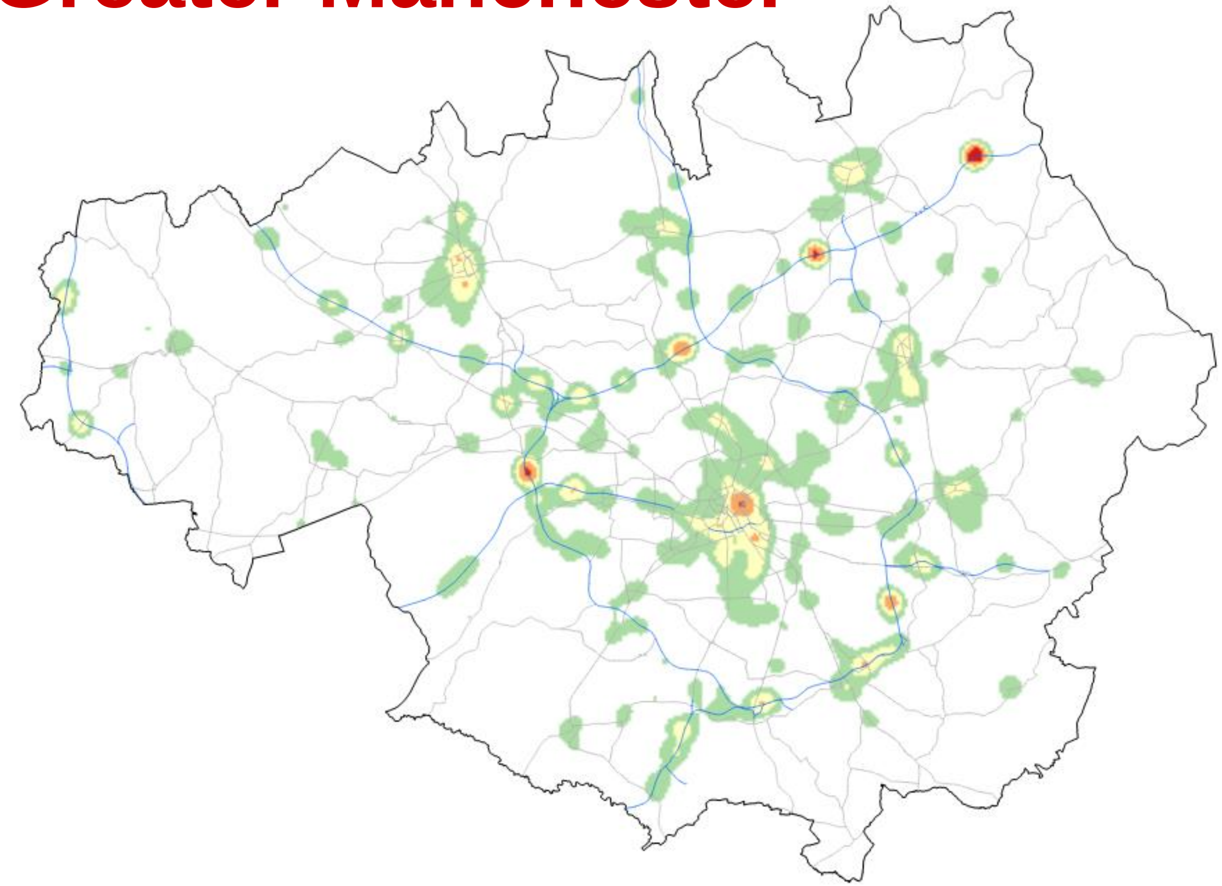
Safe and Well Targeting



- The priority lists are provided to station managers and crews in Excel format and to view on corporate GIS
- Will soon be held in a central database making it more accessible

GREATER MANCHESTER FIRE AND RESCUE SERVICE

Road Traffic Collisions in Greater Manchester



Road Traffic Collisions that GMFRS attend account for more deaths and injuries than house fires

GMFRS attend approximately 10% of all RTCs in Greater Manchester, so we are often not the primary responder. Prevention must be done within partnerships

RTCs are not part of our overall risk model but are analysed separately using KDE Hotspots.

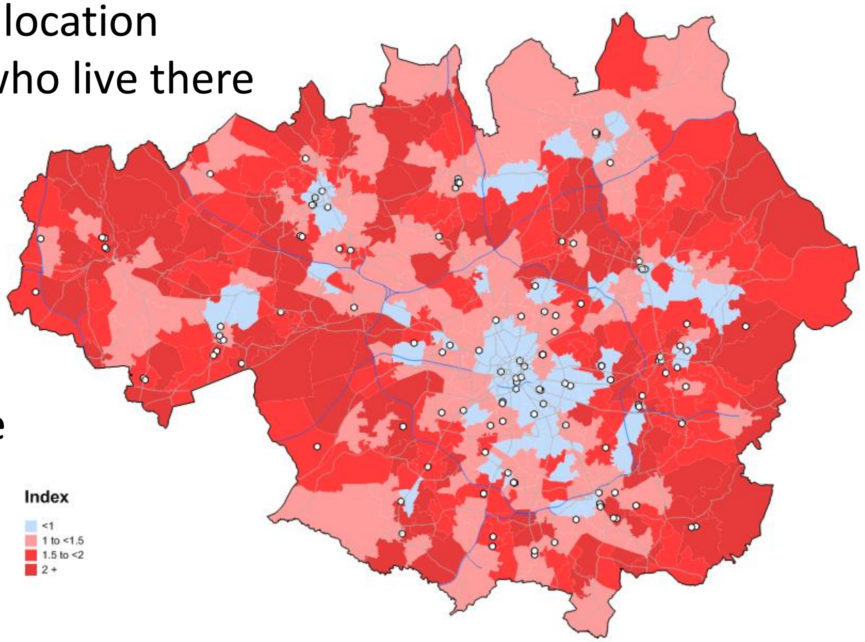
Road Traffic Collisions in Greater Manchester

- We know young people (17-25) are more likely to be a casualty and be a driver in a RTC

- Prevention where the incidents occurs isn't that useful
  - MAST data records Driver Home location
  - Map shows Index of YP's home location relative to total number of YP who live there

- Use Address Base to extract FE Colleges in the areas with high index score

- This is used to target colleges for the "Safe Drive Stay Alive" campaign



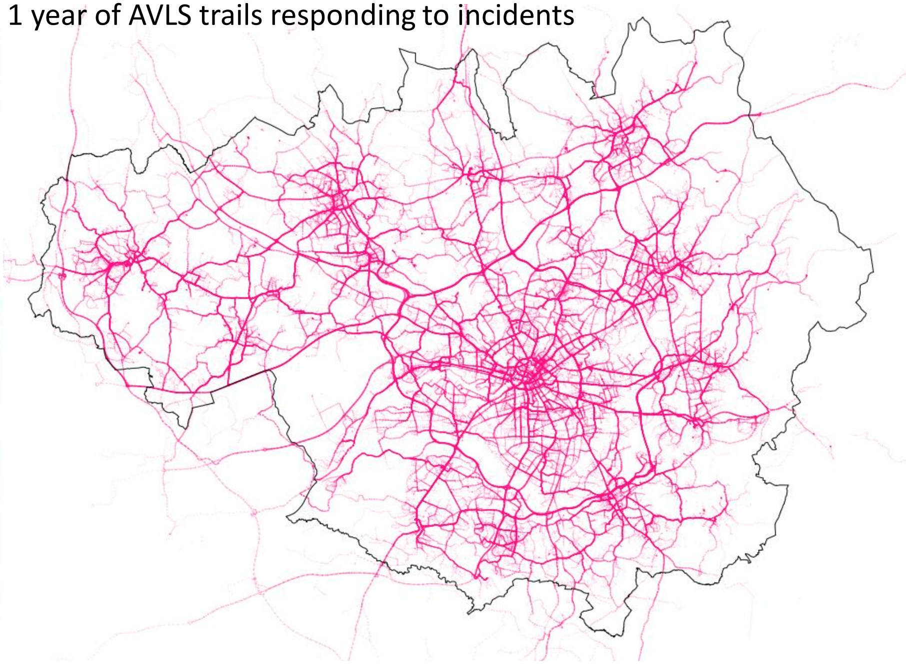
Road Safety Analysis

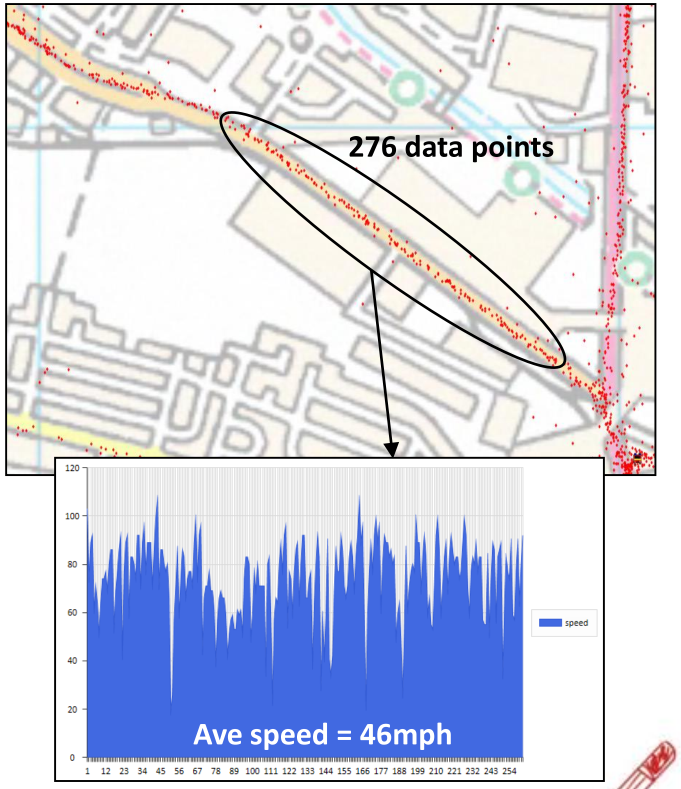
GREATER MANCHESTER FIRE AND RESCUE SERVICE

Creating a Bespoke Road Network

Our fire engines and officers are tracked so Control know their current location/status at any given time and they record location information every 10-30 seconds

1 year of AVLS trails responding to incidents





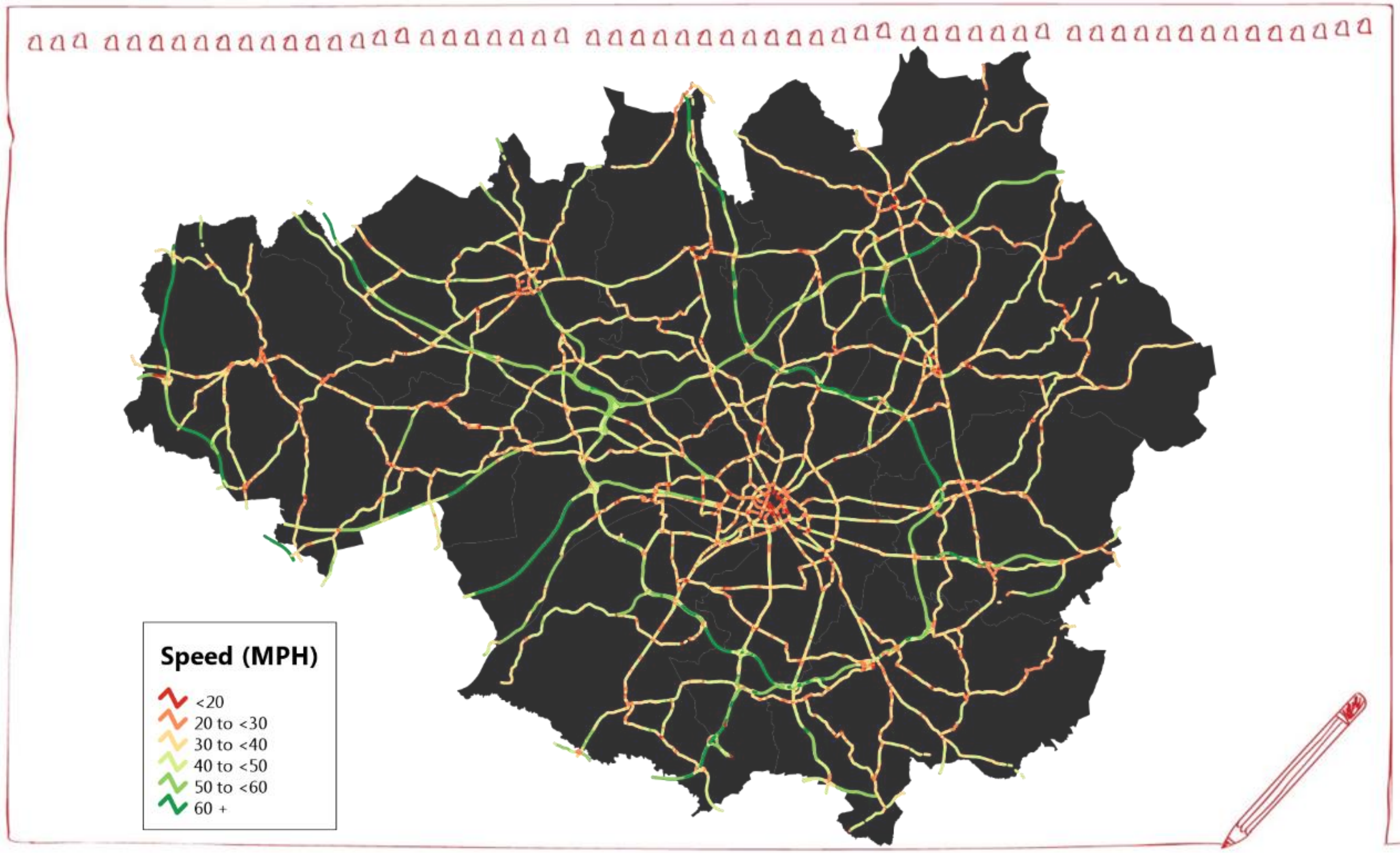
The speed values are attributed to the road segment they are closest to, then an average speed can be calculated for that segment.

Data recorded

- Easting/northing
- Speed
- Heading
- Status

In 2014/15 recorded 12.6 million data points

Creating a Bespoke Road Network



- The Cadcorp AVLS tool does this calculation for all road segments and applies it to the ITN layer
- This bespoke road network is used for workload modelling and any resource or deployment analysis.
- Also used to fine tune the road speeds in the mobilising system.

GREATER MANCHESTER FIRE AND RESCUE SERVICE

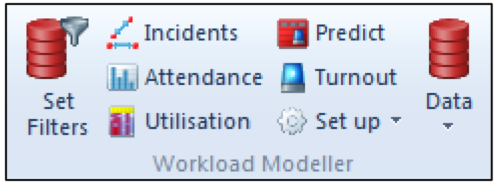
Workload Modelling

Every Fire Service is obligated to create an Integrated Risk Management Plan (IRMP) at least every three years. Usually happens yearly.

In the next four years GMFRS must save £14.79m which equates to 285 firefighters. Despite this reduction in resources we must still provide the best fire cover possible for Greater Manchester.

Workload modelling software is used to analysis the location of resources (stations, vehicles, shifts, people) to meet current and predicted demand.

Cadcorp Workload Modeller is integrated into Map Modeller and also uses MS Access as a base



What If?!?

- Moving a station
- Change shift patterns
- Closing a station
- Change attendance rules
- Introducing new vehicle types
- Attending new types of incidents (i.e. cardiac arrests)

GREATER MANCHESTER FIRE AND RESCUE SERVICE

Workload Modelling

Input

- *102,042 incidents* from the past three years
- 135,745 mobilisations
- Pre-determined attendance
- Risk model
- Road network
- Shift patterns
- Vehicles/station locations

Incident Type	Property Type	Named Period	Appliance Class	No Of
Fire - Building	Dwelling	All_Time	any applicable	3
Fire - Building	NonResidential	All_Time	any applicable	3
Fire - Building	High Rise	All_Time	any applicable	4
Fire - Building	*	All_Time	any applicable	2
Fire - Persons *	*	All_Time	any applicable	3
Fire - Aircraft *	*	All_Time	any applicable	4
Fire - Boat	*	All_Time	any applicable	2
Fire - Fire in the open *	*	All_Time	any applicable	1

Processing

Using all the data and parameters set, the modelling software re-creates each incident and mobilises the **correct number** of **available** appliances to the incident.

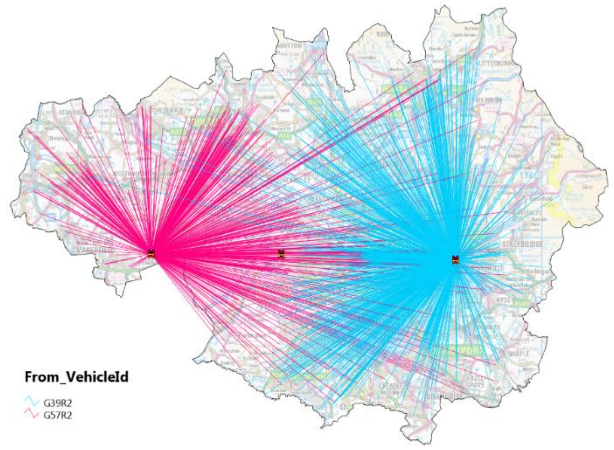
Repeat for all incidents (make a brew!)

~45 minutes per model

Vehicle	Shift	Station	No Of
Pump 1	WT_Mon	G10	1
Pump 1	WT_Tues	G11	1
Pump 1	WT_Wed	G12	1
Pump 1	WT_Thu	G13	1
Pump 2	WT_Fri	G13	1
Pump 1	WT_Sat	G14	1
Pump 1	WT_Sun	G15	1
Pump 2	WT_Mon	G15	1

Output

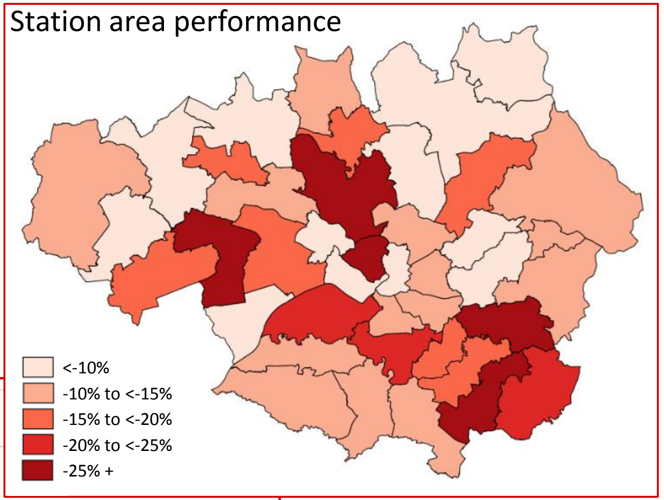
- Output can be mapped automatically within Map Modeller ☺
- Dataset is exported for further analysis
- All comparison is against a basecase



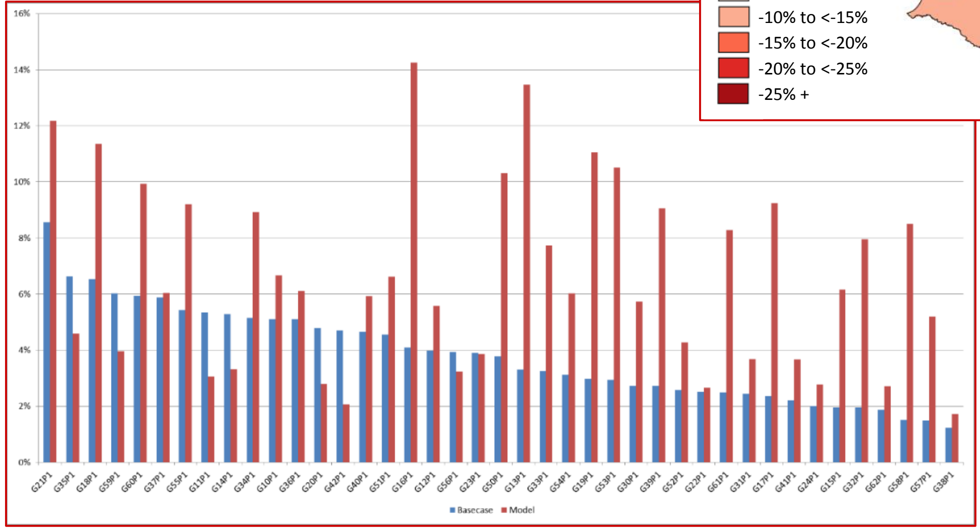
Workload Modelling Output

The output from all models is analysed in a similar way that we analyse actual performance

- Performance at different geographical levels
- Performance by appliances
- Appliance utilisation
- Where appliances are mobilised to
- Average response times



Percentage Utilisation

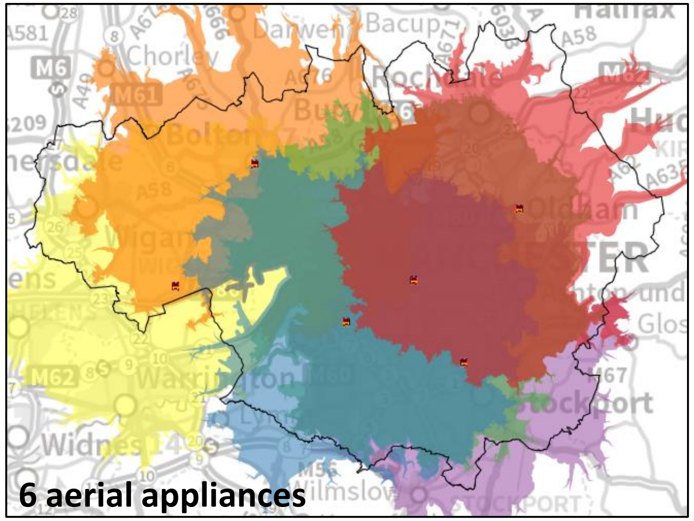


Current Average Response Time 2015/16		Estimated Average Response Time			
		Year 1 2016/17	Year 2 2017/18	Year 3 2018/19	Year 4 2019/20
5 minutes 33 seconds	Day	5 minutes 33 seconds (no change)	5 minutes 35 seconds (increase of 2 seconds)	5 minutes 42 seconds (increase of 9 seconds)	6 minutes 2 seconds (increase of 29 seconds)
5 minutes 46 seconds	Night	5 minutes 46 seconds (no change)	6 minutes 1 second (increase of 15 seconds)	6 minutes 19 seconds (increase of 33 seconds)	6 minutes 28 seconds (increase of 42 seconds)
5 minutes 34 seconds	Overall	5 minutes 34 seconds (no change)	5 minutes 38 seconds (increase of 4 seconds)	5 minutes 50 seconds (increase of 16 seconds)	6 minutes 6 seconds (increase of 32 seconds)

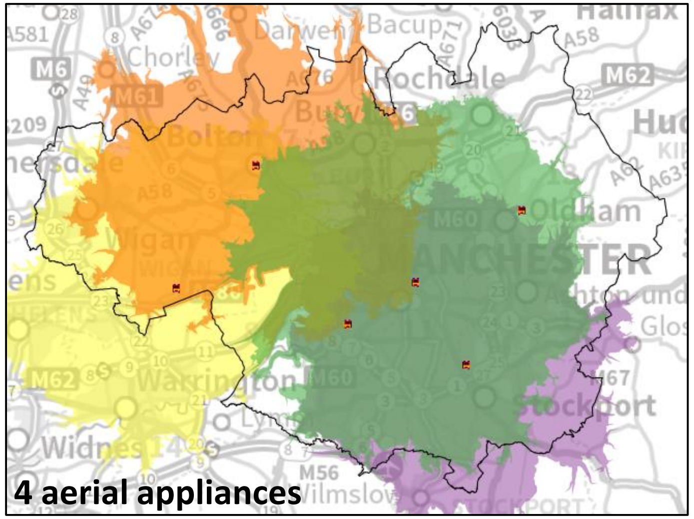
GREATER MANCHESTER FIRE AND RESCUE SERVICE

Creating Isochrones for Coverage of Aerial Appliances

- Using routing tools and the ITN layer we have created Isochrones for each station to show how far appliances can travel within a given time
- Can use these to visualise geographical coverage for single or multiple stations



6 aerial appliances



4 aerial appliances

- Also use isochrones for identifying 'hard to reach properties' and potential new workforce for retained stations

GREATER MANCHESTER FIRE AND RESCUE SERVICE

Future Plans

Launch web map layers

Refresh road network and workload modelling base case

Corporate Plan consultation ends in May so further modelling will be required as we move from ‘plan’ to ‘implementation’

Cadcorp Noticeboard

Any Questions?

GREATER MANCHESTER FIRE AND RESCUE SERVICE