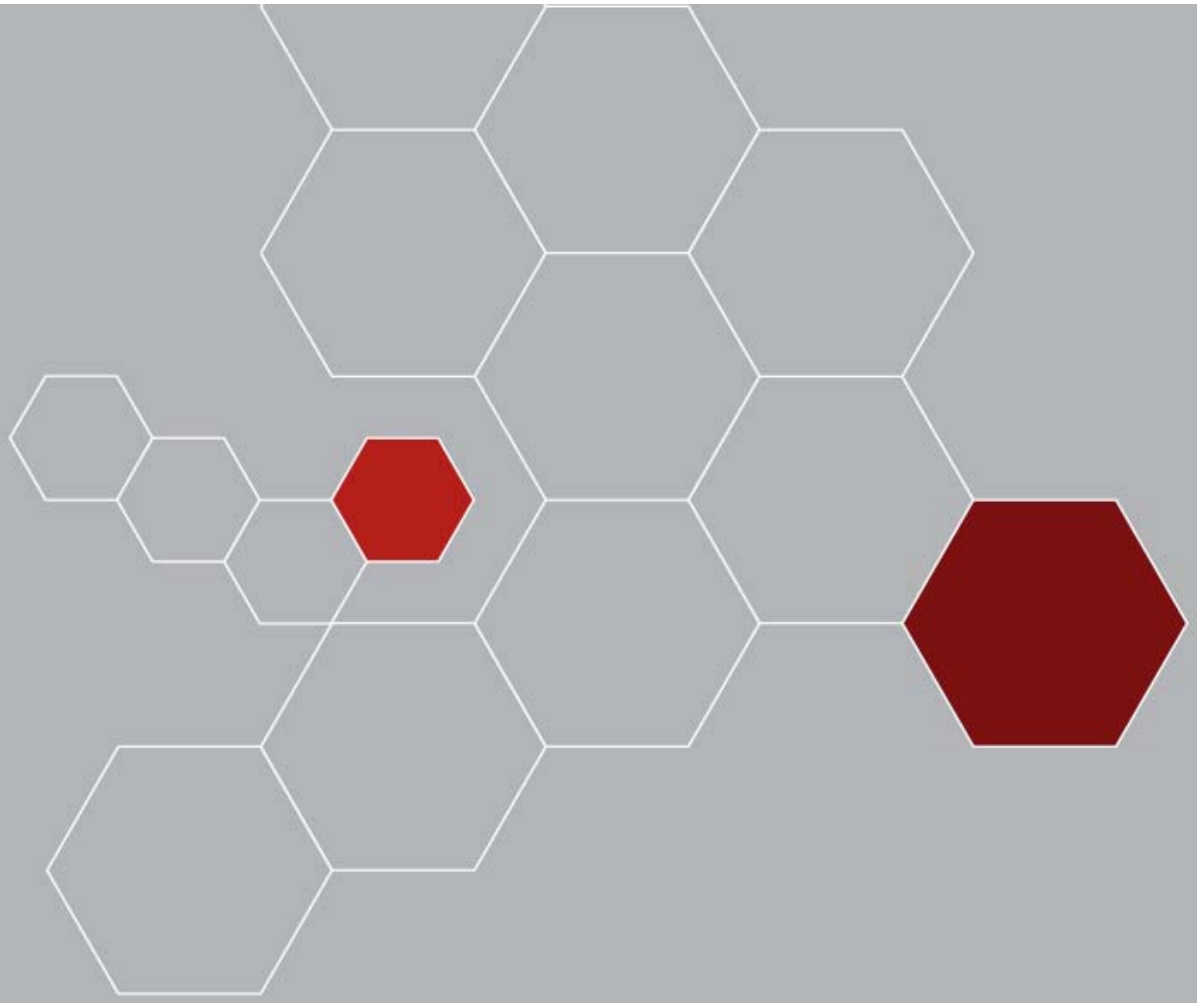
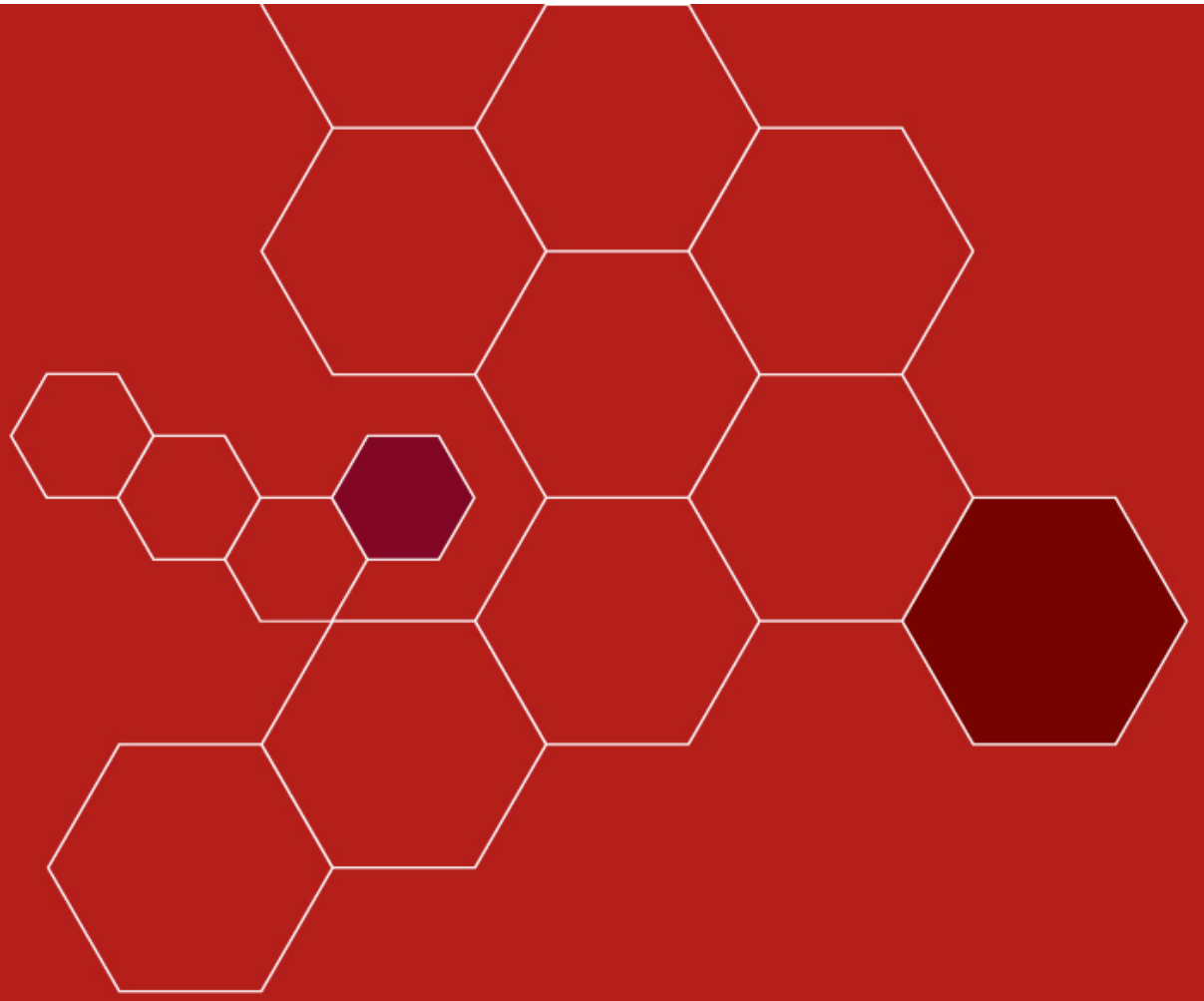


The Geography of Noise – Implementing the Environmental Noise Directive

Nigel Jones, Director

11 May 2010

Extrium



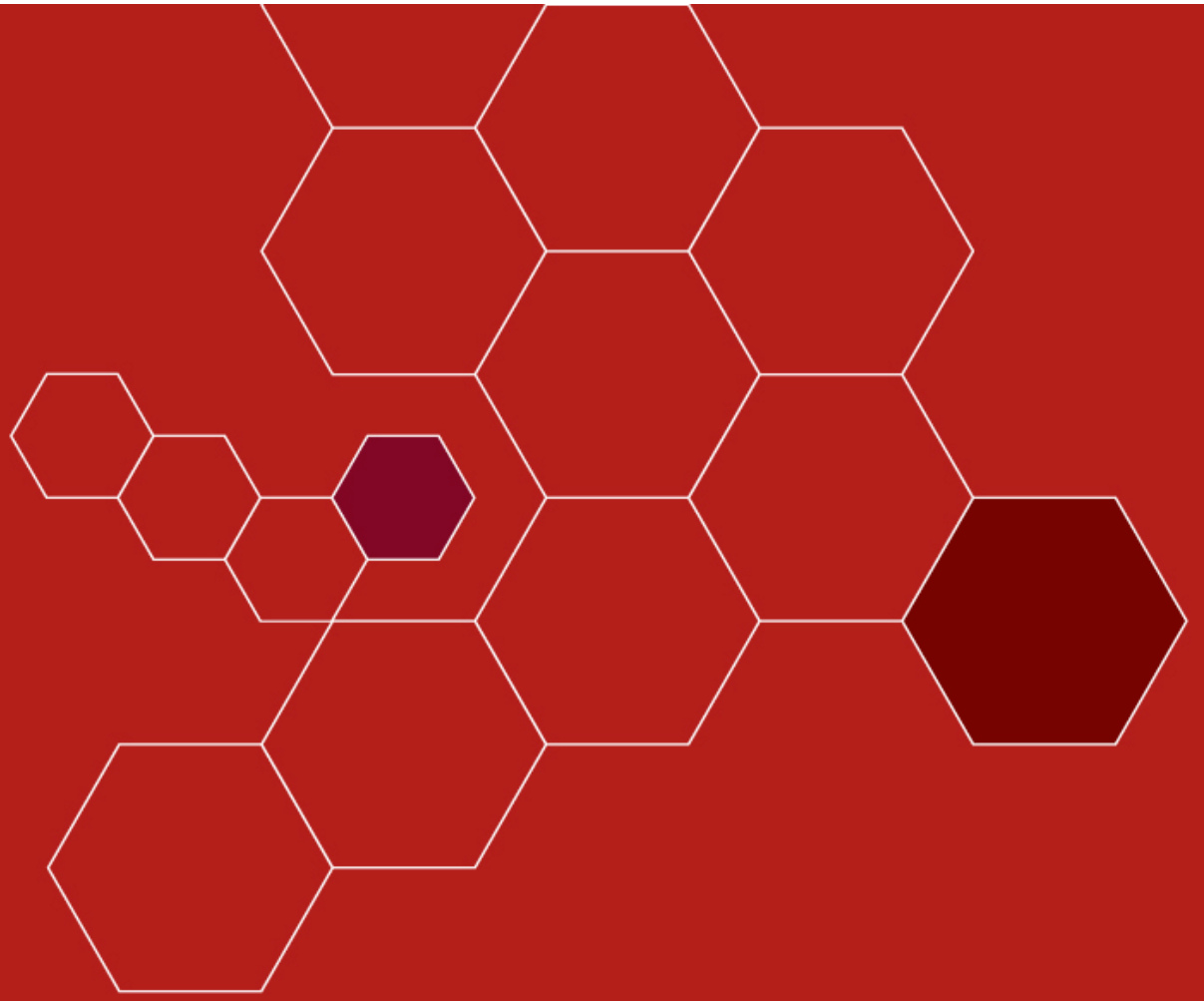
Overview

Extrium

Presentation Overview

- Introduction and Background
- Quick Guide to the Environmental Noise Directive
- Definitions
- Implementation
- EC Reporting
- END Future Developments

Extrium



Introduction and Background

Extrium

Nigel Jones

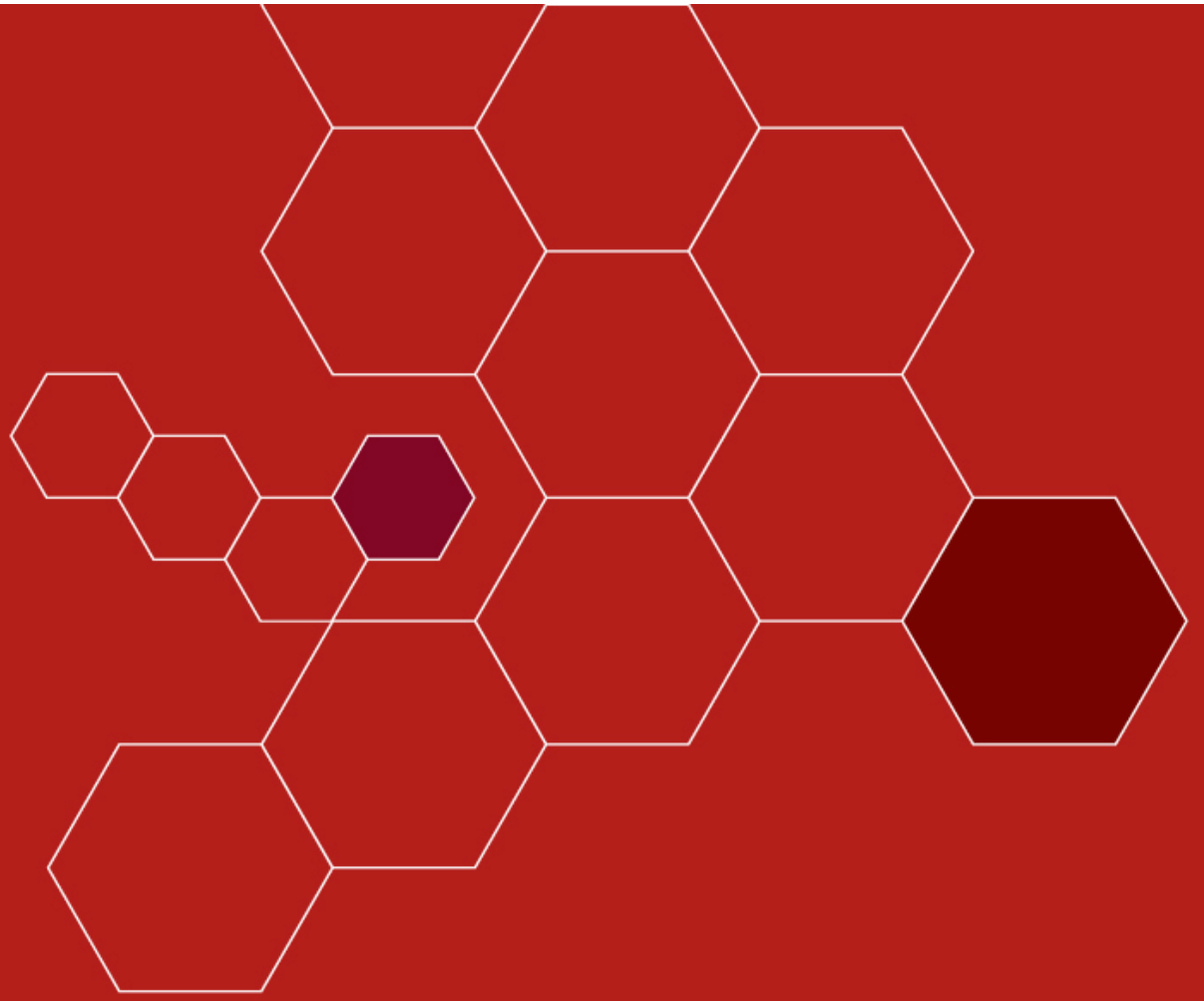
- BSc (Hons) Geography
- MSc Environmental Monitoring
- 1990's
  - Underwater ecological surveyor – English Nature
  - World Bank funded EIA's in Africa
  - Community water supply
- Stanger/Casella/Bureau Veritas (1999-2006)
- Director of Extrium (2006 to date)

Extrium

END Experience

- Defra: NRAS (1999 – 2008)
- DoE/EHS: Northern Ireland Noise Mapping Data Study (2005-6)
- EEA: END Reporting Mechanism (2006-7)
- EPA Ireland: END Implementation Advice (2006-8)
- WAG: Construction of Noise Maps (2006-8)
- DoENI: END implementation (2007-8)
- WAG: Noise Action Plan Development (2008-9)
- Defra: Acoustic Modelling/GIS Advisory Contract (2008-13)
- WAG: Round 2 Implementation (2009-13)
- DG Env/DG JRC: Common Method Guidelines (2009 -)
- EEA: Reporting Mechanism Update (2010 -)

Extrium



Quick Guide to the Environmental Noise Directive

Extrium

Environmental Noise Directive

- Directive 2002/49/EC
- Relating to the assessment and management of environmental noise
- aka “END”
- Environmental noise:
  - Transport
    - Roads
    - Railways
    - Airports
  - Industry
- 5 year cycle

Extrium

Environmental Noise Directive

- Requires mapping of prescribed “sources”
  - Agglomerations >250k/100k people
    - Roads
    - Railways
    - Aircraft
    - Industry
  - Major Roads >6m/3m vehicles
  - Major Railways >60k/30k passages
  - Major Airports >50k movements
- Round 1 maps (2007)
- Round 2 maps (2012)
- Noise action plans are end deliverable (maps +1 year)

Extrium

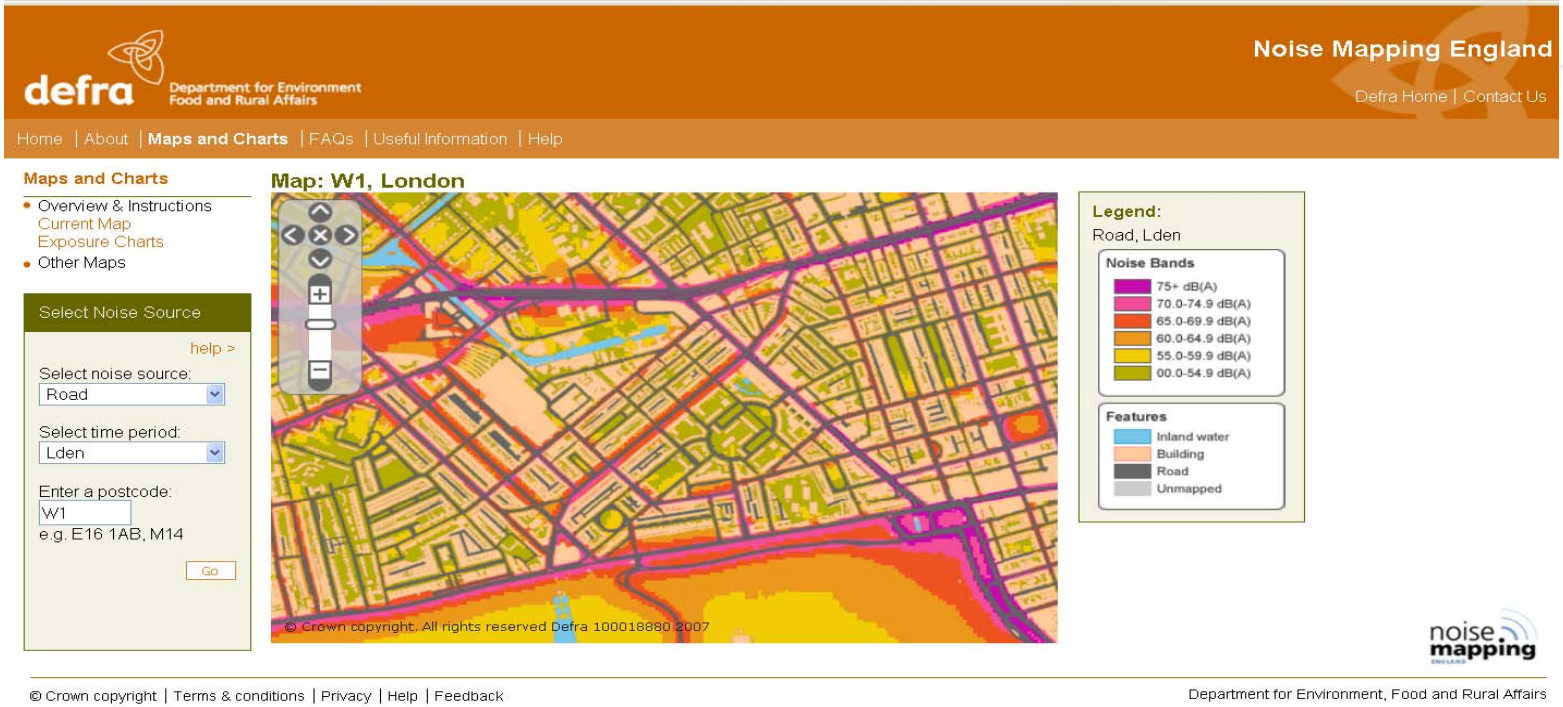
Environmental Noise Directive

- Assessment of two annual averages
  - weighted 24 hour Lden indicator
    - d (Day) – 12 hrs
    - e (Evening) – 4 hrs
    - n (night) – 8 hrs
  - night time noise level
    - Lnight
- Member States can also use additional supplementary indicators
  - LA10,18h
  - LAeq,18h
  - LAeq,16h
  - LAeq,6h

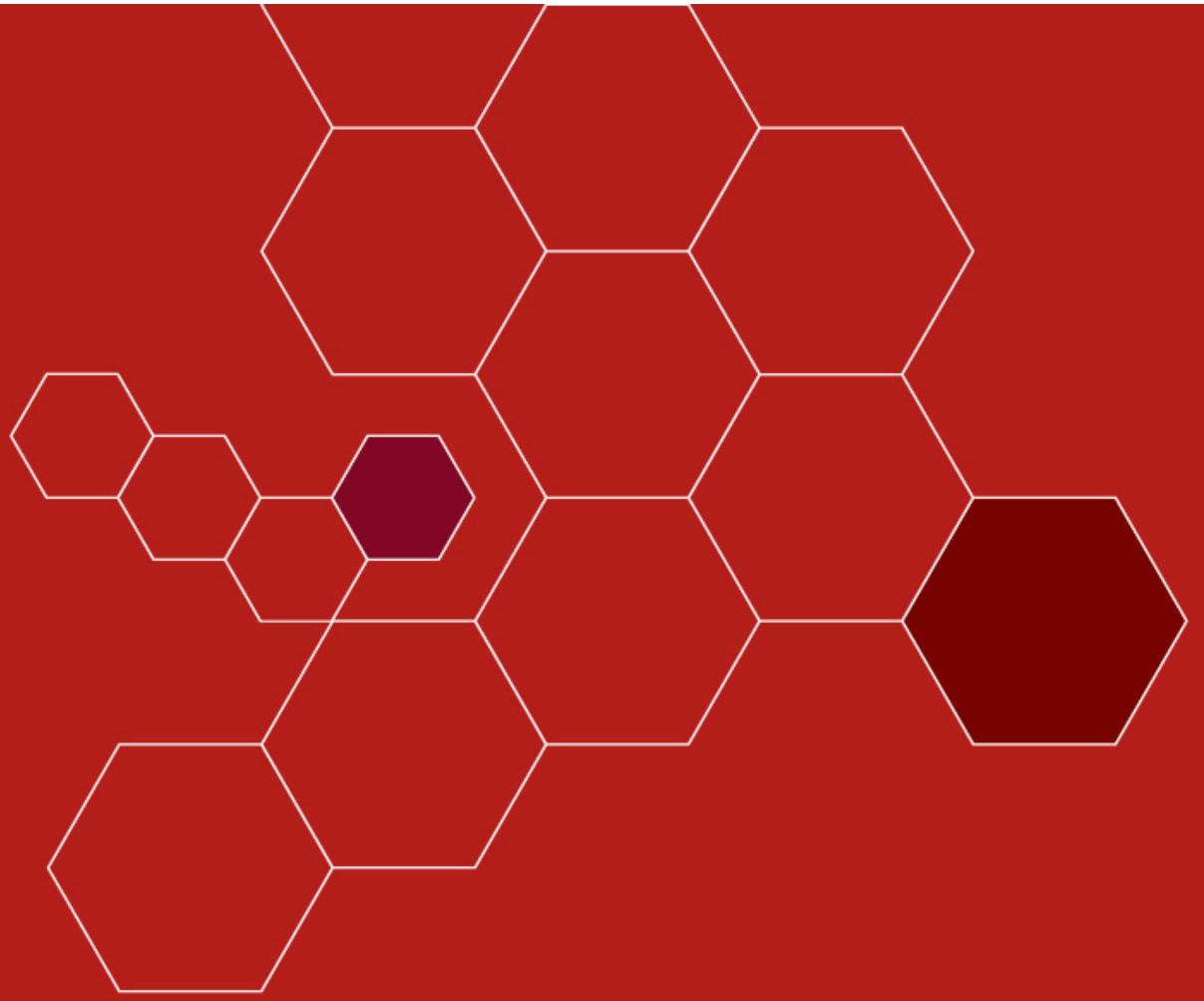
Extrium

Environmental Noise Directive

- http://services.defra.gov.uk/wps/portal/noise



Extrium



Definitions

Extrium

Defining Agglomerations

END Agglomeration ‘Definition’:

‘agglomeration’ shall mean part of a territory, delimited by the Member State, having a population in excess of 100 000 persons and a population density such that the Member State considers it to be an urbanised area;

Extrium

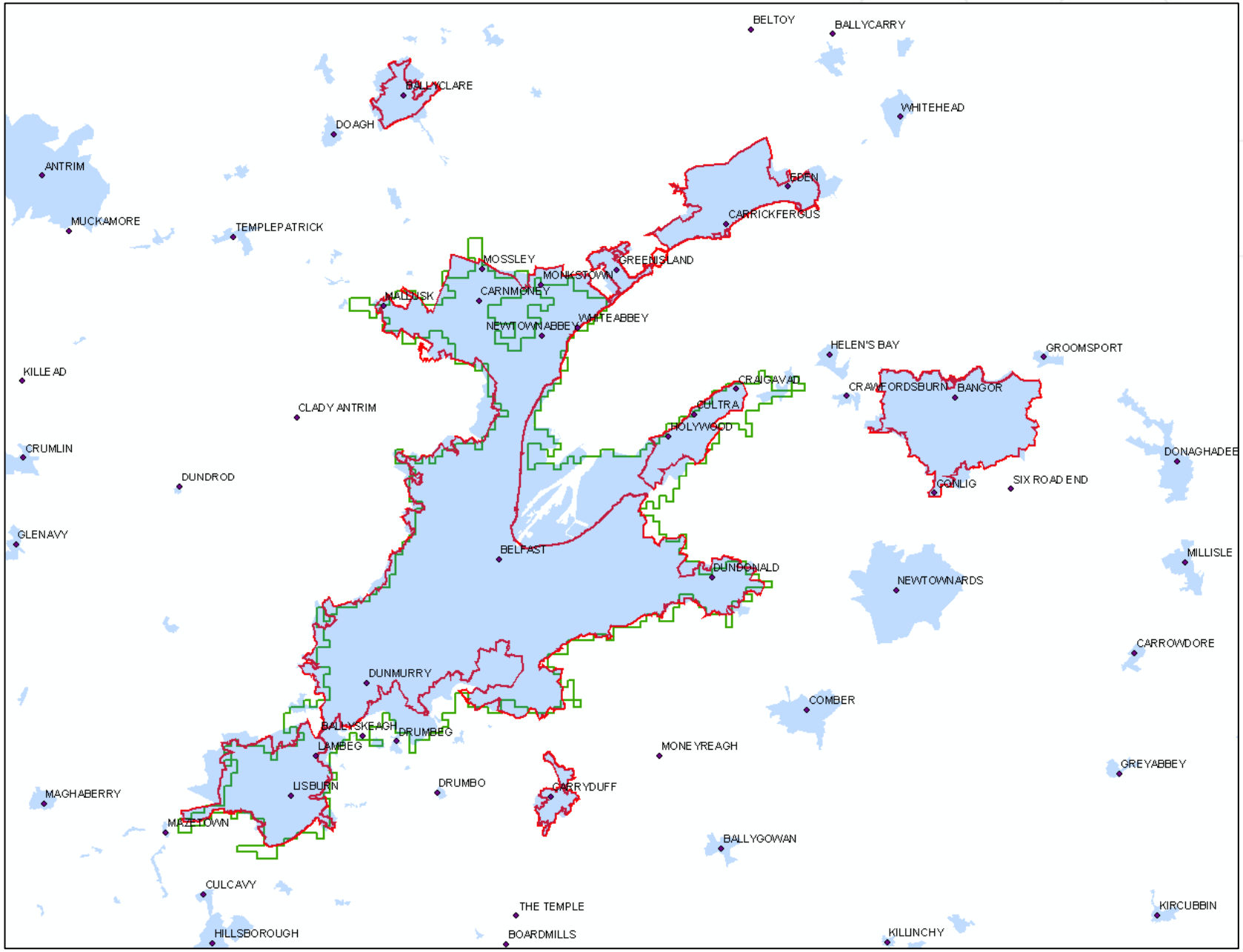
Defining Agglomerations

- Many options available to Member States:
  - City Administrative Areas – City Council
  - LAU2 codes
  - Urbanised Areas
  - Proximity of suburbs and satellite settlements
  - Planning Areas

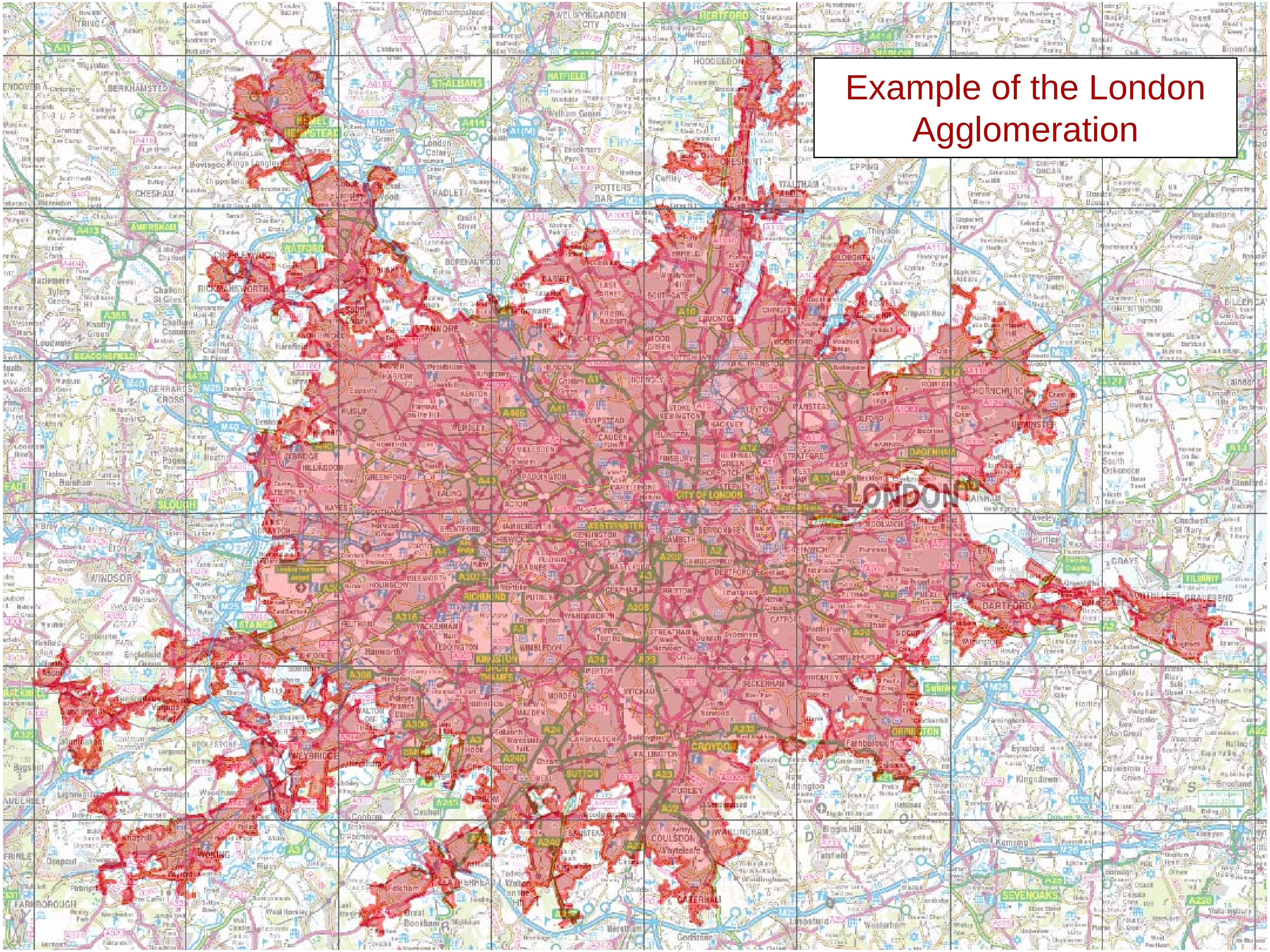
- Different approaches and data sources have been utilised across the UK (and Europe)
  - Eng and Wales – Urban Areas
  - Scotland – Settlements and Localities
  - NI – Belfast Metropolitan Urban Area

Extrium

Options in Belfast



Example of the London Agglomeration



Defining Major Roads

END Major Road Definition:

‘major road’ shall mean a regional, national or international road, designated by the Member State, which has more than three million vehicle passages a year;

Extrium

Defining Major Roads

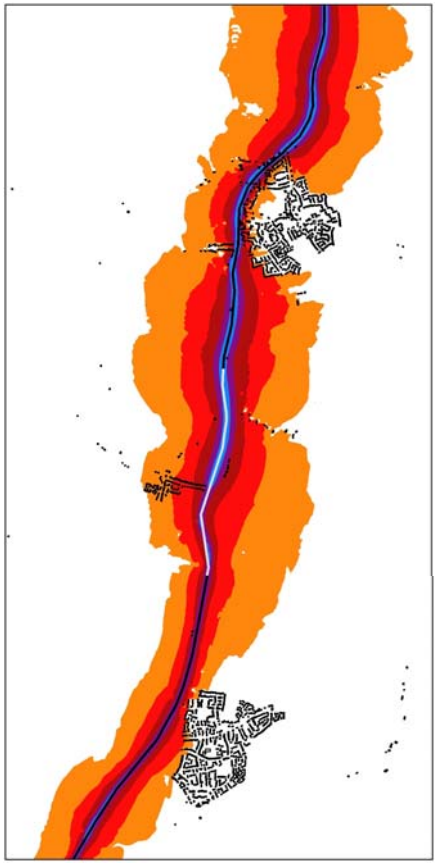
- Options available to Member States include:
  - Trans European Road Network?
  - Nationally Classified Roads..
  - But different classification schemes exist
    - Primary Routes
    - Trunk Roads
    - Motorways/A Roads

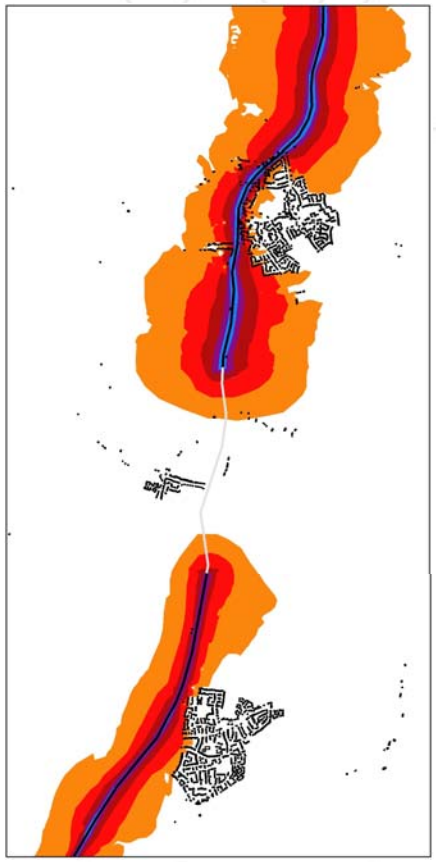
- ….including sections below 6m threshold?

Extrium

Defining Major Roads

Include sections below 6m threshold?





Extrium

Defining Roads for agglomerations

Defining Railways

END Major Railway ‘Definition’:

‘major railway’ shall mean a railway, designated by the Member State, which has more than 30 000 train passages per year;

Extrium

Defining Railways

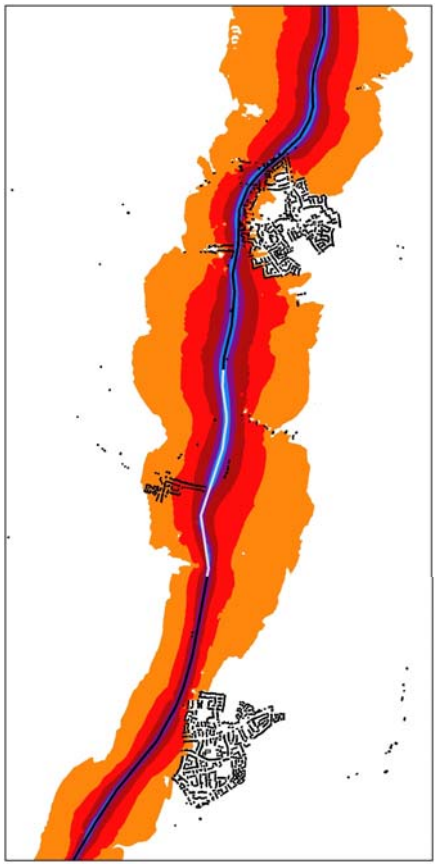
Many options are available to Member States to address the following issues:

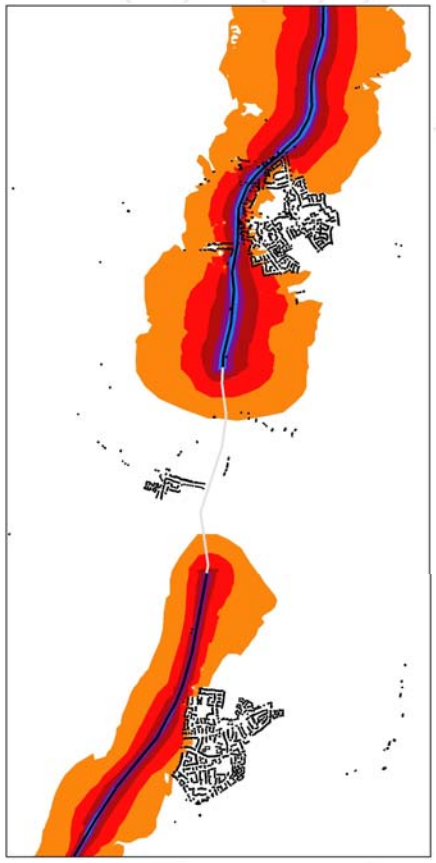
- Need to define a ‘Railway’, but different terminologies exist:
  - A railway corridor
  - A rail route
  - Track
- Need to define “Train passages”
  - but CRN requires Vehicle movements
- Should ‘Metro’ sources be included?
  - E.g. Croydon Tram, DLR
- Ownership!

Extrium

Defining Major Railways

Include sections below 60,000 threshold?





Extrium

Defining Industry

- END Industry ‘Definition’

‘environmental noise’ shall mean unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity such as those defined in Annex I to Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control ([2]);

Extrium

Defining Industry

Many options are available to Member states:

- A1’s
- A2’s
- B’s
- C’s
- Other non-PPC regulated sites

- Different approaches and data sources have been implemented across the UK

Extrium

Defining Major Airports

END Major Airport Definition

‘major airport’ shall mean a civil airport, designated by the Member State, which has more than 50 000 movements per year (a movement being a take-off or a landing), excluding those purely for training purposes on light aircraft;

Defining Major Airports

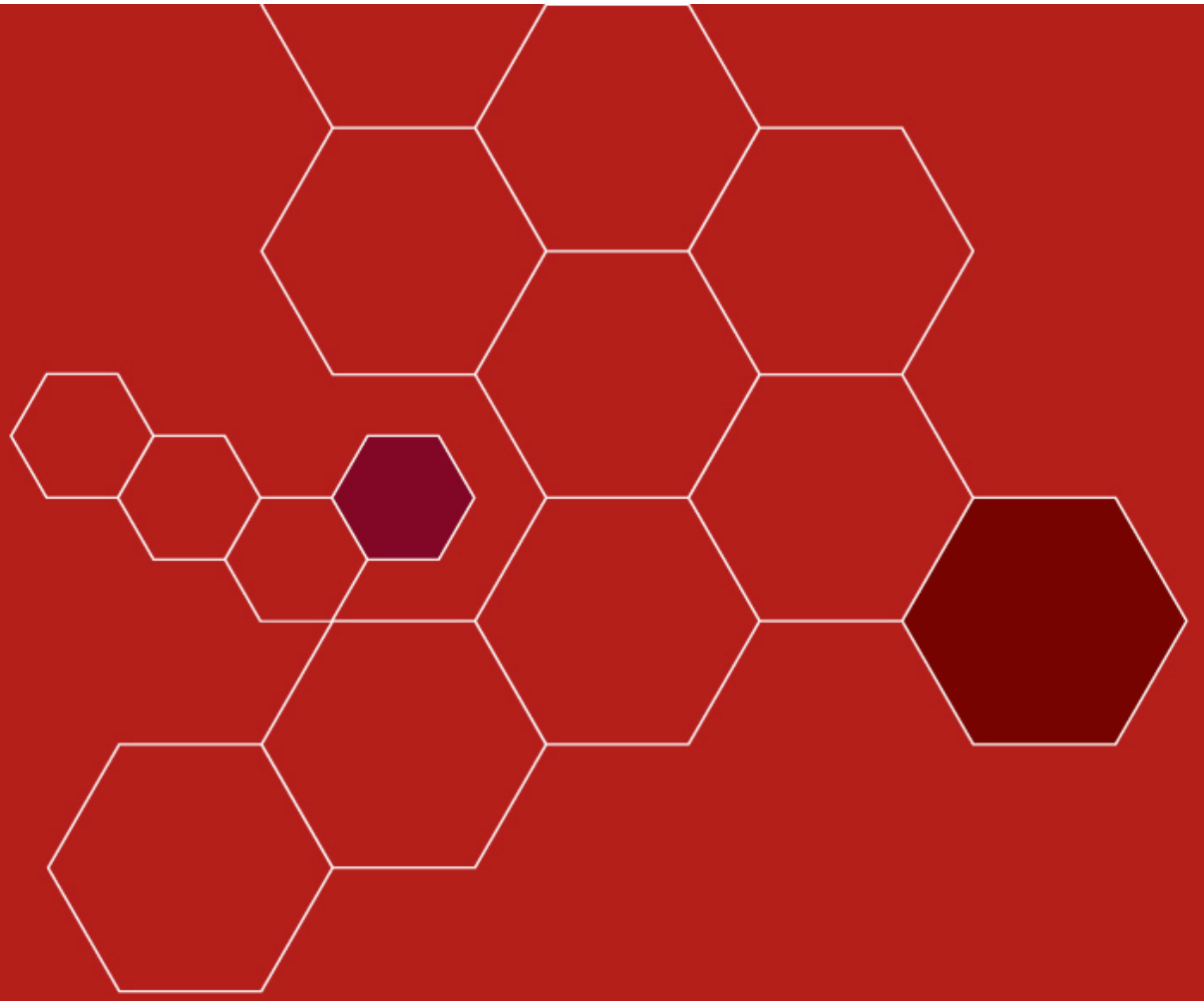
Many options are available to Member States to address the following issues:

- Need to define and agree the definition of a movement with relevant Competent Authorities for
  - Training Movements
  - Aero Club Movements, and
  - Military Movements

- Bring definition in line with current flight recording systems?

Extrium

	Total	Commercial Movements				Non-Commercial Movements						
		Air Transport	Of Which Air Taxi	Positioning Flights	Local Movements	Test and Training	Other Flights by Air Transport Operators	Aero Club	Private	Official	Military	Business Aviation
London Area Airports												
GATWICK	263 653	257 834	1 482	4 881	17	126	227	-	17	6	4	541
HEATHROW	478 693	474 180	973	1 632	4	49	103	-	57	638	95	1 935
LONDON CITY	94 516	90 266	6 192	3 672	-	278	8	-	8	-	1	283
LUTON	117 859	89 935	4 274	5 853	18	280	562	2	281	64	8	20 856
SOUTHEND	37 227	2 207	1 338	1 095	108	3 554	455	18 286	9 561	278	206	1 477
STANSTED	193 282	178 997	1 712	5 600	-	261	107	-	1 005	184	68	7 060
Total London Area Airports	1 185 230	1 093 419	15 971	22 733	147	4 548	1 462	18 288	10 929	1 170	382	32 152
METRO LONDON HELIPORT	11 326	2 254	2 254	2 081	23	-	2 651	-	3 357	50	436	474
Other UK Airports												
ABERDEEN	119 831	106 366	6 197	3 892	-	7 931	30	870	116	5	130	491
BARRA	1 310	1 262	13	-	-	-	-	48	-	-	-	-
BELFAST CITY (GEORGE BEST)	42 990	41 104	899	591	53	47	54	-	552	53	51	485
BELFAST INTERNATIONAL	77 943	55 000	1 369	2 063	3 270	661	-	1 700	4 210	-	9 478	1 561
BEMBRIDGE	15 462	-	-	-	704	290	-	1 391	12 905	-	172	-
BENBECULA	4 660	4 145	1 390	372	-	6	15	82	-	-	38	2
BIGGIN HILL	62 211	8 511	8 511	469	-	10	-	38 740	8 856	-	166	5 459
BIRMINGHAM	112 227	103 449	593	2 905	2 933	166	52	-	378	-	274	2 070
BLACKPOOL	54 249	12 154	1 524	144	560	1 322	17	29 947	7 814	11	841	1 439
BOURNEMOUTH	78 527	11 936	144	1 288	209	18 094	12	28 325	10 650	-	3 599	4 414
BRISTOL	76 517	60 201	133	841	5	-	2	7 416	7 663	-	388	1
CAMBRIDGE	42 602	57	16	95	2 721	1 508	-	31 198	2 792	15	492	3 724
CAMPBELTOWN	1 921	1 216	238	19	-	165	-	345	2	-	161	13
CARDIFF WALES	37 123	23 559	78	1 151	3	278	19	7 775	4 150	-	188	-
CARLISLE	19 626	175	175	109	870	90	341	12 452	4 021	2	1 126	440
CITY OF DERRY (EGLINTON)	13 035	6 054	231	75	62	1 655	12	2 577	2 518	37	18	27
COVENTRY	56 144	6 851	2 436	2 077	647	34 978	2	4 892	6 624	10	61	2
DONCASTER SHEFFIELD	13 066	7 881	455	429	24	1 927	6	2 061	625	6	42	65
DUNDEE	36 297	3 910	266	331	476	1 349	151	28 287	1 102	3	86	602
DURHAM TEES VALLEY	45 310	9 938	637	436	5 924	1 325	-	22 827	4 371	7	481	1
EAST MIDLANDS INTERNATIONAL	93 038	67 062	951	2 846	57	10 176	76	262	9 731	18	61	2 749
EDINBURGH	125 550	118 899	5 364	3 212	-	38	56	1 174	343	11	230	1 587
EXETER	44 134	15 971	905	1 433	405	18 903	579	-	4 179	-	472	2 192
GLASGOW	100 087	90 977	4 330	3 017	4	157	75	4 449	181	1	255	971
GLOUCESTERSHIRE	76 753	1 945	295	462	1 274	12 404	752	45 678	13 036	-	307	895
HAWARDEN	23 227	-	-	54	1 318	376	2 902	11 316	4 174	16	753	2 318
HUMBERSIDE	37 758	13 548	588	2 992	1 099	6 354	219	10 095	3 347	1	84	19
INVERNESS	40 538	17 936	4 399	2 850	-	2 832	8	16 244	-	46	195	427
ISLAY	2 625	1 869	392	38	-	6	4	660	1	2	12	33
ISLES OF SCILLY (ST.MARYS)	12 951	11 279	-	548	-	-	150	-	872	-	102	-
ISLES OF SCILLY (TRESCO)	2 578	2 578	-	-	-	-	-	-	-	-	-	-
KENT INTERNATIONAL	19 269	798	258	746	4	4 053	1	9 296	3 874	16	430	51
KIRKWALL	15 982	14 121	2 923	573	-	295	20	935	-	4	10	24
LANDS END (ST JUST)	11 962	5 168	416	226	980	1 123	47	2 404	1 984	2	28	-
LEEDS BRADFORD	61 699	38 150	546	1 232	1 106	8 251	30	6 776	5 827	19	98	210
LERWICK (TINGWALL)	2 085	1 863	318	129	64	16	-	-	12	-	-	1



Implementation

Extrium

Key Implementation Elements

- Acoustic understanding
- Data
- Spatial data management software (GIS)
- Noise Calculator
- IT Infrastructure
- Project management

Extrium

Acoustic Understanding

- Calculation methodologies
  - National method vs. END/Interim method
  - Adaptations/'Back-end corrections'
  - What does "equivalence" mean?
- Implementation in software
  - Non-standardised market
- Parameters and associated data requirements
  - Sensitivity and accuracy
  - Data sourcing options/availability
- Calculation time

Extrium

Data

- What are the input parameters required?
- What data is available?
  - Under what terms?
  - When will it be available?
- To what extent will data need to be edited or pre-processed?
- Are the data definitions understood?
  - Currency
  - Accuracy
  - Metadata
- Projects have used multiple data formats
  - Lidar, satellite imagery, video, GIS files, noise mapping files, grids/surfaces, ortho-rectified stereo imagery, databases, spreadsheets, Adobe, etc.. ..and paper!

Extrium

GIS

- Directive 2002/49/EC is a spatial policy!

- Therefore all data used to support production of noise maps contains a spatial dimension, e.g.
  - Coordinate referencing
  - Geometric networks (road, rail)
  - Areas (agglomerations, reporting entities, census districts)
  - Points (receptor grids, façade locations)
  - 2D, 2.5D, 3D
- GIS software used extensively on projects
  - ESRI ArcGIS
  - spatial analyst, network analyst, 3D analyst

Extrium

Noise Calculator

- Requires noise calculation software
  - Supports the required method and adaptations
  - Is supported by hardware and O/S
  - Scalable (for large area calculations)

- Data model needs to link to GIS environment

- Knowledge of calculation and efficiency settings is critical
  - …and their impact on results

- Also need to consider output formats and onward use of ’maps’

Extrium

IT Infrastructure

- Supports and links components and users
- Remote workers
  - Different teams in different offices
  - International working

- Different server requirements
  - Noise calculator requires high speed processing
  - GIS requires high capacity
  - (depending on solution)

- Mobile data capture teams

Extrium

Noise Mapping System – facts and figures

- Noise mapping production in 2007

- Noise calculator
  - Tested 8 different processors with software (LimA)
  - IBM Blade server comprising 10 x Intel Zeon dual core dual processors
  - 120 GHz capacity system

- GIS System
  - 4 x data servers
  - Total of 18 TB storage
  - ArcGIS suite supporting 14 users

Extrium

Project Management

- Large scale noise mapping requires a robust management process

- To tie together different teams
  - different technical backgrounds
  - different languages (both native and technical)
  - different locations and time zones

- Dedicated project manager employed for all major mapping projects

Extrium

Reporting

Extrium

Reporting to the EC

- One of the main objectives of END is to provide the EC with information on the noise climate across Europe
- Information therefore needs to be ‘reported’ to EC
- The EC set out reporting obligations for Member States to follow.
- There are 10 reporting obligations covering the 1st and 2nd implementations of the END
- Each reporting obligation is seen as a Data Flow (DF1,...,DF10)

Extrium

Directive 2002/49/EC - Data reporting obligations

Summary description of data sets to be reported	legally binding deadline	Updates by MS	END provision
Major roads, major railways, major airports and agglomerations designated by MS and concerned by 1st implementation step	30 June 2005	Possible At any time	Art. 7-1
All competent bodies for strategic noise maps, action plans and data collection	18 July 2005	Possible At any time	Art. 4-2
Noise limit values in force or planned and related explanations	18 July 2005	Possible At any time	Art. 5-4
Strategic noise maps related data as listed in annex VI for major roads, railways, airports and agglomerations concerned by 1st implementation step • Per agglomeration ≥ 250,000 inhab. • Per major civil airport ≥ 50,000 movts/y • For overall major roads ≥ 6 millions veh/y • For overall major railways ≥ 60,000 trains/y	31 December 2007	Mandatory Every 5 years	Art. 10-2 Annex VI
Major roads, major railways, major airports and agglomerations designated by MS and concerned by 2nd implementation step	31 December 2008	Possible At any time	Art. 7-2
Noise control programmes that have been carried out in the past and noise-measures in place • Per agglomeration ≥ 250,000 inhab. • Per major civil airport ≥ 50,000 movts/y • For overall major roads ≥ 6 millions veh/y • For overall major railways ≥ 60,000 trains/y	31 December 2008	No update	Art. 10-2 Annex VI 1.3 & 2.3
Action plans related data as listed in annex VI for major roads, railways, airports and agglomerations concerned by 1st implementation step + Any criteria used in drawing up action plans • Per agglomeration ≥ 250,000 inhab. • Per major airport ≥ 50,000 movts/y • For overall major roads ≥ 6 millions veh/y • For overall major railways ≥ 60,000 trains/y	18 January 2009	Mandatory Every 5 years	Art. 10-2 Annex VI + Art. 8-3
Strategic noise maps related data as listed in annex VI for major roads, railways, airports and agglomerations concerned by 2nd implementation step • Per agglomeration ≥ 100,000 and < 250,000 inhab. • For overall major roads ≥ 3 millions and < 6 millions veh/y • For overall major railways ≥ 30,000 and < 60,000 trains/y	31 December 2012	Mandatory Every 5 years	Art. 10-2 Annex VI
Noise control programmes that have been carried out in the past and noise-measures in place • Per agglomeration ≥ 100,000 and < 250,000 inhab. • For overall major roads ≥ 3 millions and < 6 millions veh/y • For overall major railways ≥ 30,000 and < 60,000 trains/y	18 January 2014	No update	Art. 10-2 Annex VI 1.3 & 2.3
Action plans related data as listed in annex VI for major roads, railways, airports and agglomerations concerned by 2nd implementation step + Any criteria used in drawing up action plans • Per agglomeration ≥ 100,000 and < 250,000 inhab. • For overall major roads ≥ 3 millions and < 6 millions veh/y • For overall major railways ≥ 30,000 and < 60,000 trains/y	18 January 2014	Mandatory Every 5 years	Art. 10-2 Annex VI + Art. 8-3

Extrium

Data Flows

DF1	Major roads, major railways, major airports and agglomerations designated by MS for 1st round mapping
DF2	**Competent bodies** for strategic noise maps, action plans and data collection
DF3	Noise **limit values** in force or planned and related information
DF4	Strategic **noise maps-related** data as listed in Annex VI of END for major roads, railways, airports and agglomerations for 1st round mapping
DF5	Major roads, major railways, major airports and agglomerations designated by MS and for 2nd round mapping
DF6	**Noise control programmes** that have been carried out in the past and noise measures in place.
DF7	**Action plans-**related data as listed in Annex VI of END for major roads, railways, airports and agglomerations mapped in 1st round together with any criteria used in drawing up action plans
DF8	Strategic **noise maps**-related data as listed in Annex VI for major roads, railways, airports and agglomerations concerned by 2nd implementation step
DF9	**Noise control programmes** that have been carried out in the past and noise measures in place
DF10	**Action plans**-related data as listed in Annex VI for major roads, railways, airports and agglomerations concerned by 2nd implementation step + Any criteria used in drawing up action plans

Extrium

Reporting Mechanism

- In 2005 the EC attempted to produce a reporting mechanism for Member States to follow

- Many issues identified
  - Presumptions about the means of defining sources
  - Generally ignored conventional spatial aspects of the data
  - Didn’t support the development of a scalable database
  - Generally inefficient

- Further contract awarded to BV and Extrium in 2006
  - To produce a revised Electronic Noise Data Reporting Mechanism (ENDRM)

Scoping the ENDRM

- ENDRM must reflect legal obligations of END
- Should be efficient and minimise burden to MS
- Would need to recognise that not all data is optimised in tables (recognise spatial dimension)
- Had to allow sub-state reporting (e.g. devolution in UK)
  - This required a new data flow (DF0)
- ENDRM would take the form of a relational database (allowing for conversion to a geodatabase)
  - This would allow normalisation
- Data model and data dictionary would be required
- Had to meet a range of other ‘internal’ business needs
- 3 months!!

Extrium

Challenges

- The requirements of END are complex to understand
  - Gained EC confirmation of understanding
- Approaches to END implementation are not consistent across EC
  - Had to appreciate options and maintain flexibility
  - E.g. How to define an agglomeration
- Had to draft for a predominantly non-data literate audience who are not used to terms such as metadata, xml, ETRS89, data dictionary, etc..

Extrium

Solution

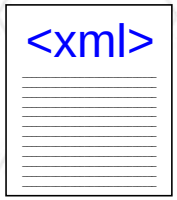
- Needed to highlight the benefits to MSs (EC Steering Committee)
  - Endorsed by EC
  - Efficient to use
  - Can be passed onto technical staff for them to follow

- Started with simple diagrams showing how the Data Flows are related
- Moved to increasingly complex models and finished with data dictionary
- Provided simple Excel based templates

Extrium

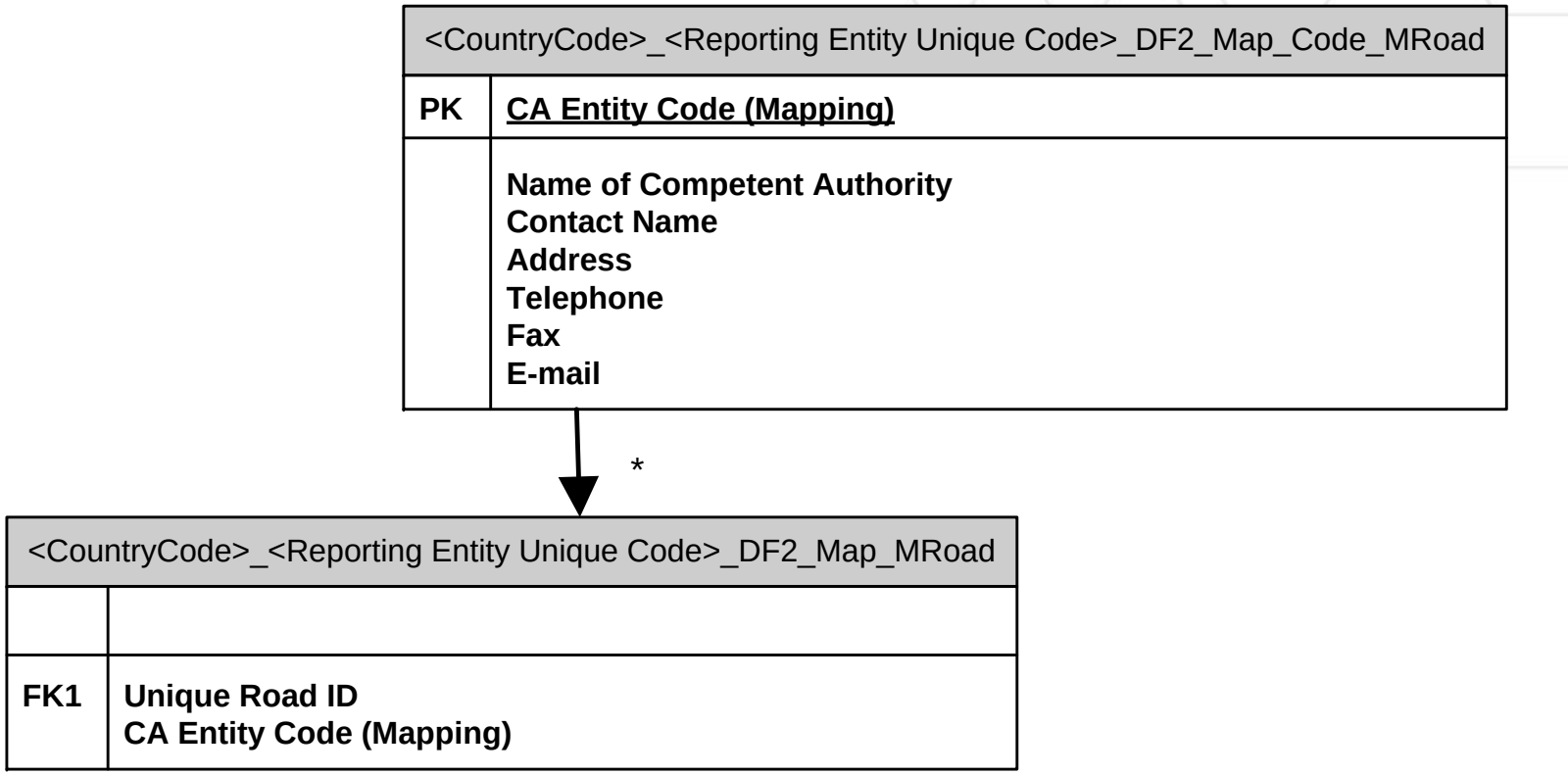
Solution (Major Roads DF1)

<CountryCode>_<Reporting Entity Unique Code>_DF1_MRoad	
PK	**Unique Road ID**
FK1	**Reporting Entity Unique Code** **EU Road ID** **National Road ID** **National Road Name** **Annual Traffic Flow** **Road Start Node (x1)** **Road Start Node (y1)** **Road End Node (x2)** **Road End Node (y2)** **Length**

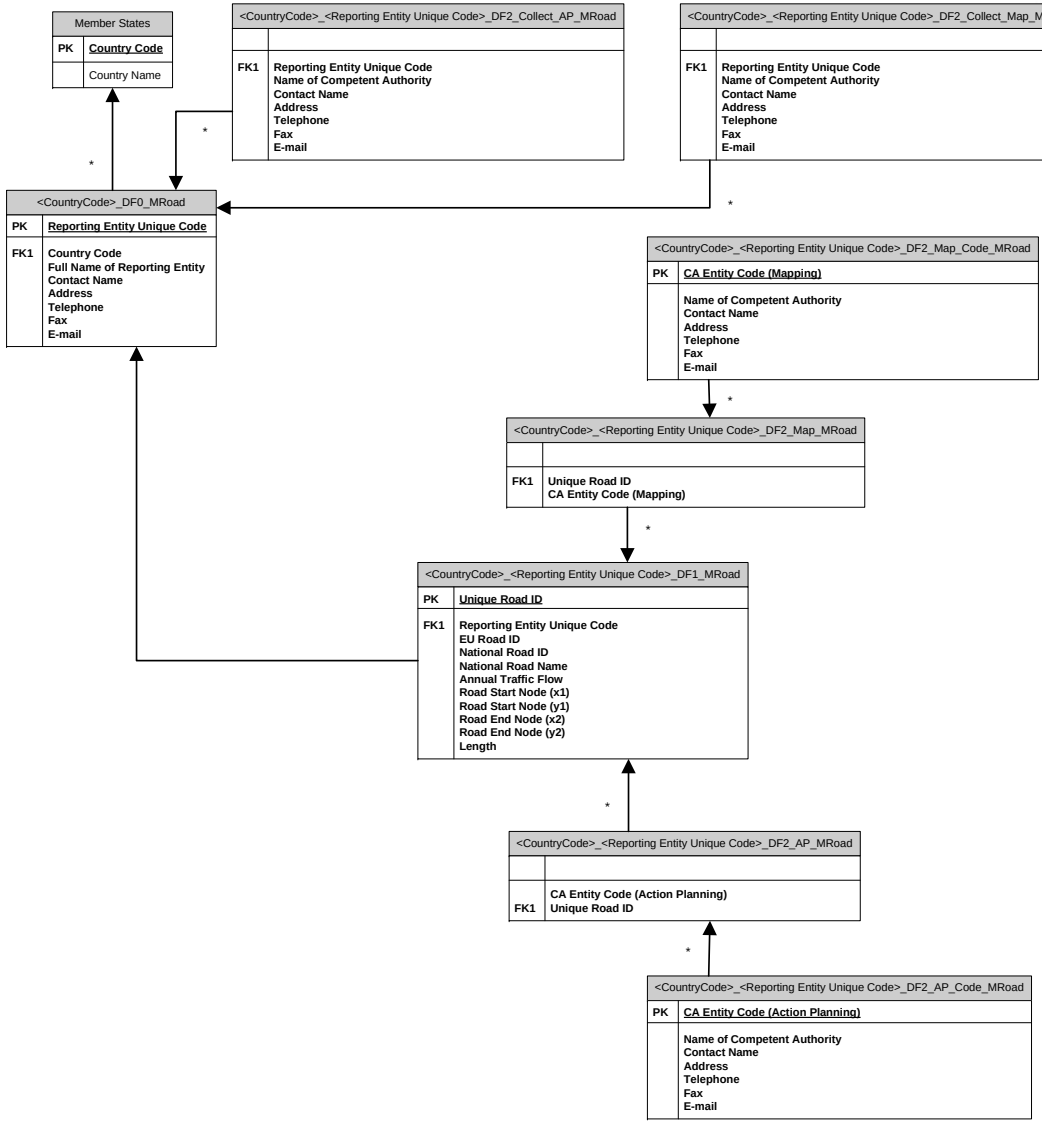


Extrium

Solution (Competent Authority DF2 – Mapping)

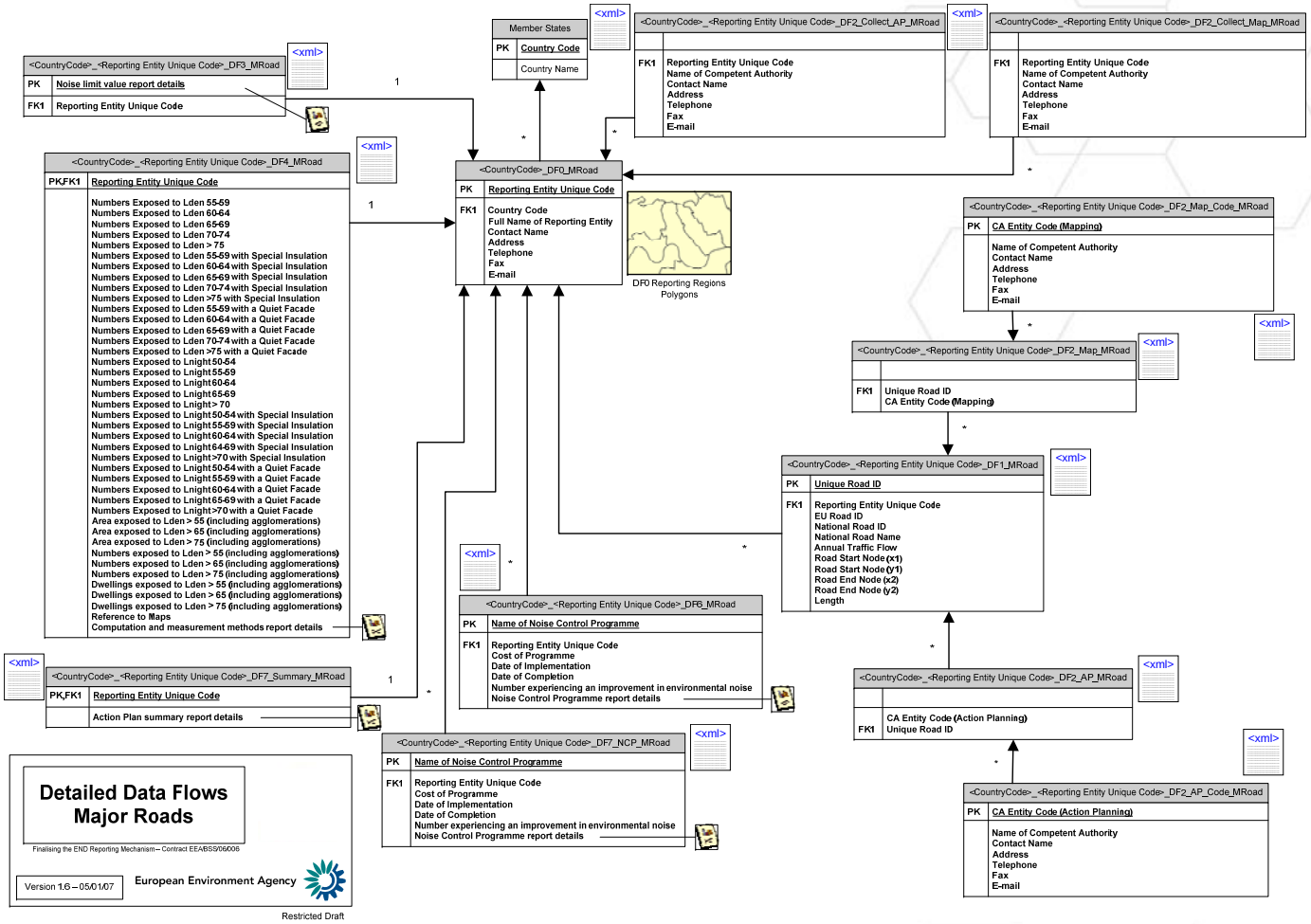


Solution (Major Roads DF0, DF1 and DF2)



Extrium

Solution (Major Roads DF1 – DF10)

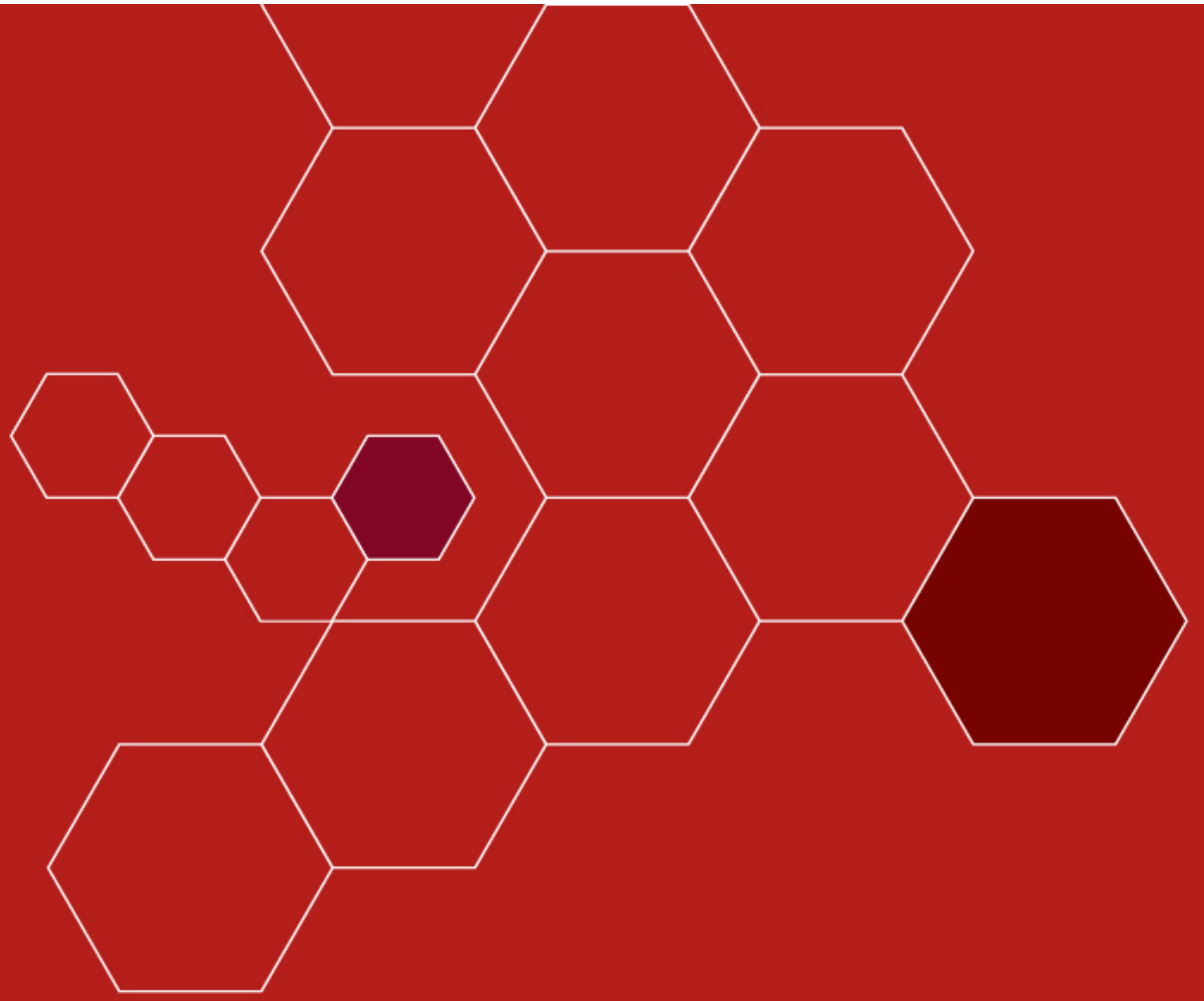


Extrium

ENDRM Success

- Commended by the EC
- Accepted as non-mandatory guidance by EC Steering Committee
- Training provided to Member States in 2007
- To date 85% of Member State data flows follow the ENDRM approach
- The ENDRM has enabled the EC to generate a European Noise Database

Extrium



Future Developments

Extrium

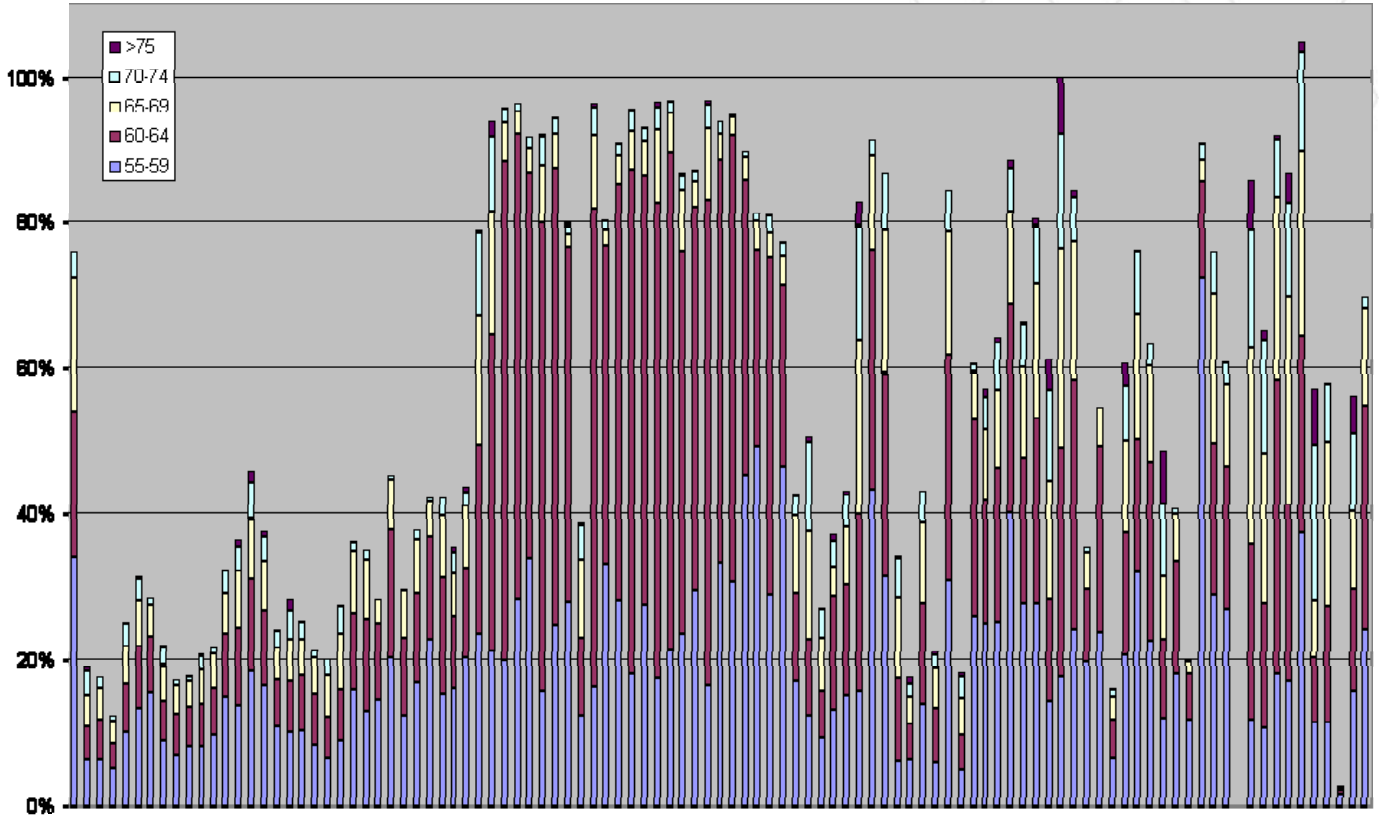
Round 1 Lessons Learnt

- Much scope for local definitions and interpretation
- Between MSs there have been significant differences:
  - Defining agglomerations
  - Which roads to include within an agglomeration
  - Noise calculation methodology
  - Input data availability (Good Practice Guide)
  - Different population assessment techniques

- Are results truly comparable?

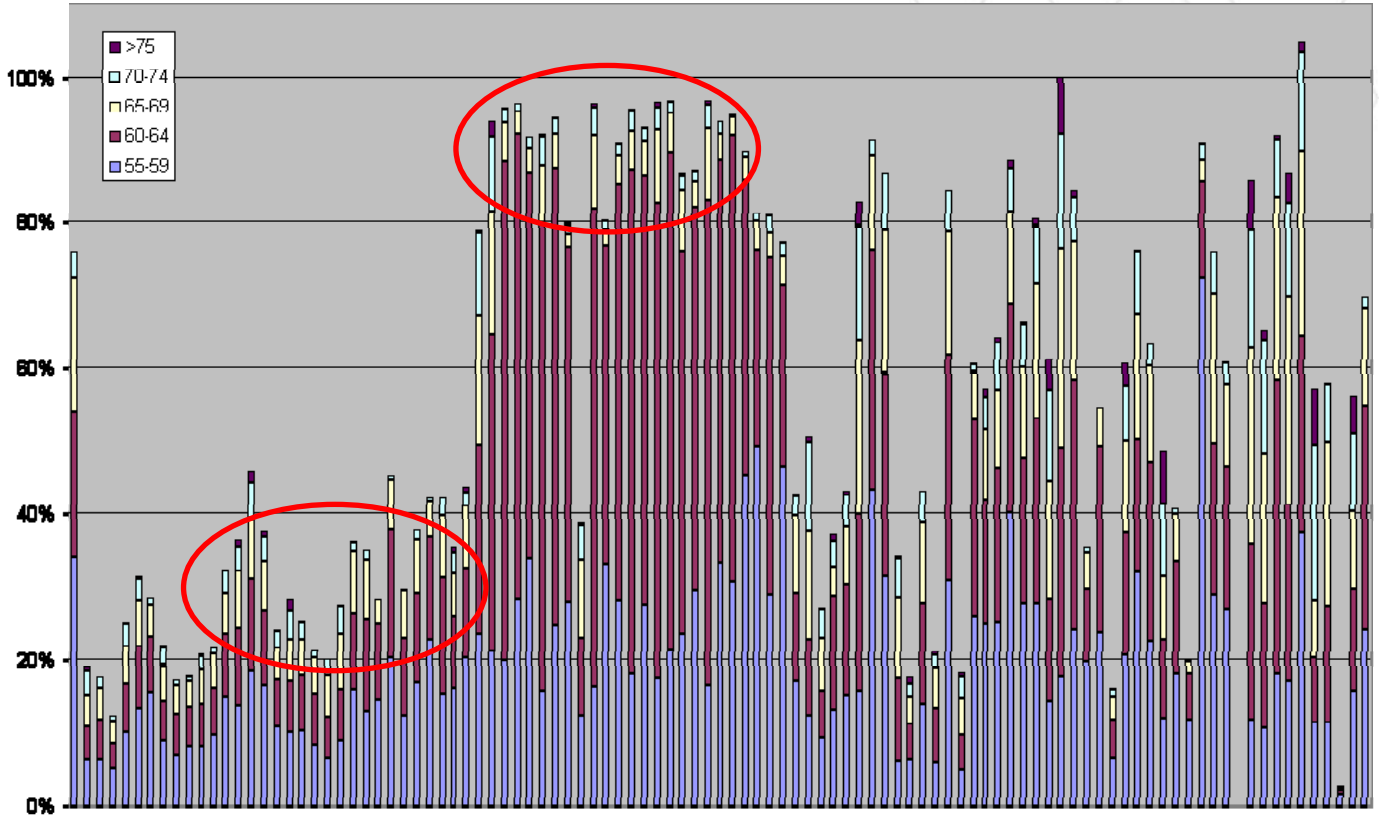
Extrium

Round 1 Lessons Learnt



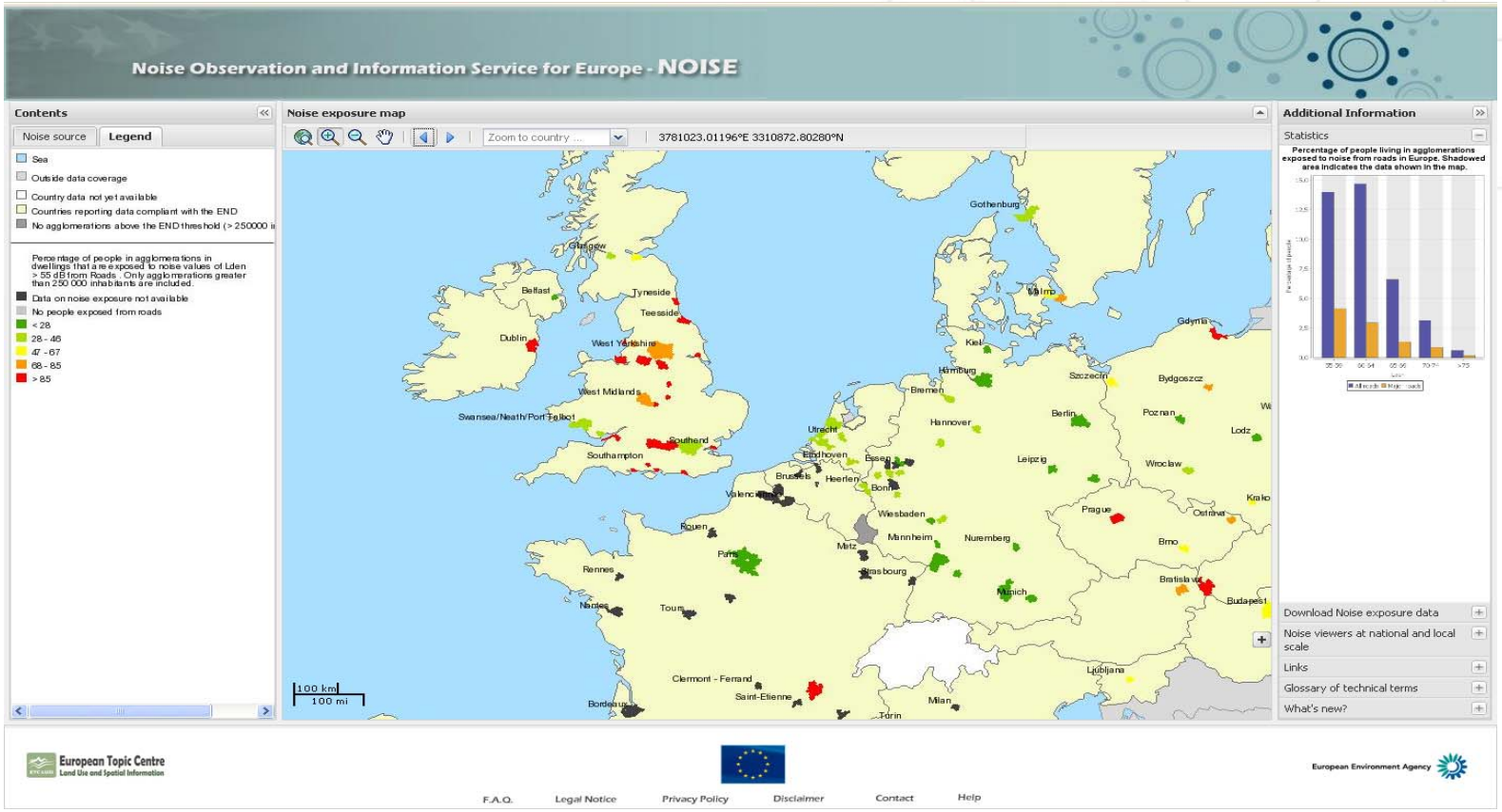
Extrium

Round 1 Lessons Learnt



Extrium

Round 1 Lessons Learnt



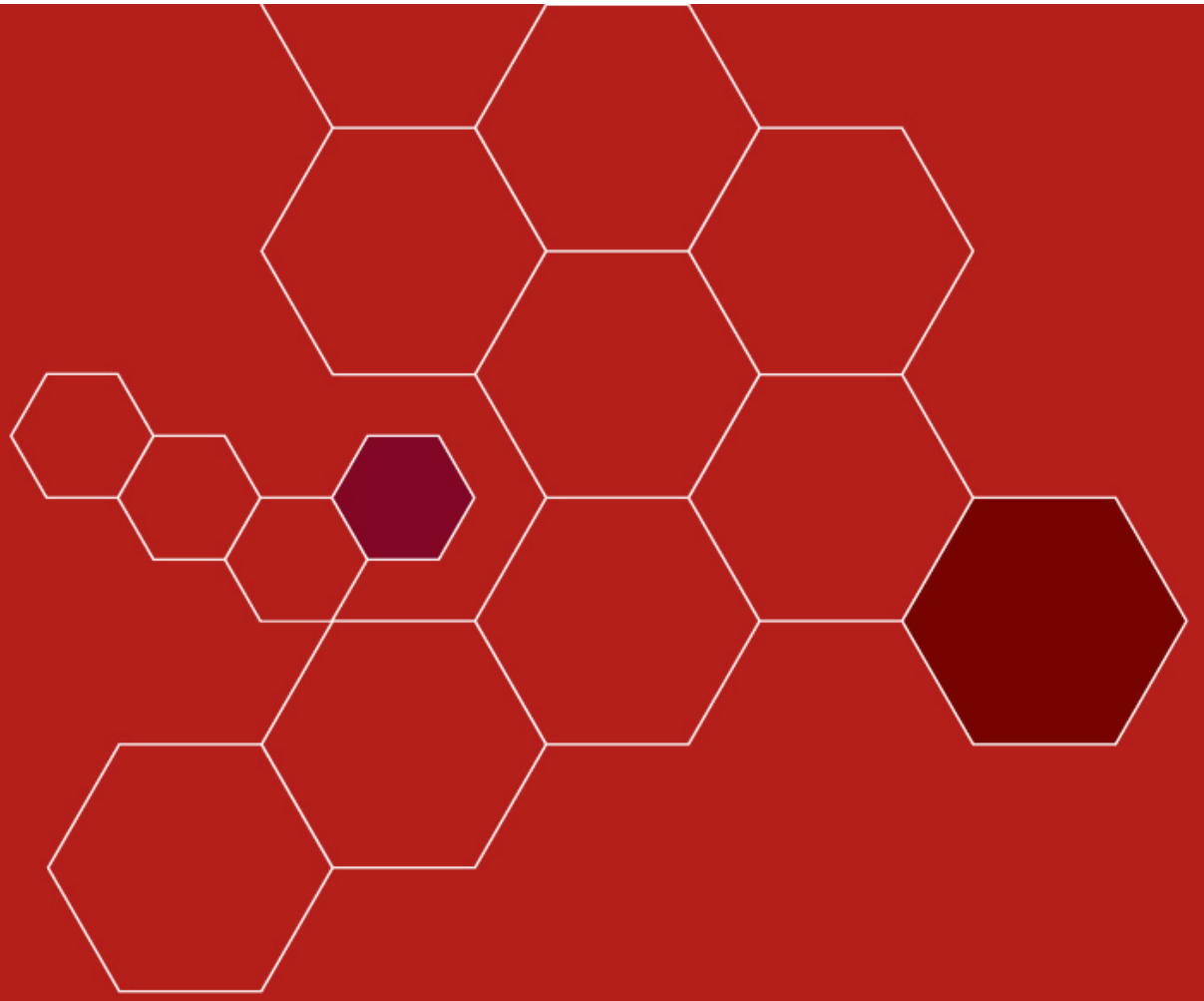
Extrium

Common NOise aSSessment methOdS in EU (CNOSSOS-EU)

1. Co-ordination Group
2. Road Noise Source
3. Railway Noise Source
4. Industrial Noise Source
5. Noise Propagation
6. Aircraft Noise Source
7. Guidelines for use of CNOSSOS-EU
8. Population Exposure
9. END Reporting Mechanism Update

Extrium

Summary



Extrium

Presentation Summary

- Introduction and Background
- Quick Guide to the Environmental Noise Directive
- Definitions
- Implementation
- EC Reporting
- END Future Developments

Extrium

Thank you

www.extrium.co.uk

01892 704040

Extrium