TfL's Strategic Transport Models
LoHAM Model and HAMoC tool

27th Nov 2015   Huy Nguyen / Martin Hayden
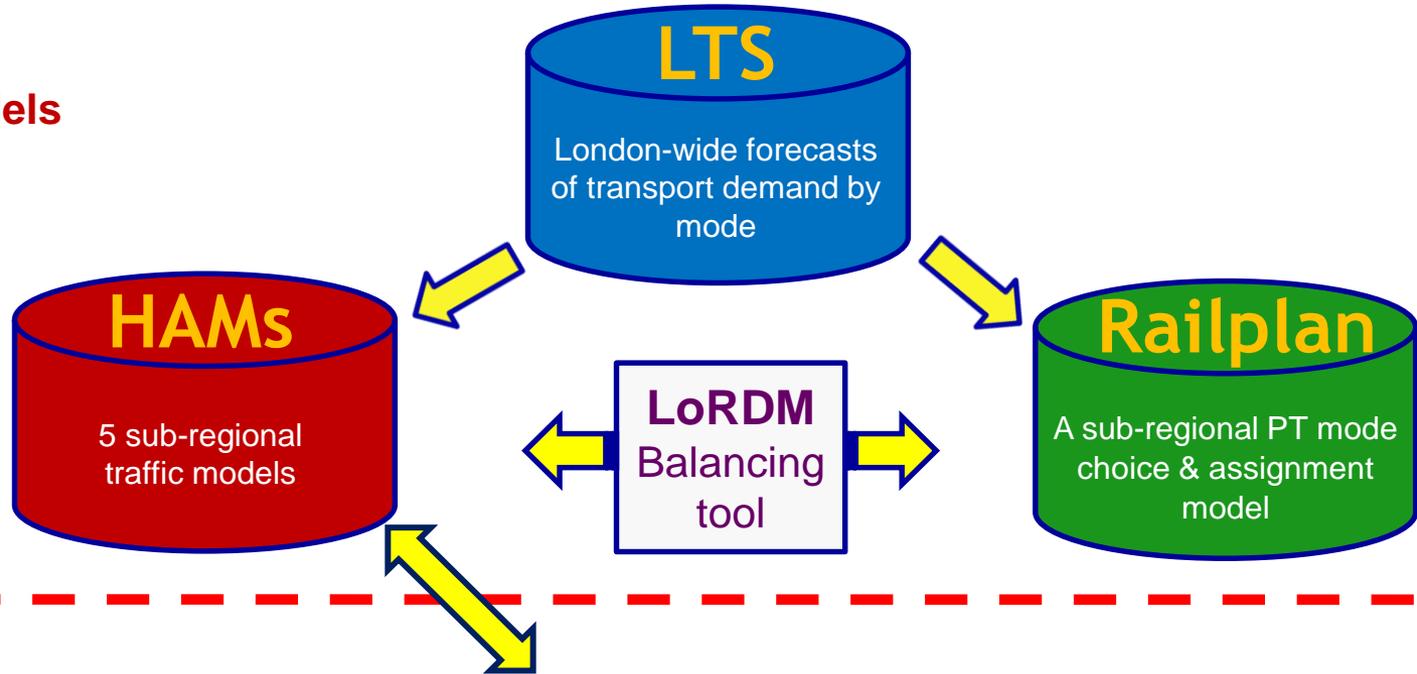
TRANSPORT FOR LONDON
EVERY JOURNEY MATTERS

Structure of the Presentation

- **Introduction**

- **LoHAM (London Highway Assignment Model)**
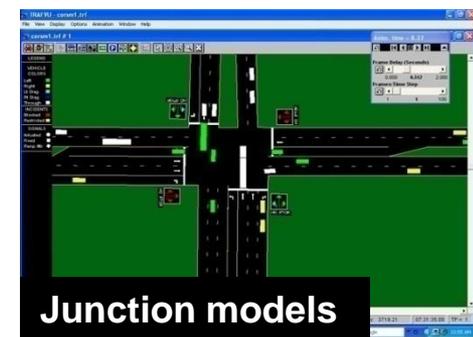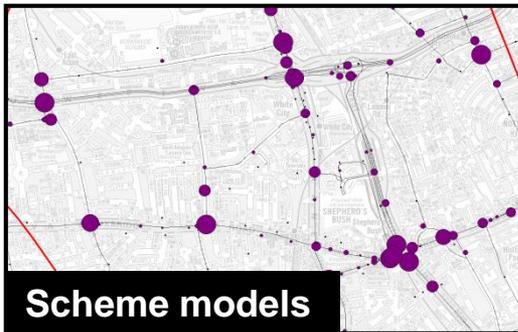
- **HAMoC (HAM Model Creator)**

- **HAM Vision**

How the models work together?

Strategic models

LTS
London-wide forecasts of transport demand by mode

HAMs
5 sub-regional traffic models

LoRDM
Balancing tool

Railplan
A sub-regional PT mode choice & assignment model

Local models

Scheme models

Microsim models

Junction models

Who has delivered the work?

Denvil Coombe Practice

HAM Development Programme - What have we done?

- Programme started in 2008
  - Major count programs
  - Continuous Road Side Interview Programme (CRISP)

- Completed Central & North - 2009

- Completed West, South & East - 2010

- Production 1 - In-house recalibration of West, South & East – completed 2011

- Production 2 - All 5 HAMs - released in 2013/14

- Major count programs in 2012

- Production version 3 – released in Nov 2015/16
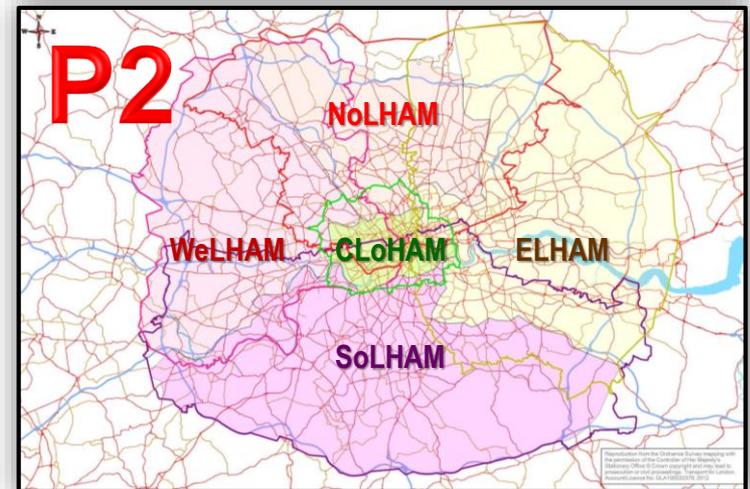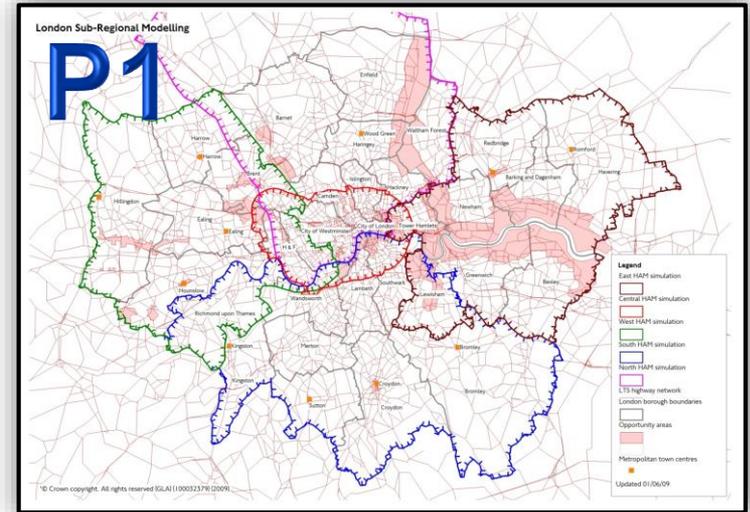
- **Over 200 studies**
- **Major schemes:**
  - River Crossings
  - HS2
  - Northern Line Extension
  - Thames Tideway Tunnel
  - Cycle Superhighways
  - Road Task Force
  - Congestion charging
  - West End Partnership
  - M25
  - Tottenham Court Road 2-way
  - Baker Street
  - Tramlink extension
  - A23/A232 corridor
  - Olympic Route Network
  - Barking Riverside Extension

- **25 TfL corridor VISSIM models**

- **Major developments:**
  - North Greenwich OAPF
  - Earls Court OAPF
  - White City OAPF
  - Harrow AAP
  - Upper Lee Valley OAPF
  - Euston AAP
  - Old Oak Common OAPF
  - Southall OAPF
  - Hounslow OAPF
  - Croydon OAPF
  - Wembley OAPF
  - Brent Cross Cricklewood
  - Victoria Vision
  - VNEB
  - Kingston Town Centre
  - Bexley Town Centre
  - Tottenham AAP
  - Olympic Legacy
  - Isle of Dogs

HAM Production 3 Development (1)

1. Adoption of a 2012 Base Year (Nov 12)

2. Recalibrate at LoHAM level

3. Recalibrated Prior Matrices
   - Revised P3 Zoning
   - Use of 2011 census based Trip Ends

4. Cycle flows as a Pre-load
   - Enhanced cycle network
   - Cycle Super Highways
   - Estimation of Cycle Flows

5. Updated Count Database
   - 2012 Count Sets
   - Revised Vehicles Splits by area

6. Redefined screenlines and mini-screenlines

HAM Production 3 Development (2)

7. **Further network detailing**
   - Additional local roads, pelican crossings
   - Improved matching to ITN network

8. **SCOOT based 2012 Traffic Signal Timings**
   - CLoHAM area in P2
   - Rest of London in P3

9. **Network enhancement**
   - Updates to reflect schemes to 2012 (43 schemes between 2009 and 2012)
   - Redefine external fixed cost speeds from (TrafficMaster) observed
   - Define Speed-flow buffer network for a collar outside the M25
   - Additional HGV/ LGV bans

10. **Revised Generalised Costs/ Simplification of Knobs**
    - Use of latest WebTAG Value of Time and GDP growth tables
    - Replacement for (local road perception/ knowledge) costs
    - Removal of external link Knobs
    - Speed-flow curves for Traffic Calming

LoHAM Network Coverage
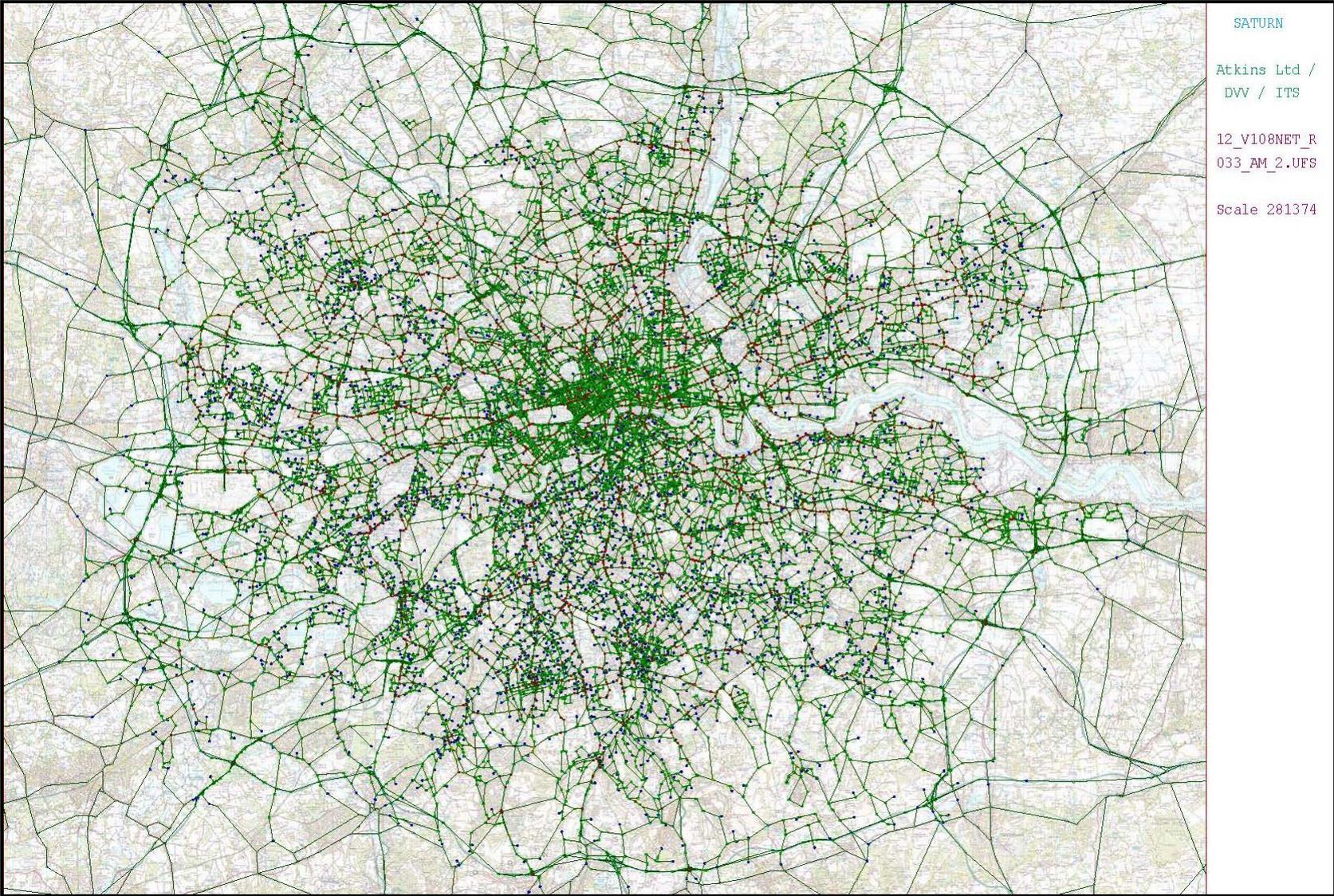
P3 Base Year 2012 Network Statistics

Category	Number
Priority Junctions	15,626
Roundabouts	1,503
Traffic Signals	5,083
External Nodes	3,362
Simulation Nodes	**25,575**
Buffer Nodes	4,748
Zones	**5,194**
Links	101,161

User Class
Car IWT
Car OWT
Taxi
LGV
HGV

Calibration / Validation	Number
Screenlines	290
Mini screenlines	2,385
Enclosures	94
Counts	5,318
Journey time Routes	352

By far the largest SATURN models in the world

Calibration / Validation Statistics

Production 3 November 2015	Screenline Flow Diff < 5%	Enclosure Flow Diff < 5%	Journey Time Time Diff < 15%
Number	290	94	352
AM Peak	89%	94%	87%
Inter peak	93%	95%	97%
PM Peak	89%	90%	88%

All values passed WebTAG recommended >85%

Screenlines & Enclosures

Journey Time Routes
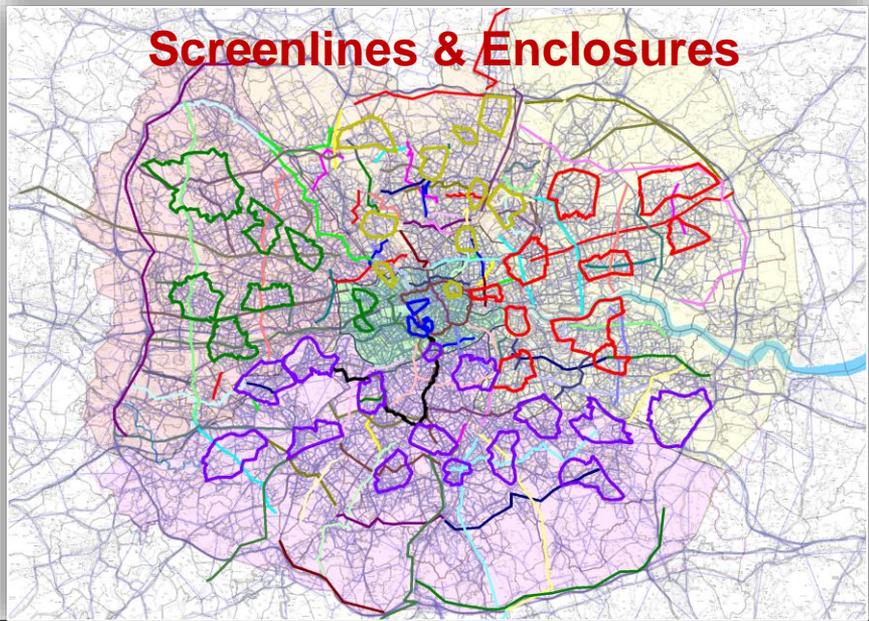
Run time / Hardware / Software

1. LoHAM is the top level P3 model with the model dimensions already stated above.

2. **SATURN 11.3.12F + Update 1** is the software currently used for P3 Development

3. The following are the convergence parameters used in the LoHAM model assignment :

Convergence	Value
NITA	20
NITA_C	256
PCNEAR	2
RSTOP	98
STPGAP	0.02
UNCRTS	0.015
MASL	100
KONSTP	1

3. All of the convergence criteria are very strict for LoHAM. Currently consideration is being given to changing *KONSTP* from 1 to 5 once we are satisfied that the model can converge in a reasonable length of time.

4. The latest developments in computing power have allowed TfL to develop the LoHAM simulation model for Greater London despite its large size.

5. We have two computer systems on which to run assignments and matrix estimation which are detailed below.

|	Computer Specifications	
	HP Z400	**Dedicated Blade VM Server**
OS	Windows 7 SP1	Windows Server 2012 R2
Memory	12GB	32GB
Cores	4	12
Processor	Intel Xeon W3550 3.07GHZ	Intel Xeon E5-2643 V2 3.5 GHZ

6. The assignment and matrix estimation runtime on the different computer systems is very large and highlights the need for future model development to have dedicated servers to run large models efficiently.

Run time / Hardware / Software

7. The table and graph below summarises the run times on both the desktop computer and blade VM server.

Times denoted in Minutes	Iteration 1 Assignment	Iteration 1 Pija Car	Iteration 1 SATME 2 Car	Iteration 1 Pija and SATME2 Remaining Vehicle classes	Iteration 1 Total	Iteration 1 Total HH:MM
4 Core ONELONDON (12GB RAM)	342	530	50	732	1654	27:34
VM 12 SATURN SERVER (32GB RAM)	108	164	28	234	534	8:54
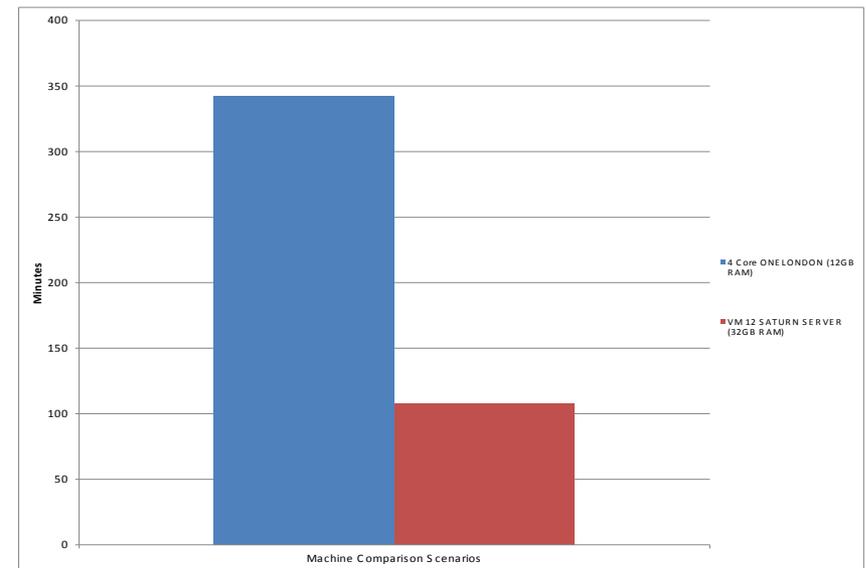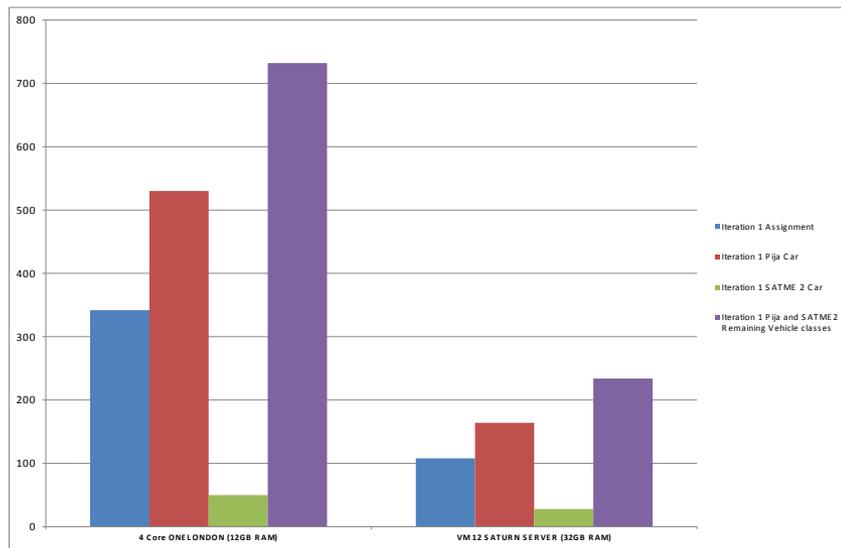
HAMoC tool – Highway Assignment Model Creator

- **Why HAMoC**?
  - LoHAM network database for P2
  - Recalibrate at LoHAM level in P3
  - Create the standard 5 sub-regional HAMs from LoHAM
  - Customised model where none of the 5 HAMs is suitable

- **What's its purpose?**
  - A flexible tool to generate customised HAM seamlessly
  - Overcome AUTOX issue
  - Generate a complete pack for customised HAM including:
    - Network
    - Matrix
    - Matrix estimation files
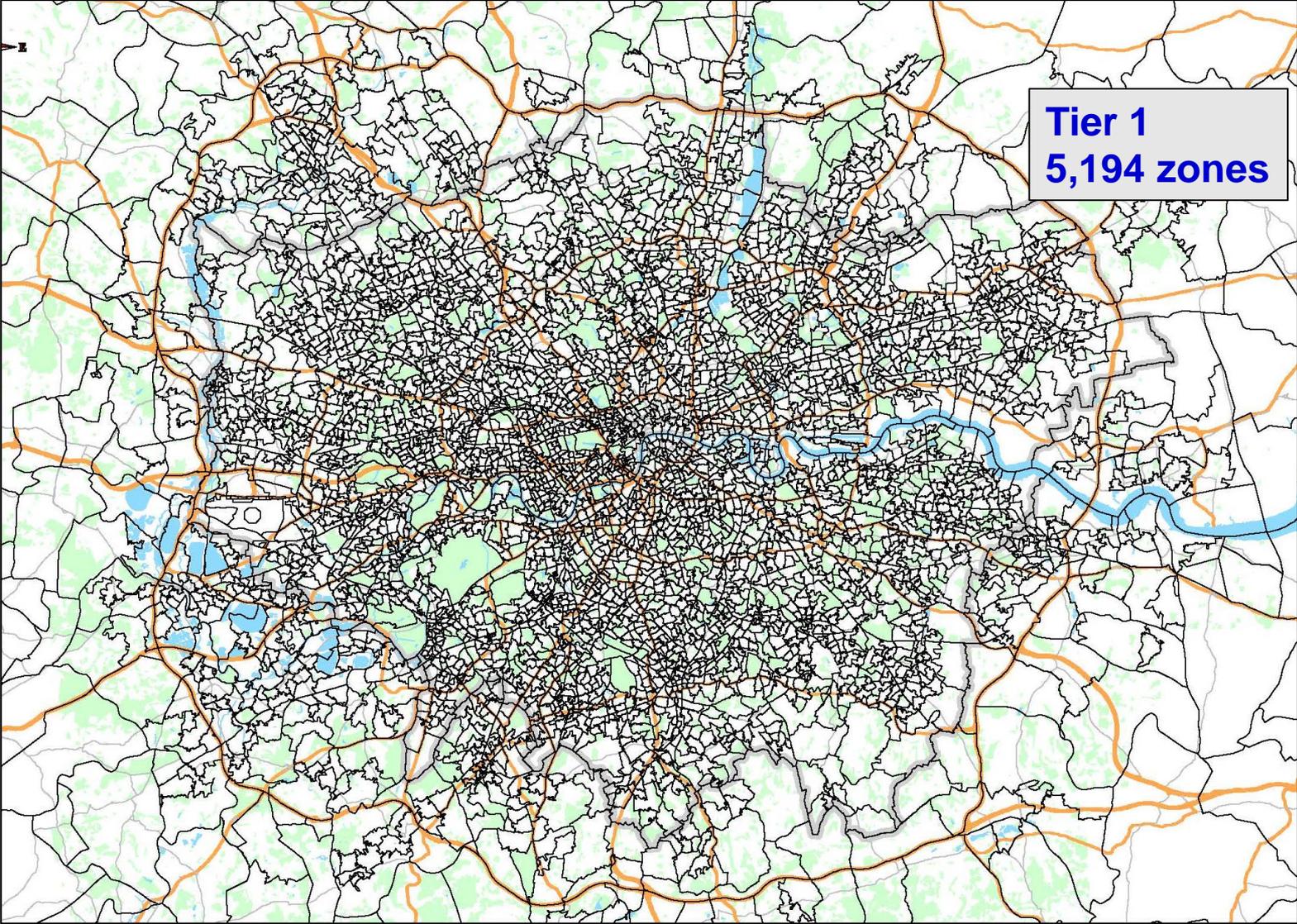   - Analysis tools (Dashboard, JTAT, Borough Stats)
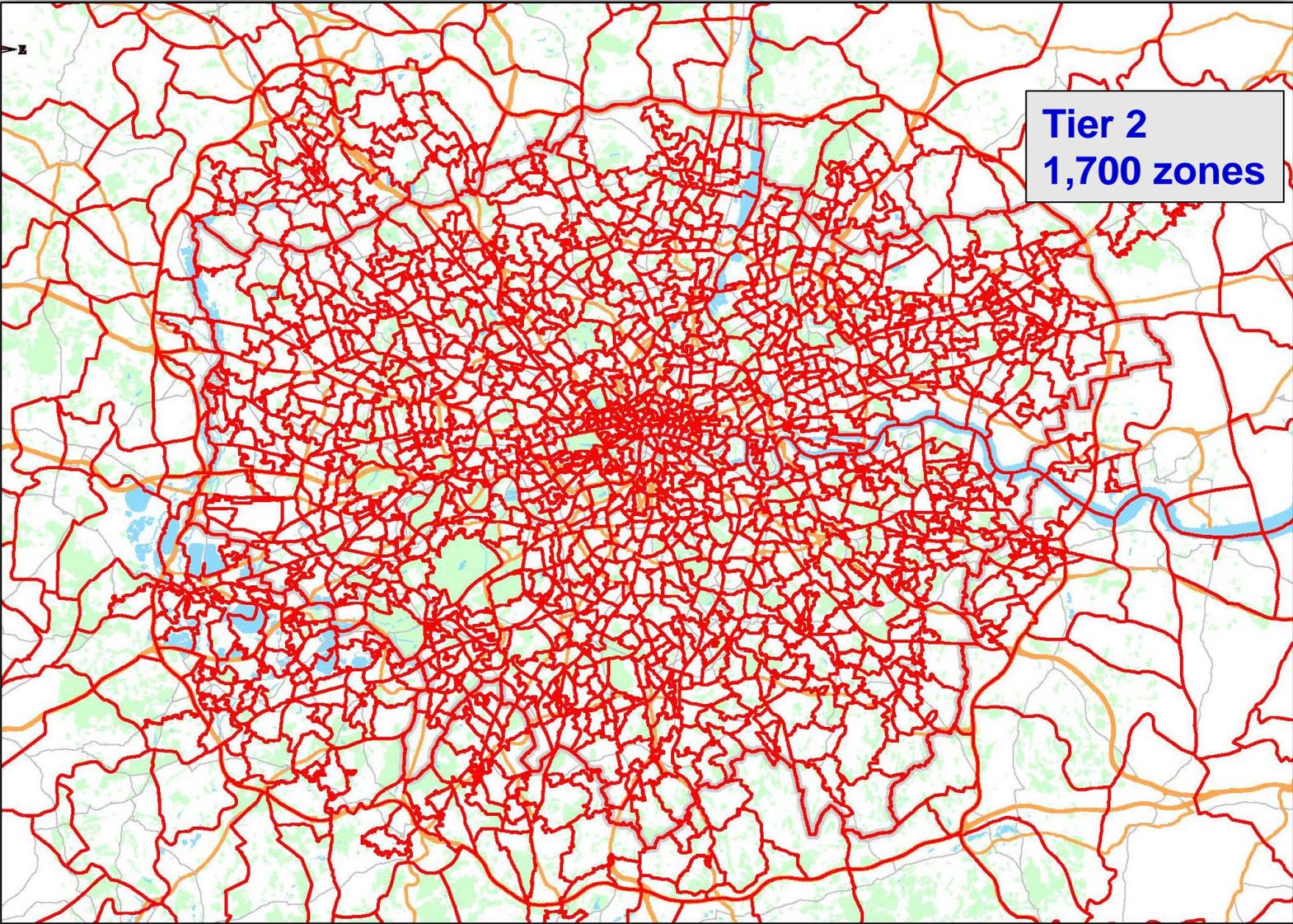
HAMoC – How does its work? (1)

1. 3 tiers network (simulation, buffer, fixed speed) with identical network structure apart from centroid connectors

2. 3 tiers zonal systems (5194, 1700, 602)

3. Create customised models from LoHAM based on users' defined boundaries

LoHAM – Tier 1 Zones

**Tier 1
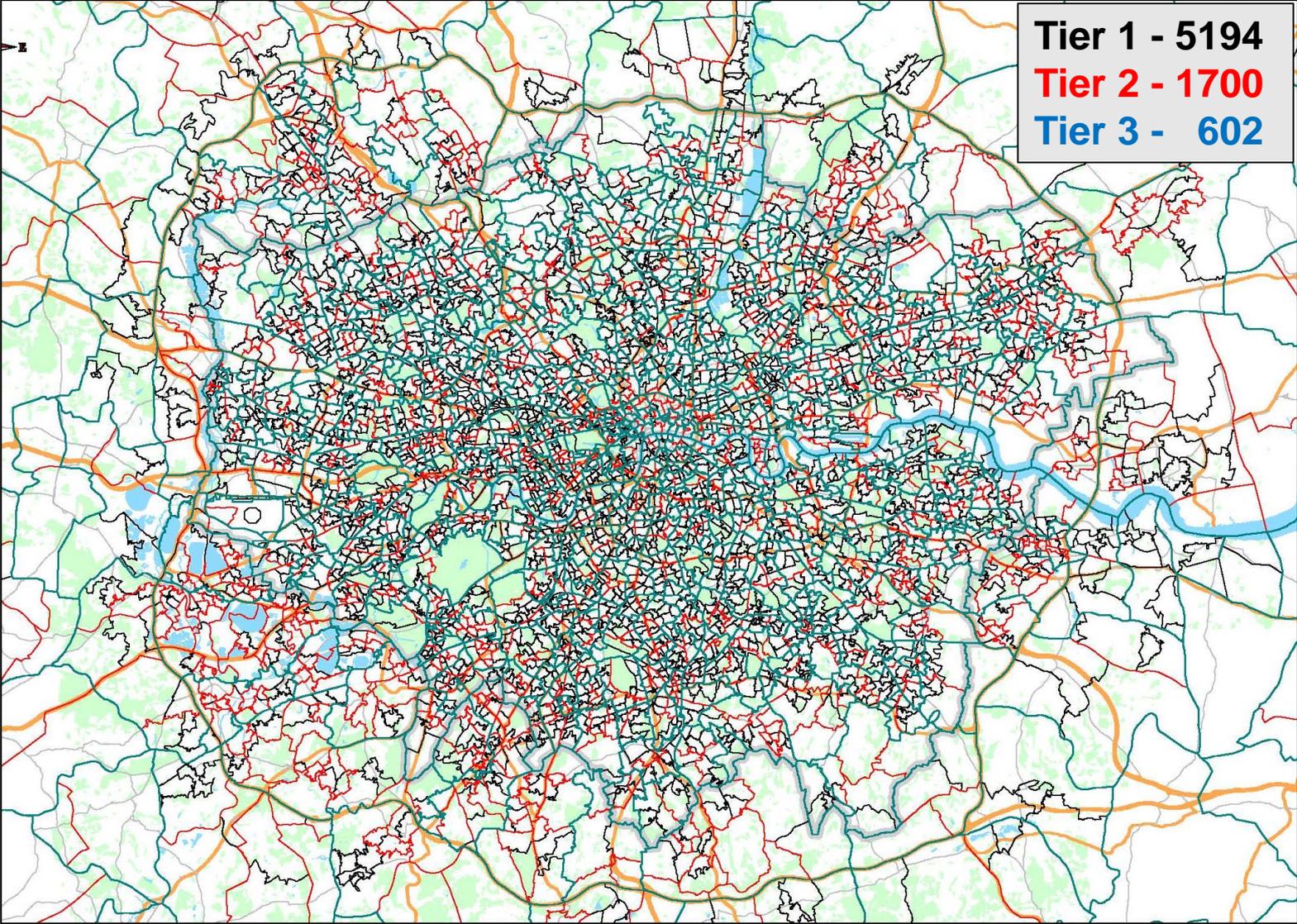5,194 zones**

LoHAM – Tier 2 Zones

Tier 2
1,700 zones

LoHAM – Tier 3 Zones

**Tier 3
602 zones**

LoHAM – 3 Tier Zonal System

Tier 1 - 5194
Tier 2 - 1700
Tier 3 - 602

LoHAM – Simulation Network
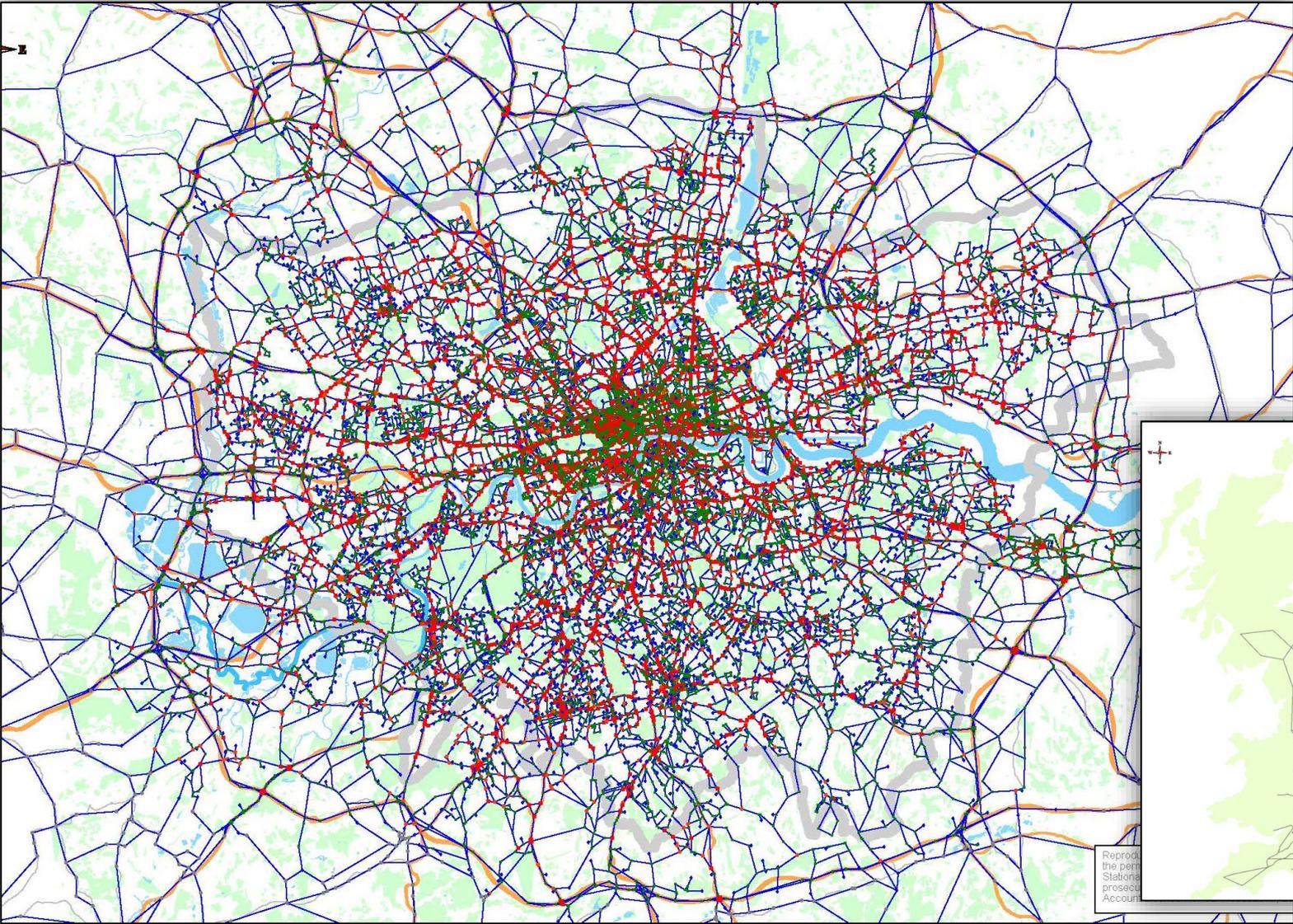
Example: Kingston Model – Area boundaries

Buffer with fixed speed

Buffer with SFC

Simulation
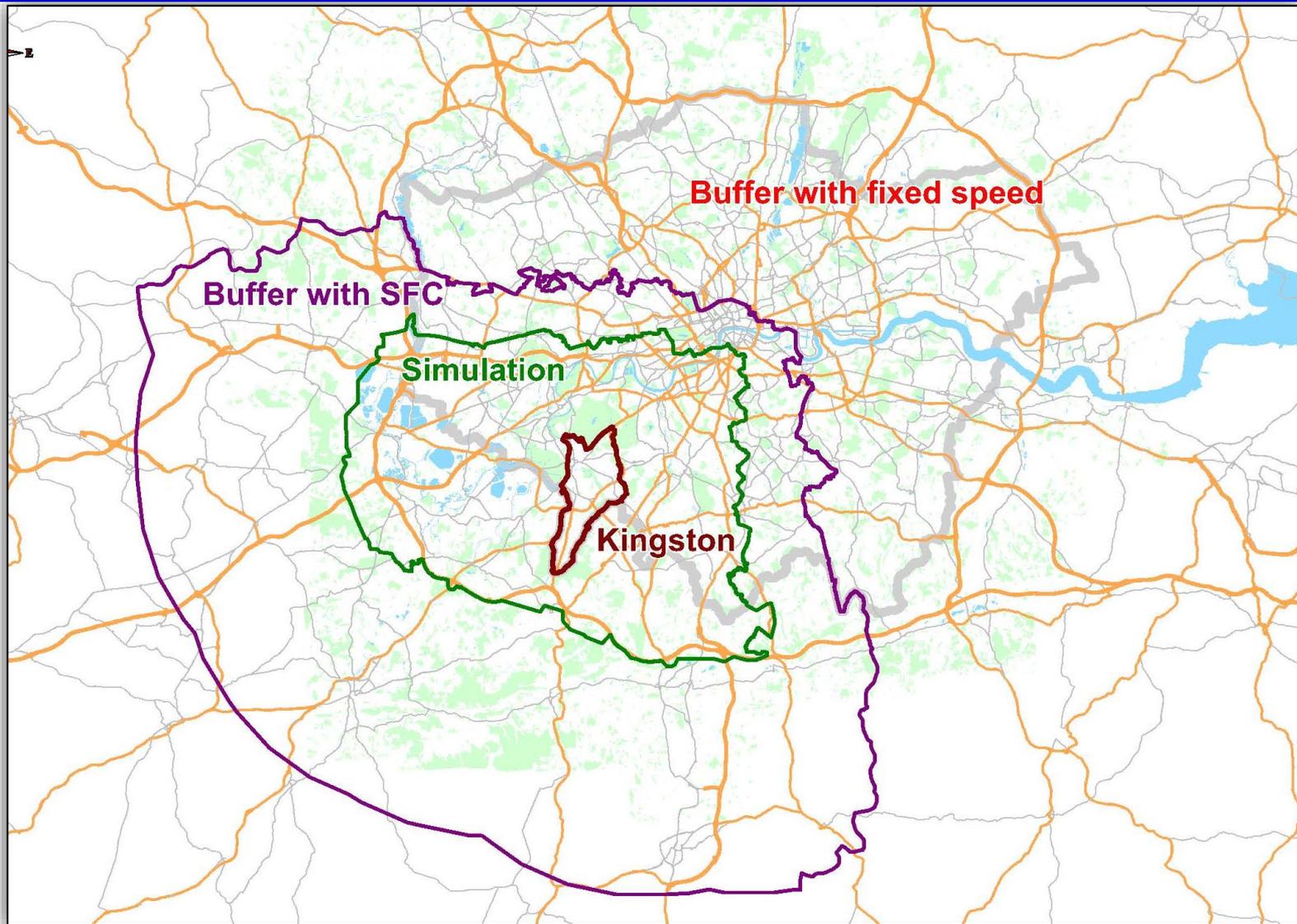
Kingston

Example: Kingston Model – Zonal System
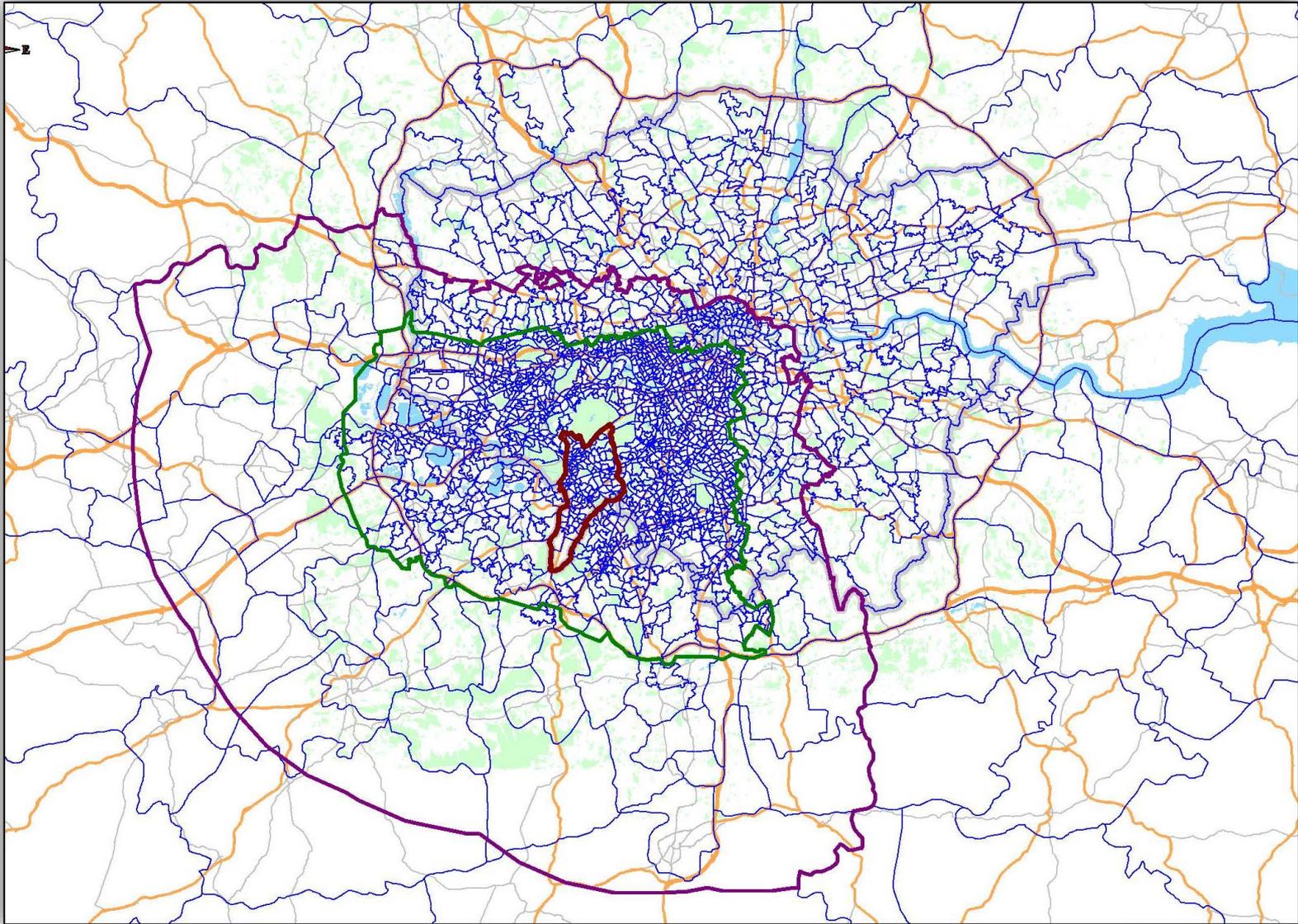
Example: Kingston Model – Network
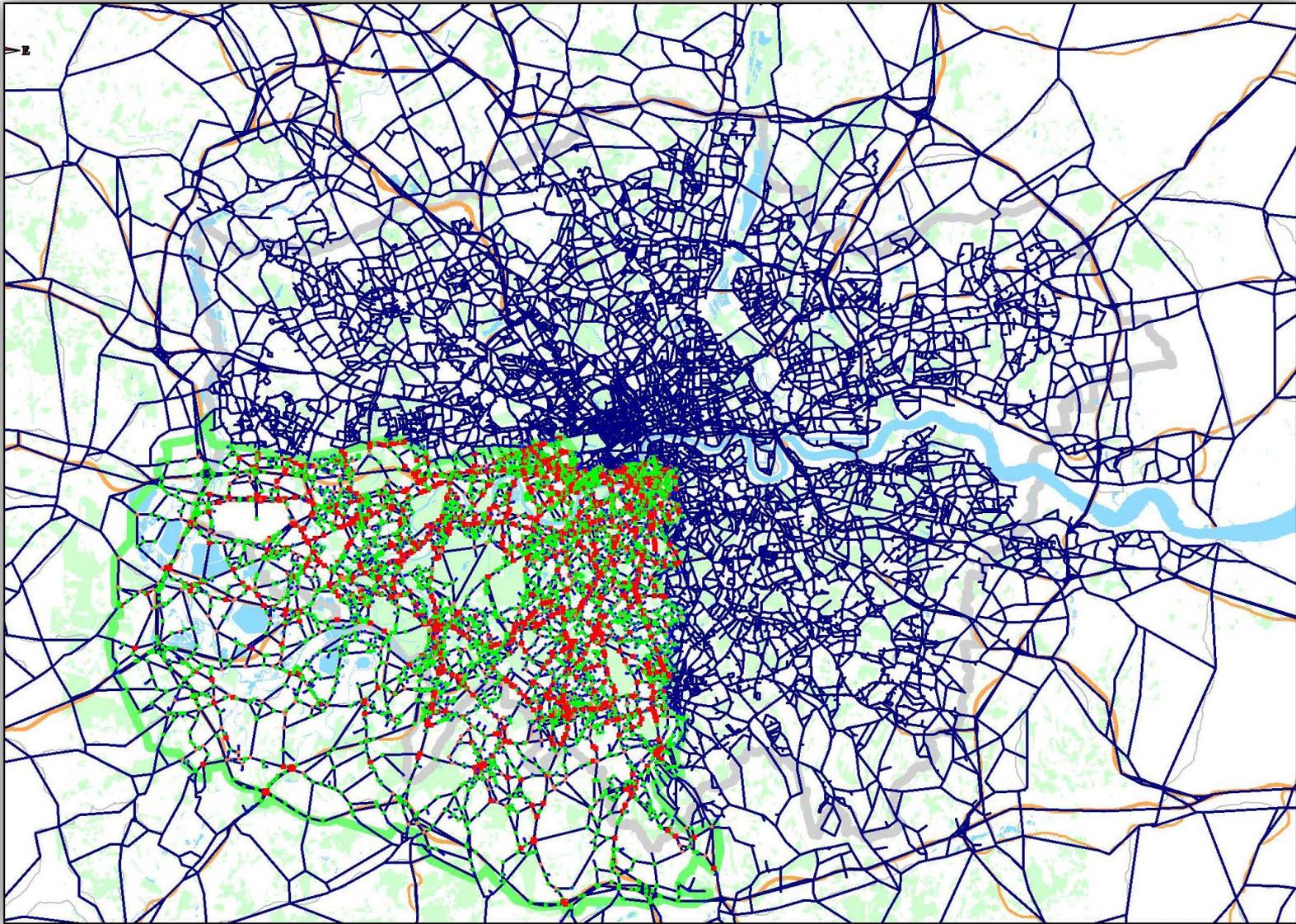
HAMoC – How does it work? (2)

1. Donor model
   - Fully assigned LoHAM
   - Three tier zonal system
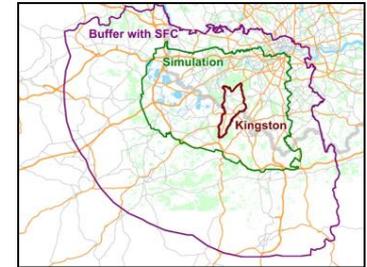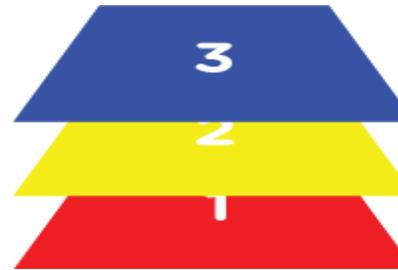
2. Define the simulation and SFC buffer boundaries in MapInfo

3. Run HAMoC which include the following steps:
   - Create lists of nodes, links and zones for Simulation / SFC / Fixed speed areas using defined boundaries
   - Create a list of links intersecting the simulation boundary
   - Create buffer network using SATBUF
   - Generate External node coding
   - Create CCs for SFC and Fixed speed buffers
   - Construct customised SATURN network
   - Create matrix using MXM5

HAMoC – How does it work? (2)

4. Run SATNET

5. Adjust network simulation boundary to resolve SATNET errors (multiple simulation nodes to one external node)

6. Create files for Matrix Estimation using HAMPIG

    ▪ SATPIJA file

    ▪ SATME file

    ▪ 77777 card

7. Create Analysis spreadsheets

    ▪ Dashboard

    ▪ Journey Time Comparison (JTAT)

    ▪ Borough Statistic (Boro-Stat)

HAMoC Control Panel

Highway Assignment Model Creator (HAMoC)				Control Panel

V1.1 03/09/15

INITIAL SETUP		Click to check ALL Paths & Files		**Run HAMoC**
SATURN Path	Select	C:\ProgramData\App-V\F8319FAE-3381-46B9-91BA-DB94402C47E0\CBFB4554-2DFB-413D-B93D-A97D46976B5D\Root\VFS		
Work Directory	Select	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\		**Transport for London**
Time Peiod		AM		
HAMNET version	Select	HAM_Network_Extract_Tool_v6.1.xlsm		

LoHAM FILES

	Time Period	Select ..	File Name	Full Path
Networks	AM	Select	L3_FY31_V128NET_R053_AM.dat	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	IP	Select		\
	PM	Select		\
Matrices	AM	Select		\
	IP	Select		\
	PM	Select		\
Assignments	AM	Select	L3_FY31_V128NET_R053_AM.UFS	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	IP	Select		\
	PM	Select		\

Process Files - Standard Files Not to be updated

	Area Type		File Name	Full Path
HAMNET Logs	Sim		HAMNET_LOG_Main.DAT	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	VS Buf		HAMNET_LOG_VSB.DAT	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	FS Buf		HAMNET_LOG_FSB.DAT	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\

Output Files

|	Time Period	Select ..	File Name	Full Path
Bespoke Networks	AM	Select	N3_FY31_V128NET_R001_AM-v1.dat	L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	IP	Select		L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	PM	Select		L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
Bespoke Matrices	AM	Select		L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	IP	Select		L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\
	PM	Select		L:\Modelling\02_P3_Dev\04_NoLHAM\06_Model\02_FY31\01_Net\HAMoC\R53\AM\

HAMoC Flow Chart

1) Check Files

Check MapINFO Query outputs are in Working Directory and all file paths in HAMoC are correct

2) Extract Buffer coding

Run SATBUF to generate FS and VS coding. Then build a FS and VS LoHAM network

3) Produce 11111 coding for external nodes

Runs module which converts links which intersect with boundary to 11111 SATURN external node coding

4) Produce HAMNET log files

Runs module which creates HAMNET extraction files from input MapInfo queries and the 11111 SATURN external nodes output file

5) 33333 Buffer CC coding

Runs module which creates 33333 C coding

6) 55555 CC coding

Runs module which creates 55555 C coding

7) Run HAMNET to extract sim, FS and VS coding

Opens HAMNET spreadsheet and runs extraction modules based on outputs from 2) , 4) and the input LoHAM

8) Build network from steps

Puts together outputs from parts 2) 3) 5) 6) 7) and runs satnet

Flow Chart

Analyse SATNET results:
If process has run correctly:
a) there should be no errors in 111
b) approximately 0-30 NAFFS. The
inconsistencies between the sim a
c) check the parameter options. ma
been applied
d) any errors in 66666 card should

Although there should be no errors
errors in these cards is small its adv

TfL Pla

HAMoC – How good is it?

1. Model performance is very similar to the donor model within the simulation area with comparable calibration / validation statistics (screenlines / Journey times)

2. Reasonable in the buffer area and less well in the fixed speed area partially due to less network detail but mainly due to coarser zonings

3. Recommendation – ensure that the simulation area is large enough to capture the affects of the scheme to be tested
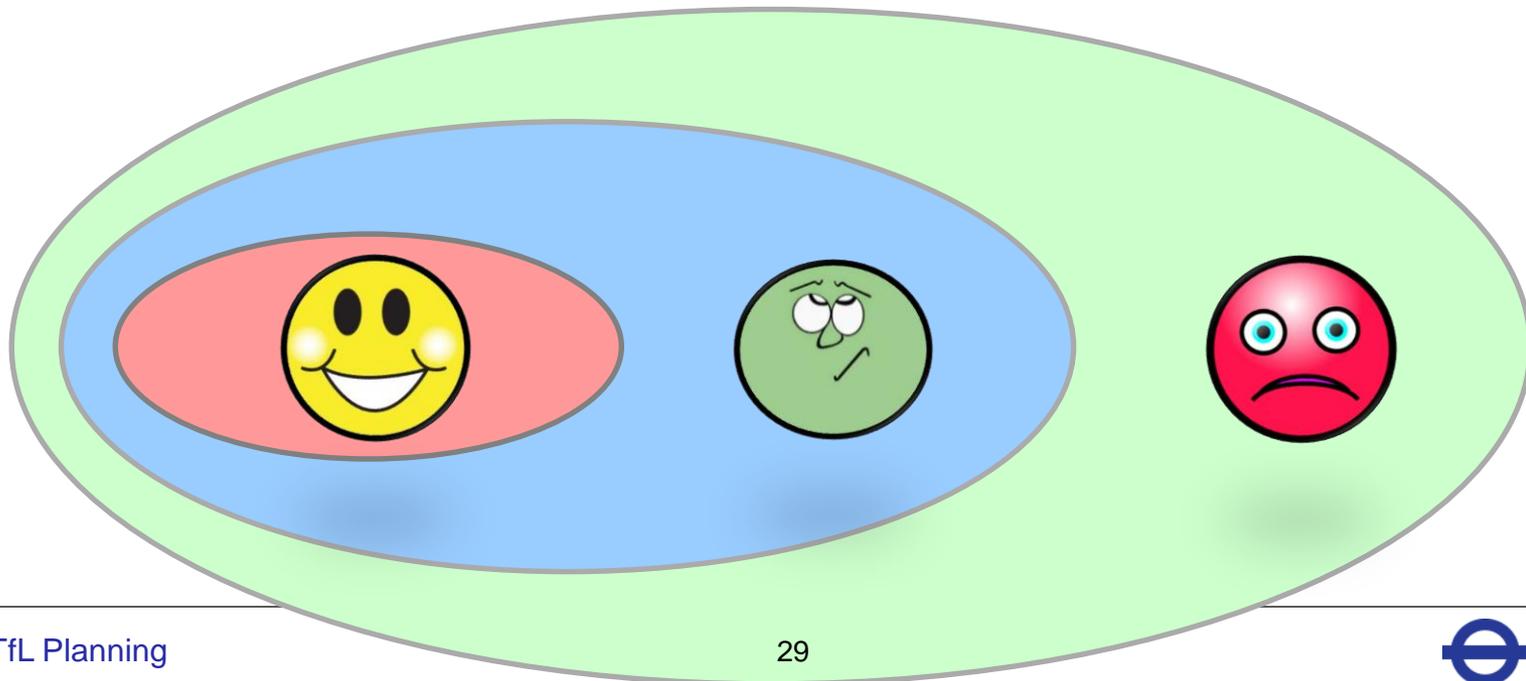
HAMoC – Some applications to date

5 sub-regional HAMs

Road Task Force Model

ILoHAM

Kingston
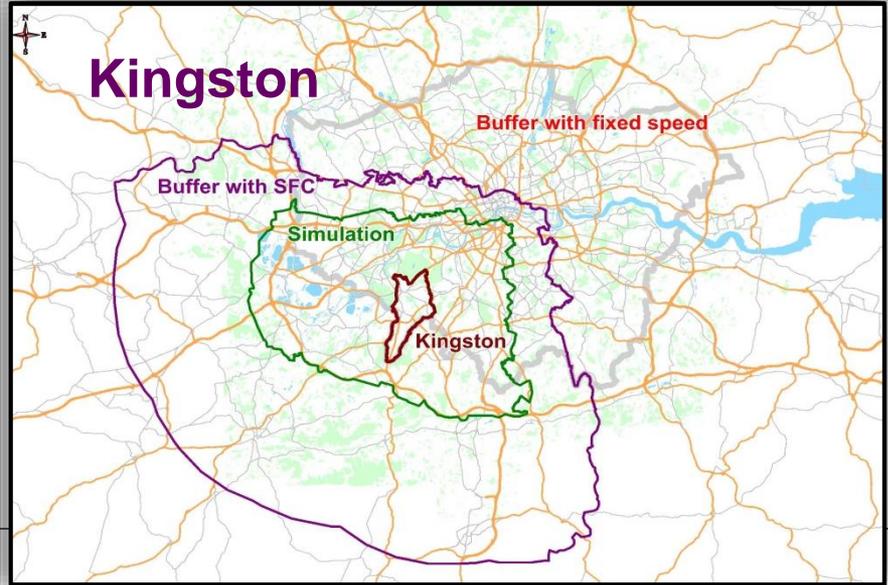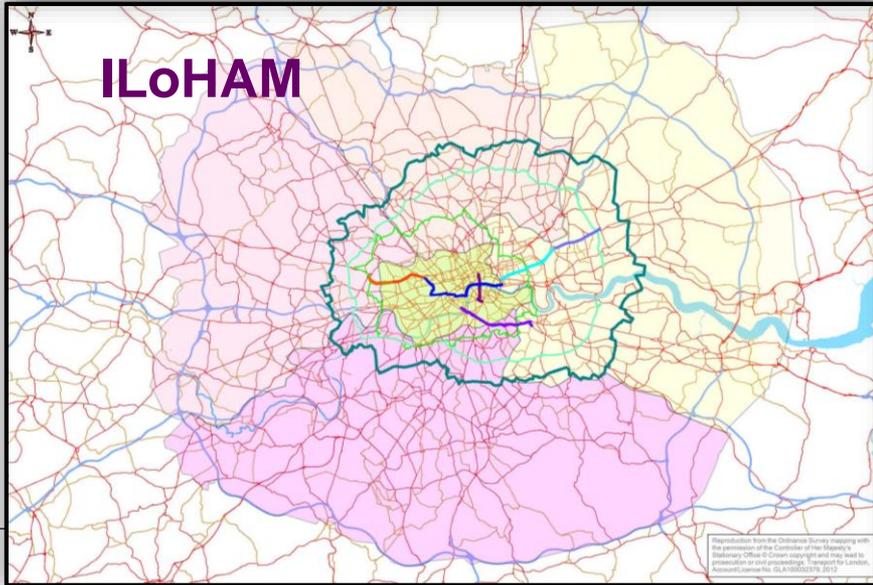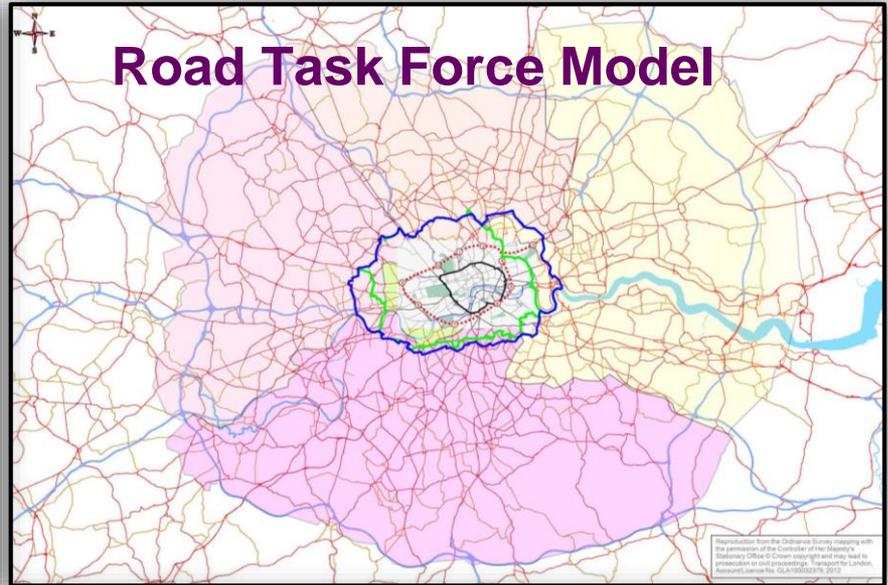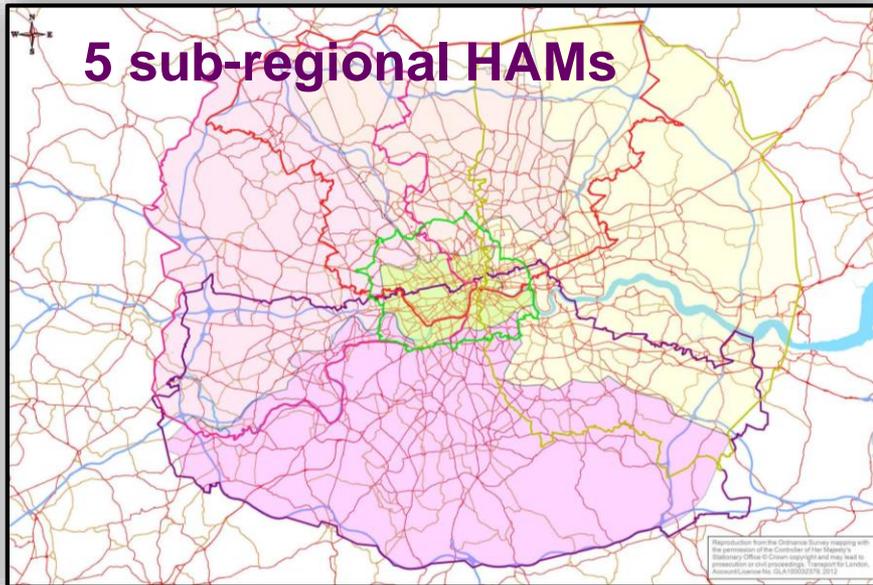
HAM Vision ?

1. LoHAM becomes the core model

2. Create standard 5/6 sub-HAMs so that they are readily available for use
   - Introduce ILoHAM? or
   - Enlarge CLoHAM?

3. Create customised models for studies where none of the standard HAMs is suitable

4. Update the demand using big data - EDMOND

5. Improve Cycle demand - CYNEMON

6. Rebased models to 2015

7. Incorporate LoHAM into LTS