

TRANSPORT FOR LONDON

STANDARD LOHAM P5 NETWORK OUTPUTS

21 APRIL 2023

I. Introduction

TfL has developed a London-wide Highway Assignment Model (LoHAM) which covers the whole of London including the M25.

The model has been calibrated to a base of November 2019.

The modelled time periods are as follows:

- AM Peak (08:00-09:00)
- Inter Peak (10:00-16:00 average hour)
- PM Peak (17:00-18:00)

Future year planning forecast and hybrid models are available for the years 2026, 2031 and 2041. These use predicted traffic growth from the MoTiON modelling suite. All committed schemes are included. The MoTiON scenarios for the future year models are:

- 2026: A26refl6, A26hyb05
- 2031: A31ref09, A31hyb09
- 2041: A41refl9, A41hyb04

Dartford Crossing, Blackwall Tunnel and Silvertown Tunnel tolls and the ULEZ and London Congestion Charge have been applied in the model for each user class for 2026, 2031 and 2041.

There are two different sets of modelled User Classes. These are six user class and nine user class. The difference is due to the way ULEZ compliance has been modelled. For the six user class models ULEZ compliance has been modelled using global compliance factors for Car (In Work Time), Car (Out of Work Time) and Light Goods Vehicles. The nine use class models split out the ULEZ compliant trips for Car (In Work Time), Car (Out of Work Time) and Light Goods Vehicles into separate matrices.

Six user class models are used by the MoTiON model, so there are six user class models for every year modelled, i.e. 2019, 2026, 2031 and 2041.

The six user class model matrices factored to PCUs are as follows:

1. Car (In Work Time) – PCU Factor 1
2. Car (Out of Work Time) – PCU Factor 1
3. Private Hire Vehicles (PHV) – PCU Factor 1
4. Taxi – PCU Factor 1
5. Light Goods Vehicles (LGV) – PCU Factor 1
6. Other Goods Vehicles (OGV) – PCU Factor 2.3

A PCU factor of 2.3 is also applied to buses.



Nine user class models are available for the 2019 base year and the 2026 future year models. The following user class definitions are included in the nine-user class model:

1. Car (In Work Time) ULEZ Compliant – PCU Factor 1
2. Car (In Work Time) ULEZ Non-Compliant – PCU Factor 1
3. Car (Out of Work Time) ULEZ Compliant – PCU Factor 1
4. Car (Out of Work Time) ULEZ Non-Compliant – PCU Factor 1
5. Private Hire Vehicles (PHV) – PCU Factor 1
6. Taxi – PCU Factor 1
7. Light Goods Vehicles (LGV) ULEZ Compliant – PCU Factor 1
8. Light Goods Vehicles (LGV) ULEZ Non-Compliant – PCU Factor 1
9. Other Goods Vehicles (OGV) – PCU Factor 2.3

A PCU factor of 2.3 is also applied to buses.

2. The Shapefile Outputs

Some GIS shapefiles have been produced using the SATVIEW software for the SATURN models. These files are standard GIS shapefiles that can be imported into many GIS tools for further analysis (e.g. MapInfo, ArcGIS, QGIS).

For each model four sets of shapefiles are produced:

- UserNodes
- UserLinks
- AssignmentNodes
- AssignmentLinks

The UserNodes and UserLinks contain the basic Link and Node geometry of the SATURN models. The AssignmentNodes and AssignmentLinks are a more detailed representation of the SATURN model network with the nodes exploded to allow data on turns at the nodes to be stored.

In the UserNodes shapefile the nodes are referenced by NodeID and in the UserLinks shapefile the links are referenced by LinkID (ANode_BNode). In the AssignmentNodes shapefile the node (ANode) turns are referenced by AssignmentN (ANode>BNode or ANode<BNode) and in the AssignmentLinks shapefile the links are referenced by AssLinkID (ANode_BNode).

There is also a common shapefile giving the zone boundaries which is common to all the models as the zones do not change between models. The zones are referenced by ZoneID. This shapefile is:

- L5_0_ZoneBoundariesWithTfLSectorsWGS84.shp

The shapefile co-ordinate reference system used is EPSG: 3857 – WGS 84 / Pseudo-Mercator

3. Model Output files

Along with each geometry shapefile there are four CSV data files containing a basic set of node, link, turn and trip end total model data for each set of nodes, links, turns and zones respectively. These can be associated with the UserNodes, UserLinks, AssignmentLinks and Zone Boundaries shapefiles to allow model outputs to be displayed and analysed with GIS tools such as QGIS, ArcGIS and MapInfo.

Nodes CSV file

This contains the following attributes for each node in the model.

NodeID: The Node ID (if negative this is the centroid/zone ID)

VoC: The % ratio of the total actual flow arriving at the stop line summed over each entry link divided by the sum of the capacities per entry link

Delay: Flow-weighted average delay over either all turning movements at a simulation node or all entry links at a buffer node (s)

DemandFlow: Demand flow summed over all entry arms (pcu/hr)

ArriveFlow: Arrive flow summed over all entry arms (pcu/hr)

Capacity: Capacity summed over all entry arms (pcu/hr)

ActualFlow: Actual flow summed over all entry arms (pcu/hr)

FixedFlow: Fixed flow summed over all entry arms (pcu/hr)

QueueHere: Queue here (pcu)

MeanQueue: Queue averaged over all arms (pcu)

CycleTime: The cycle time as input (s)

Offset: The offset time as input (s)

JcnType: 0 – External; 1 – Priority; 2/5 – Roundabout; 3 – Signals; 4 – Dummy

TotalDelay – Total Delay, i.e. Delay * ArriveFlow (s)

Links CSV file

This contains the following attributes for each link in the model.

LinkID: The Link ID (of form ANode_BNode)

Demand: Demand flow (pcu/hr)

Actual: Actual flow (pcu/hr)

Dem_UC1: Demand flow for User Class 1 (pcu/hr)

Dem_UC2: Demand flow for User Class 2 (pcu/hr)

Dem_UC3: Demand flow for User Class 3 (pcu/hr)

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Dem_UCn: Demand flow for User Class n (6 or 9 depending on the modelled year) (pcu/hr)

Bus: Bus demand flow (pcu/hr)

PreLoad: Pre-load flows (pcu/hr)

PASSQ: PASSQ flows – the flows “passed” from a previous time slice due to queues therein. (pcu/hr)

Fixed: Fixed flows – total of all fixed flows; i.e. buses, pre-load, passq (pcu/hr)

Capacity: Capacity (pcu/hr)



Speed: Speed based on total simulation link travel time (km/hr)

Delay: Simulation links: Flow-weighted delay to include: (a) transient delays, (b) V>C queuing delays and (c) any delays associated with link capacity restraint (speed-flow) curves. Buffer links: Difference between congested (speed-flow) and free-flow travel times (secs)

Time: Simulation links: Sum of delays and free-flow travel time on simulation links. (N.B. Since delays includes delays due to speed-flow curves this may also be thought of as cruise time plus weighted simulation turn delays.) Buffer links: congested time. (secs)

Fuel: Fuel consumption (l/hr)

Act_UC1: Actual flow for User Class 1 (pcu/hr)

Act_UC2: Actual flow for User Class 2 (pcu/hr)

Act_UC3: Actual flow for User Class 3 (pcu/hr)

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Act_UCn: Actual flow for User Class n (6 or 9 depending on the modelled year) (pcu/hr)

CapIndex: A numerical index whose interpretation is open to the user to decide. Capacity indices are used to distinguish groups of links with some common attribute which might be, e.g., either geographical or physical. For LoHAM they are used to define default speed flow curves for different road types in the 33333 cards, e.g. Capacity Index 524 applies to 50mph two-lane dual carriageway urban/suburban roads.

FFTime: Simulation links: Stoplevel to stopline travel time under free flow conditions. Buffer links: free flow travel time. (s)

FFSpeed: Speed based on free-flow time (km/h)

Length: The input link length (m)

Powerx100: The power n as used in the link cost-flow curve.

Queue over S %: The average queue divided by the link stacking capacity and expressed as a percent. N.B. The link stacking capacity is that used in assessing blocking back so, depending on the link properties and the degree of blocking back, it may be either: (a) the stacking capacity of the link on its own or (b) the stacking capacity of its “chain”.

Average Queue Total: The sum of the average transient queues and the average V>C queues as summed over all turning movements and all lanes. (pcu)

Queue at end of time period: Permanent V > C queue (pcus) aggregated over all lanes and/or turns at the end of the simulated time period. Excludes any transient queues.

Trip Ends CSV file

This contains the following attributes for each zone in the model.

ZoneID: The zone ID

FromUCI: The trips from the zone by User Class I (pcu/hr)



ToUC1: The trips to the zone by User Class 1 (pcu/hr)

IntrasUC1: The intra-zonal trips within the zone by User Class 1 (pcu/hr)

FromUC2: The trips from the zone by User Class 2 (pcu/hr)

ToUC2: The trips to the zone by User Class 2 (pcu/hr)

IntrasUC2: The intra-zonal trips within the zone by User Class 2 (pcu/hr)

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FromUCn: The trips from the zone by User Class n (6 or 9 depending on the modelled year) (pcu/hr)

ToUCn: The trips to the zone by User Class n (6 or 9 depending on the modelled year) (pcu/hr)

IntrasUCn: The intra-zonal trips within the zone by User Class n (6 or 9 depending on the modelled year) (pcu/hr)

FromTotal: The total trips from the zone by all User Classes (pcu/hr)

ToTotal: The total trips to the zone by all User Classes (pcu/hr)

IntrasTotal: The total intra-zonal trips within the zone by all User Classes (pcu/hr)

Boundary shapefiles

Some boundary shapefiles are also supplied to aid analysis of LoHAM outputs. These are:

CULAX – The boundaries of various existing and potential charging zones. (C – Central Congestion Charging, ULEX expanded to North/South Circular, London GLA boundary, Annulus between GLA and M25, eXternal to M25.)

SATURN TfL Sectors – Forty five areas that correspond to the 33 London Boroughs, the home counties and areas in Great Britain beyond. These are indexed as follows.

Borough	BoroSector
City of London	1
City of Westminster	2
Camden	3
Islington	4
Hackney	5
Tower Hamlets	6
Greenwich	7
Lewisham	8
Southwark	9
Lambeth	10
Wandsworth	11
Hammersmith and Fulham	12
Kensington and Chelsea	13
Waltham Forest	14
Redbridge	15
Havering	16



Barking and Dagenham	17
Newham	18
Bexley	19
Bromley	20
Croydon	21
Sutton	22
Merton	23
Kingston upon Thames	24
Richmond upon Thames	25
Hounslow	26
Hillingdon	27
Ealing	28
Brent	29
Harrow	30
Barnet	31
Haringey	32
Enfield	33
Buckinghamshire	34
Hertfordshire	35
Essex	36
Berkshire	37
Surrey	38
Kent	39
Oxfordshire	40
East Anglia	41
South Coast	42
South West	43
Wales	44
The Midlands, North and Scotland	45