



Modelling ULEZ in SATURN 11.5

Ken Fox on behalf of Martin Hayden – Principal Modeller



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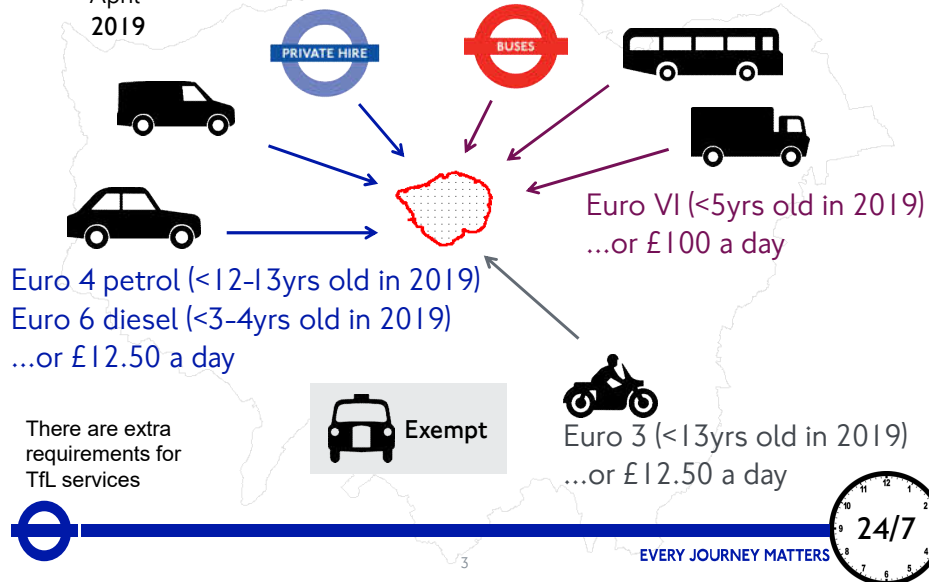
**London
Ultra Low Emission Zone
1. Background**



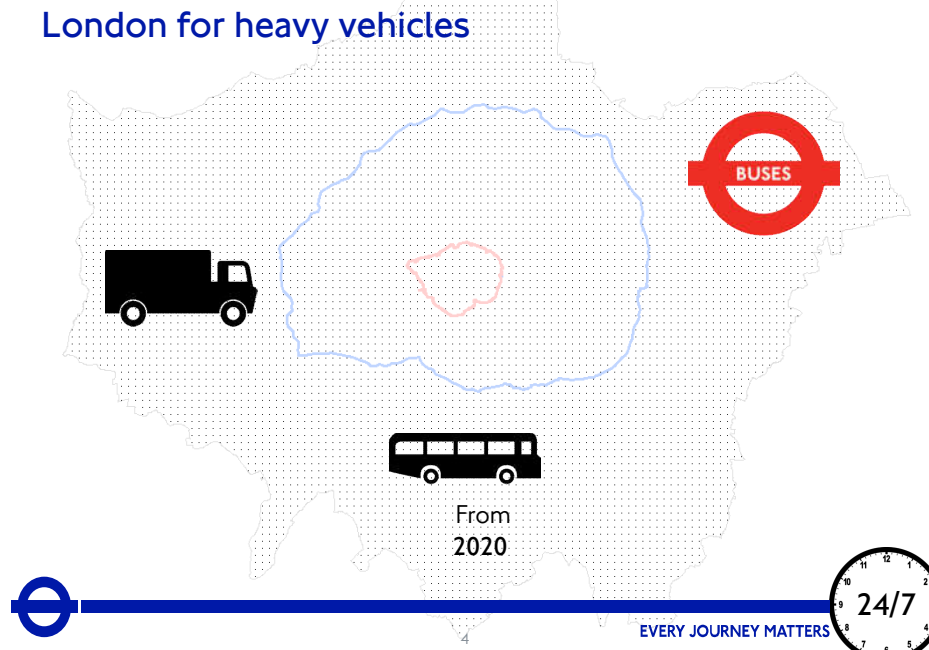
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The Central London Ultra Low Emission Zone

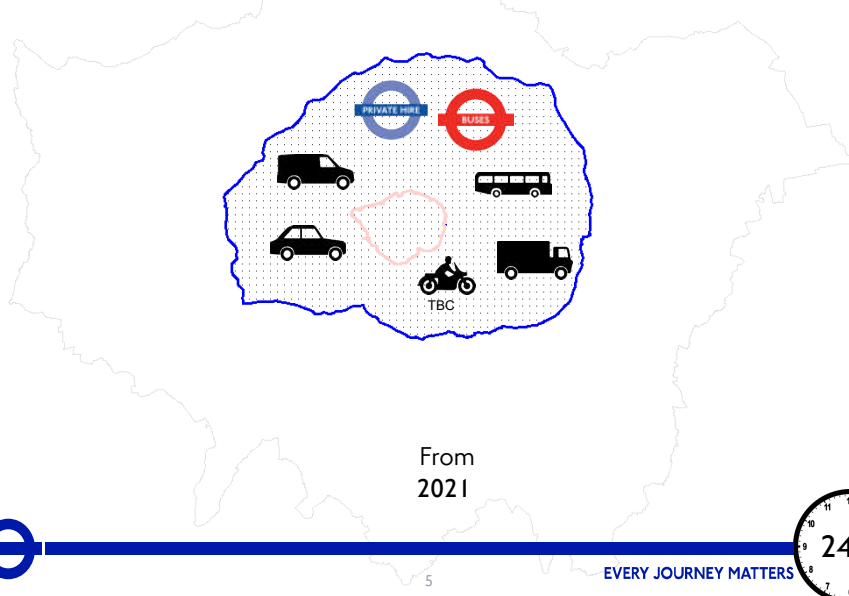
April
2019



Expanding the ULEZ standards to the whole of London for heavy vehicles

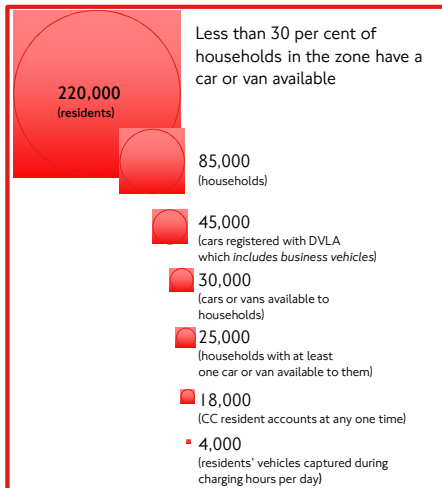


Expanding the ULEZ standards to Inner London for all vehicles

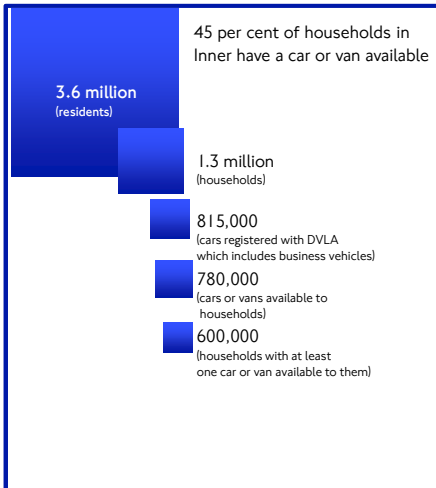


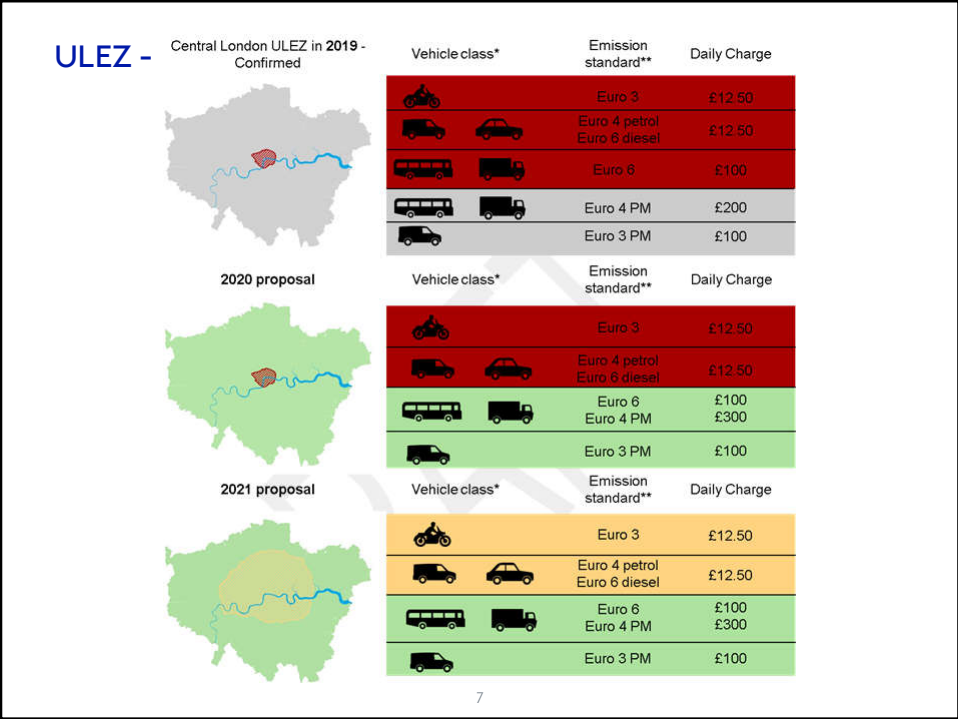
Expanded ULEZ Population- Many more residents

Central ULEZ



Inner ULEZ





London Ultra Low Emission Zone

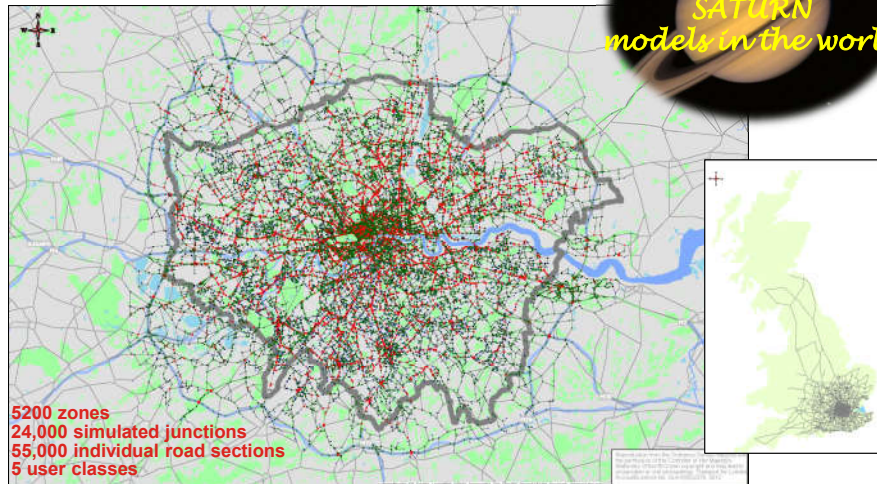
2. Modelling Requirements



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LoHAM – London-wide HAMs

*By far the largest
SATURN
models in the world*



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ULEZ - Modelling challenges and Requirements

- Requirement to model different charging regimes
 - Central Charging Zone (CCZ)
 - CCZ & Central ULEZ Charge
 - CCZ & expanded Inner Area ULEZ Charge
- Requirement to model vehicle compliance
 - Model different vehicle classes based on compliance with ULEZ standards
 - Software needed ability to assign 8 user classes on a 5194 zone matrix
- Requirement to model demand responses
 - Integrate modelling in an iterative loop with LoRDM (London Regional Demand Model) to derive a demand response
 - Skim costs from the assignment model as input for LoRDM



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London Ultra Low Emission Zone 3. SATURN 11.5 Development



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ULEZ – SATURN Software Development

- TfL Commissioned Atkins to add functionality to SATURN to achieve the following modelling objectives:
 1. Ability to model multiple adjacent charging zones with different charges, thus CCZ, CCZ with ULEZ for non compliant vehicles and Inner ULEZ. **COMPLETE**
 2. Cumulative tolls are additive when moving from one charging zone to another. **PARTIAL**
 3. Free routes through a charging zone to be specified without incurring additional costs to pass across this free route **NO**
 4. Define UCs flexibly by charging regime e.g. as a percent of a single UC or as a user-defined O-D **PARTIAL BUT 8 STACK ASSIGNABLE**
 5. Apply charges for trips entirely within a charged area **COMPLETE**
 6. Allow for a single charge for multiple passes **COMPLETE**
 7. Skim post assignment costs reflecting the charges **PARTIAL**
 8. Display graphically charging zone combinations as input in PIX **PARTIAL**



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ULEZ – SATURN Software Development – .dat file Coding

- The New method of tolling replaces the KNOBS values as modelled in the current LoHAM (London Highway Assignment Model) with a cordon and toll values in a new section of the 44444 Card.

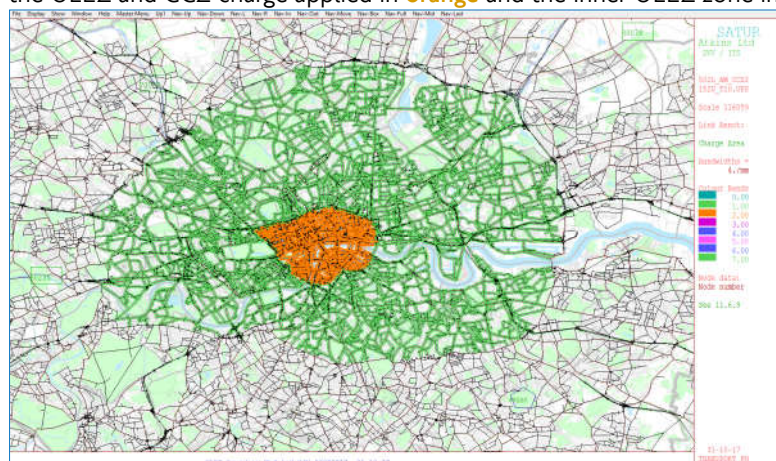
```

44444
*** INCLUDED TAC2c.dat ***
TAC CONGESTION CHARGING CCZ £2.15
215.0 215.0 215.0 215.0 0.0 108.0 108.0 508.0
TAZ CENTRAL AREA
* A B Node Cordon
10113 10170
...
TAC EMISSIONS CHARGING ULEZ £4.75
0.0 475.0 0.0 475.0 0.0 0.0 475.0 0.0
TAZ CENTRAL AND INNER AREA
* A B Node Cordon
60631 60122
...
99999
    
```



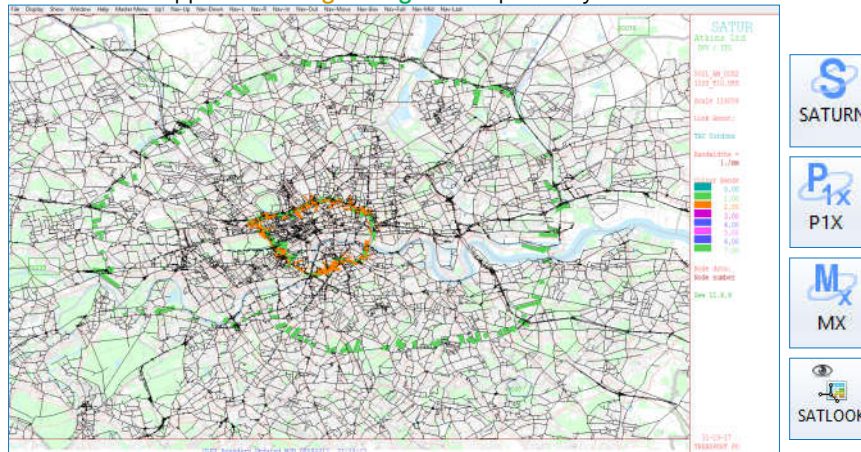
SATURN | 1.5 Development Coded ULEZ Output Areas

- Based on 44444 card coding the following plot shows the central zone with the ULEZ and CCZ charge applied in orange and the Inner ULEZ zone in green.



SATURN | 1.5 Development Coded ULEZ Output Cordons

- Based on 44444 card coding the following plot shows the CCZ and Inner cordons applied in **orange** and **green** respectively



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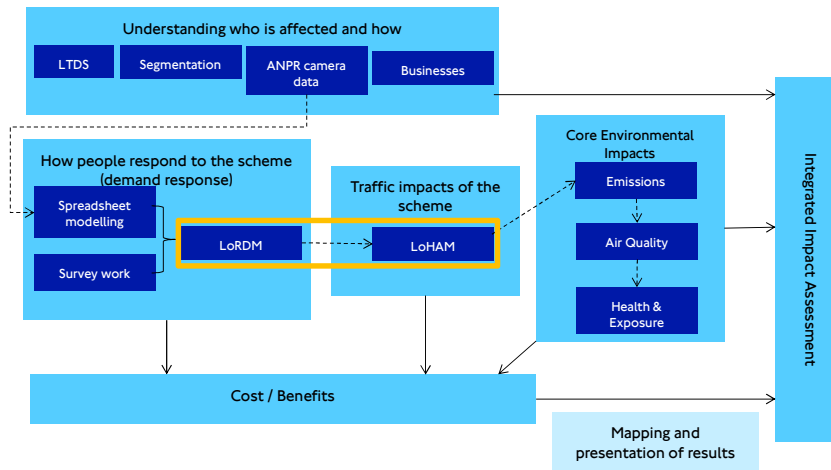
London Ultra Low Emission Zone 4. ULEZ Assessment Process



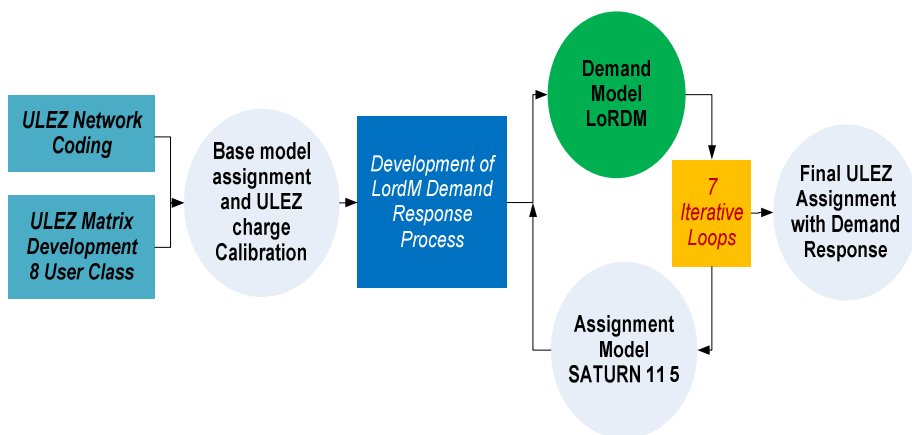
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ULEZ - Assessment Overview



ULEZ - Assessment Overview – LoRDM & LoHAM



ULEZ – Modelling Methodology – Central CCZ Area

- The following methodology was employed in the production of the ULEZ Model.
 1. Assessment of CCZ area using current tolling methodology employing the 2021 Future Year model.
 2. Re-assignment of the model in SATURN 11.5 and analyse the impacts. (Updating the model from 11.3.12W to 11.5.02T does impact the model significantly)
 3. Coding and applying the new toll cordon method in the updated software and re-assigning the model.
 4. Check routing, flows, delays, and employing trees and forests to assess the proportion of through trips when compared with the base.
 5. Calibrate the CCZ charge using data available to TfL from anonymised camera data and previous studies. *The charge is £2.15*
 6. Do final assignment to re-create the model with new methodology and updated CCZ charge.
 7. Add ULEZ charge into coding and run model assessment for central ULEZ area.
 8. Sense check outputs and confirm CCZ model.



ULEZ – Modelling Methodology – Central & Inner Area

- The following methodology was employed in the production of the ULEZ Model.
 1. The new bespoke 2021 LoHAM based ULEZ model with new CCZ methodology was adapted to include a ULEZ charge by adding the calibrated charge into the model .dat file for the Central Area.
 2. The model was then assigned and checks carried out to ensure that the model was responding to the higher combined CCZ and ULEZ charge for non-compliant vehicles in the Central area.
 3. Subsequent to applying ULEZ to the central area the costs were adjusted to include ULEZ in the Central and Inner Area.
 - The charge of £4.75 is coded as follows for non compliant cars and LGV's:

```
TAC  EMMISIONS CHARGING ULEZ £4.75
0.0 475.0 0.0 475.0 0.0 0.0 475.0 0.0
TAZ  CENTRAL AND INNER AREA
```
 4. Final assignment checks and then the model was run through 7 loops of the LoRDM model to achieve 4 stage demand effects.



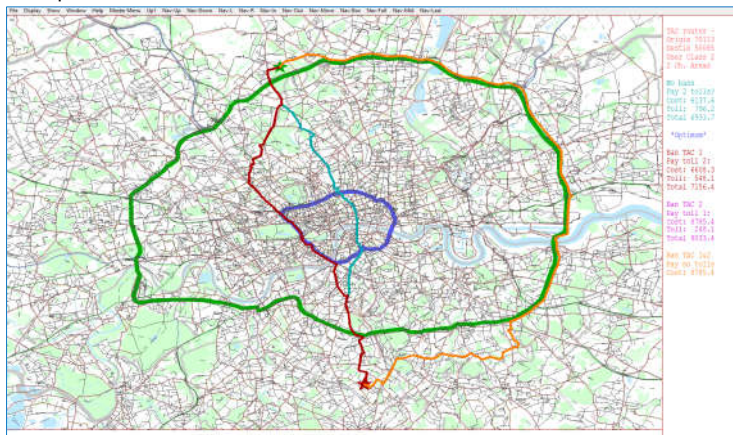
London Ultra Low Emission Zone 5. ULEZ Outputs



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SATURN | 1.5 ULEZ External to External Tree

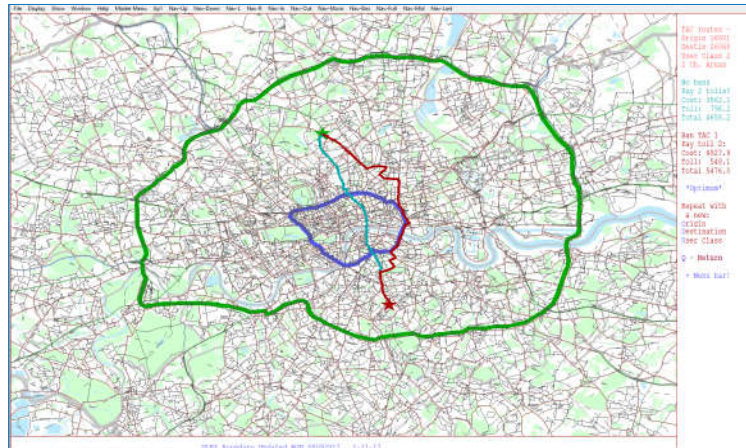
- External Zone (70113) to External Zone (50085) Routes for UC2 (Car Non Compliant)



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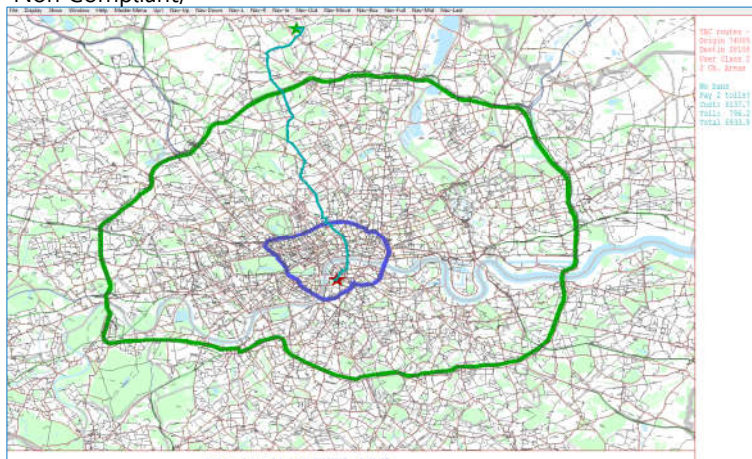
SATURN | I.5 ULEZ Inner to Inner Tree

- Inner Zone (16001) to Inner Zone (26068) Routes for UC2 (Car Non Compliant)



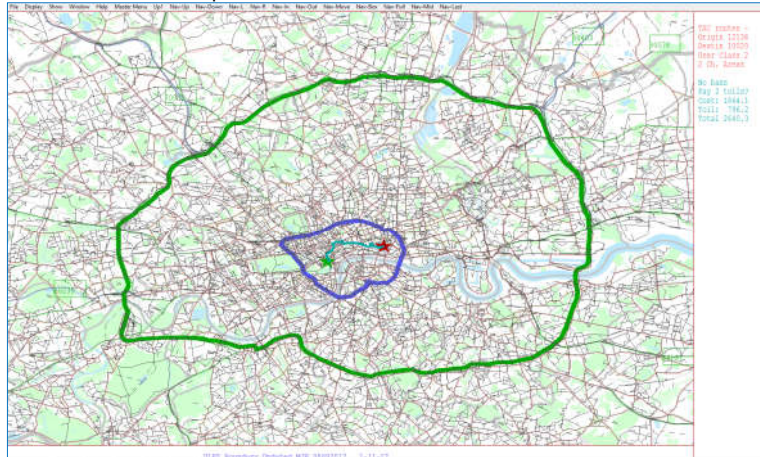
SATURN | I.5 ULEZ External to Central Tree

- External Zone (74005) to Congestion charge Zone (28108) Routes for UC2 (Car Non Compliant)



SATURN 11.5 ULEZ Central to Central Tree

- Congestion charge Zone(12136) to Congestion charge Zone (10020) Routes for UC2 (Car Non Compliant)



London Ultra Low Emission Zone 6. SATURN 11.5 Project Review and Future



SATURN 11.5 Development Coded ULEZ Output Areas

- Project Review
 1. Project commission an excellent example of collaborative working to resolve a complex problem regarding multi area tolling.
 2. Objectives prioritised to allow ULEZ programme of work to be delivered and preparation undertaken for public consultation.
 3. Further checks to be completed before final NON BETA version is released. Current version is 11.5.02T BETA
 4. The development of SATURN 11.5 is the beginning of a major change in how we model road user charging in the future giving more flexibility to model how the charges have been implemented.
 5. Enhancements delivered within the agreed budget.



SATURN 11.5 Development Coded ULEZ Output Areas

- Expected Future Enhancements and Next Steps
 1. Complete the initial list of requirements where possible.
 2. Complete functionality to skim for generalised costs
 3. Develop a method to allow for the coding of free through routes traversing a zone.
 4. Allow for the inclusion of additionally charged non contiguous zones such as town centres.
 5. Tolling method based on highest price and ability to group charging areas into schemes.
 6. Enhance SATVIEW / SATCODER to be fully compatible with SATURN 11.5
 7. Resolve outstanding display issues



London Ultra Low Emission Zone 7. Summary and Conclusion



SATURN 11.5 Development Summary and Conclusions

1. Currently completing ULEZ assessment
2. Public consultation later this year on the expansion
3. Subject to consultation, scheme due to be signed off next year with implementation in 2021
4. Plan to implement new methodology for ULEZ and CCZ charges into next LoHAM P4 version currently going through a planning and scoping exercise.

*Please watch for and engage in the **Inner Zone Expansion Public Consultation** due to launch before Christmas. More information from this modelling analysis will be available at that stage*





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