



McDonalds Pontardawe Model Scoping Report

For McDonalds Restaurants Ltd

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1. Introduction

1.1 Overview

- 1.1.1 Hydrock has been appointed by McDonalds Restaurants Ltd to prepare a microsimulation traffic model in support of a planning application for a proposed McDonalds Restaurant. The restaurant will also include a drive-thru facility and is located on part of the existing Tesco car park in Pontardawe, to the north-east of Swansea. This Model Scoping Report outlines the proposed content of the microsimulation traffic model.
- 1.1.2 The site is located 600m to the south of Pontardawe town centre, and 12.5km north-east of Swansea city centre.
- 1.1.3 The proposed site is located within the existing car park of a Tesco Superstore (with an associated Tesco Petrol Filling Station). The site is bound by the River Tawe to the north-west, the A4067 to the south-east, a Tesco Petrol Filling Station to the north-east and Tesco Superstore parking to the south-west.
- 1.1.4 The location of the site in its local context is shown in Figure 1.1.

Figure 1.1: Site Location



1.2 Note Purpose and Structure

- 1.2.1 Due to limitations of traditional modelling methods, a detailed microsimulation model is considered the most appropriate tool to ensure a thorough and robust operational assessment is undertaken.

- 1.2.2 This report presents the proposed model scope and has been prepared to inform all parties concerned in the project of the scope and depth of the network model analysis. It considers, in particular, the appropriateness of the selected modelling tool and pertinent elements concerning network coding, demand modelling, scenario testing, calibration & validation and reporting.
- 1.2.3 Following this introduction, the report is structured as follows:
- » Section 2 provides a brief overview of the junctions and proposed modelling process;
 - » Section 3 presents the proposed base and future forecast model parameters; and
 - » Section 4 sets out the model calibration and validation methodology as well as reporting of results.

2. Model Overview

1.2 Existing Use of the Site and Access Arrangements

- 1.2.1 The site comprises part of the car park for the existing Tesco supermarket which operates under A1 food retail Use Class.
- 1.2.2 Vehicular access to the site is provided via the A4067 roundabout to the north-east of the site. The roundabout offers a connection to the Tesco access road, which links to the internal site car park and roundabout with the foodstore and its petrol filling station.
- 1.2.3 There are multiple points of pedestrian access into the existing site. Pedestrian access can be taken directly from the site access road which connects to the A4067 roundabout to the north-east. Alternatively, pedestrian access to the site is offered via a footbridge over the A4067 from Lon Tanyrallt to the east or via a footbridge over the River Tawe connecting to a footpath on the river's northern bank. Both footbridges are suitable for access for people with disabilities, with flat terrain and ramped entrance/exit points.

1.3 Local Highway Network

Tesco Access Road

- 1.3.1 The access to the site is via an unnamed access road which forms the fourth arm of a roundabout junction with the A4067. The site access road contains footways and street lighting, as well as pedestrian zebra crossings.
- 1.3.2 There are pedestrian links to this route via two separate footbridges over the River Tawe and the A4067 respectively. At the respective points where the footbridges meet the site access road, there are pedestrian zebra crossings located on pedestrian desire lines to the site.

A4067

- 1.3.3 The A4067 runs in a south-west/north-east alignment immediately east of the site, providing vehicular access to the site via the site access roundabout to the north-east. The A4067 forms the principal vehicle route between Pontardawe and Swansea to the south-west, and also offers direct access to the strategic road network via the M4 J45 some 6.5km south-west of the site.
- 1.3.4 In the vicinity of the site the road is comprised of a single carriageway in either direction, which flares to two lanes northbound on the approach to the site access roundabout. The speed limit of the road is 40mph, but this lowers to 30mph on the approach to the site access roundabout.
- 1.3.5 There are no footways or pedestrian facilities on the A4067 in the vicinity of the site, with the aforementioned footbridge providing pedestrian access over the A4067 from Lon Tanyrallt. However, to the west, pedestrian footways are provided on either side of the A4067 link road carriageway over the River Tawe.

Lon Tanyrallt

- 1.3.6 Lon Tanyrallt is a residential road that runs parallel to the A4067 located to the east of the site. Access from Lon Tanyrallt to the site is provided via a footbridge from the road over the A4067 to the Tesco superstore access road.

- 1.3.7 The road itself is residential in nature, with 2m wide footways along the western side of the carriageway adjacent to the residential frontages. Street lighting is also provided along the road.
- 1.3.8 The speed limit of the road varies between 20mph (near to the Alltwen Primary School to the north) and 30mph, with changes in the speed limit clearly denoted by signposts and on road markings. Traffic calming measures are also present along the road in the form of speed humps.

2.1 Benefits of Microsimulation Modelling

- 2.1.1 In order to accurately assess the operational performance of the site and associated junctions and potential impact of the development in Pontardawe, it is proposed that a detailed microsimulation model of the junctions is developed using PTV Vissim software.
- 2.1.2 Vissim is a microscopic, behavioural based, multi-modal and multi-purpose traffic simulation program developed by PTV Group. It realistically simulates and balances highway capacity and traffic demand, providing a significant benefit to modelling the impact of transport and development schemes across a large network, where route choice may change as a result of congestion.
- 2.1.3 In addition to modelling and combining various types of junctions, corridors and town centres, other key benefits of Vissim include:
 - » Exact simulation of traffic patterns;
 - » Flexible input of model geometries, with any level of complexity;
 - » Driver behaviour under differing physical conditions;
 - » Calibration and representation of real-life route choice through networks, using cost and surcharge facilities, influencing driver behaviour;
 - » The effect of various network constraints such as lane changing and traffic calming;
 - » Modelling the interaction of all modes of transport, including public transport routes and stops/stations;
 - » Fine tuning of traffic signals / adaptive control and representation of intelligent transportation systems;
 - » Avoiding over-prediction of queues and delays at congested junctions; and
 - » Pedestrian Simulation.
- 2.1.4 For the purposes of this model, the replication of yield on entry behaviour is of primary interest. Vissim can realistically simulate gap acceptance, forced merging, reactive overtaking and acceleration/deceleration behaviour under changing conditions, allowing the results to be interpreted with real confidence.

3. Model Specification

3.1 Preamble

- 3.1.1 The model will be developed by Hydrock for a base year of 2023 to replicate the existing local road layout and traffic conditions, as derived from empirical traffic survey data. The base model will be calibrated against observed Manual Classified Counts and validated against journey time and queue length data.
- 3.1.2 The model will be developed in accordance with best industry standards and in compliance with TAG and DMRB guidance, as well as TfL Modelling Guidelines.

3.2 Base Model

Model Study Area

- 3.2.1 The proposed Vissim base year model network extent is shown in Figure 3.1.

Figure 3.1: Proposed Model Extents



- 3.2.2 The extent of the Vissim model will include the following three junctions:
- » Site Access/Tesco Petrol Station 3-arm roundabout junction
 - » Tesco Access Road/A4067/Ffordd Cwm Tawe 4-arm roundabout junction
 - » A474/A4067 5-arm roundabout junction
- 3.2.3 While the above figure offers a useful illustration, the modelled upstream length for each arm will ultimately be dictated by the journey time validation routes and the simulated levels of queue build up insofar as ensuring that model locking does not take place and driving behaviour is not unrealistically affected.
- 3.2.4 Upstream junctions along the A4067 may be considered to obviate the risk of demand latency.

Model Parameters

- 3.2.5 The base year model will be developed using the latest version of PTV Vissim, to replicate baseline conditions.
- 3.2.6 The local highway authority requested that traffic surveys be carried out to provide a weeks' worth of traffic flow data from 07:00 to 19:00. These surveys were carried out from Monday 15th May 2023 to Sunday 21st May 2023.
- 3.2.7 Hydrock has undertaken an analysis of the survey data to identify network peak periods across the week.
- 3.2.8 The modelled time periods will be consistent with a maximum weekday AM peak, a maximum weekday PM peak and a maximum weekend peak for the area, as follows:
 - » 07:00 – 10:00 – (Weekday AM Peak)
 - » 16:00 – 19:00 – (Weekday PM Peak)
 - » 11:00 – 15:00 – (Weekend Peak)
- 3.2.9 These peak days for detailed assessment, evaluation and model validation have been determined following identification of the network peak periods based on the traffic survey data collected at the three identified junctions on Monday 15th May 2023 to Sunday 21st May 2023 and will reflect a 'worst case scenario'.
- 3.2.10 The weekday AM peak will be consistent with the highest traffic flows observed during the AM peak period of 07:00 and 10:00, which was on Friday 19th May.
- 3.2.11 The weekday PM peak will be consistent with the highest traffic flows observed during the PM peak period of 16:00 and 19:00, which was on Thursday 18th May 2023.
- 3.2.12 The weekend peak will be consistent with the highest traffic flows observed during the midday peak period of 11:00 and 15:00, which was on Saturday 20th May 2023.

Baseline Traffic Data

- 3.2.13 To ascertain the current baseline traffic conditions and to enable a thorough and fit for purpose assessment of the proposed scheme, the following two types of survey data have been collected at the three identified junctions on Monday 15th May 2023 to Sunday 21st May 2023:
 - » Manual Classified Turning Counts [MCTCs]; and
 - » Queue Lengths;
- 3.2.14 The data collected is considered acceptable and representative of typical neutral weekday and weekend traffic conditions and then analysed for peak periods, thus undertaking the modelling for a 'worst case' scenario.
- 3.2.15 All surveys were undertaken between the hours of 07:00-19:00. MCTCs and queue lengths were recorded in 15-minute intervals. Vehicles were subsumed under the following individual vehicle types:
 - » Pedal Cycles (CYCLE)
 - » Motorcycles (M/CYCLE)
 - » Cars (CAR)
 - » Light Goods Vehicles (LGV)

- » Other Goods Vehicles 1 (OGV1)
- » Other Goods Vehicles 2 (OGV2)
- » Public Service Vehicles (BUS)

- 3.2.16 The MCTCs were undertaken using high mast video cameras, which also assists in understanding local driver behaviour at each junction. The full MCTC data will be provided in the modelling reports' appendices.
- 3.2.17 In addition to the survey data, observed journey times will be obtained through TomTom mass dataset extraction for a sufficiently large sample size. The data will be exported from the TomTom portal based on an Integrated Transport Network [ITN] layer used as a digitised polygon to represent a set of determined points on the existing road network. The use of TomTom and other 'big data' sources is current best-practice and state of the art, providing greater numbers of individual data points.
- 3.2.18 A total of 42 journey time routes have been identified within the modelled area for analysis. These will be obtained as a matrix between seven different locations, expressed as origins and destinations. The locations will be precisely plotted and the distance from the stop lines measured. The journey time markers in the model will be based on the said distances and later corroborated against the aerial background imagery in Vissim to ensure an accurate comparison is undertaken.

Public Transport Services

- 3.2.19 Bus route timetables and bus stop information within the study area will be obtained from Traveline and/or equivalent local journey planning websites for all services travelling through the network within the modelled time periods.

Matrix Estimation

- 3.2.20 It is proposed that the Vissim model consists of eight zones and is built using static assignment. An Origin-Destination [O-D] base matrix will be derived from the MCTCs for each vehicle class and time period allowing for the total volume of traffic along each route within the network to be estimated. A total of 56 static routes are proposed, with partial routes added, if required, to divide traffic further within the static routes and achieve the required lane changing behaviour.
- 3.2.21 The base matrix will be produced at 15-minute intervals for each peak period, to ensure the peak profile is accurately represented. It will also be individually produced for each vehicle type, with the exception of buses, which will coded using fixed public transport routes.

Highway Network Coding

- 3.2.22 Geometric calculations for the base model will be derived from a digital Ordnance Survey (OS) base map. A check on the accuracy of the base map will be undertaken against junction video surveys, satellite imagery and Google Street view. Should discrepancies be identified, these will be accounted for in the Vissim model. These calculations will inform lane widths, link lengths and number of lanes parameters within the model. The OS base map will additionally be transposed from its cartesian coordinates to correspond with the Bing map aerial imagery in Vissim, thus further corroborating the geometric parameters of the model.

- 3.2.23 Emergency stop and lane change parameters will be used to model lane change behaviour. This will be determined by reviewing the physical characteristics of the local network as well as existing driving behaviour, positioning of signage, lane occupancy and proximity of other junctions.
- 3.2.24 The emergency stop distance specifies the last possible position value for a vehicle to change lanes. It is proposed that this is left at a default value of 5.0m and adjusted during calibration, if required.

Vehicle / Link Speeds

- 3.2.25 The vehicle types represented in the model will accord with the traffic data classifications collected and will be defined as follows:
- » 100 - Car;
 - » 110 - LGV;
 - » 200 - OGV1;
 - » 210 - OGV2;
 - » 300 - Bus;
 - » 600 - MCY; and
 - » 610 - PCY.
- 3.2.26 To replicate the on-street speed limits, the following speed distributions, created using the most recent (2021) statistics available from the Department for Transport (DfT) for the associated speed limits, will be used as appropriate:
- » 20mph - Car / MCY, LGV, OGV1, OGV2 and Bus
 - » 30mph - Car / MCY, LGV, OGV1, OGV2 and Bus
 - » Single Carriageway National Speed Limit (60mph) - Car, MCY, LGV, OGV1, OGV2 and Bus
 - » Motorway - Car, MCY, LGV, OGV1, OGV2 and Bus
- 3.2.27 Statistics for 40mph, 50mph and dual carriageway speed limits are not available from the DfT. Therefore, these profiles will be obtained from the latest TfL Vissim template, which Hydrock are in possession of:
- » 40mph - Car/MCY and Bus
 - » 50mph - Car/MCY and Bus
 - » Dual Carriageway National Speed Limit (70mph) - Car, MCY and Bus
- 3.2.28 Additional speed distributions will also be created for pedal cycles.

Reduced Speed Areas

- 3.2.29 Reduced Speed Areas will be used throughout the model in locations where a bend is of such a radius that it will always require a motorist to brake when negotiating it. It is important to understand that a Reduced Speed Area upon a bend will result in a vehicle decelerating on the approach to the bend, matching the defined speed and accelerating again thereafter.
- 3.2.30 For on-street physical changes in speeds such as bends, junction approaches, traffic calming and on-street parking, three profiles have been created and will be assigned to network objects 'Reduced Speed Areas'.

3.2.31 The three profiles created are as follows:

- » Slight (18mph – 20mph);
- » Medium (14mph – 16mph); and
- » Tight (8mph – 12mph).

3.2.32 It should also be noted that the majority of the Reduced Speed Areas coded within the model will be split to 'slight' for cars and LGVs, while OGVs and buses will have 'medium' profiles associated with them. In the same vein, a medium - tight split will also be used for the same vehicle types at certain locations, if deemed appropriate.

Priority Rules and Conflict Areas

3.2.33 Priority Rules and Conflict areas will be included to model give-way behaviour at all three junctions.

3.2.34 Priority Rules are deemed more suitable for complex multi-lane interactions and it is proposed they are predominately used for junction control at the three roundabouts within the base model. They will be split down to specific vehicle types, where observations from the video surveys consider it appropriate.

3.2.35 As the model build is taken through calibration and validation, values will be adjusted to replicate the performance of the junction accurately. Gap times and headway values will vary dependent on driver behaviour and visibility.

3.2.36 Conflict areas will be used sparingly, mainly to model give-way behaviour at simple junctions as well as branching behaviour and where a connector overlaps a link. The latter two will be set as 'undetermined'.

Public Transport Routes

3.2.37 All bus routes that travel through the model study area will be coded into the model on fixed paths with frequency and stops entered from the information provided in the timetables.

3.2.38 Bus stop usage / passenger demand data has not been collected so a default dwell time distribution will be used for all stops within the model study area.

Driver Behaviour

3.2.39 The 'urban' driver behaviour link type will be applied to most links within the model study area, with the exception of cycle tracks and footways. It is generally considered best practice that driver behaviour parameters are left at their default values as much as possible, unless supported by site observations and measurements.

3.3 Forecast Models

Assessment Scenarios

3.3.1 A total of 15 scenarios, 12 of which constitute future year assessments, will be devised in conjunction with any preceding Transport Assessment [TA] documents, to gauge the operational performance of the junctions for the base year, with and without future proposed development in place. The following notation will be used:

1. 2023 Weekday AM Peak Base
2. 2023 Weekday PM Peak Base
3. 2023 Weekend Peak Base
4. 2025 Weekday AM Peak Base (Do Minimum [DM])
5. 2025 Weekday PM Peak Base (Do Minimum [DM])
6. 2025 Weekend Peak Base (Do Minimum [DM])
7. 2035 Weekday AM Peak Base + Development (Do Something [DS])
8. 2025 Weekday PM Peak Base + Development (Do Something [DS])
9. 2025 Weekend Peak Base + Development (Do Something [DS])
10. 2033 Weekday AM Peak Base (Do Minimum [DM])
11. 2033 Weekday PM Peak Base (Do Minimum [DM])
12. 2033 Weekend Peak Base (Do Minimum [DM])
13. 2033 Weekday AM Peak Base + Development (Do Something [DS])
14. 2033 Weekday PM Peak Base + Development (Do Something [DS])
15. 2033 Weekend Peak Base + Development (Do Something [DS])

3.3.2 The structure and content of the forecast year scenarios will be documented in detail in the Model Forecasting Report [MFR], along with a comprehensive results comparison and analysis of the operational junction performance.

Committed Forecast Growth

- 3.3.3 To identify the future year traffic flows, the National Trip End Model [NTEM] will be interrogated to obtain local traffic growth factors using the TEMPro software, in conjunction with the Road Traffic Forecast 2018 [RTF 2018] dataset. The growth factors take into account the underlying planning information in the local area, such as strategic housing and employment allocations, as well as national projections of population, employment and socioeconomic factors including car ownership.
- 3.3.4 Thus, applying the derived growth to the surveyed traffic flows will aim to ascertain the increase in background traffic flows in the vicinity of the site.
- 3.3.5 Given the nature of the local highway network, growth factors will be derived for the 2025 and 2033 Weekday and Weekend forecast scenarios.
- 3.3.6 It is proposed to use TEMPro V8.0 for the purposes of this study.
- 3.3.7 As part of the future year assessments, it is imperative that, in addition to background growth, traffic growth arising from other key committed development sites permitted through the planning system is also accounted for. This would ensure that a cumulative traffic impact assessment is undertaken.
- 3.3.8 Committed developments are defined as those having a valid planning consent but which are currently unimplemented or incomplete.
- 3.3.9 Committed development traffic is taken into account in TEMPro V8.0 as the developments identified by the local authority are included within the local plan and local impact is likely to be minimal.

3.3.10 Any alterations to the NTEM planning assumptions will be clearly evidenced.

Proposed Development Traffic

- 3.3.11 The TA undertaken by Hydrock in July 2022 analysed data (provided by McDonald's) of existing McDonald's drive-thru sites in comparable locations (i.e. adjacent food-retail) and undertook a comparison assessment based on the operational information for the proposed site. The data includes traffic counts and customer interviews at McDonald's restaurants with drive-thru facilities. Three restaurants are considered to be comparable to the proposed restaurant due to the similar 'edge of town location' and close to food-retail stores, as well as being within close proximity to residential areas.
- 3.3.12 The McDonald's survey data covers the development peak periods of Friday 16:00-19:00 and Saturday 11:00-15:00. The average of the three surveyed site results has been applied as the proposed traffic generation for Pontardawe for the Weekday PM Peak and Weekend Peak.

Table 3.1: Proposed Traffic Generation based on Surveyed Existing Drive Thru Sites - Weekday PM

Time Period	Proposed Traffic Generation (Vehicles)		
	Arrivals	Departures	Total
16:00-17:00	102	101	203
17:00-18:00	113	112	225
18:00-19:00	101	107	208

Table 3.2: Proposed Traffic Generation based on Surveyed Existing Drive Thru Sites - Weekend

Time Period	Proposed Traffic Generation (Vehicles)		
	Arrivals	Departures	Total
11:00-12:00	89	78	167
12:00-13:00	121	113	234
13:00-14:00	117	128	245
14:00-15:00	105	108	213

- 3.3.13 McDonald's research has proven that there is no statistically significant relationship between McDonald's traffic to floor area, dining area, number of seats or parking provision. Therefore, the averaged surveyed traffic has not been adjusted for any variable.
- 3.3.14 McDonald's data is not available for the Weekday AM peak period as it falls outside of their surveyed peak periods. For robustness, the Weekday AM peak period trip generation will be calculated from the TRICS data identified in Hydrock's TA as it forms the best data available for this time period.

Table 3.3: Proposed Traffic Generation based on TRICS - Weekday AM

Time Period	Proposed Traffic Generation (Vehicles)		
	Arrivals	Departures	Total
07:00-08:00	7	6	13
08:00-09:00	11	11	22
09:00-10:00	17	14	31

- 3.3.15 The trip generation levels associated with the proposed development scheme will be redistributed in line with the May 2023 traffic survey data and assigned using the agreed profiles and loaded onto the network.

4. Calibration, Validation and Results Analysis

4.1 Base Model Calibration

- 4.1.1 Before the final results are collated, a calibration exercise will be undertaken to ensure that the modelled flows are within a permissible degree of unity with the observed. The GEH Statistic, which is a form of a Chi Squared test, will be used to define the calibration threshold, as per TAG and DMRB Guidance. The model will be calibrated to ensure that there are no statistically significant differences between modelled and observed flows for all movements and all 15-minute time periods in the base network. Typically, this necessitates the methodology yielding GEH values < 5 .

4.2 Base Model Validation

- 4.2.1 Following the successful calibration of the model, journey time validation will be undertaken using the separately sourced TomTom route analysis data, which involves extracting aggregated historical travel time data based on a predetermined sample size. The data will be further processed and manipulated to correspond to the journey time measurements defined in Vissim.
- 4.2.2 In accordance with DMRB and TAG guidance, the modelled and observed journey times will be compared to assess the degree of validation of the base model AM and PM hours. The journey time results produced by Vissim should be close to the average observed for the comparative route; within 15% of observed times (or one minute if higher than 15%) for at least 85% of the routes observed. Given the extent of the modelled network, the former criterion is considered more appropriate for this assessment.
- 4.2.3 Given that the objective of the study is to assess the detailed operational performance of the junction, the journey times validation will be supplemented with the surveyed queue lengths. While not an official measure of validation due the random fluctuation and varying definitions, a comparison of modelled and observed queue lengths will be presented to ensure that at the very least they occur at the same times and in the same locations, with less importance ascribed to the order of magnitude.
- 4.2.4 The methodology and applied assumptions will be presented within a Local Model Validation Report (LMVR).

4.3 Results Analysis

- 4.3.1 A whole range of network performance indicators can be obtained from Vissim, such as Level of Service [LOS], Queue lengths, Journey times, Delay etc. For the purposes of this assessment and the exercise in question, modelled journey times (in seconds) and vehicle queue lengths will be obtained, summarised and presented tabularly and graphically per time period to give an informative indication of the changes in delay experienced by drivers through the junction.
- 4.3.2 To produce a statistically valid set of data/results, multiple runs of each model scenario will be undertaken. Vissim uses a random seed to vary the vehicle demand profiles for each model run. The 'random seed' increments used aim to replicate daily differences in traffic flow profiles.

- 4.3.3 Each modelled scenario will be run 10 times, using a different random seed and increment values for each scenario. The results will then be averaged over the 10 runs to smooth out any local discrepancies.
- 4.3.4 As alluded to before, the results and supporting analysis/commentary will be provided in full within the MFR upon completion.

5. Summary

5.1.1 Agreement/discussion is sought on the following:

- » The appropriateness of the proposed network extent and Vissim modelling methodology
- » The scope of the baseline data collection is acceptable.
- » The forecast modelling years and scenarios are acceptable.
- » The committed developments that should be included in the future year assessments.
- » Capping the development growth and applying the NTEM adjustments in TEMPro are acceptable.
- » The proposed development trip rates to be used
- » Trip distribution to be based on the agreed profiles from Hydrock's TA, redistributed in line with the May 2023 traffic survey data