



## **KILDARE COUNTY COUNCIL**

### **Report on Traffic Impact Assessment**

**for**

### **Proposed Development of a New Machinery Yard and Regional Salt Barn, Jigginstown, Newhall, Naas, Co Kildare**



**Kildare County Council,  
County Hall  
Devoy Park  
Naas, Co. Kildare  
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**17032-R-TIA  
Issue PL1**

**Kilgallen & Partners  
Consulting Engineers  
Well Road, Kylekiproe  
Portlaoise, Co. Laois**

## REVISION HISTORY

<b>Client</b>	Kildare County Council
<b>Project</b>	Proposed Development of a New Machinery Yard and Regional Salt Barn, at Jigginstown, Newhall, Naas, Co Kildare
<b>Title</b>	Report on Traffic Impact Assessment

<b>Date</b>	<b>Details of Issue</b>	<b>Issue No.</b>	<b>Origin</b>	<b>Checked</b>	<b>Approved</b>
15/02/19	Initial Issue	PL1	PB	MK	PB

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Appendix I Results of Traffic Analysis for Bundle of Sticks Roundabout

## **1. INTRODUCTION**

### **1.1 INTRODUCTION**

Kildare County Council proposes the construction of a machinery Yard and regional Salt Barn at Jigginstown, Newhall, Naas, Co. Kildare, hereafter referred to as the 'proposed development'.

Kildare County Council has appointed Kilgallen and Partners to assess the impact of the proposed development on traffic flows and to recommend appropriate mitigation measures where the need for such measures are demonstrated by this assessment.

This report presents the findings of this assessment.

### **1.2 STRUCTURE OF THE REPORT**

The structure of this report is outlined as follows:

- Section 2 provides a description of the site of the proposed development and its immediate environs;
- Section 3 describes the proposed development;
- Section 4 defines the scope of the assessment;
- Section 5 and identifies the data sources used in the assessment and predicts the impact on trip assignment that will result from the proposed development;
- Section 6 assesses the impact of the proposed development on the Bundle of Sticks Roundabout;
- Section 7 provides a summary of the report.

## 2. DETAILS OF SITE

### 2.1 SITE LOCATION AND DESCRIPTION

Figure 2-1 shows the location of the proposed development.

The site measures 1.88 hectares and is located on the southern side of the M7 Slip Road, which connects the Bundle-of-Sticks Roundabout to the southbound on-ramp to the M7 Motorway. This road also serves a Local Road (the Rathasker Road) located southwest of the site. Eastbound traffic flows (i.e. from the Local Road to the Bundle-of-Sticks Roundabout) are very low in comparison to the westbound traffic flows towards the M7.



**Figure 2.1 Site Location**

The site, which was historically used for agricultural purposes, is undeveloped and currently unused, and so does not generate traffic flows. There are no facilities for vulnerable road users on the M7 Slip Road - this is not untypical for a road of this nature.

Access to the site is from the existing M7 Slip Road.

### 2.2 UPGRADE OF M7 INTERCHANGE

Figure 2-2 shows the layout of the upgrade to the adjacent M7 Interchange that is under construction as part of the M7 Naas to Newbridge Bypass Upgrade Scheme. The upgrade will relocate the existing westbound M7 on-ramp. The existing M7 Slip Road will no longer connect to the M7 and will only carry traffic between the Bundle-of-Sticks Roundabout and the Local Rathasker Road. Figure 2-3 shows the proposed development and upgraded interchange in context.

The upgrade is due to be completed in April 2019 and will therefore be fully open during the construction and operational stages of the proposed development.

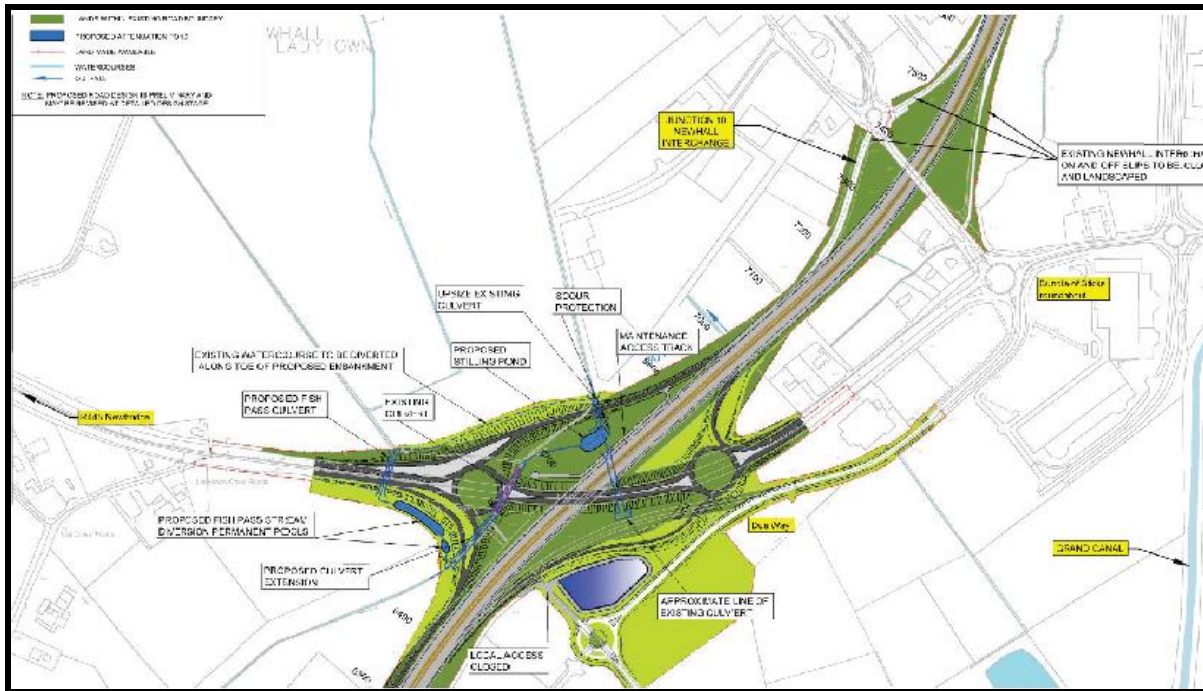


Figure 2.2 Upgraded M7 Interchange



Figure 2.3 Proposed Development and Upgraded M7 Interchange in Context

### 3. PROPOSED DEVELOPMENT

The proposed development is located on a 1.88 hectare site on the current M7 Slip Road southwest of the Bundle of Sticks Roundabout outside Naas.

The proposed development will provide a range of services to Kildare County Council including coordination of winter maintenance, coordination of surface dressing operations, vehicle hire and purchase, provision of vehicles for pothole repair and street sweeping, fuel storage, salt storage, bitumen storage, vehicle re-spray facility, plant storage, workshop facilities and offices for administration purposes. The two main structures to be constructed on the site are :

- An Administration building and workshop. The administration building comprises offices on the first floor (350sq.m) over storage and ancillary accommodation on the ground floor (320sq.m). The workshop will be 630sq.m and is attached to the Administration building.
- A 23,000 tonne (3,480sq.m) Regional Salt Barn for use by Kildare County Council and the Department of Transport. There is an open fronted lean-to (415sq.m) proposed to the side of the saltbarn for the storage of snow ploughs, gritters and other equipment associated with the salt barn. A small welfare building (52sq.m) is proposed for the use of night time gritter drivers.

Ancillary structures to be constructed on the site are:

- a 30,000 litre raised bitumen tank with access stairs and platform
- 2no. 10m x10m aggregate storage bays
- 1no. covered 10m x 10m covered ancillary storage bay
- covered truck wash area with raised platform
- brine storage tank

Other ancillary and associated works are

- site entrance
- weighbridges
- perimeter fences/walls
- internal fencing to secure storage areas
- parking areas
- fuel storage and pumps
- drainage and site services.

A direct access to the proposed development will be provided on the M7 Slip Road. The access will be a simple priority junction.

The Development is described in detail in the drawings and reports listed in Table 3-1.

Reference No	Type	Title
17032-000	Drg	Cover & Index of Drawings
17032-100	Drg	Site Location Map
17032-101	Drg	Site Layout Plan
17032-102	Drg	3d Site Layout Plan
17032-103	Drg	Contextual Sections & Elevations
17032-200	Drg	Admin & Workshop Ground Floor GA
17032-201	Drg	Admin & Workshop First Floor GA
17032-202	Drg	Admin & Workshop Elevations
17032-203	Drg	Admin & Workshop Sections
17032-205	Drg	Salt Barn GA & North East Elevation
17032-206	Drg	Salt Barn Elevations & Sections
17032-207	Drg	Truck Wash, Chip Store & Bitumen Tank
17032-210	Drg	Computer Generated Images
17032-211	Drg	Computer Generated Images
17032-DR-CEI-01	Drg	General Layout of Civil Engineering Infrastructure
17032-DR-CEI-02	Drg	Enabling Infrastructure in The Public Road
17032-R-CEI	Report	Report on Civil Engineering Infrastructure
17032-R-TIA	Report	Traffic Impact Assessment
17032-R-FRA	Report	Site Specific Flood Risk Assessment
	Report	Appropriate Assessment Screening Report
	Report	Ecological Impact Assessment (EcIA) Report
	Report	Archaeological Heritage Impact Assessment
	Report	Ground Investigation Report (March 2018)
17032-EIA	Report	EIA Screening Report

**Table 3-1 Schedule of Drawings showing details of Proposed Development**



#### **4. SCOPE OF ASSESSMENT**

The purpose of this assessment is to consider the impact of the proposed development on the operation of the public road network.

Upon completion of the upgrade to the M7 Interchange, the road from which the proposed development will be accessed will become a local road and will be lightly trafficked. The access to the development will therefore operate comfortably within its capacity.

Very few of the trips generated by the proposed development will have the Rathasker Road as their origin or destination. For the purposes of this assessment, it is assumed that all trips arriving at and departing from the proposed development will do so via the Bundle of Sticks Roundabout. The operation of this roundabout in the with-development and without-development scenarios will be analysed. For the purposes of this analysis, it is assumed that trips generated by proposed development will arrive at the Bundle of Sticks Roundabout in the same proportions as predicted flows for the without-development scenario.

Beyond the Bundle of Sticks roundabout, trips generated by the proposed development will be divided between the three other arms of the roundabout. This dilutes the potential impact of the proposed development on the operation of these roads to the extent that assessment of the impact of the proposed development on roads beyond the Bundle of Sticks Roundabout is not considered necessary.

The proposed development does not include proposals for vulnerable road users. However, this is acceptable given its location and function. It is noted that the proposed development will not preclude the provision of facilities for vulnerable road users on the existing M7 Slip Road upon completion of the M7 Interchange Upgrade.

## 5. TRAFFIC FLOWS

### 5.1 TRAFFIC TRIPS GENERATED BY THE PROPOSED DEVELOPMENT

Trips that will be generated by the proposed development are summarised in Table 5-1. All figures are quoted in passenger car units (PCU).

Time Range	Staff / Visitors		Workshop		Salt Barn	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
07:00-08:00					7	7
08:00-09:00	30		1.7	1.7	7	7
09:00-10:00	3	3	1.7	1.7	7	7
10:00-11:00	3	3	1.7	1.7	7	7
11:00-12:00	3	3	1.7	1.7	7	7
12:00-13:00	3	3	1.7	1.7	7	7
13:00-14:00	33	33	1.7	1.7	7	7
14:00-15:00	3	3	1.7	1.7	7	7
15:00-16:00	3	3	1.7	1.7	7	7
16:00-17:00	3	3	1.7	1.7	7	7
17:00-18:00	3	30	1.7	1.7	7	7
18:00-19:00					7	7
12 hr total	87	87	17	17	84	84

**Table 5-1 Summary of Traffic Flows to and from the Development**

The figures provided in Table 5-1 are derived as follows:

**Staff / Visitors** The proposed development provides 39no. parking spaces. It is assumed that 30 of these will be taken by staff (for the Admin Building, Workshop and Salt Barn). The remaining spaces will be taken by visitors. It is conservatively assumed that the arrival of staff in the morning will be coincident with the AM peak at the Bundle of Sticks Roundabout, and the departure in the evening will be coincident with the PM peak.

All staff will leave the site in the 15minutes interval after 13:00 and return in the 15minutes interval after 14:00.

Each visitor space will generate three arrivals and three departures every day, equivalent to 27 arrivals and 27 departures over the day. This is rounded up to 3 PCU per hour.

Workshop The workshop will attract 3 no. HCVs per day for repair purposes and 5 no. light goods vehicles per day delivering equipment. Total arrivals per day, in terms of PCU, will be  $(3 \times 2.3) + (5 \times 2) = 16.9$ , spread evenly over the day. Total departures will be same.

Salt Barn The Salt Barn will typically attract approximately 3 HCVs per day. During peak times, this will increase to a maximum of 36 vehicles, equivalent to 3 vehicles per hour.

Total arrivals per day, in terms of PCU, will be  $(36 \times 2.3) = 82.8$ , spread evenly over the day. Total departures will be same. This is rounded up to 84 PCU, equivalent to 7 per hour.

## **5.2 TRAFFIC FLOWS AT THE BUNDLE OF STICKS ROUNDABOUT**

The upgrade of the M7 interchange will significantly alter traffic patterns at the Bundle-of-Sticks Roundabout. As a result, traffic flows cannot be extrapolated from current flows.

Instead, 'without-development' traffic flows at the Bundle-of-Sticks Roundabout are based on the traffic flows predicted in the EIS prepared for the M7 Naas to Newbridge Bypass Upgrade Scheme. 'With-development' traffic flows are based on these 'without-development' figures but with the trip generation numbers shown in Table 5-1 added.

For the purpose of this assessment, the Design Year is taken as 2030, this being the Design Year used in the EIS prepared for the M7 Naas to Newbridge Bypass Upgrade Scheme.

Tables 5-2 and 5-3 show, for the 2030 AM and PM peaks respectively, 'without-development' traffic flows, trips that will be generated by the proposed development and 'with-development' traffic flows.

<b>2030 AM peak without development (veh/min)</b>						
	07:45 to 08:00	08:00 to 08:15	08:15 to 08:30	08:30 to 08:45	08:45to 09:00	09:00 to 09:15
Bridge over motorway	4.35	5.2	6.37	6.37	5.2	4.35
R445 East	12.56	15	18.37	18.37	15	12.56
M7 Slip Road	0.68	0.81	0.99	0.99	0.81	0.68
R445 West	13.38	15.97	19.56	19.56	15.97	13.38

<b>Trips generated by proposed development in AM peak (veh / min)</b>						
	07:45 to 08:00	08:00 to 08:15	08:15 to 08:30	08:30 to 08:45	08:45to 09:00	09:00 to 09:15
Bridge over motorway	0.02	0.09	0.09	0.09	0.09	0.03
R445 East	0.05	0.27	0.27	0.27	0.27	0.08
M7 Slip Road	0.80	0.96	1.14	1.14	0.96	0.88
R445 West	0.05	0.28	0.28	0.28	0.28	0.09

<b>2030 AM peak with development (veh/min)</b>						
	07:45 to 08:00	08:00 to 08:15	08:15 to 08:30	08:30 to 08:45	08:45to 09:00	09:00 to 09:15
Bridge over motorway	4.37	5.29	6.46	6.46	5.29	4.38
R445 East	12.61	15.27	18.64	18.64	15.27	12.64
M7 Slip Road	1.48	1.77	2.13	2.13	1.77	1.56
R445 West	13.43	16.25	19.84	19.84	16.25	13.47

**Table 5-2 2030 Traffic Flows at Bundle-of Sticks Roundabout During AM Peak**

<b>2030 PM peak without development (veh/min)</b>						
	16:45 to 17:00	08:00 to 08:15	08:15 to 08:30	08:30 to 08:45	08:45to 09:00	09:00 to 09:15
Bridge over motorway	5.72	6.83	8.37	8.37	6.83	5.72
R445 East	12.33	14.73	18.04	18.04	14.73	12.33
M7 Slip Road	0.55	0.66	0.81	0.81	0.66	0.55
R445 West	17.93	21.41	26.22	26.22	21.41	17.93

<b>Trips generated by proposed development in PM peak (veh / min)</b>						
	16:45 to 17:00	08:00 to 08:15	08:15 to 08:30	08:30 to 08:45	08:45to 09:00	09:00 to 09:15
Bridge over motorway	0.03	0.03	0.03	0.03	0.03	0.02
R445 East	0.07	0.07	0.07	0.07	0.07	0.04
M7 Slip Road	0.75	1.31	1.46	1.46	1.31	0.67
R445 West	0.10	0.10	0.10	0.10	0.10	0.06

<b>2030 PM peak with development (veh/min)</b>						
	16:45 to 17:00	08:00 to 08:15	08:15 to 08:30	08:30 to 08:45	08:45to 09:00	09:00 to 09:15
Bridge over motorway	5.75	6.86	8.40	8.40	6.86	5.74
R445 East	12.40	14.80	18.11	18.11	14.80	12.37
M7 Slip Road	1.30	1.97	2.27	2.27	1.97	1.22
R445 West	18.03	21.51	26.32	26.32	21.51	17.99

**Table 5-3 2030 Traffic Flows at Bundle-of Sticks Roundabout During PM Peak**

## 6. ANALYSIS OF IMPACT ON THE BUNDLE OF STICKS ROUNDABOUT

For both the without-development and with-development scenarios, the operation of the Bundle-of-Sticks Roundabout was assessed for the peak AM and PM periods. This assessment was carried out using the industry-standard modelling package ARCADY produced by the Transport and Road Research Laboratory (UK) and the traffic flow figures contained in Tables 5-2 and 5-3. The results of the analysis are summarised in Tables 6-1 and 6-2 and reproduced in full in Annex I.

The operation of each entry arm is considered under two criteria: the maximum RFC value and the queueing delay per vehicle (RFC is the ratio of traffic flow to junction capacity; an approach arm is typically considered to be operating within capacity if it has an RFC less than 0.85). Of these criteria, the more important for assessing the impact of the proposed development is the queueing delay, since this is a better measure of the impact on individual drivers.

The proposed development will increase queueing delay for all arms. The relative increase will be greatest for the existing M7 Slip Road (which will at this time be a local road); this is to be expected given the low traffic flows that will be on this road once the interchange upgrade is complete. It is acceptable since in overall terms, the queueing delay will remain low on this approach.

For other approaches, the relative increases in Queueing Delay will generally be less than 10.0%. The exception will be the approach from Naas (i.e. R445 East), which will see an increase of 10.8% in the AM peak. This is because this junction will operate close to capacity under the without-development scenario, and so additional traffic flows are less easily absorbed. However the relative increase in RFC values is much smaller for all arms and so the proposed development will have little or no impact on the operating capacity of the roundabout.

In summary, the proposed development will have a slight to moderate, permanent impact on the operation of the Bundle of Sticks Roundabout during peak AM and PM periods. The impact will be insignificant during other times of the day.

From	Without development		With development		% increase in Queueing Delay
	max RFC	Queueing Delay (veh.min/interval)	max RFC	Queueing Delay (veh.min/ interval)	
Bridge over Motorway	0.412	10.4	0.426	11.0	5.8%
R445 East	0.865	87.1	0.879	96.5	10.8%
Rathasker Road	0.093	1.5	0.204	3.8	153.3%
R445 West	0.609	23.1	0.627	24.9	7.8%

**Table 6-1 Results of ARCADY Analysis for 2030 AM Peak**

From	Without development		With development		% increase in Queueing Delay
	max RFC	Queueing Delay (veh.min/interval)	max RFC	Queueing Delay (veh.min/ interval)	
Bridge over Motorway	0.660	28.1	0.679	30.	6.8%
R445 East	0.885	100.0	0.888	103.0	3.0%
Rathasker Road	0.081	1.3	0.227	4.4	238.5%
R445 West	0.806	60.2	0.820	65.3	8.5%

**Table 6-2 Results of ARCADY Analysis for 2030 PM Peak**

## 7. SUMMARY

The proposed development is located on a 1.88 hectare site on the current M7 Slip Road southwest of the Bundle of Sticks Roundabout outside Naas. The proposed development comprises a Machinery Yard, Regional Salt Barn, ancillary buildings and associated site services. A direct access to the proposed development will be provided on the M7 Slip Road. The access will be a simple priority junction.

The purpose of this assessment is to consider the impact of the proposed development on the operation of the public road network.

Upon completion of the upgrade to the M7 Interchange, the road from which the proposed development will be accessed will become a local road and will be lightly trafficked. The access to the development will therefore operate comfortably within its capacity.

Effectively all trips arriving at and departing from the proposed development will do so via the Bundle of Sticks Roundabout. The operation of this roundabout in the with-development and without-development scenarios was analysed. The analysis found that the proposed development will have a slight to moderate, permanent impact on the operation of the Bundle of Sticks Roundabout during peak AM and PM periods. The impact will be insignificant during other times of the day.

Beyond the Bundle of Sticks roundabout, trips generated by the proposed development will be divided between the three other arms of the roundabout. This dilutes the potential impact of the proposed development on the operation of these roads to the extent that assessment of the impact of the proposed development on roads beyond the Bundle of Sticks Roundabout is not considered necessary.

The proposed development does not include proposals for vulnerable road users. However, this is acceptable given its location and function. It is noted that the proposed development will not preclude the provision of facilities for vulnerable road users on the future Rathasker Road.



**APPENDIX I**

**RESULTS OF ARCADY ANALYSES FOR OPERATION OF BUNDLE OF STICKS**

**ROUNDAABOUT**

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CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM  
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Run with file:-  
"q:\217 All Jobs\17032 KCC Road Mtce Depot\03 Design & Calcs\3-1 Civil\3-1-6 Traffic\BoS Rbt\  
Bundle of Sticks\_2030 -PM.vai"  
(drive-on-the-left) at 13:09:56 on Wednesday, 13 February 2019

ROUNDABOUT CAPACITY AND DELAY  
\*\*\*\*\*

RUN TITLE  
\*\*\*\*\*  
Bundle of Sticks\_2030 PM\_Without Development

INPUT DATA  
\*\*\*\*\*  
ARM A - L2030 Overbridge  
ARM B - R445 East  
ARM C - M7 Access Road  
ARM D - R445 West

GEOMETRIC DATA  
-----

I	ARM	I	V (M)	I	E (M)	I	L (M)	I	R (M)	I	D (M)	I	PHI (DEG)	I	SLOPE	I	INTERCEPT (PCU/MIN)	I
I	ARM A	I	4.20	I	6.20	I	5.00	I	22.90	I	67.50	I	44.0	I	0.470	I	24.553	I
I	ARM B	I	3.90	I	6.50	I	5.00	I	28.50	I	67.50	I	25.0	I	0.497	I	25.410	I
I	ARM C	I	3.70	I	5.50	I	5.00	I	22.60	I	67.50	I	36.0	I	0.458	I	22.561	I
I	ARM D	I	7.10	I	8.30	I	2.50	I	30.50	I	67.50	I	41.0	I	0.600	I	37.429	I

V = approach half-width      L = effective flare length      D = inscribed circle diameter  
E = entry width                  R = entry radius                      PHI = entry angle

TRAFFIC DEMAND DATA  
-----

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

LENGTH OF TIME PERIOD - 90 MINUTES.  
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)							
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D				
16.45 - 18.15	ARM A	0.000	0.380	0.010	0.610				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM B	0.120	0.000	0.010	0.870				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM C	0.060	0.390	0.000	0.550				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM D	0.230	0.760	0.010	0.000				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
16.45-17.00								
ARM A	5.72	15.76	0.363		0.0	0.6	8.2	
ARM B	12.33	21.26	0.580		0.0	1.4	19.3	
ARM C	0.55	13.38	0.041		0.0	0.0	0.6	
ARM D	17.93	33.00	0.543		0.0	1.2	17.1	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.00-17.15								
ARM A	6.83	14.46	0.472		0.6	0.9	12.7	
ARM B	14.73	20.90	0.705		1.4	2.3	32.6	
ARM C	0.66	11.96	0.055		0.0	0.1	0.9	
ARM D	21.41	32.79	0.653		1.2	1.9	26.7	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.15-17.30								
ARM A	8.37	12.73	0.658		0.9	1.8	25.6	
ARM B	18.04	20.41	0.884		2.3	6.3	80.0	
ARM C	0.81	10.14	0.080		0.1	0.1	1.3	
ARM D	26.22	32.53	0.806		1.9	4.0	54.5	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.30-17.45								
ARM A	8.37	12.68	0.660		1.8	1.9	28.1	
ARM B	18.04	20.39	0.885		6.3	6.9	100.0	
ARM C	0.81	10.02	0.081		0.1	0.1	1.3	
ARM D	26.22	32.51	0.806		4.0	4.1	60.2	

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	17.45-18.00									I
I	ARM A	6.83	14.39	0.474		1.9	0.9	14.5		I
I	ARM B	14.73	20.87	0.706		6.9	2.5	42.0		I
I	ARM C	0.66	11.78	0.056		0.1	0.1	0.9		I
I	ARM D	21.41	32.77	0.653		4.1	1.9	30.2		I

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	18.00-18.15									I
I	ARM A	5.72	15.71	0.364		0.9	0.6	9.0		I
I	ARM B	12.33	21.24	0.580		2.5	1.4	22.1		I
I	ARM C	0.55	13.29	0.041		0.1	0.0	0.7		I
I	ARM D	17.93	32.98	0.544		1.9	1.2	18.6		I

QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.6	*
17.15	0.9	*
17.30	1.8	**
17.45	1.9	**
18.00	0.9	*
18.15	0.6	*

QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	1.4	*
17.15	2.3	**
17.30	6.3	*****
17.45	6.9	*****
18.00	2.5	**
18.15	1.4	*

QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.0
17.15	0.1
17.30	0.1
17.45	0.1
18.00	0.1
18.15	0.0

QUEUE AT ARM D

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	1.2 *
17.15	1.9 **
17.30	4.0 ****
17.45	4.1 ****
18.00	1.9 **
18.15	1.2 *

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND	* QUEUEING * * DELAY *	* INCLUSIVE QUEUEING * * DELAY *
(VEH)	(VEH/H)	(MIN)	(MIN/VEH)
A	627.6	98.0	0.16
B	1353.0	296.0	0.22
C	60.6	5.6	0.09
D	1966.8	207.3	0.11
ALL	4008.0	607.0	0.15

\* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD.

\* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

\* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

\*\*\*\*\* ARCADY 5 run completed.

==== end of file =====

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CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM  
RELEASE 1.1 (MAY 2001)

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EMAIL: SoftwareBureau@trl.co.uk  
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Run with file:-

"q:\217 All Jobs\17032 KCC Road Mtce Depot\03 Design & Calcs\3-1 Civil\3-1-6 Traffic\BoS Rbt\  
Bundle of Sticks\_2030 - PM - Proposed.vai"  
(drive-on-the-left) at 13:15:42 on Wednesday, 13 February 2019

ROUNDABOUT CAPACITY AND DELAY  
\*\*\*\*\*

RUN TITLE  
\*\*\*\*\*  
Bundle of Sticks\_2030 PM\_With Development

INPUT DATA  
\*\*\*\*\*  
ARM A - L2030 Overbridge  
ARM B - R445 East  
ARM C - M7 Access Road  
ARM D - R445 West

GEOMETRIC DATA  
-----

I	ARM	I	V (M)	I	E (M)	I	L (M)	I	R (M)	I	D (M)	I	PHI (DEG)	I	SLOPE	I	INTERCEPT (PCU/MIN)	I
I	ARM A	I	4.20	I	6.20	I	5.00	I	22.90	I	67.50	I	44.0	I	0.470	I	24.553	I
I	ARM B	I	3.90	I	6.50	I	5.00	I	28.50	I	67.50	I	25.0	I	0.497	I	25.410	I
I	ARM C	I	3.70	I	5.50	I	5.00	I	22.60	I	67.50	I	36.0	I	0.458	I	22.561	I
I	ARM D	I	7.10	I	8.30	I	2.50	I	30.50	I	67.50	I	41.0	I	0.600	I	37.429	I

V = approach half-width            L = effective flare length            D = inscribed circle diameter  
E = entry width                    R = entry radius                    PHI = entry angle

TRAFFIC DEMAND DATA  
-----

TIME PERIOD BEGINS 16.45 AND ENDS 18.15

LENGTH OF TIME PERIOD - 90 MINUTES.  
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)							
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D				
16.45 - 18.15	ARM A	0.000	0.380	0.010	0.610				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM B	0.120	0.000	0.010	0.870				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM C	0.060	0.390	0.000	0.550				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM D	0.230	0.760	0.010	0.000				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
16.45-17.00								
ARM A	5.75	15.58	0.369		0.0	0.6	8.4	
ARM B	12.40	21.25	0.583		0.0	1.4	19.6	
ARM C	1.30	13.34	0.097		0.0	0.1	1.6	
ARM D	18.03	32.79	0.550		0.0	1.2	17.5	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.00-17.15								
ARM A	6.86	14.19	0.483		0.6	0.9	13.3	
ARM B	14.80	20.89	0.709		1.4	2.3	33.1	
ARM C	1.97	11.92	0.165		0.1	0.2	2.9	
ARM D	21.51	32.44	0.663		1.2	1.9	27.9	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.15-17.30								
ARM A	8.40	12.43	0.676		0.9	2.0	27.4	
ARM B	18.11	20.41	0.887		2.3	6.5	81.9	
ARM C	2.27	10.11	0.225		0.2	0.3	4.2	
ARM D	26.32	32.13	0.819		1.9	4.3	58.5	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
17.30-17.45								
ARM A	8.40	12.38	0.679		2.0	2.1	30.4	
ARM B	18.11	20.38	0.888		6.5	7.1	103.0	
ARM C	2.27	9.98	0.227		0.3	0.3	4.4	
ARM D	26.32	32.11	0.820		4.3	4.4	65.3	

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	17.45-18.00									I
I	ARM A	6.80	14.11	0.482		2.1	0.9	15.0		I
I	ARM B	14.80	20.88	0.709		7.1	2.5	42.9		I
I	ARM C	1.97	11.75	0.168		0.3	0.2	3.1		I
I	ARM D	21.51	32.41	0.664		4.4	2.0	31.8		I

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	18.00-18.15									I
I	ARM A	5.74	15.56	0.369		0.9	0.6	9.1		I
I	ARM B	12.37	21.24	0.583		2.5	1.4	22.3		I
I	ARM C	1.22	13.26	0.092		0.2	0.1	1.6		I
I	ARM D	17.99	32.80	0.548		2.0	1.2	19.0		I

QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	0.6	*
17.15	0.9	*
17.30	2.0	**
17.45	2.1	**
18.00	0.9	*
18.15	0.6	*

QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE	
17.00	1.4	*
17.15	2.3	**
17.30	6.5	*****
17.45	7.1	*****
18.00	2.5	***
18.15	1.4	*

QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	0.1
17.15	0.2
17.30	0.3
17.45	0.3
18.00	0.2
18.15	0.1



-----  
 QUEUE AT ARM D  
 -----

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.00	1.2 *
17.15	1.9 **
17.30	4.3 ****
17.45	4.4 ****
18.00	2.0 **
18.15	1.2 *

-----  
 QUEUEING DELAY INFORMATION OVER WHOLE PERIOD  
 -----

ARM	TOTAL DEMAND	* QUEUEING * * DELAY *	* INCLUSIVE QUEUEING * * DELAY *
(VEH)	(VEH/H)	(MIN)	(MIN/VEH)
A	629.3	103.6	0.16
B	1358.9	302.8	0.22
C	165.0	17.7	0.11
D	1975.2	220.0	0.11
ALL	4128.3	644.0	0.16

\* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD.  
 \* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.  
 \* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

\*\*\*\*\* ARCADY 5 run completed.

===== end of file =====

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CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM  
RELEASE 1.1 (MAY 2001)

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Run with file:-  
"q:\217 All Jobs\17032 KCC Road Mtce Depot\03 Design & Calcs\3-1 Civil\3-1-6 Traffic\BoS Rbt\  
Bundle of Sticks\_2030 - AM.vai"  
(drive-on-the-left) at 12:53:41 on Wednesday, 13 February 2019

ROUNDABOUT CAPACITY AND DELAY  
\*\*\*\*\*

RUN TITLE  
\*\*\*\*\*  
Bundle of Sticks\_2030 AM\_Without Development

INPUT DATA  
\*\*\*\*\*  
ARM A - L2030 Overbridge  
ARM B - R445 East  
ARM C - M7 Access Road  
ARM D - R445 West

GEOMETRIC DATA  
-----

I	ARM	I	V (M)	I	E (M)	I	L (M)	I	R (M)	I	D (M)	I	PHI (DEG)	I	SLOPE	I	INTERCEPT (PCU/MIN)	I
I	ARM A	I	4.20	I	6.20	I	5.00	I	22.90	I	67.50	I	44.0	I	0.470	I	24.553	I
I	ARM B	I	3.90	I	6.50	I	5.00	I	28.50	I	67.50	I	25.0	I	0.497	I	25.410	I
I	ARM C	I	3.70	I	5.50	I	5.00	I	22.60	I	67.50	I	36.0	I	0.458	I	22.561	I
I	ARM D	I	7.10	I	8.30	I	2.50	I	30.50	I	67.50	I	41.0	I	0.600	I	37.429	I

V = approach half-width            L = effective flare length            D = inscribed circle diameter  
E = entry width                    R = entry radius                    PHI = entry angle

TRAFFIC DEMAND DATA  
-----

TIME PERIOD BEGINS 07.45 AND ENDS 09.15

LENGTH OF TIME PERIOD - 90 MINUTES.  
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)							
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D				
07.45 - 09.15	ARM A	0.000	0.470	0.010	0.520				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM B	0.140	0.000	0.000	0.860				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM C	0.280	0.350	0.000	0.370				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM D	0.270	0.710	0.020	0.000				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
07.45-08.00								
ARM A	4.35	17.63	0.247		0.0	0.3	4.8	
ARM B	12.56	21.83	0.575		0.0	1.3	19.0	
ARM C	0.68	13.77	0.049		0.0	0.1	0.8	
ARM D	13.38	32.72	0.409		0.0	0.7	10.1	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.00-08.15								
ARM A	5.20	16.71	0.311		0.3	0.4	6.6	
ARM B	15.00	21.57	0.695		1.3	2.2	31.3	
ARM C	0.81	12.44	0.065		0.1	0.1	1.0	
ARM D	15.97	32.47	0.492		0.7	1.0	14.1	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
ARM A	6.37	15.46	0.412		0.4	0.7	10.1	
ARM B	18.37	21.23	0.865		2.2	5.6	72.1	
ARM C	0.99	10.69	0.093		0.1	0.1	1.5	
ARM D	19.56	32.13	0.609		1.0	1.5	22.3	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
ARM A	6.37	15.44	0.412		0.7	0.7	10.4	
ARM B	18.37	21.23	0.865		5.6	6.0	87.1	
ARM C	0.99	10.60	0.093		0.1	0.1	1.5	
ARM D	19.56	32.11	0.609		1.5	1.5	23.1	

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	08.45-09.00									I
I	ARM A	5.20	16.69	0.312		0.7	0.5	7.0		I
I	ARM B	15.00	21.57	0.695		6.0	2.4	39.0		I
I	ARM C	0.81	12.29	0.066		0.1	0.1	1.1		I
I	ARM D	15.97	32.44	0.492		1.5	1.0	15.0		I

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	09.00-09.15									I
I	ARM A	4.35	17.61	0.247		0.5	0.3	5.1		I
I	ARM B	12.56	21.82	0.576		2.4	1.4	21.6		I
I	ARM C	0.68	13.69	0.050		0.1	0.1	0.8		I
I	ARM D	13.38	32.71	0.409		1.0	0.7	10.6		I

QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.3
08.15	0.4
08.30	0.7 *
08.45	0.7 *
09.00	0.5
09.15	0.3

QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	1.3 *
08.15	2.2 **
08.30	5.6 *****
08.45	6.0 *****
09.00	2.4 **
09.15	1.4 *

QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.1
08.15	0.1
08.30	0.1
08.45	0.1
09.00	0.1
09.15	0.1

-----  
 QUEUE AT ARM D  
 -----

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.7 *
08.15	1.0 *
08.30	1.5 **
08.45	1.5 **
09.00	1.0 *
09.15	0.7 *

-----  
 QUEUEING DELAY INFORMATION OVER WHOLE PERIOD  
 -----

ARM	TOTAL DEMAND	* QUEUEING * * DELAY *	* INCLUSIVE QUEUEING * * DELAY *
(VEH)	(VEH/H)	(MIN)	(MIN/VEH)
A	477.6	43.9	0.09
B	1377.9	270.1	0.20
C	74.4	6.7	0.09
D	1467.3	95.3	0.06
ALL	3397.2	416.0	0.12

\* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD.  
 \* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.  
 \* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

\*\*\*\*\* ARCADY 5 run completed.

===== end of file =====

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CAPACITIES, QUEUES AND DELAYS AT ROUNDABOUTS

ARCADY 5.0 ANALYSIS PROGRAM  
RELEASE 1.1 (MAY 2001)

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Run with file:-

"q:\217 All Jobs\17032 KCC Road Mtce Depot\03 Design & Calcs\3-1 Civil\3-1-6 Traffic\BoS Rbt\  
Bundle of Sticks\_2030 - AM - Proposed.vai"  
(drive-on-the-left) at 13:04:40 on Wednesday, 13 February 2019

ROUNDABOUT CAPACITY AND DELAY  
\*\*\*\*\*

RUN TITLE  
\*\*\*\*\*  
Bundle of Sticks\_2030 AM\_With Development

INPUT DATA  
\*\*\*\*\*  
ARM A - L2030 Overbridge  
ARM B - R445 East  
ARM C - M7 Access Road  
ARM D - R445 West

GEOMETRIC DATA  
-----

I	ARM	I	V (M)	I	E (M)	I	L (M)	I	R (M)	I	D (M)	I	PHI (DEG)	I	SLOPE	I	INTERCEPT (PCU/MIN)	I
I	ARM A	I	4.20	I	6.20	I	5.00	I	22.90	I	67.50	I	44.0	I	0.470	I	24.553	I
I	ARM B	I	3.90	I	6.50	I	5.00	I	28.50	I	67.50	I	25.0	I	0.497	I	25.410	I
I	ARM C	I	3.70	I	5.50	I	5.00	I	22.60	I	67.50	I	36.0	I	0.458	I	22.561	I
I	ARM D	I	7.10	I	8.30	I	2.50	I	30.50	I	67.50	I	41.0	I	0.600	I	37.429	I

V = approach half-width            L = effective flare length            D = inscribed circle diameter  
E = entry width                    R = entry radius                    PHI = entry angle

TRAFFIC DEMAND DATA  
-----

TIME PERIOD BEGINS 07.45 AND ENDS 09.15

LENGTH OF TIME PERIOD - 90 MINUTES.  
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS (PERCENTAGE OF H.V.S)							
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D				
07.45 - 09.15	ARM A	0.000	0.470	0.010	0.520				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM B	0.140	0.000	0.000	0.860				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM C	0.280	0.350	0.000	0.370				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				
	ARM D	0.270	0.710	0.020	0.000				
		( 10.0)	( 10.0)	( 10.0)	( 10.0)				

DEFAULT PROPORTIONS OF HEAVY VEHICLES ARE USED

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
07.45-08.00								
ARM A	4.37	17.48	0.250		0.0	0.3	4.8	
ARM B	12.61	21.82	0.578		0.0	1.3	19.2	
ARM C	1.48	13.74	0.108		0.0	0.1	1.8	
ARM D	13.43	32.42	0.414		0.0	0.7	10.3	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.00-08.15								
ARM A	5.29	16.46	0.321		0.3	0.5	6.9	
ARM B	15.27	21.55	0.709		1.3	2.4	33.1	
ARM C	1.77	12.29	0.144		0.1	0.2	2.5	
ARM D	16.25	32.08	0.507		0.7	1.0	14.9	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.15-08.30								
ARM A	6.46	15.17	0.426		0.5	0.7	10.6	
ARM B	18.64	21.21	0.879		2.4	6.2	78.4	
ARM C	2.13	10.56	0.202		0.2	0.3	3.7	
ARM D	19.84	31.68	0.626		1.0	1.7	23.9	

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)
08.30-08.45								
ARM A	6.46	15.16	0.426		0.7	0.7	11.0	
ARM B	18.64	21.20	0.879		6.2	6.6	96.5	
ARM C	2.13	10.46	0.204		0.3	0.3	3.8	
ARM D	19.84	31.66	0.627		1.7	1.7	24.9	

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	08.45-09.00									I
I	ARM A	5.29	16.44	0.322		0.7	0.5	7.4		I
I	ARM B	15.27	21.54	0.709		6.6	2.5	42.2		I
I	ARM C	1.77	12.13	0.146		0.3	0.2	2.6		I
I	ARM D	16.25	32.05	0.507		1.7	1.0	16.0		I

I	TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	I
I	09.00-09.15									I
I	ARM A	4.38	17.43	0.251		0.5	0.3	5.2		I
I	ARM B	12.64	21.81	0.580		2.5	1.4	22.0		I
I	ARM C	1.56	13.65	0.114		0.2	0.1	2.0		I
I	ARM D	13.47	32.37	0.416		1.0	0.7	11.0		I

QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.3
08.15	0.5
08.30	0.7 *
08.45	0.7 *
09.00	0.5
09.15	0.3

QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	1.3 *
08.15	2.4 **
08.30	6.2 *****
08.45	6.6 *****
09.00	2.5 ***
09.15	1.4 *

QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.1
08.15	0.2
08.30	0.3
08.45	0.3
09.00	0.2
09.15	0.1



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 QUEUE AT ARM D  
 -----

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
08.00	0.7 *
08.15	1.0 *
08.30	1.7 **
08.45	1.7 **
09.00	1.0 *
09.15	0.7 *

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 QUEUEING DELAY INFORMATION OVER WHOLE PERIOD  
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I	ARM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I	I	I	I	I	* DELAY *	I	* DELAY *	I		
I	I	I	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)		
I	A	I	483.7	I	322.5	I	45.9	I	0.09	I
I	B	I	1396.1	I	930.7	I	291.5	I	0.21	I
I	C	I	162.6	I	108.4	I	16.3	I	0.10	I
I	D	I	1486.2	I	990.8	I	101.0	I	0.07	I
I	ALL	I	3528.6	I	2352.4	I	454.6	I	0.13	I

\* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD.  
 \* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.  
 \* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

\*\*\*\*\* ARCADY 5 run completed.

===== end of file =====