

**SLEAFORD RENEWABLE ENERGY PLANT
BOSTON ROAD, SLEAFORD**

HIGHWAYS TECHNICAL NOTE 4

**Review of anticipated Sleaford REP development traffic impact at the
Bone Mills Interchange, Sleaford North**

1.0 INTRODUCTION

1.1 This Technical Note has been prepared by Axis to provide a comprehensive review of the anticipated operational impact of the proposed Sleaford REP development on highway operational conditions at the A17 Sleaford Bypass / A153 East Road / B1517 interchange (also known as the Bone Mills Interchange). The note has been prepared in response to comments raised by LCC regarding the extent of the technical review of impact conditions at this interchange as included in the Transport Statement report submitted to NKDC in August 2007 in support of the formal planning application.

1.2 Additional information included as part of this Technical Note includes the following:

- Review of existing background conditions at the Bone Mills interchange - including new background traffic count data for the main internal junction layouts;
- Identification of the levels of Sleaford REP development traffic anticipated to utilise the key Bone Mills interchange elements;
- Results of relevant PICADY and ARCADY assessment runs including for Sleaford REP traffic;
- Results of relevant link / flow assessment runs including for Sleaford REP traffic.

1.3 The remainder of the report considers the following issues:

- A description of local operating conditions at the Bone Mills Interchange;
- A review of Sleaford REP development traffic demand anticipated to access the Bone Mills Interchange;
- A review of future year junction capacity tests and link / flow assessments for the main internal junctions under background + Sleaford REP development scenarios.
- Summary and conclusions

2.0 DESCRIPTION OF EXISTING NETWORK CONDITIONS

2.1 Junction location and layout

2.1.1 This Technical Note has been prepared to consider highway operational conditions at the A17 / A153 Bone Mills Interchange. The location of this junction is highlighted in Figure 1.

2.1.2 The Bone Mills Interchange is a grade separated junction providing all-movement slip road access to / from the A17 Sleaford Bypass. The interchange is made up of two main elements:

- A ghost island T-junction to the north of the A17 over-bridge;
- A 5-arm roundabout to the south of the A17 over-bridge.

2.1.3 Base plans of these layouts are provided as Figure 2 to this report, with appropriate aerial photographs included as Appendix A.

2.1.4 Access to / from the Bone Mills Interchange from the A17 Sleaford Bypass mainline dual carriageway is delivered via taper diverge layouts.

2.1.5 Background traffic demand at the Bone Mills Interchange has been established via the undertaking of suitable traffic count exercises during early March 2008. These surveys included for the following:

- Ghost island T-junction traffic demand;
- Roundabout traffic demand;
- Slip road traffic flows.

2.1.6 Hourly traffic demand observed during the 2008 surveys are illustrated in Figure 3(a-c) to this report. These flows represent the highest hourly demand figures recorded across the different surveyed periods. These hourly flows consider the following time periods:

- AM peak period: 07:45 – 08:45
- Lunchtime (off-peak) period: 13:00 – 14:00
- PM peak period: 16:15 – 17:15

2.1.7 Review of this traffic information identified that traffic demand during the traditional AM & PM rush hour peaks is significantly higher than at off-peak times (such as lunchtime / mid-day periods).

2.2.8 Review of the detailed classified count data at the Bone Mills junctions identifies the following large vehicle (OGV 1, OGV2 & PSV) proportions:

Northern T-junction

Approach	07:45 – 08:45	13:00 – 14:00	16:15 – 17:15
A153 (N'bnd)	11.0%	8.9%	5.7%
A17 Off-slip	5.9%	12.1%	9.0%
A153 (S'bnd)	1.5%	11.3%	5.8%

Southern Roundabout

Approach	07:45 – 08:45	13:00 – 14:00	16:15 – 17:15
A153 (S'bnd)	5.1%	9.4%	7.8%
A17 Off-slip	7.4%	12.1%	5.9%
Lions Way	33.3%	4.5%	0.0%
B1517 (N'bnd)	10.7%	4.9%	2.0%
Pride Parkway	35.0%	9.0%	3.1%

2.2.9 The high HGV proportions on the Lions Way and Pride Parkway approaches reflect the fact that these routes are generally lightly trafficked and directly serve industrial / employment developments which have regular access requirements for HGV service vehicles.

3.0 PREDICTED TOTAL SLEAFORD REP DEVELOPMENT TRAFFIC MOVEMENTS

3.1 Total Sleaford REP operational HGV demand

3.1.1 The formal Transport Statement report submitted in support of the planning application for the Sleaford REP scheme (Doc Ref: 552-01-01e), included a detailed review of anticipated operational traffic demand to / from the facility.

3.1.2 The Transport Statement report identified two estimates of development trip generation:

- 'Typical' anticipated operating demand - based on average demand spread across the year;
- 'Sensitivity' operating demand – based on maximum hourly operation of the vehicle unloading cranes at the site.

3.1.3 On the basis of the predicted constant supply of biomass material across the day, the two estimate methodologies predicted the following levels of two way (in + out) hourly traffic demand:

- 'Typical demand' 100 HGV trips per day or 8-9 per hour;
- 'Sensitivity demand' 192 HGV trips per day or 16 per hour.

NB - It should be noted that the sensitivity demand scenario effectively represents the 'absolute worst case' hourly operational demand to the site, as it is based on the maximum hourly crane unloading capacity. Input levels above this hourly rate could not be processed by site input cranes and would result in significant vehicle unloading delays and would effectively be unsustainable.

3.1.4 Given the above, it can be considered that the 'worst case' peak hour operational trip generation of the Sleaford REP scheme would be of the order 16 HGV movements per hour (in + out). In reality however, day to

day peak hour demand is likely to be much less, indeed of the order of half of this 'worst case' hourly value.

3.2 **Total Sleaford REP Staff Car Trip Demand**

3.2.1 Operational staff at the Sleaford REP site would work a two shift pattern, with such movements not predicted to take place during traditional AM & PM peak hour periods.

3.2.2 The Transport Statement identifies that up to 10 'day staff' would also be required at the Sleaford REP site, who are anticipated to work a more typical 9-5 office pattern. Such staff may well therefore arrive / depart during traditional AM / PM peak periods. In order to provide a robust assessment of traffic demand to / from the site, the Transport Statement assumed that all such staff movements would be undertaken via single occupancy private vehicle trips. Such an approach would represent:

- AM Peak Period: 10 arrivals, 0 departures
- PM Peak Period: 0 arrivals, 10 departures.

3.2.3 It is not considered that this staff car traffic demand would likely represent a material traffic impact at the Bone Mills Interchange, which is located some 4.5km distance from the proposal site and would only really cater for local staff movements to the A153 corridor.

3.3 **Total peak hour REP demand**

3.3.1 Given the above review of issues, 'worst case' peak hour demand to the proposed Sleaford REP site is anticipated to be as follows:

AM Peak:	8 HGV arrivals:	8 HGV departures:
	10 car arrivals:	0 car departures.

PM Peak:	8 HGV arrivals:	8 HGV departures:
	0 car arrivals:	10 car departures.

4.0 **PREDICTED SLEAFORD REP OPERATIONAL TRAFFIC MOVEMENTS AT THE BONE MILLS INTERCHANGE**

4.1 **Sleaford REP demand to North Eastern destinations via the A153 corridor**

4.1.1 The submitted Transport Statement did not provide an estimate of the extent of operational development traffic demand anticipated to utilise the A153 corridor to the north of Sleaford via North Kyne, Tatershall and Horncastle towards Louth. Based on a vehicle routing assessment of the proposed 40mile straw catchment, however, it is considered that potentially up to 20% of Sleaford REP development traffic could utilise this corridor and therefore access the Bone Mills Interchange (see Figure 4 to this report).

4.1.2 Assuming that 20% of total development demand could utilise this access corridor, this could represent daily 2-way (in+out) demand totals as illustrated below:

- 'Typical demand' 20 HGV trips per day or 1 - 2 per hour;
- 'Sensitivity demand' 38 HGV trips per day or 3 - 4 per hour.

4.1.3 The assignment of these daily trips at the Bone Mills Interchange are illustrated in Figure 5 (a&b) to this Technical Note.

4.2 **U-turn traffic demand for Sleaford REP vehicles to destinations served by the A17(E)**

4.2.1 The submitted Transport Statement included for a detailed assessment of anticipated traffic impact on key sections of the A17 Sleaford bypass route. This assessment included for both base and 'maximum' development traffic generation scenarios and also considered two distribution options:

- Base anticipated case (all traffic to / from A17 to the west of Kirby La Thorpe);
- Alternative case (80% traffic to the west / 20% to the east).

4.2.2 The base traffic distribution was based on the catchment area identified from the main commercial straw contracts relating to the Sleaford REP site, with the sensitivity distribution simply included in order to provide an absolute 'worst case' indication of potential traffic demand to / from the eastern section of route (see Figure 4).

4.2.3 In order to minimise impact at the Kirby La Thorpe interchange, the developers of the Sleaford REP scheme have proposed a local routeing agreement for development HGV traffic exiting the site and seeking to travel to destinations served by the A17(E). This routeing agreement proposes that eastbound vehicle movements from the Sleaford REP site, would travel west from the Kirby La Thorpe interchange and undertake a safe 'U-turn' at the Bone Mills Interchange.

4.2.4 Reference to Figures 12 & 13 of the submitted Transport Statement (attached as Appendix B for reference) identifies that U-turn traffic movements at Bone Mills Interchange as a consequence of the routeing agreement would be as follows:

- 'Typical demand' 10 HGV trips per day or 1 per hour;
- 'Sensitivity demand' 19 HGV trips per day or 1-2 per hour.

4.2.5 The assignment of these U-turn daily trips at the Bone Mills Interchange are illustrated in Figure 6 (a&b) to this Technical Note.

4.3 **Total Sleaford REP development traffic demand at Bone Mills Interchange**

4.3.1 Summation of the base operational development traffic demand predicted for the A153 corridor to the 'worst case' A17(E) U-turn routing demand suggests the maximum two-way (in+out) daily Sleaford REP operational HGV demand at the Bone Mills Interchange as set out below:

'Typical' Sleaford REP Daily Demand

- A153 corridor movements: 20 HGV trips
- A17(E) U-turn movements: 10 HGV trips
- **Total Bone Mills Interchange Traffic: 30 HGV trips**

'Sensitivity' Sleaford REP Daily Demand

- A153 corridor movements: 38 HGV trips
- A17(E) U turn movements: 19 HGV trips
- **Total Bone Mills Interchange Traffic: 57 HGV trips**

4.3.2 The assignment of these daily trips at the Bone Mills Interchange are illustrated in Figures 7 (a&b) to this Technical Note.

4.3.3 Typical hourly operational HGV demand is illustrated in Figure 8 (a&b).

5.0 **ASSESSMENT OF OPERATIONAL IMPACT**

5.1 **Introduction**

5.1.1 This section of the report considers the assessment of the operation of key junction elements of the Bone Mills Interchange and the ability of this part of the network to accommodate Sleaford REP development traffic. Impact assessment has been carried out through the consideration of junction capacity assessments for the key internal junction elements of:

- The ghost island T-junction to the north of the A17 over-bridge;
- The 5-arm roundabout to the south of the A17 over-bridge.

5.1.2 Assessments have been carried out using DfT standard capacity assessment models PICADY (for priority junctions) and ARCADY (for roundabout junctions).

5.2 **Assessment Assumptions**

5.2.1 Assessments have been undertaken for the future development 'design year' of 2012 (allowing for the planning and construction of the Sleaford REP facility) and a 10 year future design horizon of 2022. Such an approach reflects recent guidance set out by the DfT re: the assessment of development traffic impact. To ensure the most robust assessment it is assumed that the Sleaford REP facility would be operating at full capacity (240,000 tpa straw input) at both year of opening and the future design year.

5.2.2 Future background traffic demand estimates have been calculated via reference to TEMPRO / NRTF medium growth factors to ensure a robust assessment of future conditions. The calculation of these factors is illustrated in Appendix C to this report, with growth factors summarised below:

- Opening Year 2012 (Factor 2008-2012): 1.070
- Future Year 2017 (Factor 2008-2022): 1.245

5.2.3 Junction capacity assessments have been carried out for the following time periods:

- AM Peak Period
- Lunchtime (off-peak) Period
- PM Peak Period

These times represent the maximum hourly background development demand observed across the two interchange internal junctions (see section 2.1.6 to this report).

5.2.4 2012 Opening Year background traffic demand at Bone Mills Interchange for the key assessment time periods is illustrated in Figure 9 (a-c).

5.2.5 2022 Future Design Year background traffic demand at Bone Mills Interchange for the key assessment time periods is illustrated in Figure 10 (a-c).

5.2.6 2012 & 2022 Background + Development traffic demand flows (Typical Demand) are illustrated in Figure 11 (a-c) and Figure 12 (a-c) respectively.

5.2.7 2012 & 2022 Background + Development traffic demand flows (Sensitivity Demand) are illustrated in Figure 13 (a-c) and Figure 14 (a-c) respectively.

5.3 **Operation of the Bone Mills ghost island T-junction (A17 north slip roads)**

5.3.1 Junction modeling for the T-junction layout has been carried out using the DfT standard analysis computer software PICADY. In order to model the fact that the existing left turn exit slip road from the A153 northbound onto the A17 eastbound on-slip actually gives way to the southbound right turn traffic (see white line arrangements illustrated on the aerial photographs in Appendix A), two PICADY model runs have been carried out for each scenario to incorporate these different 'give way scenarios'. Appendix D illustrates the capacity assessments for the A17 off-slip entry and A153 southbound right turn and Appendix E the A153 northbound left turn give way movement. For ease of reference, all give-way turning movements considered in the PICADY runs are summarised in the tables below.

5.3.2 Initial capacity assessments have been carried out for 2022 background (i.e. no Sleaford REP) traffic conditions. The results of these base capacity assessments are illustrated in the tables below.

AM Peak

	No Development		
	Flow	RFC	Queue
A17 Off-Slip Left Turn	327	1.158	29.6
A17 Off-slip Right Turn	248	1.142	22.9
A153 Right Turn	108	0.205	0.3
A153 Left Turn	100	0.185	0.2

Lunchtime Peak

	No Development		
	Flow	RFC	Queue
A17 Off-Slip Left Turn	241	0.531	1.1
A17 Off-slip Right Turn	139	0.491	0.9
A153 Right Turn	42	0.082	0.1
A153 Left Turn	95	0.157	0.2

PM Peak

	No Development		
	Flow	RFC	Queue
A17 Off-Slip Left Turn	241	0.571	1.3
A17 Off-slip Right Turn	110	0.603	1.4
A153 Right Turn	91	0.184	0.2
A153 Left Turn	168	0.266	0.4

5.3.3 Review of these background traffic model runs identifies that the northern T-junction is predicted to operate efficiently for the lunchtime (off-peak) and PM peak conditions. During these periods, all junction give-way approach arms would operate with RFC's at or below 0.6, with limited queuing.

5.3.4 AM peak background assessments however, demonstrate that the A17 off-slip approach would likely be operating at over-capacity conditions. The PICADY model assessment runs indicate that both left and right turn movements could experience RFC values of in excess of 1.1, with significant queuing of over 25 vehicles. This congestion and queuing is a reflection of the busy nature of the A153 during these conditions and the potential difficulty in side road traffic (i.e. A17 eastbound off-slip) accessing the route.

5.3.5 Whilst these over-capacity conditions would be of some concern to the local highway authority it must be recognised that these conditions are related to background traffic demand unrelated to the Sleaford REP scheme. Indeed, the Sleaford REP development would not generate any additional traffic movements on the critical A17 off-slip itself. Development traffic impact at this junction would, in fact, be minimal.

5.3.6 The results of the 2022 'with development' assessment runs are summarised in the tables below. These tables show results for both

'typical' and 'sensitivity' development traffic demand. Such results are directly comparable with the background traffic runs outlined in the tables above.

AM Peak

	'Typical' Development			'Sensitivity' Development		
	Flow	RFC	Queue	Flow	RFC	Queue
A17 Off-Slip Left Turn	327	1.163	30.2	327	1.169	30.7
A17 Off-slip Right Turn	248	1.147	23.3	248	1.152	23.7
A153 Right Turn	109	0.208	0.3	110	0.211	0.3
A153 Left Turn	101	0.188	0.2	101	0.188	0.2

Lunchtime Peak

	'Typical' Development			'Sensitivity' Development		
	Flow	RFC	Queue	Flow	RFC	Queue
A17 Off-Slip Left Turn	241	0.532	1.1	241	0.533	1.1
A17 Off-slip Right Turn	139	0.494	1.0	139	0.496	1.0
A153 Right Turn	43	0.085	0.1	44	0.089	0.1
A153 Left Turn	96	0.160	0.2	96	0.160	0.2

PM Peak

	'Typical' Development			'Sensitivity' Development		
	Flow	RFC	Queue	Flow	RFC	Queue
A17 Off-Slip Left Turn	241	0.573	1.3	241	0.575	1.3
A17 Off-slip Right Turn	110	0.607	1.5	110	0.611	1.5
A153 Right Turn	92	0.188	0.2	93	0.192	0.2
A153 Left Turn	169	0.268	0.4	169	0.269	0.4

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5.3.7

Review of the 'with development' junction assessment runs for the northern T-junction demonstrates that the addition of the limited predicted Sleaford REP demand would have only a marginal impact on operating conditions. Lunchtime (off-peak) and PM peak operation would still show some element of spare capacity, whilst the AM peak tests demonstrate only a strictly limited operational impact. Indeed, comparison of predicted RFC and queuing conditions for the critical A17 off-slip approaches to the junction demonstrates that the additional development traffic demand would lead to only of the order of a 0.01 change in RFC values and associated queue increases of 0.5 – 1 vehicle.

5.3.8

It is not considered that such changes in conditions represent a material traffic impact that would require capacity mitigation works.

5.4 **Operation of the Bone Mills roundabout junction (A17 south slip roads)**

5.4.1 Results of the 'with development' ARCADY assessment model runs for the southern roundabout internal junction are summarised in the tables below. Detailed ARCADY printouts are provided in Appendix F to this report.

5.4.2 The table below illustrates the results of the 2022 Background + Typical Sleaford REP development traffic scenarios. Review of these results demonstrates that the southern roundabout junction is predicted to operate with substantial spare capacity for all of the time periods analysed. Peak demand conditions are predicted to take place for the AM peak period. Maximum RFC during this period is predicted to be of the order of 0.683 for the A513 Southbound approach, with a related queue of just 2 vehicles. This junction approach arm would be unaffected by the operation of the Sleaford REP development.

AM Peak

	'Typical' Development			'Sensitivity' Development		
	Flow	RFC	Queue	Flow	RFC	Queue
A153 (S'bnd)	1103	0.683	2.1	1103	0.683	2.1
A17 Off-slip	322	0.273	0.4	323	0.275	0.4
Lions Way	7	0.009	0.0	7	0.009	0.0
B1517 (N'bnd)	443	0.343	0.5	443	0.343	0.5
Pride Parkway	75	0.068	0.1	75	0.068	0.1

Lunchtime Peak

	'Typical' Development			'Sensitivity' Development		
	Flow	RFC	Queue	Flow	RFC	Queue
A153 (S'bnd)	609	0.402	0.7	609	0.402	0.7
A17 Off-slip	146	0.115	0.1	147	0.117	0.1
Lions Way	27	0.021	0.0	27	0.021	0.0
B1517 (N'bnd)	560	0.404	0.7	560	0.404	0.7
Pride Parkway	111	0.085	0.1	111	0.085	0.1

PM Peak

	'Typical' Development			'Sensitivity' Development		
	Flow	RFC	Queue	Flow	RFC	Queue
A153 (S'bnd)	749	0.501	1.0	749	0.501	1.0
A17 Off-slip	192	0.142	0.2	193	0.143	0.2
Lions Way	32	0.024	0.0	32	0.024	0.0
B1517 (N'bnd)	802	0.574	1.3	802	0.574	1.3
Pride Parkway	159	0.129	0.1	159	0.129	0.1

5.4.3 Additional capacity tests have been undertaken at the southern roundabout junction for the Background + Sensitivity Sleaford REP development demand. Review of these results identifies extremely similar results to those for the 'typical' demand conditions - reflecting the relatively small changes in hourly development demand flow between the two different scenarios.

5.4.4 Overall it is considered that maximum operational conditions for both scenarios are well below the critical threshold RFC levels of 0.85 for all approach arms and is therefore considered to represent efficient junction operation for the future design year of 2022. It is therefore concluded that no capacity mitigation works would be required at this location.

5.5 Link Flow Impact

5.5.1 In addition to the above junction capacity assessment work, further link flow comparison tests have been carried out for key approach links to the two main internal junction elements. These tests have been undertaken to demonstrate the percentage change in vehicle approach flows associated with the development of the Sleaford REP sites. Such assessment has been carried out for 2012 Opening Year conditions only, as this represents the time period of lowest background demand and therefore highest potential percentage change.

5.5.2 The summary tables below demonstrate the predicted percentage change in overall vehicle flow for the main A513 / B1517 approaches and A17 on / off slip roads at the internal junctions at Bone Mills Interchange. Tests have been carried out for both 'typical' and 'sensitivity' development estimates.

AM Peak

	'Typical' Development			'Sensitivity' Development		
	B'grnd flow	Sleaford REP flow	%'tage change	B'grnd flow	Sleaford REP flow	%'tage change
Northern T-junction						
A513 S'bnd	830	1	0.12%	830	2	0.24%
A513 N'bnd	382	2	0.52%	382	3	0.79%
A17 On Slip	182	1	0.55%	182	1	0.55%
A17 Off Slip	494	1	0.20%	494	2	0.40%
Southern R'bout						
A513 S'bnd	948	-	-	948	-	-
B5117 N'bnd	381	-	-	381	-	-
A17 On Slip	397	-	-	397	-	-
A17 Off Slip	278	2	0.72%	278	3	1.08%

Lunchtime Peak

	'Typical' Development			'Sensitivity' Development		
	B'grnd flow	Sleaford REP flow	%'tage change	B'grnd flow	Sleaford REP flow	%'tage change
Northern T-junction						
A513 S'bnd	442	1	0.23%	442	2	0.45%
A513 N'bnd	424	2	0.47%	424	3	0.71%
A17 On Slip	120	1	0.83%	120	1	0.83%
A17 Off Slip	327	1	0.31%	327	2	0.61%
Southern R'bout						
A513 S'bnd	523	-	-	523	-	-
B5117 N'bnd	482	-	-	482	-	-
A17 On Slip	334	-	-	334	-	-
A17 Off Slip	127	2	1.57%	127	3	2.36%

PM Peak

	'Typical' Development			'Sensitivity' Development		
	B'grnd flow	Sleaford REP flow	%'tage change	B'grnd flow	Sleaford REP flow	%'tage change
Northern T-junction						
A513 S'bnd	630	1	0.16%	630	2	0.32%
A513 N'bnd	653	2	0.31%	653	3	0.46%
A17 On Slip	225	1	0.44%	225	1	0.44%
A17 Off Slip	302	1	0.33%	302	2	0.66%
Southern R'bout						
A513 S'bnd	644	-	-	644	-	-
B5117 N'bnd	689	-	-	689	-	-
A17 On Slip	589	-	-	589	-	-
A17 Off Slip	167	2	1.20%	167	3	1.80%

- 5.5.3 Review of the above results demonstrates that the predicted Sleaford REP development traffic demand levels are unlikely to result in a material increase in traffic volumes on key approach arms. Even for worst case 'sensitivity' development scenario conditions, development impact during the busiest AM & PM 'rush hour' periods is not anticipated to represent a change in approach flow demand of greater than 2% of background conditions. Maximum percentage change would be experienced during the lunchtime period, when background flows are lower than for rush hour demand, when a percentage change of 2.36% is predicted for the A17 off slip approach to the southern roundabout from A17 (E). It should be noted that this higher percentage change is more a reflection of the low levels of background demand (127 vehicles per hour) on this approach rather than a material level of development demand (just 3 HGV movements per hour).
- 5.5.4 In addition to the above review of percentage change when comparing Sleaford REP operational development demand to all vehicle movements on key junction approach arms, a further assessment has been undertaken to consider the changes in large vehicle movements only (i.e. OGV1, OGV2 & PSV). Such an assessment is more relevant to the review of the environmental effects of traffic, rather than operational capacity criteria, however, it does provide a useful indication of development effects.
- 5.5.5 Institute of Environmental Assessment guidelines for the assessment of road traffic, suggests that an increase in HGV movements in excess of 30% represents an appropriate 'rule of thumb' threshold for potential material impact and the need for additional analysis. Predicted changes in 2012 large vehicle traffic demand at the Bone Mills junction as a result of the Sleaford REP development are summarised in the tables below:

AM Peak

	'Typical' Development			'Sensitivity' Development		
	B'grnd flow	Sleaford REP flow	%'tage change	B'grnd flow	Sleaford REP flow	%'tage change
Northern T-junction						
A513 S'bnd	47	1	2.12%	47	2	4.26%
A513 N'bnd	42	2	4.80%	42	3	7.14%
A17 On Slip	28	1	3.57%	28	1	3.57%
A17 Off Slip	44	1	2.27%	44	2	4.55%
Southern R'bout						
A513 S'bnd	48	-	-	48	-	-
B5117 N'bnd	53	-	-	53	-	-
A17 On Slip	41	-	-	41	-	-
A17 Off Slip	20	2	10.0%	20	3	15.0%

Lunchtime Peak

	'Typical' Development			'Sensitivity' Development		
	B'grnd flow	Sleaford REP flow	%'tage change	B'grnd flow	Sleaford REP flow	%'tage change
Northern T-junction						
A513 S'bnd	40	1	2.50%	40	2	5.00%
A513 N'bnd	25	2	8.00%	25	3	12.0%
A17 On Slip	13	1	7.69%	13	1	7.69%
A17 Off Slip	40	1	2.50%	40	2	5.00%
Southern R'bout						
A513 S'bnd	49	-	-	49	-	-
B5117 N'bnd	37	-	-	37	-	-
A17 On Slip	45	-	-	45	-	-
A17 Off Slip	15	2	13.3%	15	3	20.0%

PM Peak

	'Typical' Development			'Sensitivity' Development		
	B'grnd flow	Sleaford REP flow	%'tage change	B'grnd flow	Sleaford REP flow	%'tage change
Northern T-junction						
A513 S'bnd	37	1	2.7%	37	2	5.41%
A513 N'bnd	10	2	20.0%	10	3	30.0%
A17 On Slip	10	1	10.0%	10	1	10.0%
A17 Off Slip	34	1	2.94%	34	2	5.88%
Southern R'bout						
A513 S'bnd	50	-	-	50	-	-
B5117 N'bnd	25	-	-	25	-	-
A17 On Slip	27	-	-	27	-	-
A17 Off Slip	10	2	20.0%	10	3	30.0%

5.5.6 Review of the above information demonstrates that, in general, predicted HGV increases on the key junction approach routes associated with the Sleaford REP development would be low, with most increases well below 10%. Some individual links would experience higher percentage changes, however, further review of this data reveals that such links currently have an extremely low background HGV demand (less than 20 HGV's per hour), meaning that any increase in such vehicle movements would have a disproportionate percentage change when compared to their actual operational effects.

5.5.7 Overall, on the basis of the above review of anticipated link flow impact (both 'all vehicle' and 'large vehicle' tests) it is concluded that the development of the Sleaford REP facility would not result in a material change in operational or environmental capacity conditions at the Bone

Mills Interchange. Such results reflect the conclusions of the junction capacity analyses and demonstrate that there is no requirement for any highway improvement works at this location to support the development of the Sleaford REP proposal scheme.

6.0 SUMMARY AND CONCLUSIONS

6.1 This report has been prepared to consider highway capacity issues at the Bone Mills Interchange and to assess the potential operational impact of additional Sleaford REP operational HGV traffic movements. This assessment has been carried out through an appraisal of both junction capacity and link / flow percentage impact.

6.2 The Bone Mills Interchange is made up of two main internal junction elements. A ghost island T-junction to the north and a southern roundabout layout. These access points provide 'grade separated' access to the on / off slip roads to the A17 Sleaford Bypass. In addition the southern roundabout also serves surrounding local industrial estate development. Both junctions are of a suitable design standard and regularly cater for large HGV movements.

6.3 Traffic demand at the Bone Mills Interchange associated with the Sleaford REP proposal scheme is anticipated to be minimal, with the majority of trips remaining on the A17 mainline from origins from the west. Development traffic utilising the main interchange internal junctions would be limited to:

- Eastbound 'U' turn traffic which has been routed away from the Kirkby La Thorpe interchange;
- Trips from north-east origins likely to be served by the A153.

Even taking into account 'worst case' traffic generation assumptions, maximum two way traffic associated with the Sleaford REP site would only be of the order of 57 HGV trips per day.

6.4 Junction capacity tests have been undertaken for a future year of 2022. These tests demonstrate that the southern roundabout junction would be operating efficiently (including anticipated worst case Sleaford REP operational traffic). Tests at the northern T-junction layout show that this layout would also operate efficiently for background + development conditions for off-peak and PM peak periods. AM peak demand conditions illustrate over-capacity on the A17 off-slip access to the junction. Such over-capacity conditions, however, are related to background demand flows. Indeed, no Sleaford REP traffic is predicted to utilise this approach arm. Comparison junction capacity tests for 'with development' demand illustrate that the effects of this traffic during AM peak periods would be marginal and certainly not of an extent that would require any capacity improvements to mitigate.

- 6.5 Additional link / flow assessments reflects the results of the junction capacity tests. This link flow analysis demonstrates that key approach routes would only experience overall traffic flow increases of less than 3% under Sleaford REP development conditions. HGV increases would typically be under 10%.
- 6.6 Overall, it is concluded that the development of the Sleaford REP facility would not result in a material change in operational or environmental capacity conditions at the Bone Mills interchange. There is therefore no requirement for any highway improvement works at this location to support the development of the Sleaford REP proposal scheme.