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**Airports National Policy Statement Consultation  
Technical Adviser  
Note in relation to Conclusions on ATM Capacities of Heathrow Runway Options**

**Summary Conclusions**

1. Based on our examination of the evidence presented on behalf of HHL **(Text redacted under Section 43(2) of the Freedom of Information Act 2000.)**, we consider that it has not been demonstrated by HHL that the ENR scheme could deliver an annual capacity in excess of 700,000 annual ATMs at an acceptable level of service and whilst maintaining periods of respite for the local population. Based on the evidence presented, there must be some doubt as to whether 700,000 annual ATMs would be achieved in practice, having regard to realistic airline schedules and containing delays to an acceptable level consistent with achieving resilience.
2. Although we have not seen a full capacity assessment report for HAL's NWR scheme, we have seen no evidence that it is not capable of delivering the target 740,000 annual ATMs, subject to detail design and confirmation of airspace capacity. The larger area of the expanded airport provides the ability to de-conflict taxiway routings to a large extent, providing greater resilience.

**Background**

3. York Aviation has been asked by the Department for Transport (DfT) to provide assurance in respect of the Airports Commission's conclusions on the relative capacities of the Heathrow Airport Limited (HAL) Northwest Runway (NWR) and the Heathrow Hub Limited (HHL) Extended Northern Runway (ENR) schemes.
4. The (revised) draft Airports NPS sets out that the Heathrow Northwest Runway (NWR) scheme was the preferred scheme for expansion at Heathrow, based on three factors:
  - Resilience;
  - Respite from noise for local communities; and
  - Deliverability<sup>1</sup>.
5. DfT's reasoning is set out in the revised draft Airports NPS as follows:

*"3.56 The Heathrow Northwest Runway scheme would provide respite by altering the pattern of arrivals and departures across the runways over the course of the day to give communities breaks from noise. However, respite would decrease from one half to one third of the day.*

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<sup>1</sup> Some deliverability risks were noted in relation to the ENR due to its innovative nature but consideration of this aspect falls outside the scope of this note.

*The Heathrow Extended Northern Runway scheme has much less potential for respite. It would use both runways for arrivals and departures for most of the day, although it may be able to ‘switch off’ one runway for a short time during non-peak periods with a corresponding reduction in capacity.*

*3.57 The Heathrow Northwest Runway scheme should provide greater resilience than the Heathrow Extended Northern Runway scheme because of the way the three separate runways could operate more flexibly when needed to reduce delays, and the less congested airfield. It delivers greater capacity (estimated on a like for like basis by the Airports Commission at 740,000 flights departing and arriving per annum compared to the Extended Northern Runway scheme at 700,000), accordingly higher economic benefits, and a broader route network. It also provides greater space for commercial development, which could be used to enhance onsite freight capacity.*

6. Both of these aspects ultimately flow through to the capacity deliverable from each of the schemes. In reaching its view as to the preferred scheme, we understand that the DfT relied principally on the capacity assessment undertaken by the Airports Commission (AC). We are requested to assess whether the Department is correct in its current position agreeing with the AC that the ENR delivers less capacity than the NWR scheme.

## Documents Reviewed

7. We have reviewed a number of relevant documents provided by the DfT or otherwise in the public domain. In approximate chronological order, these documents are:
  - HHL Ground Movement Modelling October 2014 – submitted to the Airports Commission
  - Jacobs 14: Operational Facilities and Efficiency Review for Airports Commission June 2015
  - CAA CAP1215 Preliminary Safety Review for Airports Commission September 2014
  - NATS Support to Airports Commission Appraisal Module 14: Operational Efficiency: Airspace Efficiency Report
  - Airports Commission Final Report July 2015
  - text redacted under Section 43(2) of the Freedom of Information Act 2000
  - text redacted under Section 43(2) of the Freedom of Information Act 2000
  - text redacted under Section 43(2) of the Freedom of Information Act 2000
8. We do not comment on these documents one by one but draw out the key points to reference our conclusions.

## Capacity

9. As is made clear in the revised draft Airports NPS, the DfT based its view on the annual movement capacity deliverable by each scheme on the work of the AC. The AC set out its position at paragraph 12.8ff:

*“12.8 A number of responses to consultation questioned the capacity estimates put forward, suggesting that they under or over-estimated the capacity that would be provided.*

*12.9 The Commission asked its technical advisors to review these responses. They noted that it was possible to produce different capacity estimates for each scheme depending upon the assumptions on resilience and respite used. However, the review concluded that the capacity estimates published for consultation represented a plausible view of the capacity of each*

scheme, based upon a combination of consistent assumptions and the promoters' own plans in relation to respite.

12.11 Of the two Heathrow schemes, the Northwest Runway scheme offers the largest increase in capacity. This is due to lower anticipated congestion on taxiways and also simpler respite procedures associated with that scheme, which would keep all three runways in operation throughout the day, albeit with certain runways only used for arrivals or departures at certain times. The Extended Northern Runway scheme, by contrast, would be more susceptible to taxiway congestion and would not operate all three runways at certain times of the day to provide respite. While, in principle, the highest number of peak-hour movements is not significantly different between the schemes, it would be easier to schedule a larger number of movements over the course of the full operating day with the Northwest Runway scheme."

10. **Text redacted under Section 43(2) of the Freedom of Information Act 2000.** The technical advice provided by Jacobs (2015) did not assess the capacity of any of the schemes from first principles but worked from generic estimates of the annual movement capacity deliverable from segregated and mixed mode runways. In Section 2.1.1 on the Runway System, it is stated that the practical average sustainable capacity deliverable from a runway operated in mixed mode is 50 movements per hour and that the annual capacity would be in the range of 250,000 to 300,000 annual ATMs taking into account the need to allow for weather, resilience and operational patterns. For a segregated mode runway (arrivals or departures only), Jacobs assessed the sustainable hourly capacity to be 45 movements per hour, delivering 220,000 to 280,000 annual ATMs. In broad terms, we would agree with these estimates but, the actual capacity deliverable will also depend heavily on the adequacy of the taxiway network serving each runway, also needs to be taken into account.

11. In the Jacobs Report, HAL's NWR was assessed on the basis that it would operate as three mixed mode runways providing capacity the range 750,000 to 900,000 annual ATMs:

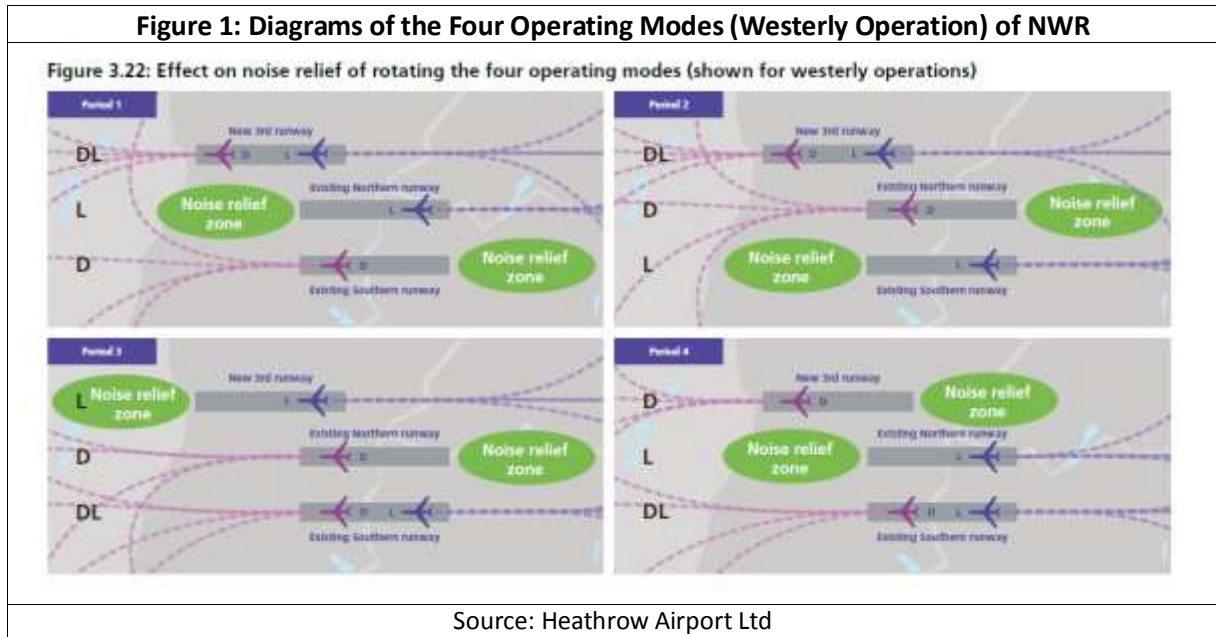
*"Similarly, the three independent mixed mode runways proposed at Heathrow Airport by Heathrow Airport Ltd (HAL), could accommodate an annual throughput of between 750,000 and 900,000 ATMs. The capacity stated by HAL, of 740,000 ATM pa, lies at the low end of this range. This reflects the greater proportion of larger/heavier aircraft and the long haul/hub operation which makes maximum use of available capacity more difficult to achieve and HAL's aspiration to enhance resilience and reliability."*

12. In respect of HHL's ENR scheme, Jacobs concluded:

*"Heathrow Hub (HH) [sic] proposed extended northern runway (ENR) at Heathrow Airport does not provide two northern runways that could be operated independently in mixed mode. Rather they would be operated independently in segregated mode....."*

*Therefore, HHL's proposal, operating two independent segregated mode runways and one independent mixed mode runway over the same annual periods, could provide around 850,000 ATMs per annum (pa) as a theoretical maximum, but between 700,000 and 850,000 ATMs pa as a practical range. As for HAL above, the capacity stated by HHL, of 700,000, lies at the low end of this range reflecting the long haul/hub operation which makes maximum use of available capacity more difficult to achieve, the same aspiration to enhance resilience and reliability, and HH's additional proposal to alternate movements between runways to provide enhanced noise respite."*

13. In summary, Jacobs stated its view that the capacity estimates being put forward by the promoters of each scheme were within a plausible range and did not verify the capacity provided from first principles. We note that the HAL proposal subsequently changed from one of three mixed mode runways to the current proposal to operate at all times with one mixed mode runway and two segregated mode runways to provide regular reliable periods of respite as illustrated in **Figure 1** below. We note that, as discussed further below, NATS assessed the airspace implications of the NWR scheme on the basis of this latter configuration of runway use at the same stage of the AC's work. Even on the more complex operating pattern, delivering respite, the estimated 740,000 annual ATM capacity would still remain within the range assessed by Jacobs for one mixed mode runway and two segregated mode runways.



14. Assessments were made by the CAA and NATS, at broadly the same time as the Jacobs work for the AC, of the airspace implications of the various schemes under consideration. Again, it is evident that these assessments were made on the basis of the capacities being put forward by the promoters of 740,000 annual ATMs (NWR) and 700,000 annual ATMs (ENR). In particular, NATS Airspace review for the AC in 2015 made this clear:

In respect of the NWR:

*“6.3.1 The scheme proposer is proposing a maximum movement rate of 128 per hour during normal operating conditions, comprising 48 per hour Mixed Mode, 38 per hour Arrivals and 42 per hour Departures. A traffic volume of 740k ATMs pa is proposed. Such rates can be supported by the London TMA as being redeveloped by LAMP.*

*6.3.2 The annual figure of ATMs is not considered to be maximum or upper limited that can be operated from a revised Heathrow operation as proposed by the scheme promoter. The extension of peak operating hours would result in greater annual movements being delivered. There is however a trade-off between the amount of traffic movements that can be managed and the resilience of the operation at both the airport and within the London TMA.”*

and in respect of the ENR:

*“7.3.1 The scheme proposer is proposing a maximum movement rate of 130 per hour during normal operating conditions, comprising 48 per hour Mixed Mode, 40 per hour Arrivals and 42 per hour Departures. A traffic volume of 700k ATMs pa is proposed. Such rates and volumes can be supported by the London TMA as being redeveloped by LAMP.*

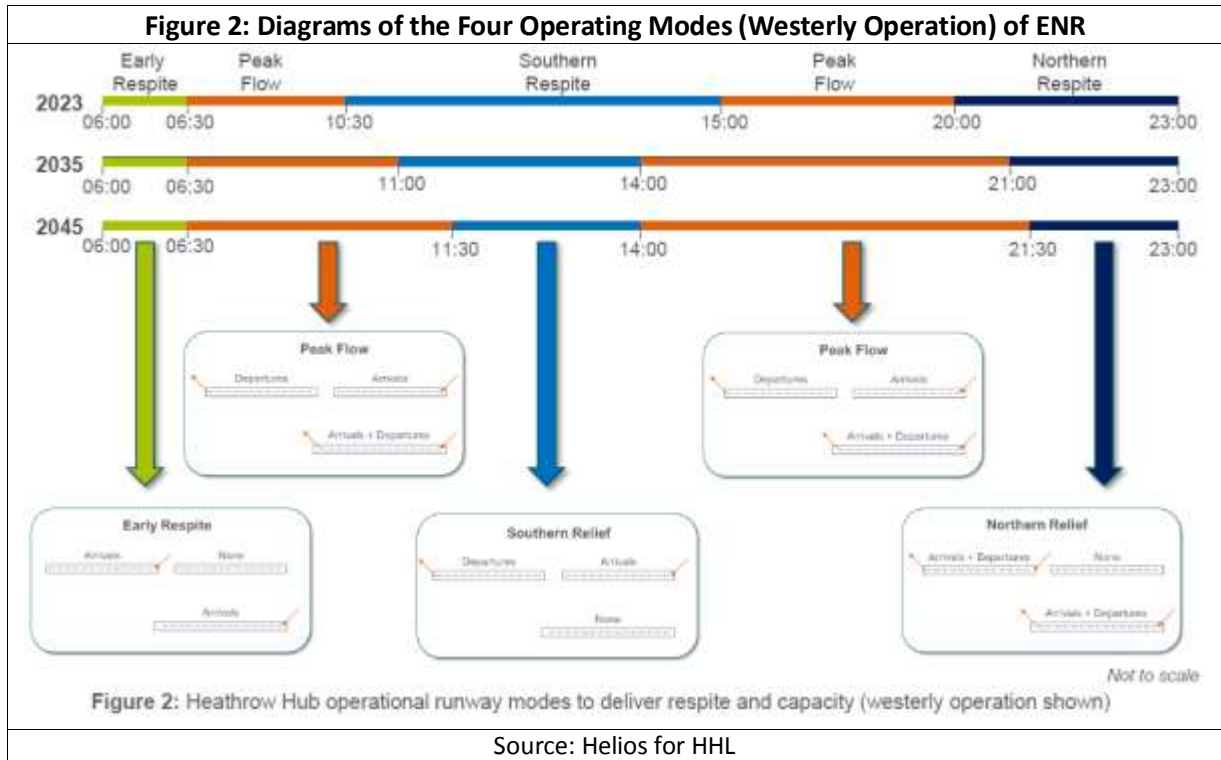
*7.3.2 The annual figure of ATMs is not considered to be maximum or upper limited that can be operated from a revised Heathrow operation as proposed by the scheme promoter. The extension of peak operating hours would result in greater annual movements being delivered. There is however a trade-off between the amount of traffic movements that can be managed and the resilience of the operation at both the airport and within the London TMA.*

15. Again, the assessments were made based on the schemes as submitted. It is important to note that the review undertaken by NATS at this stage was an initial assessment of operational viability and identified the issues, e.g. overlap with Northolt, which would need to be addressed in designing the final configuration of the airspace at a later, post approval, stage of the process. The report did not set out to provide a detailed assessment of capacity or the precise airspace requirements to support a particular throughput given the early stage of the overall process of option selection.

### ***Helios Capacity Assessments***

*2014*

16. Helios produced an initial capacity assessment report on behalf of HHL in 2014 as an input to the work of the AC. This focussed on ground movement issues in supporting the ENR concept. This analysis tested a “smoothed” (page 9) 700,000 annual ATM schedule to assess the ground movement issues and delays. It was not presented as a runway capacity assessment as such, although reported delays would be a substantive component of a runway capacity assessment. This modelling was carried out on a simplified basis and it was claimed that the results were inherently conservative (page 16 of the Helios report).
17. This study set out different combinations of runways being used at different times of day, so that at some times of day, unlike with HAL’s NWR proposal, only two runways would be in use to provide some periods of respite. This means that there is a fundamental assumption within HHL’s ENR proposal that lower hourly capacity would be acceptable for substantial parts of the operating day, although the periods of respite and the reductions in capacity are shown as diminishing over time as forecast usage of Heathrow builds up as shown in **Figure 2**. It is not entirely clear how this is consistent with the concept of a ‘smoothed’ schedule, as assessed by Helios, which might imply demand more evenly spread over the day.



18. On the basis of this pattern of respite, the ENR scheme is shown to be operating at maximum capacity of three available runways for only 12.5 hours out of 17 at 2045) compared to the NWR which can operate at full available capacity (average hourly movement rate) over three runways for the full 17 hours if required and still maintain greater respite periods for local residents than the ENR scheme.
19. Helios also presented hourly capacity estimates under each mode as set out in **Figure 3**. We note that the maximum rate shown is 129 not 130 assumed by NATS. Using figures presented in the Helios Report for the duration of the operating modes (Figure 2 above) and the capacity deliverable in each mode as shown in Figure 3, it is possible to calculate the average hourly movement rate. Helios cite 1,949 movements being possible each day but we calculate the figure to be 1,935 in 2045 based on the respite pattern shown. This suggests that the average hourly movement rate deliverable by ENR scheme is c.114, i.e. some 11% less than the capacity cited for the NWR.

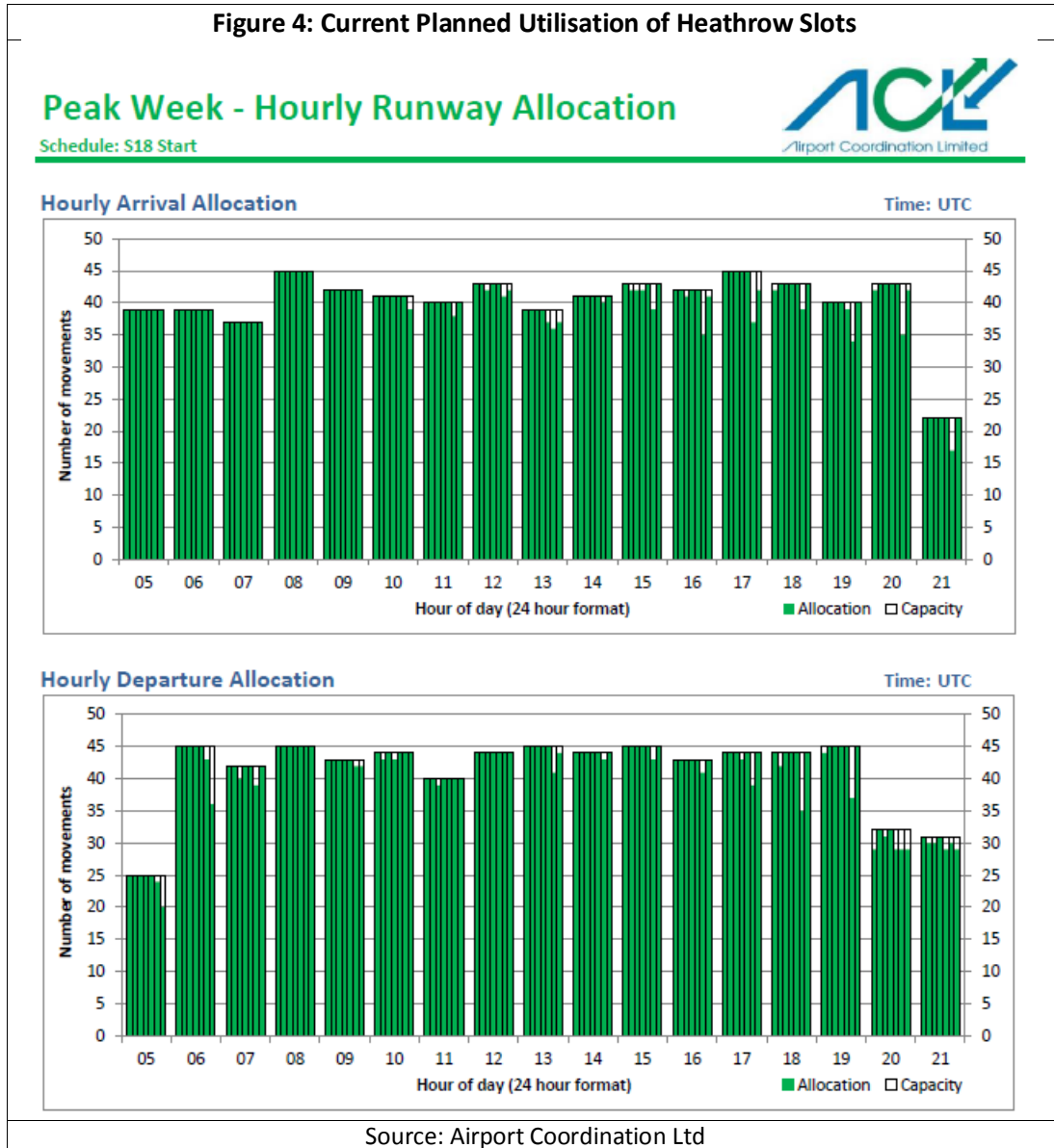
**Figure 3: Capacity under Each Operating Mode of ENR**

Airport capacity	2023	2035	2045
<b>Hourly</b>			
Early respite	46	46	46
Morning peak flow	124	125	123
Southern respite	81	84	82
Afternoon peak flow	128	129	129
Northern respite	87	83	83
<b>Daily</b>	1,709	1,922	1,949
<b>Annual</b>	623,602	701,347	711,385

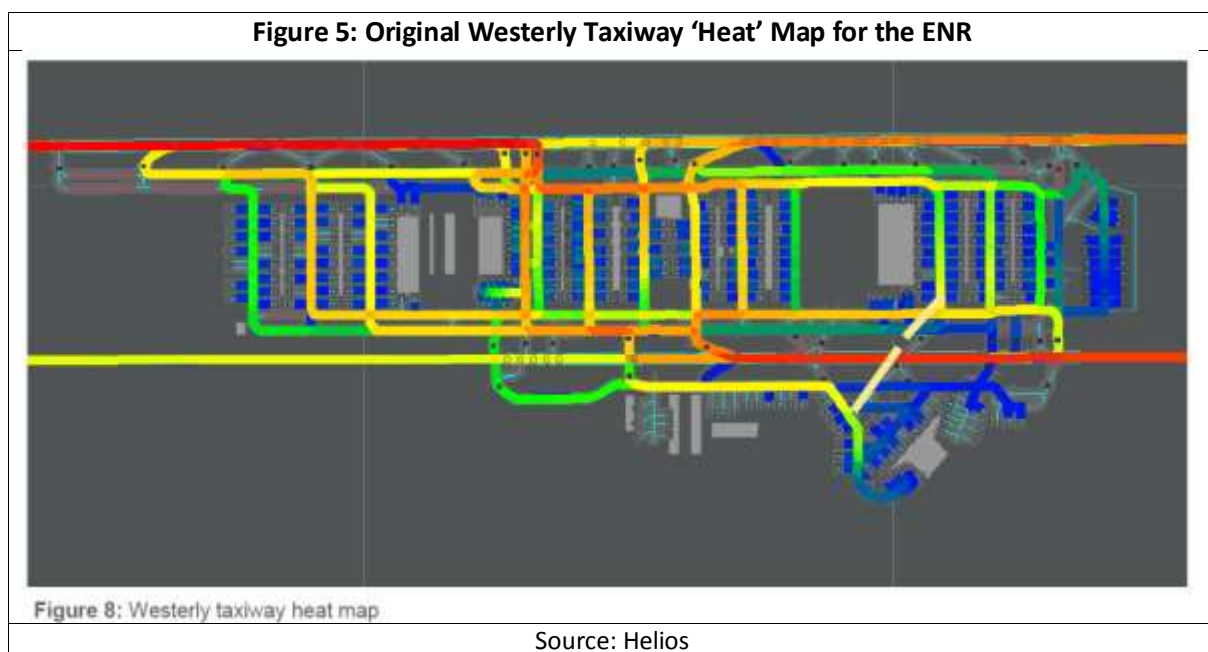
Source: Helios for Heathrow Hub

20. We note that Helios assumed that the daily movement capacity is used fully on 365 days of the year to derive an estimated annual movement capacity of 711,000 annual ATMs capacity. This is clearly not realistic as the current Heathrow schedule demonstrates clearly that there are days when all slots are not used, as shown in **Figure 4**, even when there are high levels of excess demand as is currently the case. This is normal in airport schedules. If the same 17 hour 365 day assumption was applied to HAL's estimated 128 movements per hour from the NWR scheme, the annual ATM capacity of that scheme would be 795,000 movements.

**Figure 4: Current Planned Utilisation of Heathrow Slots**



21. A further consideration is whether HHL’s asserted peak hourly movement rates for the ENR, based on the Helios work, are sustainable. The original simulation modelling work submitted to the AC in 2014 suggested that the attainable runway movement rate was 123 movements per hour at peak (page 21), which is below the maximum taken into account in the overall assessment of capacity deliverable (Figure 3 above). Delay information is presented only for 2023 and this shows departure delays of over 15 minutes at peak (page 24, Figure 10) for runway queuing only, i.e. excluding any delays due to taxiway congestion on route to the holding point. This is substantially in excess of the 10 minutes average delay criterion usually applied in the assessment of declarable capacity at busy airports<sup>2</sup>. Hence, we do not consider (nor did Helios claim) that its modelling demonstrated conclusively that 123 movements per hour could be sustainably delivered with the ENR scheme at an acceptable level of service in terms of delay. Furthermore, it is reasonable to expect that delays would grow with higher movement rates and a more intensive schedule of movements with traffic growth beyond 2023 based on the airfield layout tested.
22. The Helios work shows substantial taxiway congestion hotspots, shown in orange/red on the various illustrations the taxiway congestion with the ENR scheme as evident in the Helios Report as shown in **Figure 5** below.



23. Indeed, Helios noted that:

*“For 2045 push back, taxiing and runway delays became large especially during the relief periods which means that the additional optimisations (described on page 25) are likely to be required”*

No equivalent delay information is provided at 2045 traffic levels but it is reasonable to assume they would be substantially greater than 15 minutes and the higher levels of usage overall would remove the opportunity for excessive delays to be recovered by scheduling a reduced number of movements in hours adjacent to the peak for any given pattern of runway use.

<sup>2</sup> We have confirmed with Airport Coordination Ltd that this is the criterion applied at Heathrow.



24. Of particular concern is the reliance on one way taxiway routings between rows of stands as a part of the main circulatory system for the airport, as these would frequently be blocked by aircraft pushing back in peak periods. This will both lead to substantial delays to taxi times and potentially delays to push back. Such single taxiways are also a feature of the NWR scheme but the key differentiator is the proposal for twin Around the End Taxiways (ATETs) to the west of T5 to provide an additional two-way main taxiway route between the central area and the Northway, which is located so as to be clear of pushbacks<sup>3</sup>.
25. Helios discuss a number of optimisations they applied to reduce delays within the simulation modelling. It is stated that these increased the attainable hourly movement rate to over 130 movements per hour but no information is provided regarding the delays or taxiway congestion at this higher movement rate. It would be reasonable for the DfT to place little reliance on the assertion by HHL that such a capacity is attainable, given the delays inherent at 123 movements per hour and the lack of any equivalent information regarding the 'optimised' simulation.

2016

26. Text redacted under Section 43(2) of the Freedom of Information Act 2000.

27. Text redacted under Section 43(2) of the Freedom of Information Act 2000.

28. Text redacted under Section 43(2) of the Freedom of Information Act 2000.

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<sup>3</sup> York Aviation has considered separately representations made to the DfT with regard to the relationship between the safety case of the NWR scheme and its capacity. York Aviation and the Department have found no reason to assume that the design of the end-around taxiways would prevent the NWR scheme achieving its expected capacity of 740,000 ATMs.

**Figure 6: Diagram redacted under Section 43(2) of the Freedom of Information Act 2000**

29. **Text redacted under Section 43(2) of the Freedom of Information Act 2000.**

**Figure 7: Diagram redacted under Section 43(2) of the Freedom of Information Act 2000**

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