Annex G

Note on the application of optimism bias for Phase 2

Phase 2 currently uses Optimism Bias (OB) at c. 40% to calculate contingency levels for both Phase 2A and 2B. The application of this is in line with HMT's Green Book, and Supplementary Guidance on OB for a major project of this nature, and in line with guidance from the Department's TAG.

It has been suggested that a project of this level of maturity should utilise 66% contingency for the funding envelope, however HS2 Ltd believe that it has a reasonable level of understanding about the project requirements by applying the learnings and improvements to the design specifications adopted by Phase 1. HS2 has categorised the key components of the cost estimate into the categories of civils and buildings and whether they are standard or non-standard. Informed judgements have been applied to each of these, using a team of experts that has enabled an adjustment to the standard percentage uplifts to be applied to calculate the overall contingency percentage. This is set out in Figure 1 below.

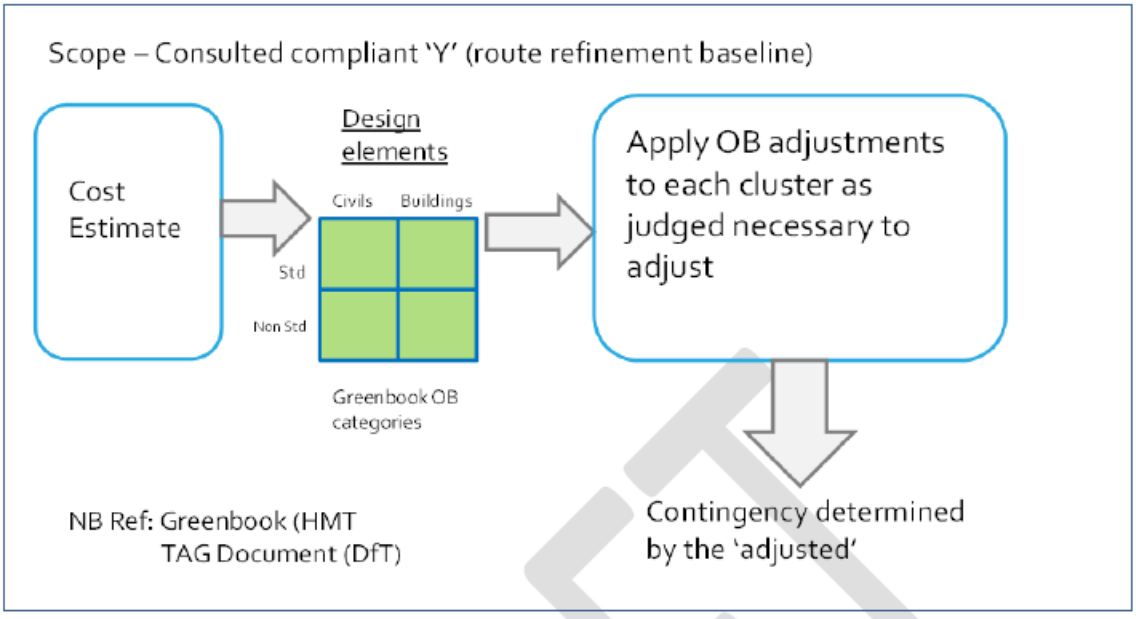

Figure 1: Phase 2 risk approach.

The Department's project representative (P-REP) has previously made representations that this level is inadequate based on the current level of design, and that provision should be made for c50% OB for the cost estimate. HMT has further suggested that HS2 should utilise the full 66% OB set out in the Green Book guidance, akin to the levels that Network Rail use for the development of projects. Much of HS2's construction is akin to highways construction, therefore complete direct rail project comparison can be inappropriate.

Phase 2 differs from the approach taken on Phase 1 with its approach to contingency, which utilises QCRA, because it is at a greater level of design certainty than the Phase 2

programme. We have previously provided supporting information on our approach to contingency, including how we propose to migrate from OB to QCRA as the design certainty improves. The illustration below shows the point in time that HS2 expect to be able to utilise QCRA.

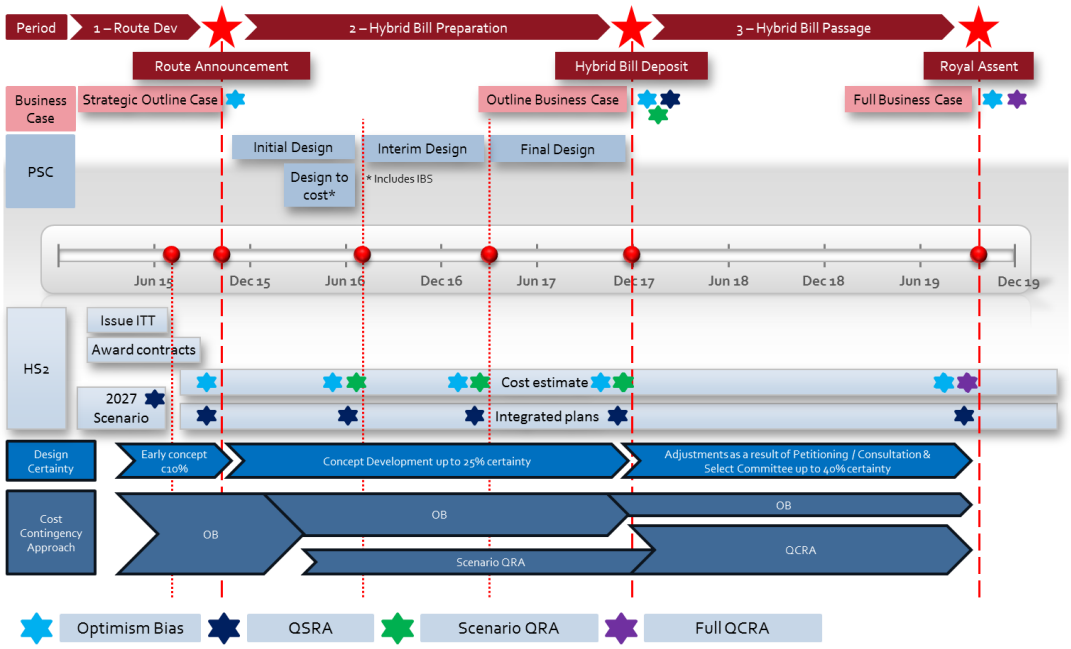

Figure 2: Risk maturity model.

The above illustration (figure 2) is limited to Phase 2A but the expectation is that HS2 will be able to better inform a QCRA piece of analysis when there is a final design for the scheme and will apply the same approach for Phase 2B.

Levels of OB

The methodology used for Phase 2 Optimism Bias has followed the guidance set out in the Green Book (Appraisal and Evaluation in Central Government (Treasure Guidance 2011)), and the 'Supplementary Green Book Guidance'.

The approach that HS2 has taken to develop the OB levels currently employed is set out in the following steps:

1) Application of the guidance generically across all route sections, elements and assets contained within the Phase 2 cost estimate. This will apply the Upper Bound OB percentages to the Phase 2 Capital Estimate treating as a Benchmark all Civil Elements as Standard Civil and all Building Elements as Standard Building.

2) Refine the generic application of the guidance by looking at the Phase 2 estimate on an asset by asset basis to determine a reflective assessment of which 'Project Type' is appropriate for each asset based on known Phase 2 specific complexities.

   This approach will enable a 'pin pointed' application of Optimism Bias where those assets with the greatest level of complexity in their design or site conditions, have

the appropriate provision for Optimism Bias applied, while at the same time not over inflating the budget for those assets with greater budget certainty (as is the case when applying a generic Optimism Bias percentage). This process therefore assesses the impact of Project Specific 'Project Type' assessment whilst still applying the Upper Bound Optimism Bias percentages from the Supplementary Green Book Guidance.

3) At the next stage, HS2 applies 'Mitigation Factors' to each Project Type 'Contributory Factors' in accordance with the Supplementary Green Book Guidance via the following process:

    A. Mitigation Factor Assessment by Phase 2 Optimism Bias, delivering an initial assessment of mitigated Optimism Bias percentages to apply for each Project Type.
    B. Mitigation Factor Assessment by wider Phase 2 Cost, Risk and Investment Planning Team (Response rate of 75%+ to be achieved).
    C. Delivery of an interim assessment of mitigated Optimism Bias percentages to apply for each project type which evaluates and concludes assessments achieved in A and B above.
    D. Mitigation Factor Assessment review with Phase 2 Lead Route Engineers for the Eastern and Western Legs to review Interim Mitigation Factor Assessment achieved in C above.
    E. Delivery of a final assessment of mitigated Optimism Bias percentages to apply for each project type which evaluates and concludes assessments achieved in A, B, C and D above.

Using the Green Book categories for looking at the type of assets being estimated, we categorise those asset types into the four categories (Non-Standard Civils, Standard Civils, Standard Buildings, and Non-Standard Buildings). Based on the analysis undertaken, we believe that the asset types that are within the initial design for Phase 2 fall within categories with the upper bounds for OB up to a maximum of 46%.

The definitions of the types of work packages are set out below:

- **Standard building** projects are those which involve the construction of buildings not requiring special design considerations i.e. most accommodation projects e.g. offices, living accommodation, general hospitals, prisons, and airport terminal buildings.
- **Non-standard building** projects are those which involve the construction of buildings requiring special design considerations due to space constraints, complicated site characteristics, specialist innovative buildings or unusual output specifications i.e. specialist/innovative buildings e.g. specialist hospitals, innovative prisons, high technology facilities and other unique buildings or refurbishment projects.

- **Standard civil engineering** projects are those that involve the construction of facilities, in addition to buildings, not requiring special design considerations e.g. most new roads and some utility projects.
- **Non-standard civil engineering** projects are those that involve the construction of facilities, in addition to buildings, requiring special design considerations due to space constraints or unusual output specifications e.g. innovative rail, road, utility projects, or upgrade and extension projects.

As part of this process, having applied the general level of OB, there is a process of undertaking a review of the types of work within those categories. This essentially derives a level of OB which varies within the banding suggested by HMT under its Green Book.

Mitigation factors

Following the stage of work to identify the work packages within the OB categories, which has then derived a specific level of OB to apply to asset types within those, HS2 apply mitigation factors to develop a final level of OB. As set out above, the Green Book guidance suggests that the upper bound for optimism represents a starting point and the 'Contributory Factors' that may affect the OB levels are assessed in terms of whether they can be mitigated or not.

The assessment of mitigation factors is developed by performing an adjustment to each 'Project Type' Upper Bound Optimism Bias Percentage via the application of 'Mitigation Factors' to each 'Contributory Factor'. Determination of each Mitigation Factor has been assessed prior the SR15 submission by the HS2 leads to validate the reasoning behind the initial assessment presented to the Department.

This assessment provides a specific OB percentage for each Project Type that forms the percentages to be applied within the Phase 2 Estimate for the route refinement baseline. The final outcome of this is that we apply a 40% level of OB to the Phase 2 project.

Assurance

An Updated Programme Cost Estimate (UPCE) was delivered to DfT at the end of May, encompassing BL5 for Phase 1 and the Route Refinement Baseline for Phase 2. This underwent a thorough assurance process which included assurance of the application of OB. The key findings from the assurance from early in 2015 were:

- The method of calculation of the unmitigated OB is consistent with and conforms to the HMT and Departmental guidance.
- The method of calculation for the mitigated optimism bias figure followed the HMT and Departmental guidance. The result was determined by the selection of mitigated contributory factor percentages. The greatest contribution to the overall mitigated percentage was the mitigation values selected for the 'inadequacy of the business case' which require greater justification.

- The method of assigning values of works for Phase 2 to the categories for OB was seen to be in general accordance with the HMT and the Department's guidance.

To assist the Department, the P-REP has undertaken a large number of reviews of the cost estimates, and the process of applying Optimism Bias. Whilst P-REP have some concerns remaining about the overall percentage of OB applied, they have confirmed they were content with the approach taken by HS2 in applying the Green Book guidance to HS2's cost estimate for formulate OB.